HELMeTO 2023
UNIVERSITY OF FOGGIA

5th International Conference on
Higher Education Learning Methodologies and
Technologies Online

Foggia, September 13th - 15th, 2023

BOOK OF ABSTRACTS

Università di Foggia

sirem

LSh

Autori vari
HELMeTO 2023 - Book of Abstracts

Editore STUDIUM s.r.l. a socio unico
Prima edizione Settembre 2023

ISBN 978-88-99978-64-8

The 5th International Conference on Higher Education Learning Methodologies and Technologies Online (HELMeTO2023) confirmed a growing interest in the topics of higher education learning methodologies and technologies, as well as the relevance of the interdisciplinary approach that characterizes our community.
This increased interest drove us to translate the HELMeTO event from a workshop to a conference (for the second year), hosting a higher number of contributions from several countries and bringing a more international perspective on the topics. During the presentations and talks, it became clear that there is a complex relationship between technology and pedagogical approaches. These discussions also brought up new emerging topics, such as the potential role of learning analytics, artificial intelligence, augmented and virtual reality, and big data analytics. Additionally, the importance of tutorship and learning design in online learning was emphasized.

The Department of Humanities at the University of Foggia hosted the 2023 edition of HELMeTO. This was the second in-person event since HELMeTO 2020 and 2021 were conducted fully online due to the Covid-19 pandemic. We received 108 submissions from over 313 authors and 19 countries (Algeria, Brazil, Croatia, Estonia, Germany, Italy, Japan, Latvia, Malta, Morocco, Netherlands, Poland, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom), thus confirming the growing interest from the scientific community in the conference and its international scope.

The 2023 edition of HELMeTO featured dozens of high-quality contributions spread across 11 special tracks and two general tracks. This volume provides an overview of the current international context of online learning. Theoretical approaches, technologies, and practical cases are covered in-depth, making it a valuable resource for scholars and researchers interested in online learning and the future of education from pedagogical and technological perspectives.

This editorial does not aim to systematically review every publication but rather provide a general overview of each track, assisting readers in deciding what to pursue further. To this extent, *General Track 1* is focused on *"Online pedagogy and learning methodologies"*. It presents how to design a survey, how to implement social learning for professional development, the outcome of using a machine-learning app on peer assessment, and the after-effects of COVID-19 in Higher Education.
General Track 2 is focused on *"Learning technologies, data analytics, and educational big data mining as well as their applications"*. It presents predictions both in course quality and in students' success. It also presents analytics on a specific MOOC and on university data cultures, as well as a deep analysis of digital tools and the related roles.

Special Track 1 is focused on *"Smart Systems for context-aware Education"*. It aims to create a platform for discussing the latest research trends and applications of smart systems integrated with artificial intelligence approaches for context-aware education. It provides an opportunity for instructors, researchers, instructional designers, and administrators to identify and discuss new and promising research directions in this challenging field.

Special Track 2 is focused on *"Emotions and art in higher distance education"*. It aims to collect and analyze eLearning practices that focus on the role of emotions in university courses. It invites teachers and researchers to reflect on the relationship between emotions, community building, and art, and to reconstruct teaching methods and participatory mechanisms that clarify this relationship. Specifically, the track focuses on the following aspects: emotional presence in building an online learning community, aspects of interaction (such as emotional intelligence, empathy, and affect), emotional responses experienced in an e-learning environment, and the effects of emotional presence on disciplinary knowledge.

Special Track 3 is focused on *"Performing art-based methodology to improve online learning experiences"*. It aims to investigate how a specific laboratory teaching experience, which is conducted remotely and focuses on performance, can impact the perception of the empathic relationship, learner interaction/engagement, and the perception of non-verbal cues such as body language, gaze, and tone of voice. These factors are crucial to establish a meaningful teaching process that promotes participatory online learning experience, emphasizing a shift from a mere "experience-of" some object to an "experience-with" that involves active engagement and collaboration among learners.

Special Track 4 is focused on *"E-learning for providing "augmented" mathematics education at University level"*. The use of technology, especially the internet, cannot be overlooked in any aspect of modern life. In the field of education, students naturally turn to digital resources like videos, tutorials, and mathematical software. This poses a challenge for university teachers to create new learning environments that integrate both traditional and digital resources, and utilize them to enhance students' learning experiences. It is important to explore how technology can be leveraged to create new and innovative teaching methods that provide students with augmented learning experiences.

Special Track 5 is focused on *"Supercyberkids! The importance of promoting cybersecurity education among teacher education students"*. It aims to facilitate the exchange of research results, experiences, and products related to cybersecurity education in primary school settings, including teachers and parents. Its ultimate goal is to explore new ideas and trends in gamification platforms and specific games related to cybersecurity, with a focus on teacher education and professional development as a reference context.

Special Track 6 is focused on *"Effects of high-performance artificial intelligence systems and immersive technologies in education"*. It aims to discuss the impact, potential, viewpoints, merits and drawbacks of both high-performance AI systems and immersive technologies in the field of education. It includes contributions related to the impact of new AI systems on education, novel artificial intelligence systems to bolster education, the use of readily available AI systems for education from the perspective of students and teachers, supportive AI for creating XR scenarios, XR in education and teaching.

Special Track 7 is focused on *"The future of learning: Exploring the intersection of posthumanisms, e-health, technologies, and artificial intelligence in education innovations"*. This track covers new research directions in e-health education, including virtual reality, gamification, mobile health, and personalized healthcare. It also explores the challenges and opportunities of integrating e-health technologies into clinical practice and the ethical considerations of using them. Additionally, it addresses health equity and implementation of e-health education interventions in diverse settings.

Special Track 8 is focused on *"Technology-based learning interventions in higher education for combating inequalities and increase the psychological well-being of youngsters"*. The purpose of this special track is to gather reflections, best practices, and experiences related to the use of serious games and digital interventions in higher education. The goal is to ensure inclusive environments for youngsters that help improve their well-being, combat inequalities and promote psychological wellness.

Special Track 9 is focused on *"Innovative inclusive university"*. It aims to encourage discussions, sharing of best practices, and personal experiences regarding the latest teaching methodologies that promote inclusion in higher education. This track puts emphasis on the use of new technological tools that support truly inclusive teaching.

Special Track 10 is focused on *"Beyond borders: exploring immersive environments and new didactic approaches in higher education"*. The aim and scope of this track are to identify the key elements that arise from studying immersive reality in higher educational contexts. Additionally, it aims to develop innovative teaching models and approaches for higher education students and lifelong learners, while exploring theoretical and practical settings for the construction and management of knowledge. Finally, the track aims to stimulate interdisciplinary discussions on the topic.

Finally, *Special Track 11* is focused on *"Learning technologies and faculty development in the digital framework"*. It addresses two main areas of interest, namely: online or blended approaches to academic/faculty development, and how faculty development can enhance teachers' skills to design, implement, and assess learning in a higher education digital environment. The track features research, best practices, and experiences related to online or blended initiatives for faculty development, as well as papers on topics such as the promotion of academic staff profiles and skills development in the digital environment. These topics include learning design, curriculum design, teaching methodologies, assessment, digital publishing, open science, online learning, e-mentoring, e-tutoring, digital skills, and related topics.

In summary, this book of abstracts provides a comprehensive overview of the methodologies and technologies used in online learning in higher education. This has been the focus of HELMeTO since its first edition. The book brings together

theoretical concepts and practical experiences related to online technologies and learning. It is a valuable resource for anyone interested in this field.

Gabriella Casalino, University of Bari, Italy
Raffaele Di Fuccio, University of Foggia, Italy
Giovanni Fulantelli, National Research Council of Italy
Paolo Raviolo, University eCampus, Italy
Pier Cesare Rivoltella, “Sacro Cuore” Catholic University, Italy
Davide Taibi, National Research Council of Italy
Giusi Antonia Toto, University of Foggia, Italy

Organizing Committee

***General Chairs*:**

Raffaele Di Fuccio	Pegaso University, Italy
Gabriella Casalino	University of Bari, Italy

***Permanent Steering Committee*:**

Daniel Burgos	Universidad Internacional de La Rioja, Spain
Christian Stracke	European Institute for Learning, Innovation and Cooperation, Germany
Pier Cesare Rivoltella	University of Bologna, Italy
Paolo Raviolo	eCampus University, Italy
Pietro Picerno	University of Sassari, Italy
Riccardo Pecori	eCampus University, Italy
Marta Cimitile	UniTelma Sapienza University, Italy
Gabriella Casalino	University of Bari, Italy
Davide Taibi	CNR – Institute for Education Technology, Italy
Giosuè Lo Bosco	University of Palermo, Italy

***Program Chairs*:**

Paolo Raviolo	eCampus University, Italy
Giusi Antonia Toto	University of Foggia, Italy
Pier Cesare Rivoltella	University of Bologna, Italy
Raffaele Di Fuccio	Pegaso University, Italy
Davide Taibi	CNR – Institute for Education Technology, Italy

***Special Session Chairs*:**

Giusi Antonia Toto	University of Foggia, Italy
Catia Giaconi	University of Macerata, Italy
Fiorella Vinci	eCampus University, Italy
Antonella De Blasio	eCampus University, Italy
Nadia Carlomagno	Suor Orsola Benincasa University, Italy
Antonella Montone	University of Bari, Italy
Giovannina Albano	University of Salerno, Italy
Michele Fiorentino	University of Bari, Italy
Anna Pierri	University of Salerno, Italy
Ilaria Matteucci	CNR - Istituto di Informatica e Telematica (IIT-CNR), Italy
Daniele Schicchi	CNR & University of Palermo, Italy
Mariella Farella	CNR & University of Palermo, Italy
Raffaele Di Fuccio	Pegaso Online University, Italy
Francesco Sulla	University of Foggia, Italy
Loredana Perla	University of Bari, Italy
Pasquale Ardimento	University of Bari, Italy
Paolo Raviolo	eCampus University, Italy
Antonella Lotti	University of Foggia, Italy
Barbara Bruschi	University of Turin, Italy
Manuela Repetto	University of Turin, Italy

***Publication Chairs*:**

Giovanni Fulantelli	CNR – Institute for Educational Technology, Italy
Raffaele Di Fuccio	Pegaso University, Italy

***Publicity and Communication Chairs*:**

Marco di Furia	University of Foggia, Italy
Francesca Finestrone	University of Foggia, Italy

***Local Organization Chairs*:**

Anna Dipace	University of Foggia, Italy
Antonella Lotti	University of Foggia, Italy
Lucia Martiniello	Pegaso University, Italy
Genny Manzo	Pegaso University, Italy
Giacinto Angelo Sgarro	University of Foggia, Italy
Domenico Santoro	University of Bari, Italy
Emiliano del Gobbo	University of Foggia, Italy
Luca Grilli	University of Foggia, Italy
Barbara Cafarelli	University of Foggia, Italy

***Web Master*:**

Francesco Santangelo	University of Foggia, Italy

Program Committee

Pasquale Ardimento	University of Bari Aldo Moro
Sezen Arslan	Bandirma Onyedi Eylul University
Federica Baroni	Università degli Studi di Bergamo
Fabrizio Barpi	Politecnico di Torino
Giorgia Bassi	IIT CNR
Mario Luca Bernardi	University of Sannio
Barbara Bruschi	Università di Torino
Nadia Carlomagno	Università Suor Orsola Benincasa
Maria Concetta Carruba	Università Telematica Pegaso
Gabriella Casalino	Università degli studi di Bari "A.Moro"
Marta Cimitile	Unitelma Sapienza University
Davide Dalmazzo	Politecnico di Torino
Antonella De Blasio	Università eCampus
Berardina De Carolis	University of Bari
Marina De Rossi	Università di Padova
Rosario Del Rey Alamillo	Universidad de Sevilla
Raffaele Di Fuccio	University of Foggia
Marco di Furia	University of Foggia
Benedetto Di Paola	Università degli Studi di Palermo
Federico Diano	University of Naples Federico II
Yannis Dimitriadis	University of Valladolid
Martin Drlik	Constantine the Philosopher University in Nitra
Andrea Esposito	University of Bari "Aldo Moro"
Ylenia Falzone	Università degli Studi di Palermo
Mariella Farella	National Research Council of Italy
Simona Ferrari	Università Cattolica
Francesca Finestrone	University of Foggia
Michele Fiorentino	University of Bari
Alberto Fornasari	University of Bari Aldo Moro
Giovanni Fulantelli	CNR - National Research Council of Italy
Sandra Gama	University of Lisbon, IST
Catia Giaconi	University of Macerata
Isabel González Enríquez	Universidad Complutense of Madrid
Annalisa Guarini	
Piergiorgio Guarini	University of Foggia
Alfonso Guarino	University of Foggia
Sherri Harms	Creighton University
Sara Havzi	Faculty of Technical Sciences
Enzo Iuliano	eCampus University
Sebastien Jacques	GREMAN CNRS-UMR 7347
Udo Kruschwitz	University of Regensburg
Sandra Kucina Softic	University of Zagreb University Computing Centre

Marco Lazzari	University of Bergamo
Pierpaolo Limone	
Giosue Lo Bosco	Universita' di Palermo
Renato Lombardo	Università degli Studi di Palermo
Antonella Lotti	University of Foggia
Jacek Marciniak	Adam Mickiewicz University
Federica Martino	Università degli Studi di Palermo
Tawfik Masrour	ENSAM Meknes My Isma¨ıl University
Stefania Massaro	University of Bari
Ilaria Matteucci	IIT-CNR
Domenico Monacis	
Eric Monfroy	LERIA, Université d'Angers
Antonella Montone	University of Bari, Italy
Antonio José Moreno Guerrero	University of Granada
Manuel Ninaus	TU Graz
Vahid Norouzi Larsari	
Dimitri Ognibene	Università degli Studi di Milano Bicocca
Guendalina Peconio	University of Foggia
Riccardo Pecori	eCampus University, Italy
Loredana Perla	University of Bari
Pietro Picerno	Università di Sassari
Paolo Raviolo	eCampus University
Angelo Rega	University of Naples Federico II
Manuela Repetto	Università degli Studi di Torino
Pier Cesare Rivoltella	University of Bologna, Italy
Marco Rondonotti	Uniecampus
Martina Rossi	University of Foggia
Domenico Santoro	Università degli Studi di Bari Aldo Moro
Daniele Schicchi	CNR - National Research Council of Italy
Anna Serbati	University of Trento
Maria Grazia Simone	Università Telematica E Campus
Francesco Sulla	University of Foggia
J. Roberto Sánchez Reina	Universitat Pompeu Fabra
Davide Taibi	CNR - National Research Council of Italy
Melania Talarico	Università degli Studi di Torino
Gaetano Tieri	Unitelma Sapienza
Lukasz Tomczyk	Jagiellonian University
Crispino Tosto	CNR - National Research Council of Italy
Giusi Antonia Toto	University of Foggia
Ottavia Trevisan	Università degli Studi di Padova
Christos Troussas	University of West Attica
Fiorella Vinci	eCampus University
Viviana Vinci	University of Reggio Calabria Mediterranea
Gianluca Zaza	University of Bari

Additional Reviewers

Adamoli, Matteo
Agostini, Daniele
Arrigo, Marco

Balestra, Antonio
Benghabrit, Asmaa
Bruschi, Barbara

Calderaro, Salvatore
Camandona, Fabiola
Consorti, Fabrizio

De Vincenzi, Marco
del Gobbo, Emiliano

Fabbri, Stefania
Fedeli, Laura

Gentile, Manuel
Lomonaco, Francesco
Maggi, Daniela
Massaro, Stefania
Messina, Salvatore

Perna, Salvatore
Picasso, Federica
Pierri, Anna
Pitrella, Vanessa

Rondonotti, Marco

Santoro, Domenico
Scalera, Michele
Scarinci, Alessia
Simone, Maria Grazia

Talarico, Melania
Tomczyk, L- ukasz
Tosto, Crispino

Vinci, Viviana

Table of Contents

General Track 1: Online pedagogy and learning methodologies

General Track 2: Learning technologies, data analytics and educational bigdata mining and their applications

Special Track 1: Smart Systems for Context-aware Education

Special Track 2: Emotions and Art in Higher Distance Education and Special Track 3: Performing art-based methodology to improve online learning experiences

Special Track 4: E-learning for providing ”augmented” mathematicseducation at University level

Special Track 5: SuperCyberKids!: the importance of promoting Cybersecurity Education among teacher education students

Special Track 6: Effects of High-performance Artificial Intelligence systemsand Immersive Technologies in Education

Special Track 7: The Future of Learning: Exploring the Intersection ofPosthumanism, E-Health Technologies and Artificial Intelligence in Education Innovations

Special Track 10: Beyond borders: exploring immersive environments and new didactic approaches in higher education

Special Track 11: Learning Technologies and Faculty Development in the digital framework

GENERAL TRACK 1

“ONLINE PEDAGOGY AND LEARNING METHODOLOGIES”

Toward identifying the most suitable programming language to engage students: an exploratory study in non-formal settings

Lucio Negrini[1[0000-0001-6793-6258]], Arianna Marras[2[0009-0006-2144-3822]], Christian Giang[1[0000-0003-2034-9253]], Masiar Babazadeh[1[0000-0002-5827-9812]]

[1] Scuola Universitaria professionale della Svizzera Italiana, Dipartimento Formazione e Apprendimento, Laboratorio Media e MINT, Locarno, Switzerland
[2] Università degli studi di Salerno, Dipartimento di Scienze Umane, Filosofiche e della Formazione, Salerno, Italy
lucio.negrini@supsi.ch

1 Introduction and literature review

Educational robotics (ER) activities are widely implemented in schools worldwide across all grades to develop computational thinking skills, promote Science, Technology, Engineering, and Mathematics (STEM) disciplines [1], and address the gender gap in these fields by engaging young female students [2]. The choice of educational robots and programming languages varies based on the grade level. Typically, programming languages used in schools can be categorized into visual and text-based programming languages [3]. Myers [4] argued that text-based languages are more suitable for professionals, while visual languages can support the teaching process for users of all ages. In K-12 schools, visual programming languages are predominantly used, aiming to present programming as enticing, creative, and easy to grasp, while providing user-friendly interfaces with various features [3].

This study aims to compare two commonly used visual programming languages and analyze which one is more intuitively attractive and interesting for compulsory school children, taking into account different school grades and gender distinctions.

To answer these questions, a 45-minute escape game was developed based on the star model [5] in which children, grouped in teams of up to four, utilized the Thymio II robot and two different visual programming languages: VPL and Blockly. The game scenario involved the participants discovering how to program Thymio to follow a black line representing a ski slope. Prior to accessing the computer and the code, two riddles were presented, both essential for progressing in the game. One riddle required deciphering four small algorithms in VPL, while the other involved deciphering three programming sequences created with Blockly. Thymio is an open-source robot specifically designed for educational purposes [6], serving as a valuable tool for exploring the world of robotics and taking initial programming steps. It possesses various sensors and actuators at the hardware level, and can be programmed using different interfaces, including VPL and Blockly.

The escape game was initially introduced to several school classes during the 'Science Festival' in Genoa (545 teams), held in the latter half of October 2022. Subsequently, it was presented to additional classes during the 'Sportech' event (59 teams) in the last week of January 2023. In total, 604 teams participated in the robotics activities. The

majority of participants were from middle school (67.8%), followed by primary school (20.9%), and a smaller proportion from high school (11.3%). Male-only teams accounted for 38.6% of the participants, while female-only groups constituted 35.1%, and mixed groups represented 26.3%.
At the conclusion of the escape game, participants were asked to complete a questionnaire, which aimed to explore their perspectives on the presented programming languages. The questionnaire included inquiries about the languages used to write the code, languages they were able to explore, preferences, perceived ease of use, and level of enjoyment. Additionally, two questions were included to assess the participants' overall experience with robotics and programming.

2 Results

The findings of the study indicate that, overall, VPL is the most commonly used language (44.5%), followed by Blockly (37.6%), with a smaller proportion using both languages (17.9%). VPL is also the preferred programming language (47.7%), compared to Blockly (43.9%), with a small percentage having no preference (8.4%). Participants perceive VPL as the easiest language to use (57%), while Blockly is considered slightly less easy (37.6%), and both languages are seen as enjoyable, with VPL being slightly more fun (45%) compared to Blockly (40.2%), and again, a small proportion finding both languages equally enjoyable (14.7%).
Chi-squared analysis revealed significant correlations between gender and language usage, language exploration, perceived ease of use, and enjoyment. Specifically, girls tend to choose VPL more frequently, while boys tend to choose Blockly. However, no correlations were found with respect to school grade. Additionally, a significant correlation was observed between prior programming experience and language usage, preference, perceived ease of use, and enjoyment. Participants with prior programming experience were more likely to choose Blockly, prefer it, find it easier to use, and consider it more enjoyable. Furthermore, logistic regression analysis demonstrated that children with prior programming experience are more inclined to choose Blockly over VPL, express a preference for Blockly, find it easier to use, and perceive it as more fun. Another analysis revealed that girls are more likely than boys to consider VPL a more enjoyable language compared to Blockly.

3 Discussion

This study aims to analyze the programming language preference among children, specifically between VPL and Blockly, in order to provide guidance to teachers on which language to choose to engage more K-12 students in programming. The findings reveal that children without prior programming knowledge prefer VPL, and girls also perceive VPL as more enjoyable compared to Blockly. These initial results suggest that VPL could be a more favorable choice to attract and spark the interest of children in programming. However, for expert users, Blockly appears to be more attractive.

By understanding the programming language preferences of different groups, teachers can make informed decisions about which language to adopt in order to maximize student engagement and interest in programming.

References

1. Chalmers, C.: Preparing teachers to teach STEM through robotics. International Journal of Innovation in Science and Mathematics Education, 25(4), 17–31 (2017).
2. Sullivan, A., & Bers, M. U.: Investigating the use of robotics to increase girls' interest in engineering during early elementary school. International Journal of Technology and Design Education, 29(5), 1033–1051 (2018).
3. Garneli, V., Giannakos, M. N. & Chorianopoulos, K.: Computing education in K-12 schools: A review of the literature. IEEE Global Engineering Education Conference (EDUCON) (pp. 543-551) (2015).
4. Myers, B. A.: Taxonomies of visual programming and program visualization. Journal of Visual Languages & Computing, 1(1), 97-123 (1990).
5. Botturi, L. & Babazadeh, M.: Designing educational escape rooms: validating the Star Model. International Journal of Serious Games, 7(3), 41–57 (2020).
6. Mondada, F., Bonani, M., Riedo, F., Briod, M., Pereyre, L., Rétornaz, P., & Magnenat, S.: Bringing robotics to formal education: The Thymio open-source hardware robot. IEEE Robotics & Automation Magazine, 24(1), 77-85 (2017).

Distance learning universities: an exploratory research in tutoring practices in STEM

Lucia Martiniello[0000-0002-5194-6061], Sara Selmi[0009-0006-6334-4128] and

Gaia Turconi[0000-0002-5689-3210]

Università Telematica Pegaso, Napoli, Italy
lucia.martiniello@unipegaso.it, sara.selmi@unipegaso.it,
gaia.turconi@unipegaso.it

1 E-tutoring in Telematic University: an overview

Reflections on the identity of the e-tutor and the multifaceted nature of this role ([1]) within academic research still leave the question open as to whether it is "a *role*, i.e., a professional profile, or a *set of activities*, i.e., a system of competencies that need to be operationalized" ([2], p.19), in Italian Telematic Universities. The complexity, fluidity and continuous evolution of e-tutoring ([3]), as well as the diversification of its functions according to pedagogical models and learning environments ([4], [5]) and its strategic importance in the context of distance e-learning ([6]), can also be guessed from the semantic richness of the term, which is often used to refer to different thematic areas (e-moderating, e-mentoring, media-education, virtual community management, teacher assistance). Furthermore, the advancements in AI systems and their application in educational contexts pose new pedagogical questions and challenges, including those related to e-tutoring. The progress of Intelligent Tutoring Systems (ITS), exemplified by automated forms of one-to-one tutoring, intelligent support for collaborative learning and moderation of student communities, and virtual agents in the context of Intelligent Virtual Reality (IVR) [7], may lead to further evolution of online tutors by re-centering their role in the socio-communicative and pedagogical aspects, rather than focusing solely on administrative and technical tasks. Therefore, exploratory studies on the Italian situation are desirable as well. Recent studies in the literature have examined the roles, competencies, functions and activities performed by e-tutors in important Italian universities ([8], [9], [10]), based on established indicators and models ([11], [12], [2]). However, considering the emerging evidence, it seems appropriate to place a further focus on mathematics and, in general, on STEM disciplines, given their specificities and unique learning needs, apparently in contrast to the blended and asynchronous modes often dominant in Telematic Universities.
Entry into the university context, in fact, is considered by teachers and educators to be one of the main problems in mathematics education ([13]), as it assumes not only an advancement in the complexity of the topics covered, but also a paradigm shift in

learning methodology: the tendency of students, in fact, is often to reproduce the practices presented by the teacher ([14]), generating an equivalence between learning mathematics and learning its procedures ([15]). This implies a difficulty in moving from an instrumental conception of mathematics - typical of high school - to a conceptual one - typical instead of Advanced Mathematical Thinking ([16], [17]). An important supportive role should therefore be given to disciplinary tutoring, particularly in asynchronous and blended-mode courses, as a facilitator not only in the difficult transition to AMT, but especially in the proper management of teaching resources and in the acquisition of the autonomy and self-regulation ([18]) necessary to cope with an advanced course of study ([19]).
In our paper, we address mostly the subject of mathematics as an illustrative example of learning methodologies in STEM disciplines, with the intention of expanding our analysis to other disciplines in the future. The focus on mathematical disciplines appeared to be more suitable for evaluation about the supportive or replacement role of automated forms of tutoring already in use in some universities, particularly abroad.

2 Research: aims and methods

This work is part of a broader research whose goal is to reconstruct the expectations of tutors working in Telematics Universities, in order to lay the foundations of a model applicable more generally in digital learning contexts.
The specific objectives of this initial exploratory research are:

1. Reconstruct the practices and strategies used by science-math tutors;
2. To investigate tutors' expectations from the perspective of intrastructural tools and more interactive pedagogical-didactic and/or social communication techniques;
3. Focus on the level of awareness of tutors with respect to the functions of their role.

This will enable us to examine potential overlaps between mentoring and tutoring activities. The research project we have undertaken is exploratory in nature and involves gathering and analyzing qualitative data, specifically through in-depth interviews with mentors who have been integrated within a telematics university for a period of, at least, six months. The ongoing research aims to include a sample size of at least 20 individuals.
This phase is considered a starting point for subsequent analyses, which will involve the collection of quantitative data and a comparison among universities with similar and different models ([20]). The ultimate goal is to define an optimal e-tutor profile that aligns with technological advancements and demonstrates both perceived and actual effectiveness.

References

1. Rivoltella, P.C. (ed.): Apprendere a distanza. Teorie e metodi, Raffaello Cortina Editore, Milano (2021).
2. Rivoltella, P.C. (ed.): E-Tutor. Profilo, metodi e strumenti, Carocci, Roma (2006).
3. Lentell, H.: The importance of the tutor in open and distance learning. In: Tait, A., Mills, R. (eds.), Rethinking Learner Support In Distance Education, 64-76. Routledge, London (2003).
4. Rotta, M., Ranieri, M.: E-tutor: identità e competenze. Un profilo professionale per l'e-learning, Erickson, Trento (2005).
5. De Metz, N., Bezuidenhout, A.: An importance-competence analysis of the roles and competencies of e-tutors at an open distance learning institution. Australian Journal of Educational Technology, 34(5), 27-43 (2018).
6. Vegliante, R., De Angelis, M.: L'e-tutoring nei percorsi di formazione online. E-tutoring in online training courses. Giornale Italiano della Ricerca Educativa, Lecce: Pensa Multimedia, 56-68 (2019).
7. Garavaglia, A.: Adaptive Learning, AI. In: Rivoltella, P.C. (ed.), Apprendere a distanza. Teorie e metodi, Raffaello Cortina Editore, Milano, 251-258 (2021).
8. Ferrari, S., Mauro, I., Rivoltella, P. C., Messina, S., Raviolo, P.: E-tutoring nella didattica telematica, pratiche di modellamento. Excellence and innovation in learning and teaching: research and practices: 6, Special Issue (2021).
9. Raviolo, P., Messina, S., Mauro, I., Rondonotti, M.: E-tutoring in Higher Education: A case Study. In: Bridges and Mediation in Higher Distance Education, Springer International Publishing, 289-299 (2021).
10. Ferrari, S., Triacca, S.: The Strategic Role of the E-Tutor in New Learning Contexts. In: Bridges and Mediation in Higher Distance Education, Springer International Publishing, 300-314 (2021).
11. Salmon, G.: E-moderating: the key to teaching and learning online, Routledge, New York, (2001).
12. Denis, B., Watland, P., Pirotte, S., Verday, N.: Roles and competencies of the e-Tutor. In: Proceedings of the Networked Learning Conference (NLC 2004), Lancaster, UK (2004).
13. Gueudet, G.: Investigating the secondary–tertiary transition. Educational studies in mathematics, 67(3), 237-254 (2008).
14. Gueudet, G., Pepin, B.: Didactic Contract at the Beginning of University: a Focus on Resources and their Use. Int. J. Res. Undergrad. Math. Ed. 4, 56–73 (2018).
15. Albano, G.: Orchestrating affective, cognitive and metacognitive dimensions of undergraduate mathematics learning in digital environments. In: Twelfth Congress of the European Society for Research in Mathematics Education (CERME12), Bozen-Bolzano, Italy (2022).
16. Skemp, R.: Relational Understanding and Instrumental Understanding. Mathematics Teaching, 77, 20–26 (1976).
17. Tall, D. (ed.): Advanced mathematical thinking (Vol. 11). Springer Science & Business Media (1991).
18. Zimmerman, B.J.: Attaining self-regulation: A social cognitive perspective. In: Handbook of self-regulation. Academic press, 13-39 (2000).
19. Di Martino, P., Maracci, M.: The secondary-tertiary transition: beyond the purely cognitive. Proceedings of 33rd Conference of the International Group for the Psychology of Mathematics Education (2009).
20. Martiniello, L.: Università. Verso nuovi modelli di Management, Giapeto, Napoli (2020).

The STEM approach to tackling gender discrimination: an educational project in secondary schools

Dario Lombardi[1][0000-0002-3405-6016], Anna Teresa Musicco[1][0009-0009-3764-9448], and Nadia Di Leo[1][0009-0004-2919-4096]

[1] Department of Humanities, University of Foggia
{dario.lombardi, anna.musicco, nadia.dileo}@unifg.it

1 Introduction

Gender discrimination is a complex and pervasive phenomenon [1]. It influences various aspects of contemporary society, including employment and leadership. To tackle this social issue, the following paper proposes the use of the STEM methodology, in line with the recommendations of international and EU institutions [2]. The PNRR describes the STEM approach as a strategy to close gender gaps, by providing an investment in STEM skills to reduce the gap between Italy and the European average [3].

2 An overview of the research

The first part of the paper focuses on gender discrimination and how it affects several social aspects generating inequalities and restricting equal opportunities [4]. It is crucial to emphasise that it is an educational emergency, for this reason, it is necessary to provide students with tools and knowledge that promote awareness and gender equity. The data reported by Almalaurea, concerning the number of male and female students enrolled in university courses in STEM subjects in the academic year 2020/2021, highlight the significant gender gap [5]. Having said that, it is important to focus on the STEM teaching approach, as a strategy to introduce students to the critical study of science from an early age, through the use of experimentation, real applications, and an interactive workshop method, characterised by the teacher-learner interaction [6].
Then, the characteristics of the STEM (Science, Technology, Engineering, and Mathematics) [7] approach, as an effective methodological tool to promote gender equity, are described. It highlighted how the integration of information and communication technologies in STEM teaching can enhance active and immersive learning, enabling students to develop transversal and critical skills.
In the final part of the article, an educational STEM project is proposed, specifically designed for secondary schools in the Foggia area. This project aims to provide students with an inclusive and stimulating environment in which to explore and understand in-depth the issue of gender discrimination. Interdisciplinary activities, hands-on projects, and the use of innovative technologies will promote students' awareness, critical reflection, and empowerment, thus contributing to a more equal and inclusive society [8].

The research involved nine secondary school classes, with a total of 114 students from scientific high school, technical and vocational schools. The students, divided into groups, devised a total of 28 apps, aimed at ensuring greater social inclusion for women. Qualitative data analysis was conducted employing the thematic analysis research method, using the software "MAXQDA". Seven themes were searched, defined, and named: psychological approach, security and first aid, leisure and socialisation, gender inclusion in the workplace, culture, basic needs and personal care and orientation.

3 Conclusion

A preliminary analysis of the results showed that the use of the STEM approach and workshop teaching were more effective than traditional teaching in terms of learning motivation and work productivity. In addition, the observed experience showed that students are more involved and understand the problem more closely because they had the opportunity to deal with it in a practical way [9].

References

1. Ferrante, A., Passerini Gambacorti, M., Palmieri, C.: L'educazione e i margini. Temi, esperienze e prospettive per una pedagogia dell'inclusione sociale. Guerini, Firenze (2020).
2. Picardi, I.: La dimensione di genere nelle carriere accademiche: Riflessività e cambiamento nel progetto pilota. GENOVATE@ UNINA (Vol. 2). FedOA-Federico II University Press (2017).
3. MEF, Ministero dell'Economia e delle Finanze (2021), Piano Nazionale di Ripresa e Resilienza: https://www.governo.it/sites/new.governo.it/files/PNRR_2021_0.pdf.
4. Buccini, F.: L'educazione di genere tra teoria e prassi: itinerari di ricerca per l'infanzia. Education Sciences and Society, n. 2, pp. 355-366 (2020).
5. Almalaurea, 2021, XXIII Indagine Profilo dei Laureati 2020 - Rapporto 2021, URL: https://www.almalaurea.it/sites/default/files/2022-05/almalaurea_profilo_rapporto2021_0.pdf.
6. Sinaga, M., Silaban, R., & Jahro, I. S. (2021, March). Development of Chemistry Practicum Guidelines with the Support of STEM (Science, Technology, Engineering, and Mathematics) Integrating Character Education. In Journal of Physics: Conference Series (Vol. 1811, No. 1, p. 012058). IOP Publishing.
7. Gonzalez, H. B., Kuenzi, J. J.:. Science, technology, engineering, and mathematics (STEM) education: A primer. Washington, DC: Congressional Research Service, Library of Congress (2012).
8. Masterson, V., World Economic Forum, Future of jobs 2023: These are the most in-demand skills now - and beyond (2023), https://www.weforum.org/agenda/2023/05/future-of-jobs-2023-skills/, last accessed 2023/05/15.
9. Maugeri, G.: 4 Metodologie a Mediazione Sociale Come Alternative Alla Didattica Trasmissiva, L'insegnamento dell'italiano agli stranieri. Alcune coordinate di riferimento per gli anni Venti (2021), http://doi.org/10.30687/978-88-6969-523-0/004, last accessed 2023/05/16.

Digital, virtual and AI: a new pAIdeia?

Alessandro Ciasullo[1][0000-0001-6271-2554] and Flavia Santoianni[2][0000-0003-3382-5765]

[1] Università di Napoli Federico II, Italy
[2] Università di Napoli Federico II, Italy
alessandro.ciasullo@unina.it

1 First Section

1.1 The real/digital relation and new ontologies

The connection between the physical and digital worlds is evidenced through: the digital as a translation of the real; the digital as a support of the real; the digital as an augmentation of the real; the digital as a nomothetic analytical reading of real phenomena; the digits as an added cybernetic space or virtual translation of reality; and finally the digital as a generative, creative, productive system of organized and "intelligent" responses [1].
The overlapping existence of the real and the digital is reorganizing new ontologies of human/machine relationships and with them the very organization of neural parameters underlying the human/environment relationship [2]. The environment is widened and enriched by plural components which overcome the real/digital dichotomy and confront other mediatized realities, rebuilt and replaced "by" the digital and "in" the digital [3]. This appears as a further evolution of the nature/culture relationship and the relationship between the individual and the environment. Inside this profound transformation of the world, formal systems of education often appear as inactive and marginal participants, adapted (or maladaptive), placed on the sidelines, unable to build new cognitive alphabets, critical approaches, and capacities to rewrite and reprogram the relationship between subjects in training and the digital itself [1].
Among the elements to be considered in training processes and the transformations introduced by the digital, we can identify any significant conditions: neuronal potential; physical capabilities; cognitive and social subjectivity; intrinsic motivations; cognitive and social goals; educational availability environments; systems' operational flexibility; teachers' training; and institutional educational support network [2]. Learning environments should be able to drive responses. Ever-changing environments and individual propositions could be seen for every learner. These sudden social changes must profoundly transform the world of education. Changing environments, and providing new learning experiences tailored to individual topics, seem to be hyper-complex challenges that teachers without implementing their professionalism will not be able to overcome. Holding together and managing individual differences, the constant reorganization of real, digital, and virtual learning environments; the ability to structure curricula adapted to each specificity; analyzing the impact of educational interventions and the formative assessment of them; and the possibility of constructing unique experiences adapted to each person's development appears as a horizon for rewriting teaching professionalism itself [4].

2 Second Section

2.1 Generating knowledge about and trough AI

The questions that pedagogy should answer soon are: can we create a technological transition if there is no generalized culture on a given subject? Is there a culture of 'data' and the ability to read it for educational purposes? Can AI become a system of educational synthesis for the personalization of education? Can VLEs reprogram themselves, and recode themselves, to the use of the subject being educated? To prepare a reasoned proposal regarding the possible use of AI within school contexts, we proposed a structured and semi-structured qualitative survey to ascertain the degree of acceptance and openness of digital technologies within some schools in Rome. The research question we were interested in verifying was how much readiness for change the teachers had and how much they knew about the strong transitions taking place. We conducted a cognitive analysis among school-teachers of various school grades in Rome for understanding what they thought about current educational challenges. Some 110 teachers responded as follows: 54.2 percent responded that they commonly use ICT in the classroom, and some 37.4 percent are inclined to experiment with new technologies for teaching. In relation to the use of Big Data-which underlies the operation of AI systems-according to 81.7 percent, its use can only be achieved through in-depth training of the entire teaching staff. In another question, 81.7 percent of respondents believe that Machine Learning, and the systems underlying AI, can be a very important element of progress to be used for teaching. However, analysis of respondent ‘sentiment’ shows a neutral attitude, such as an expectation that is not supported by elements perceived to be important to these opportunities. Indeed, among the most frequently used words which emerged from the analysis of open responses is the word "useful" [5].

3 Conclusion

3.1 Which possible direction?

The issue of usability and how to handle the revolutionary phenomena we are about to experience in many fields, always comes through adequate education and effective usability in the contexts within which they are prepared. The real challenge, then, is not only to think of new strategies to hold together real/digital/virtual and active AI reorganization capabilities but rather the structuring of pathways of prior literacy and deepening to topics of Big Data, coding, and Machine/Deep Learning. The future is already looking here and knocking at the door for teachers’ training [6].

References

1. Ciasullo, A: ChatGPT, Le implicazioni pedagogiche e le possibilità dell'Intelligenza Artificiale. Research Trends in Humanities RTH 10, 68-76 (2023).
2. Frauenfelder, E., & Santoianni, F.: Nuove frontiere della ricerca pedagogica tra bioscienze e cibernetica. [Hauptbd.]. Ed. Scientifiche Italianae, Napoli (1997).
3. Fetzer, J. H.: What is Artificial Intelligence? In J. H. Fetzer (ed.), Artificial Intelligence: Its Scope and Limits (pp. 3–27). Springer Nethelands, (1990).
4. Hai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., & Li, Y.: A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. Complexity, 2021, 1-18, (2021).
5. Hastie, T., Tibshirani, R., & Friedman, J. H.: The elements of statistical learning: Data mining, inference, and prediction (Second edition).Springer, (2009).
6. Rainsberger, L.: Explanation: What Is New and Different About AI? In L. Rainsberger (A c. Di), AI - The new intelligence in sales: Tools, applications and potentials of Artificial Intelligence (pp. 1–16). Springer Fachmedien, (2022).

Accessibility, Digital Twins and Philosophy of Design

Lucia Campitiello[1], Fabrizio Schiavo[2], Umberto Bilotti[3], Michele Domenico Todino[4], Pio Alfredo Di Tore[5] and Stefano Di Tore[6]

[1] University of Salerno, Fisciano, Italy
lcampitiello@unisa.it
[2] University of Cassino, Cassino, Italy
fabrizio.schiavo@unicas.it
[3]University of Salerno, Fisciano, Italy
ubilotti@unisa.it
[4]University of Salerno, Fisciano, Italy
mtodino@unisa.it
[5]University of Cassino, Cassino, Italy
pioalfredo.ditore@unicas.it
[6]University of Salerno, Fisciano, Italy
sditore@unisa.it

1 The ScanItaly project between new perspectives of access to historical, artistic and cultural heritage and new semiotic issues

The ScanItaly project concerns, in extreme synthesis, the creation of Digital Twins of elements of the historical, artistic and cultural heritage in order to make them accessible in the educational field through a range of technologies (3D printing, virtual reality, augmented reality, Extended Reality). The scanned mod-els are placed in an online re-pository and made available to schools for 3D print-ing or for use in the BYOM and VirtualMuseum apps developed within the pro-ject. This work proposes a series of open questions, raised, within the project, by the process of digitization and re-proposition of archaeological finds in a digital context, but which can easily be generalized to the widely spread activities of digitization of cultural heritage. A theoretical-argumentative reflection is pro-posed here which is based, on the one hand, on the experiences achieved during the project, on the other on a review of the pertinent scientific litera-ture.
The conceptual framework of the work consists of the binomials: interac-tion/environ-ment (Berthoz, Sibilio), materiality/sociomateriality (Iannaccone), form/function (Latour).
The work identifies the possible synthesis of these pairs in the meaning of Design pro-posed by Latour in continuity with Sloterdijk.

2 Bodies in code

The re-proposition in a virtual environment of artifacts from the historical, artis-tic and cultural heritage makes it possible to visualize the artifact and also makes it possible to manipulate it. This potentially opens the way to the recovery of the dynamic dimension linked to the artifact (think of the possibility of playing a spinet or using a plane). This dynamic dimension constitutes the prerequisite for the reconstruction of the original spatial and socio-material context in which these artifacts combined form and function. If this represents an enormous poten-tial in terms of accessibility, it also poses open questions related to the design of virtual environments (for example, the scientific literature on the accessibility of virtual environments is still scarce) and the re-design of digital twins (with Latour, "design" is never a process that starts from scratch: designing is always redesigning). With digitization, the transformation of an object into a code im-plies an exponential expansion of the semiotic dimension). With Latour, if Galileo's book of nature was written in mathematical terms, prodigiously expanding the empire of interpretation and exegesis, this expansion is even more true to-day, when an ever-increasing number of objects present in our environment are, literally, transcribed in the form of numbers.
The digitization of my own body opens the way to a simple and disruptive con-sideration: the body is a text (and as such it offers itself to the cut-up). Following Haraway, "technological determination is only one ideological space opened up by the reconceptions of machine and organism as coded texts through which we engage in the play of writing and reading the world" (Haraway, 198x)

3 Metawelt

The representation of augmented or virtual reality as an alternative reality (repre-sentation, among other things, misleading) implies that I am present in two places at the same time. More than inhabiting two distinct spaces at the same time, I cre-ate a space together with the agents that allow me to experience: the body that acts is the place of construction of an experience that synthesizes elements from all around (Metawelt) that surrounds me. Whether in a "real" or virtual, digital, extended, hybrid, augmented or diminished space, the subject builds his world, his Umwelt or his MetaWelt, according to his own needs and tools of ac-tion/interaction. Such a perspective of the subject who builds worlds can be found in Bergson and in Husserl.
To forget the body-that-acts in order to better detail the nature of the territories in which it acts means indulging in an infinite, recursive and all in all idle decon-struction. The interesting fact about minds/bodies/extended environments is not to investigate the characteristics of the environments with a very high level of detail, but rather to investigate the continuous flow of information and percep-tions between the different environments (the Metawelt).

Hence the urgency of a reflection, in the properly pedagogical-didactic field, which does not indulge in recursive deconstruction, but which helps to weather the storm.

References

1. Berthoz, A.: La semplessità. Codice, Torino (2011).
2. Iannaccone, A., Cattaruzza, E.: he Negleted question of materiality in Developmental Psychology: an interdisci-pllinary overview. In: European Conference on Developmental Psychology, pp. 75-79. Medimond, Bologna (2015).
3. Latour, B.: A cautious Prometheus? A few steps toward a philosophy of design (with special attention to Peter Sloterdijk). In: Proceedings of the 2008 annual international conference of the design history society, pp. 2–10. (2008).
4. Sibilio, M.: L'interazione didattica. Scholé, Brescia (2020).

Serious Games for Lifelong Language Learning

Alessia Scarinci[1] [0000-0002-3174-7137] and Annamaria Ventura[2]

[1] Mercatorum University
[2] University of Bari Aldo Moro, Italy
alessia.scarinci@unimercatorum.it
annamaria.ventura1@uniba.it

1 Introduction

Recent research demonstrates the effectiveness of the use of technologies and games in the educational, health and preventive fields [1, 2, 3].

The playful dimension has always accompanied that of learning, mostly with the development of technologies and media. In fact, the serious game, in addition to the entertainment function, has, above all, an educational one. The relationship between play and learning, thanks to the involvement of different cognitive and metacognitive functions, has always been the object of study and investigation [4] and is supported by an extensive bibliography.

Technological innovation has favoured the transition towards digital games used for educational purposes [5]. This is how Serious Games were born, video games that offer educational content while having fun, simulating scenarios that promote learning [6]. These are interactive computer applications whose main characteristics that can influence knowledge, skills, and judgment are: “action languages, which mediate communication between game and person; assessments, which are track-records of correct answers when a questionnaire is administered; and challenges, conflicts or checks that improve a student's knowledge” [7]. The aim is to allow the learner a sustainable learning pathway and the development of an ecological mind [8].

2 Project description

The Horizon Seeds project "Serious Games for Lifelong Language Learning to Prevent Neurodegenerative Disorders: From Gut Microbiota to Brain Networking" has as its objective the implementation of an experimental model aimed at the prevention of neurological pathologies

secondary to cognitive decline through an innovative learning path of a second language (L2) through serious games.

From the perspective of a necessarily plurilingual and multicultural society, the growing and rapid demographic increase and protagonism of the adult and advanced population requires a reflection on possible models and procedures to prevent neuro-cognitive decay. The concept of lifelong learning not only represents the possibility for the individual to remain cognitively and socially active, but above all it has an important role in health, since, by promoting the development of cognitive reserve, it helps to reduce the risk of the onset of diseases inflammatory-degenerative neurology.

Learning a second language in adulthood is an important activity for increasing cognitive reserve, protecting one's brain functions, and thus postponing the onset of degenerative pathologies. From a lifelong learning perspective, the proposed project will have multiple repercussions on different levels: the impact of economic and social sustainability, the impact of social integration and the impact of technological experimentation. The project involves work in the symbiosis between the linguistic-didactic and pedagogical area, the technological area, and the medical and psychological area. During the structuring phase of the project, the researchers from area 11, the pedagogical field, collaborated with the group of researchers from area 10, the didactic-linguistic area, for content reasons related to the operational hypotheses for structuring the learning paths, of which pedagogy is an integral part.

The study of foreign languages is one of those intellectual training that we propose here to use to prevent cognitive decay. The intervention methodology, in fact, based on creativity, will proceed by testing diversified models of learning a foreign language through "serious or pervasive games" delivered on specific platforms. In addition to promoting the acquisition of the foreign/Italian language thanks to a playful and structured approach on different levels, the learning path will offer contents of strong cultural impact (artistic, musical, literary, knowledge of places, products, etc.) to increase interest and contribute to deeper integration and information of citizens.

This contribution intends through systematic research to understand the strategies and educational paths implemented in serious games to promote language learning.

3 Methodology

A systematic literature review was conducted following the methodology for systematic reviews and meta-analyses (PRISMA) [9, 10]. The studies (scientific articles and open access reviews) from 2018 to 2023 related to the keywords "serious game" AND "foreign language" AND "adults" present on the Google Scholar and Scopus databases were examined.

Of the 82 results obtained on Google Scholar, 16 articles were selected and examined, 15 of which are reviews. Of the 109 results obtained on Scopus, 15 articles were selected, 4 of which are reviews.

The analysis of the results intends to highlight the pedagogical elements, the cognitive approaches, the design, and the impacts of the use of serious games in the adult learning of foreign languages.

References

1. Backlund, P. & Hendrix, M.: *Educational games - Are they worth the effort? A literature survey of the effectiveness of serious games,* 5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES), Poole, UK, 2013, pp. 1-8, (2013). doi: 10.1109/VS-GAMES.2013.6624226.
2. Calvo-Morata, A., Alonso-Fernandez, C., Freire, M., Martínez-Ortiz, I., Fernandez-Manjon, B.: Serious games to prevent and detect bullying and cyberbullying: A systematic serious games and literature review, *Computers & Education* 157 (2020) 103958
3. Fleming, T., Cheek, C., Merry, S., Thabrew, H., Bridgman, H., Stasiak, K., Shepherd, M., Perry, Y., Hetrick, S.: Serious games for the treatment or prevention of depression: a systematic review. *Revista de Psicopatología y Psicología Clínica*, 19 (3), 227-242, (2014)
4. Anolli, L.: *La sfida della mente multiculturale. Nuove forme di convivenza.* Milano: Raffaello Cortina Editori, (2011).
5. Prensky, M.: *Digital Game-Based Learning. Computers in Entertainment (CIE)*, 1, 21, (2003). https://doi.org/10.1145/950566.950596
6. Michael, D. & Chen, S.: *Serious Games: Games That Educate, Train, and Inform.* Muska & Lipman/Premier-Trade, (2005).
7. Toto, G.A., Scarinci, A., Di Furia, M., Rossi, M.: Serious Game e strategie didattiche contempo- ranee: una revisione sistematica e meta analisi, «*Nuova Secondaria*», 2 (2022), XL, pp. 267-284
8. Mortari, L.: *Educazione ecologica*. Bari-Roma: Editori Laterza, (2020).
9. Moher D, Liberati A, Tetzlaff J, et al.: Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ. 2009 Jul 21;339: b2535, (2009)
10. 2. Page MJ, McKenzie JE, Bossuyt PM, et al.: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372: n71, (2021)

A lost historical approach to Calculus: An interactive and multitouch app for tangent problems

Pietro Milici[1[0000-0003-0478-6306]], Benedetto Di Paola[1[0000-0003-0305-5640]] and Giuseppe Bianco[1[0009-0002-5465-2373]]

[1] University of Study of Palermo, Palermo, Via Archirafi 34, Italy

1 Introduction

Calculus marked an epochal change in the evolution of scientific thought. However, this subject poses several difficulties: researchers in mathematics education highlighted obstacles and proposed different approaches in this field of mathematics [9]. We think that a fruitful perspective can be rooted in the history of mathematics and scientific instruments. Indeed, we retrace the first approach, due to Leibniz, to the "inverse tangent problems" (nowadays lost, after the XIX century arithmetization of the calculus). Within this perspective, we implemented and provided an interactive and multitouch app for tangent problems, linked to the everyday experience of students. We adopted this app for short workshop activities involving University students, with the future purpose of testing it in lower grades.

2 Mathematical machines for inverse tangent problems

The use of material and digital technology in mathematics education is increasingly widespread. Among material artifacts, mathematical machines have been studied in various teaching experiments. On the other hand, the development of digital technologies opened up questions and new perspectives for research [2].

Geometric constructions have been digitally implemented in Dynamical Geometry Systems (DGS) as GeoGebra. However, also DGS do not allow purely geometrical constructions for Calculus; for example, one can trace curves like the exponential only by formulas. To start overcoming these limits, we propose a geometric/mechanical insight based on the resolution of the "inverse tangent problems" (to construct a curve given the tangent properties). In the real world, to guide the tangent in order to construct new curves, a strong insight can be a wheel rolling perpendicular to the plane of the curve: the direction of this wheel will be the tangent to the curve traced by the contact point between the wheel and the plane.

Concerning the design of the proposed app, we propose a multitouch interactive app for tablets, aimed to experience the construction of the tangent to a given curve, by linking the wheel direction to the tangent concept.

Our aim is to make the student construct and/or reinterpret the tangent concept as the limit of the secants, by making different figures rolling along the curve (Fig. 1).

The richness of such an approach is that, besides solving the direct tangent problem (given a curve, to find its tangent), such a tool can be used to guide the direction of a

curve to-be. That means that, by guiding the wheel, one can construct derivatives and primitives given the graph of a function and geometrically solve differential equations. Such an approach is the geometrical counterpart present at the basis of Leibniz's conception of Calculus [3, 8, 10]. The app is designed to allow the change of the curve (smooth or not) and the wheel (a regular polygon with a growing number of edges or the limit circle). In a DGS like GeoGebra [4, 6], it is possible to dynamically guide the wheel by introducing two sliders. (Note that it does not suffice to drag the wheel because one has to guide both its position and direction.) That means that, even though the user can move the wheel along a path, that happens in a clumsy way. Differently, the multitouch function in our app introduces the use of two fingers to move the wheel, permitting to move the wheel (both in position and direction) in a native and natural way.

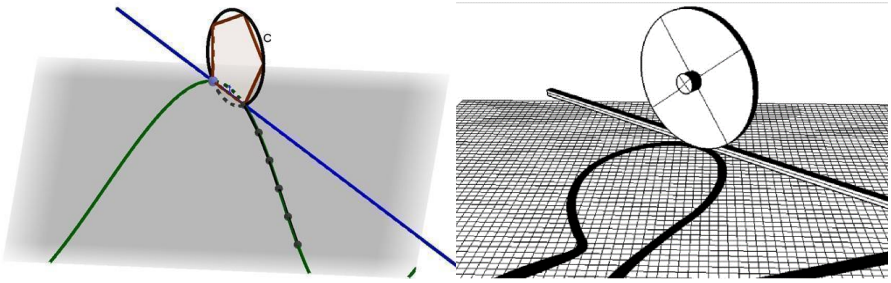


Fig. 1. Left: Considering a regular polygon rotating along a curve, by increasing the number of the sides we can imagine that the direction of the rolling wheel is the tangent as the limit of the secants. Right: Considering a wheel rolling on a curve, the direction of the wheel (in the image represented by a bar) is the tangent to the curve.

3 Methodology

We organized several activities involving University students to test the app and its design. The current version of the app cannot yet be used as a stand-alone tool but requires the mediation of researchers. They have to propose the didactics activities with the app and to orchestrate the related discussions [1, 4]. The aim of the activities is to make students grasp the idea of tangent as a ground to achieve further fundamental Calculus concepts through a hands-on approach linked to their everyday experience and previous mathematical knowledge. Therefore, we proposed the use of the app to small groups of students (around two to three people) and in presence of the researchers [4]. Further research will focus on the didactics consequences and how this app can become a useful tool to build elementary concepts of Calculus, in continuity with the historical approach by Leibniz and the research on micro-straightness [7]. Besides being a helpful support for more complex contents (e.g. derivative-primitives, differential equations [5]), we hypothesize that our digital tool can also provide an introduction to Calculus, even in lower grades.

Acknowledgments

This abstract was supported by the H2020 project no. 951822, MaTeK. https://www.projectmatek.eu/.

References

1. Albano, G., Dello Iacono U., Fiorentino G.: An online Vygotskian learning activity model in mathematics. Journal of E-Learning and Knowledge Society 12(3), 159–169 (2016).
2. Borba, M., Bartolini Bussi, M. G. (eds.): Historical aspects of the use of technology and devices in ICMEs and ICMI. ZDM The International Journal on Mathematics Education, 42 (1) (2010).
3. Bos H. J. M.: Tractional Motion and the Legitimation of Transcendental Curves, Centaurus, 31(1), 9–62 (1988).
4. Bussi, M. G. B., Mariotti, M. A.: Semiotic mediation: From history to the mathematics classroom. For the learning of mathematics, 19(2), pp. 27-35 (1999).
5. Crippa, D., Milici, P.: Transcendental curves by the inverse tangent problem: Historical and didactical insights for calculus. In: Barbin, E., Capone, R. , Fried, M. N., Menghini, M., Pinto, H., Tortoriello, F. S. (eds.). History and Epistemology in Mathematics Education - Proceedings of the 9th European Summer University, pp. 181–193 (2023).
6. Di Paola, B., Manno, G., Scimone, A., Sortino, C.: La Geometria, una guida ai suoi contenuti e alla sua didattica, Palumbo, Palermo, (2007).
7. Maschietto, M.: Graphic calculators and micro-straightness: analysis of a didactical engineering. International Journal of Computers for Mathematical Learning, 13, 207–230 (2008).
8. Milici, P.: A geometrical constructive approach to infinitesimal analysis: Epistemological potential and boundaries of tractional motion. In: Lolli, G., Panza, M., Venturi, G. (eds.), From logic to practice, Boston studies in the philosophy and history of science, vol. 308, pp. 3–21. Springer (2015).
9. Tall, D. O.: Students difficulties in calculus. Proceedings of Working Group 3 on Students' Difficulties in Calculus. ICME-7, Québec, Canada, pp. 13–28 (1993).
10. Tournès, D.: La construction tractionnelle des équations différentielles. Blanchard (2009).

From Botany to Big Data: A Citizen Science Distance Education Initiative

Giorgio Delzanno, Daniele Grosso, Giovanna Guerrini, Federico Lebole, Enrica Roccotiello, Angela Sugliano, and Giovanni Adorni

Università degli Studi di Genova, Italy
{name.surname}@unige.it

A Citizen Science and Innovative Teaching Initiative. "From Botany to Big Data" is an educational initiative created as part of the activities of the Working Group for Research and Innovation on Digital Skills in Schools of the University of Genoa[1]. It started in May 2022 to support schools that won the "Edugreen" projects of the Italian Ministry of Education, aimed at the establishment of innovative and sustainable educational gardens and school gardens. In this setting, the goal of the initiative is to provide teachers -and thus their students- with perspectives and tools to make the green experience of the school garden an opportunity to exercise a plurality of skills in the STEM area, related to the emerging fields of ecological and digital transition and to be part to a citizen science initiative. An IoT/Big Data infrastructure, for transferring observation (biomass, growth, etc) and monitored data (pH, temperature, etc) from the schools to a cloud platform (the botany dashboard), plays the role of digital accelerator for the creation of a network to share data and knowledge with experts in the domain and other schools. This way, engagement is created by experimenting how to use digital devices for making the school garden a laboratory for the environment and to become a proactive agent of a citizen science experience [2].

The Diverse Skills involved. The educational proposal encompasses diverse learning outcomes for participants: 1) they learn the fundamentals of environmental and applied botany, 2) they acquire a scientific method by participating in a citizen science project, 3) they learn how to use digital devices and applications, 4) they learn how to process, interpret, and graphically represent the data from their observations.

The aspects related to environmental and applied botany focus on defining a methodological approach and an experimental design based on the themes of biomonitoring and phytoremediation, which can be carried out by school students who, following the proposed method, acquire specific knowledge about the value of scientific observation of plants as a tool for monitoring and improving environmental quality. The following practical information are shared with schools: 1) a list of plants useful for carrying out biomonitoring of environmental matrices or phytoremediation of urban soils, 2) indications on agricultural practices needed to grow plants for this purpose, 3) a list of features to be observed in plants or obtained through direct measurements to monitor their development.

[1] competenzedigitali.unige.it/pon-green

For digital monitoring, analog and digital devices to be placed in gardens have been identified to carry out automatic monitoring of environmental parameters such as pH, soil moisture, and solar radiation. In addition to sensors connected to an app that collects and displays data from the school garden on school tablets, guidance was provided for programming an Arduino board with dedicated sensors, and a program was made available that transmits data via the Internet to the university servers.

From the computer science perspective, the focus is on the Internet-of-Things technology behind the online dashboard[2], that automatically and dynamically visualizes the data transmitted by the schools (both those entered manually through digital forms and those automatically transmitted by Arduino boards) and enables the storage of historical data. The data platform is designed according the IoT architecture guidelines: edge devices are connected via the Internet protocol to web resources hosted in the University cloud servers. Moreover, specific indications for classroom activities in which the students can process data from the school gardens are provided to develop as early as primary school a *data education* [1], a skill increasingly considered fundamental for students and identified as among the fundamental ones for digital citizens.

Practical Organization and Figures. The initiative proposes to teachers a series of eight free workshops that can be attended either in-person or online to explore the topic of digital technologies to support sustainable development. In the workshops, teachers are guided through the steps needed to collect data from their school gardens either via direct plant observation (biomass, growth, etc.) or sensors (water, pH, etc.) and transmit them to the University's servers. On the dedicated portal[3], teachers find all the resources to carry on the activities in their schools: in-depth resources, video-tutorials, and recordings of the seminars. Worksheets are also made available to support the implementation of activities with students, exercising skills in the pedagogical use of digital technologies (according to the DigCompEdu[4] framework).

In terms of *community*, the initiative supports the creation of a thematic community within the Moodle portal that multiplies the value of individual experiences through discussion with researchers and among schools engaged in the implementation of the Edugreen project. The portal of the initiative counts 115 registered participants. The majority is represented by teachers from 70 Italian schools. Four schools actively contributed data to the dashboard.

Looking Forward. The actions for the forthcoming school year include: 1) consolidating the initiative, repeating the experiment focusing on biomonitoring and on a specific plant, to get easily comparable results; 2) the realization of a smart greenhouse in the University Botanical Garden, to be used to demonstrate good practices and as a reference; 3) the realization of online mini-courses to be offered to university students, as parts of an optional learning path tailored to innovation and sustainability goals.

[2] `bit.ly/botanicdashboard`

[3] `competenzedigitali.aulaweb.unige.it`

[4] `https://joint-research-centre.ec.europa.eu/digcompedu_en`

References

1. Danyluk, A., Leidig, P., Cassel, L., & Servin, C. (2019, February). ACM task force on data science education: Draft report and opportunity for feedback. In Proceedings of the 50th ACM Technical Symposium on Computer Science Education (pp. 496-497).
2. Roche, J., Bell, L., Galvão, C., Golumbic, Y. N., Kloetzer, L., Knoben, N., ... & Winter, S. (2020). Citizen science, education, and learning: challenges and opportunities. Frontiers in Sociology, 5, 613814.

GENERAL TRACK 2

“LEARNING TECHNOLOGIES, DATA ANALYTICS, AND EDUCATIONAL BIG DATA MINING AS WELL AS THEIR APPLICATIONS”

Digital written feedback to promote motivation and engagement. A case study in Higher Education

Serena Triacca[1][000-0001-8854-5117] and Livia Petti[2][0000-0002-5980-771X]

[1] Catholic University of the Sacred Heart, Milan, Italy
[2] University of Molise, Campobasso, Italy
serena.triacca@unicatt.it
livia.petti@unimol.it

1 Theoretical framework

The scientific literature highlights that feedback is one of the most important factors in supporting study and promoting academic achievement [1, 2]. Indeed, it provides the students with information about their own learning, also making them aware of both the level of understanding achieved and the gap to the goal. Providing formative feedback in progress is relevant: pointing out strengths and weaknesses in one's work allows learners to understand whether they are moving in the right direction and to develop metacognitive awareness. A key element is learner accountability to feedback [3]: the receipt of it should not in fact be viewed passively, but it is important for the learner to reflect and act proactively on the feedback provided in order to use it productively, which requires the learner to be engaged and feedback literate [4].

In higher education, motivation [5] can be shaped by feedback on performances [6] and thus be able to affect the achievement of learners [7]. Students, in fact, benefit from feedback when they perceive that paying attention to it will move them from their current state to their desired state. When feedback focuses on the task exerts a positive influence on performance, facilitating the process of knowledge construction [8]. Written feedback is crucial, as it becomes the absolute empirical link that can be examined to reveal the teacher's intentions and ultimately provide the learner with a key to interpret the messages [9].

2 Contexts, objectives and methodology of the study

The context of the case study is the laboratory of "Educational Technology" (1 CFU) delivered in a.y. 2022/23. It is a compulsory course included in the 1° year of the blended master's degree course in "Media Education" at Catholic University of Milan. The laboratory aims to introduce students to the design of e-learning courses through online hands-on activities. Structured in five classroom meetings, it required the 22 enrolled students, divided into groups, to design a blended course starting from a provided scenario, working collaboratively in Google Drive over four weeks. The teacher provided written feedback in progress, using the "comments" function.

The purpose of the study is to understand how much the teacher's release of written feedback helped students feel motivated and involved in their participation at the lab. In order to gather students' perceptions of the working method adopted, an

exploratory survey was conducted at the end of the course by administering a semi-structured anonymous questionnaire using CAWI methodology, that consists of 15 items organized in 3 areas: personal data, previous experience about feedback in university, perceptions about feedback received during the lab.

3 Results e research perspectives

A total of 18 responses were collected. 77.8% of the students (no. 14) expresses satisfaction about receiving feedback in progress. 72.2% (no. 13) reports that they received written and/or oral feedback during their bachelor's degree, mostly from lab teachers. The finding is interesting and deserves further study since these students completed their three-year degrees during the pandemic years, when it was not possible to be physically present in the classroom. 88.8% (no. 16) affirms that the release of feedback helped them feel involved in participating in the workshop and 77.7% (no. 14) that it positively affected their motivation. Analysis of the open-ended responses also shows great awareness with respect to the importance of the feedback provided by the teacher. Finally, 77.7% (no. 14) emphasizes that the release of feedback on the way was helpful in enhancing design skills, the goal of the activity.

The formative feedback provided by the teacher involved individualized input to each group's work. Clearly, a similar activity requires the teacher to spend a significant amount of time at the project drafting stage. With large classes, sustainability is at risk: from a research perspective, it is precisely in these cases that Artificial Intelligence could help the teacher in this onerous but important duty [10].

References

1. Hattie, J., Timperley, H.: The power of feedback. Review of educational research 77(1), 81-112 (2007).
2. Wiggins, G.: A true test: Toward more authentic and equitable assessment. Phi Delta Kappan 92(7), 81-93 (2011).
3. Winstone, N.E., Nash, R.A., Rowntree, J., Parker, M.: It'd be useful, but I wouldn't use it: Barriers to university students' feedback seeking and recipience. Studies in Higher Education 42(11), 2026-204 (2017).
4. Carless, D., Boud, D.: The development of student feedback literacy: enabling uptake of feedback, Assessment & Evaluation in Higher Education 43(8), 1315-1325 (2018).
5. Schute, V. J.: Focus on formative feedback. Review of Educational Research 78(1), 153–189 (2008).
6. Ames, C.: Classrooms: Goals, structures, and student motivation. Journal of Educational Psychology 84(3), 261–271 (1992).
7. Wigfield, A., Cambria, J.: Students' achievement values, goal orientations, and interest: Definitions, development, and relations to achievement outcomes. Developmental Review 30(1), 1–35 (2010).
8. Butler, D.L., Winne, P.H.: Feedback and self-regulated learning: A theoretical synthesis. Review of educational research 65(3), 245-281 (1995).
9. Mirador, J.F.: A move analysis of written feedback in higher education, RELC Journal 31(1), 31-45 (2000).
10. Gonzàlez-Calatayud, V., Prendes-Espinosa, P., Roig-Vila, R.: Artificial Intelligence for Student Assessment: A Systematic Review, Applied Science 11(12), 5467 (2021).

VIDEOLINK - A Educational Project for Innovation in Teaching and Interconnection between Students and Professionals

Gianfaldoni Serena[1], Viale Niccolò[2] and Michele Lanzetta[3]

[1] University of Pisa, Pisa, Italy
[2] Scuola Superiore Sant'Anna, Pisa, Italy
[3]University of Pisa, Pisa, Italy

1 Project Summary

Videolink is an innovative targeted professional training project promoted by CAFRE, Link Laboratory, and Area Foundation. It aims to utilize a dedicated YouTube channel to stimulate young people's interest in the world of business and foster their active participation in various learning topics related to targeted professional training. The project is built on research demonstrating the effectiveness of short and informal videos in engaging students in learning.
Guo's (2014) showed that involving students directly in the creation of multimedia content is particularly effective in capturing attention and stimulating curiosity, which aligns with the pedagogical framebusiness studies and learning models.
Sartipa's (2022) highlighted that using YouTube as a learning tool increases students' interest in speaking, indicating relevance to online learning communities, social learning, and blended learning approaches.
Kurniawan's (2021) recommends analyzing content available on YouTube to create more comprehensible and attention-capturing teaching materials, which connects to assessment methods in online and blended learning environments and course design and e-learning curricula.
The active involvement of companies and institutions in the Videolink project, as emphasized, aligns with community building and context-dependent learning, creating an authentic learning environment that bridges the gap between academia and the world of business.
Moghavvemi's (2018) indicates that YouTube can enhance the learning experience and facilitate technology transfer, contributing to educational big data mining and learning analytics. Nevertheless, Razzaq 2021 found that medical students achieved comparable learning outcomes in cardiovascular physiology through distance learning during the COVID-19 pandemic, but most students preferred face-to-face learning.
The Videolink project's emphasis on collaboration between students, managers (who have different roles and expertise), and experts from different sectors (The managers who collaborated are from the following sectors: Energy sector, Paper sector, Large-scale retail trade, Nautical sector, Banking and finance sector, Manufacturing sector, Automotive sector, Local and continental institutions) ecc. enriches the educational offerings of their respective universities, reflecting the immersive learning approach.
Additionally, direct involvement of students in video production, as highlighted by Knol, Devlin-Scherer, and Ingram in 2013 and 2020, enables them to develop practical skills in multimedia production, which corresponds to e-learning platforms and portals, web-based learning, wikis, and blogs, and e-testing and new test theories.
It is essential to note that the Videolink project covers a wide range of learning topics in the context of targeted professional training, including pedagogical framebusiness studies, learning models, online learning communities, blended learning, assessment methods, learning analytics, course design, and more. The project's comprehensive approach aims to provide valuable educational content and opportunities for growth and personal development to students within the targeted professional training sphere.

2 Implications of the research for scholars and professionals and research questions

The Videolink project aims to stimulate young people's interest in the world of business and promote their active participation through a dedicated YouTube channel. The research conducted on Videolink will aim to answer the following research questions and provide practical implications for professionals in the education and training sector.

1) How does Videolink's YouTube channel contribute to the learning and skill development of young participants?
2) How is the Videolink project perceived by young participants and their teachers or tutors?

3) What are the long-term impacts of the Videolink project on the career and professional success of young participants?

To address the research questions concerning the Videolink project, a mixed-method academic methodology can be employed, combining qualitative and quantitative approaches. The methodologies for each of the three specific questions are described below:

1) Methodology for RQ1: An analysis of the content on Videolink's YouTube channel will be conducted to identify the topics covered, presentation methods, and teaching strategies used. Additionally, questionnaires will be administered to participants to gather data on their perceptions regarding the usefulness and impact of the videos on their learning and skill development.
2) Methodology for RQ2: Semi-structured interviews or focus groups will be conducted with young participants and their teachers or tutors to understand their opinions and perceptions of the Videolink project. This qualitative approach will allow for detailed information to be collected on the experiences and opinions of the various stakeholders involved in the project.
3) Methodology for RQ3: To assess the impact of the Videolink project, a longitudinal study will be conducted, following the young participants over time and collecting data on their approach to career and academic studies. Additionally, questionnaires and interviews will be utilized to gather information on participants' perceptions of the impact of the Videolink project on their professional success and career.

The research on Videolink offers important implications for both practitioners and scholars. For practitioners, the results can provide insights on how to develop effective educational content, promote active learning, support young people in transitioning to the world of business, engage various stakeholders, and implement monitoring and evaluation systems. For scholars, the paper contributes to the literature on digital learning, mixed research methodologies, longitudinal studies, stakeholder involvement, and educational policy, offering methodological and theoretical insights for future studies and interventions in the field of youth education and training.
Moreover, three quantitative questionnaires will be designed, targeting three different beneficiary segments of the project.

1) An internal test will be conducted among volunteers and collaborators of the laboratory, comprising a few questions about their appreciation of the video link project.
2) The same test will be administered to managers (but with a different link).
3) Additionally, a test will be conducted for "experts," i.e., all the involved suppliers.

3 Conclusions

This research focuses on assessing the impact of the Videolink project on learning and skill development among young participants in targeted professional training. It examines various learning topics, including pedagogical frame businesss, learning models, online communities, blended learning, assessment methods, and more. Additionally, the study explores the project's influence on community building, context-dependent learning, course design, and e-learning curricula. It also investigates the utilization of digital libraries, distance and e-learning in a global context, learning analytics, and web-based learning.
Furthermore, the research delves into educational big data mining, retention strategies through learning analytics, and the role of e-learning platforms and portals. It evaluates the project's effectiveness in e-testing, new test theories, distance education, immersive learning, and fostering a learning organization. The anticipated findings aim to provide valuable insights for designing innovative and targeted educational strategies, facilitating a smooth transition to the world of business, and promoting meaningful engagement with various stakeholders within the targeted professional training landscape.

References

1. Andersson, V., & Clausen, H.B. (2022). Improving Employability for Students through Co-Creation and External Collaboration: Experiences and Outcomes. Journal of Problem Based Learning in Targeted professional training.
2. Chais, C., Ganzer, P., & Olea, P.M. (2017). Technology transfer between universities and companies: two cases of Brazilian universities. RAI: Revista de Administração e Inovação, 15, 20-40.
3. Chais, C., Ganzer, P., & Olea, P.M. (2018). Technology transfer between universities and companies.
4. Devlin-Scherer, R., & Sardone, N.B. (2013). Collaboration as a Form of Professional Development: Improving Learning for Faculty and Students. College Teaching, 61, 30 - 37.
5. Fox, D., & Morrison, P. (2010). The introduction of a learning innovation to enhance the employability of event management students: an action research study.
6. Guo, P.J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: an empirical study of MOOC videos. Proceedings of the first ACM conference on Learning.
7. Ingram, J., & Andrews, N. (2020). Trying to improve communication skills: the challenge of joint sense making in classroom interactions.
8. Knol, M.H., in't Veld, R., Vorst, H.C., Driel, J.H., & Mellenbergh, G.J. (2013). Experimental Effects of Student Evaluations Coupled with Collaborative Consultation on College Professors' Instructional Skills. Research in Targeted professional training, 54, 825-850.
9. Kurniawan, Y., Wijaya, D.W., & Cabezas, D. (2021). Analysis Youtube Activities as An Engagement Media (a case study at school of information systems BINUS university). 2021 International Conference on Software Engineering & Computer Systems and 4th International Conference on Computational Science and Information Management (ICSECS-ICOCSIM), 661-666.
10. Manalu, C. (2022). The Use of Youtube to Enhance Students' Participation in Distance Learning Mode. Indonesian Journal of Instructional Media and Model.
11. Mason, C.M., Burns, S.M., & Bester, E.A. (2022). Supporting students' employability through structured, event-based engagement with employers. Education + Training.
12. Moghavvemi, S., Sulaiman, A., Jaafar, N.I., & Kasem, N. (2018). Social media as a complementary learning tool for teaching and learning: The case of youtube. The International Journal of Management Education, 16, 37-42.
13. Phan, P.H., & Siegel, D.S. (2006). The Effectiveness of University Technology Transfer.
14. Ramana, K. (2012). Collaborative Action Research - A Tool to Enrich Presentation Skills of the Professional Students.
15. Razzaq, R., Al-Shaibani, T., & Naguib, Y.M. (2021). Do Students Effectively Learn Physiology through Distance Online Instruction? Medical Students' Perceptions and Academic Performance. Advances in physiology education.
16. Sartipa, D., Munisah, E., & Sri kuning, D. (2022). Youtube as a Teaching Media to Enggage Students' Interest iIn Learning Speaking of English Language Learners At Universitas Muhammadiyah Kotabumi. e-Journal of Linguistics.

Beyond the pandemic: How has Covid-19 shaped the capability to adopt an Agile Blended Learning in HEI?

Amberlynn Bonello [1] [0009-0006-8950-5268], Emmanuel Francalanza [2] [0000-0003-0317-5909] and Antonio Maffei [3] [0000-0002-0723-1712]

[1] Department of Industrial and Manufacturing Engineering, Faculty of Engineering, University of Malta, Msida, MSD2080, Malta
amberlynn.bonello@um.edu.mt
[2] Department of Industrial and Manufacturing Engineering, Faculty of Engineering, University of Malta, Msida, MSD2080, Malta
emmanuel.francalanza@um.edu.mt
[3] Kungliga Tekniska Högskolan, SE-100 44 Stockholm, Sweden
maffei@kth.se

1 Introduction – Blended Learning post-pandemic

Blended Learning (BL) has been a topic for debate within academia for quite a long time. During the Covid-19 pandemic, in-person teaching gave way to newer pedagogies within very short periods of time. This created an incessant demand for online skills and tools which strained the resiliency of HEIs' resource availability and assurance of efficient remote access. These two, combined with the HEIs' agility to adapt to BL, are worth investigating further to anticipate and sustain potential future occurrences. Lazar et al. created a BL "scale" (BLS) to assess the relationship between the user and technology [1]. However, this BLS revolves around students; thus 'readiness' is not considered within a holistic HEI contest, underscoring the necessity for an updated scale in a post-pandemic society.

2 Research Questions: BL Agility, Resilience and Readiness

Two research questions are prompted: **RQ1: '**How did universities react to the Covid-19 situation, what skills and infrastructure were created, and will these suffice for a post Covid learning environment?' and **RQ2: '**How can the responsiveness of HEIs to take on board BL be measured with the aim of paving the way for resilient HEIs and ease of implementation of BL?'.

In attempt to answer these questions, this research work developed a framework that enlists a triad of key focus areas for HEIs: their agility, resilience, and readiness to adopt BL in a post-Covid dynamic. This paper then adopts a case study of six Faculties of Engineering in European universities from different countries, to assess said framework through an applicable and reproducible index. The ABL-HEIs (Agile Blended Learning for Higher Educational Institutions) framework provides a knowledge transfer (KT) roadmap through which an ABL-Resilience Index can be pursued. ABL echoes the ability (ABiLity) of HEIs to showcase resilience in overcoming adverse situations.

3 ABL-Resilience Index Results

The ABL-HEI index seeks to act as a guidance for any university wishing to assess its resilience, ability and preparedness to adopt BL, expanding on core issues such as what comprises a BL-oriented lecture delivery, mode of teaching, BL's impact on document sharing, modifications to examinations, psychological assistance and communication from support staff. All criteria contribute towards two scores, one pertaining to the first phase of Covid-19 (Phase 1 from 2019 to 2020) and the second result corresponding to Phase 2 that spans from 2020 to 2021. The first score indicates the agility and preparedness for BL during the pandemic, whereas the second embodies the resilience of the universities, that is, a reflection of their continuation in adopting or improving on the lessons acquired during Phase 1.

Upon analysis of the six universities' scores, it could be derived that some of them were not prepared to adopt BL on the get-go and had a slower reactive outlook than others. This stemmed from these universities making minor to no changes between the teaching pedagogy prior to Covid-19 and that during Phase 1. Thus, this reflected the potential absence of agility, preparedness, and readiness in terms of resources and knowledge available. However, in Phase 2 an interest turn of scores ensued; with most of the universities obtaining similar scores. Such scores would thus seem to imply that momentum was retained between Phase 1 and Phase 2 (for high scoring universities), but it could likewise mark a novel proactive approach being taken by universities that scored poorly in Phase 1. The choice of assigning scores for this case study is indicative of the index's potential to be embedded within engineering curriculum of HEIs seeking to opt for BL in a post Covid world.

4 Conclusion

This research work issued a two-fold contribution: a dedicated framework for assessing the agility of HEIs towards blended learning in the light of the Covid-19 pandemic, as well as an index to complement practical assessment towards understanding readiness and agility of HEIs adopting novel BL methods. Thus, this work sets the scene for wider impact and practical examples of how a BL framework ensued from the pandemic can be applied for a broader audience and diverse situations.

References

1. Lazar, I.M., Panisoara, G., Panisoara, I.O.: Digital technology adoption scale in the blended learning context in higher education: Development, validation and testing of a specific tool. PLoS ONE. 15, e0235957 (2020). https://doi.org/10.1371/journal.pone.0235957.

From tutored to self-paced MOOCs: reflections and perspectives

Simona Ferrari[0000-0002-4087-1535] and Serena Triacca[0000-0001-8854-5117]

Catholic University of the Sacred Heart, Milan, Italy
simona.ferrari@unicatt.it, serena.triacca@unicatt.it

1 Theoretical framework

Literature highlights the existence of different pedagogical formats of MOOCs dealing with two broad categories: instructor-paced and self-paced.

Generally, the former are characterized by a course path designed by the teacher, gradual release of contents, a set calendar and deadlines for learner completion of course components [1], fixed-schedule retention and work-load and tutor support.

In self-paced MOOCs, students can proceed at their own pace [2] not least because all the contents are available from the beginning. Other features include maximum user flexibility, personalization in that learners have control over when they access and complete course materials [3] and a lack of direct learner-instructor interactions.

A common issue deals with the low retention value, reaching 5-10% [4]; an increasing trend of studies on this topic among 2016-2021 lead to map the factors that affect retention, distinguishing them into external (motivation, perceived usefulness, social influence) and internal (covering content, perceived enjoyment, infrastructure) [5]. Ihantola et al. recognized a better overall retention rate (45%) in instructor-paced than its self-paced counterpart (13%) [6]. The other common feature is to require individual learners to be able to self-regulate their learning, determining when and how to engage. Indeed, weakness of self-regulation skills is one of the key factors that contribute to dropout in a MOOC [7]. Course design factors influence learners' self-directed learning and commitment above all in self-paced MOOCs [8].

2 Contexts, objectives and methodology

Since 2014 seven different MOOCs have been released by CREMIT and ILAB of Catholic University. In this contribution we will focus on three MOOCs shifted from "tutored" to "self-paced" modality over the years. The design of the tutored MOOCs [9] changed specifically with respect to timing (content availability, duration), role of the tutor, e-tivities, discussion board (Table 1). The purpose of the exploratory study is to understand whether and what design elements of self-paced MOOCs need to be strengthened to ensure an effective learning experience. From the universe of reference (17 editions of three MOOCs: "Virtually", "3-6-9-12: growing up with digital screens", "Community tutor"), the study focuses on a sample of 6 editions, 3 tutored and 3 self-paced, released in the last three years.

Table 1. Elements of design

	Content availability	Duration	E-tutor's role	E-tivities	Discussion board
Tutored	weekly release	2/3 months	subject matter expert, e-moderator, community manager, help desk	clear structure, posted in forum, reviewed by e-tutor and commented by peers (not mandatory)	strongly moderated, linked to specific modules and e-tivities
Self-paced	all available at the beginning	1 year	subject matter expert, help desk	suggested material	weakly moderated, linked to contents

A web-based survey, composed of 16 multiple-choice items organized in several areas (personal information, customer satisfaction, role acted in the course, perception of other participants), was made available to all subscribers. In the survey of self-paced MOOCs, a specific question was added to assess the perceived influence of the elements of the design on the learning process. A descriptive analysis of the items was carried out. An overview of the tracking data of the MOOCs is shown in Table 2. The completion rate is high in both modalities and differs from the literature.

Table 2. Overview of the tracking data

	No. Participants		No. Attendance certificates		% Attendance certificates		No. Collected responses (final survey)		% Collected responses (final survey)	
	universe	*sample*	*universe*	*sample*	*universe*	*sample*	*universe*	*sample*	*universe*	*sample*
Tutored	8020	1245	4774	534	59,53%	42,89%	3082	501	38,43%	40,24%
Self-paced	2613	1663	890	559	34,06%	33,61%	720	525	27,55%	31,57%
Total	10633	2908	5664	1093	-	-	3802	1026	-	-

3 Results and perspectives

Overall satisfaction between tutored and self-paced MOOCs maintains high average values ("totally satisfied/very satisfied" 83,30% and 77,47%). Values are also high with respect to several design elements. In this scenario four elements are unexpected in self-paced MOOCs, compared to tutored MOOCs:

- with respect to the average time spent consulting each module, a significant increase is evident in those spending more than 4 hours (18,22%, compared to 5% of MOOCs tutored);
- changes in self-perception of role acted in the course: data show a shift toward a more participatory behavior (-8,59% silent student; +5,27% entrepreneurial student; +4,57% altruist student);
- a significant increase of involvement in a learning community (+12,67% reports feeling "fully involved");
- openness of the MOOC seems to be not understood ("autonomy in using of the materials" is not a decisive factor for those who have completed the course -31,22%; "lack of time" is considered the main cause of non-completion +34,23%).

In perspective, in the re-design process we will focus on supporting users to build awareness about the meaning of the attendance of a self-paced MOOC and on "educating for participation", through delivering propaedeutic module, testing a chatbot to run an informative function, developing HTML-based contents and soft tutoring, in order to foster involvement through interactivity and feed-back.

References

1. Watson, W.R., Yu, J.H., & Watson, S.L.: Perceived attitudinal learning in a self-paced versus fixed-schedule MOOC. Educational Media International 55(2), 170-181 (2018).
2. Moreno-Marcos, P.M., Muñoz-Merino, P.J., Maldonado-Mahauad, J., Perez-Sanagustin, M., Alario-Hoyos, C., Kloos, C.D.: Temporal analysis for dropout prediction using self-regulated learning strategies in self-paced MOOCs. Computers & Education 145 (2020).
3. Onah, D.F., Pang, E.L., Sinclair, J.E., Uhomoibhi, J.: An innovative MOOC platform: the implications of self-directed learning abilities to improve motivation in learning and to support self-regulation. The International Journal of Information and Learning Technology 38(3), 283-298 (2021).
4. Goopio, J., Cheung, C.: The MOOC dropout phenomenon and retention strategies. Journal of Teaching in Travel and Tourism 21(2), 177–197 (2021).
5. Liliana, L., Santosa, P.I., Kusumawardani, S.S.: Completion factor in massive open online course in developing countries: A literature review in 2015-2021. World Journal on Educational Technology: Current Issues 14(2), 456-472 (2022).
6. Ihantola, P., Fronza, I., Mikkonen, T., Noponen, M., Hellas, A.: Deadlines and MOOCs: how do students behave in MOOCs with and without deadlines. In: 2020 IEEE Frontiers in Education Conference (FIE), pp. 1-9. Uppsala, Sweden (2020).
7. Zimmerman, B.J.: Attaining self-regulation: A social cognitive perspective. In: Boekaerts, M., Pintrich, P.R., Zeidner, M. (eds.) Handbook of self-regulation, pp. 13-39. Academic press (2000).
8. Kim, D., Jung, E., Yoon, M., Chang, Y., Park, S., Demir, F.: Exploring the structural relationships between course design factors, learner commitment, self-directed learning, and intentions for further learning in a self-paced MOOC. Computers & Education, 166 (2021).
9. Ferrari, S., Rivoltella, P. C., Rizzi, C., Scott, F.: Designing MOOCs in Higher Education. Outcomes of an experimentation at the Catholic University of Milan. REM, 7(1), 1-10 (2015).

PANDORA challenge

Maurizio Dabbicco[1] [0000- 0003-0571-1517] and Rosa Gallelli[2] [0000-0001-7765-5628]

[1] Università degli Studi di Bari "Aldo Moro", Dipartimento Interateneo di Fisica, via Giovanni Amendola 173, 70126 Bari, Italy
[2] Università degli Studi di Bari "Aldo Moro", Dipartimento di Scienze della Formazione Psicologia Comunicazione, via Scipione Crisanzio 46, 70122 Bari, Italy
maurizio.dabbicco@uniba.it

Despite of the extension of Sapiens' frontal cortex and the forecasting ability of the mathematical models it develops, in many senses Sapiens is a baby-species [1]: it uses words before knowing their meaning, experiments with tools before assessing the consequences, destroys entire worlds before understanding the reason for their very existence. It is on the verge of leaving the planet Earth, it has gained control over biological, emotional and willpower knobs and yet the 'big question' is: *Is Sapiens ready for it?* If not, how can we get prepared? If yes, what is the toolbox we will carry along?

PANDORA challenge aims to create a center for advanced studies on science, technology, society and advanced research in human education at large at the University of Bari. It stems from a seed-project funded in 2021 to promote contamination of different disciplinary scholars interested to the theme of *spaces* at large. The original acronym, that synthetized the idea of creating a Polymathic Agora and New Dimensional Observatory on Research in *Aerospace*, can embrace a broader scope by changing the last word with *Anthropogenetics*, thus comprising both opportunities/challenges presented by the exploration of the *outer* space and those encountered while investigating the unknowns of the *inner* space.

PANDORA will contribute to elaborate the governance of the transition from a human society biologically adapted and rationally educated to living on Earth to a humanity potentially free from the current constraints imposed by the biology, culture and ecology of this planet.

This contribution is meant to be a signal sent to the community interested and involved in educational and training processes at all levels, with the hope of receiving numerous responses about the way to stimulate self-reflective attitude on transformational questions in the higher education programs.

Paraphrasing the title of Nobel Prize winner R.P. Feynman's famous lecture [2], we could say "There's Plenty of Room at the Top: An Invitation to Enter a New Field of Humanity". There is a great deal of enthusiasm about the outer space [3]. Is it because of the innate curiosity of mankind, or is it due to the endemic irresponsibility of human society, unable to develop a systemic vision capable of preserving the conditions of life on the host planet?

Either case, while physicists explore the theoretical possibilities of breaching the space-time constraints of the observable universe [4], biologists question the perfection that we often recognize to Nature's solutions to the problems of adaptation of living beings on this planet, that has come in a few billion years of trials and errors in virtually

stationary conditions. Will we try to reproduce (artificially) similar conditions elsewhere? Will we try to substitute (artificially) our vital functions to survive on different planets? Will we accept the changes in our anatomy and physiology necessary to adapt them to life in other conditions?

In the meanwhile, other *spaces* are opening at the horizon, the nearest dealing with the geometry of Artificial Intelligence and Gene Editing, but quantum and nano technologies will soon appear as new players on the ground, questioning *Human* on the direction to take - *Species* or *Being*, *Super-* or *Trans-*.

Education programs often lag behind societal transformations that are driven by technology even before politics. The faster the technology changes, the wider the divide with formal education becomes. The university plays a special role in the model of innovation (quadruple helix): not only it is the place where knowledge is elaborated and transferred, it is the place where knowledge is created in the first instance.

The relative weight of creation, elaboration and dissemination is today unbalanced in favor of creation/research with little attention to foster critical thinking and contamination among researchers and even less effort devoted to adequate teaching methods to the learning profile of new generations and to promote *scientific citizenship rights*.

Together with the specialized training needed to keep the pace with the fast-changing world, PANDORA aims to becoming the place where the contamination between disciplinary knowledges takes place, leaven for the formation of future generations and future teachers, possibly in strict collaboration with the Teaching Learning Centre and Service and the Digital Education Hub that the host university is programming in the next years.

If, on the one hand, the opening of Pandora's box releases unstoppable currents that push towards unknown spaces, on the other hand the basic scientific knowledge even of people with a diploma of higher education, and who are, like everyone else, called to navigate these spaces, are largely inadequate. Along with research coordination and education advocacy, PANDORA will stimulate and fuel the student's and public awareness on science-based thinking and decision making.

The 'big question' asked before does not have a single answer. It is a generative question calling for interpretations and declinations, deconditioning and rethinking, imagination and vision. In the near future, if not tomorrow, the equation proposed by Y. N. Harari [5] B x C x D = AHH (*Biological* knowledge x *Computing* power x *Data* availability = *Ability* to *Hack Humans*) will begin to unfold its countless solutions out of the Pandora's box of life adapted on Earth.

PANDORA calls on the most collaborative and curious minds, willing to consider possible solutions without dogmatic prejudices, to imagine a future for humanity based on the technology we glimpse, but also on the new science we can discover.

MD acknowledges the Horizon EuropeSeed 2021 funding from the University of Bari "Aldo Moro" awarded to the PANDORA project, coordinated by Prof. Francesco Giordano.

References

1. Ceruti, M., Pievani, T.: The Incompleteness of Each Tradition: Toward an Ethic of Complexity, World Futures, 61(4), 291-306 (2005).
2. Drexel, E. (2009, December 29). There is plenty of room at the bottom. Message posted to https://web.archive.org/web/20170105015142/http://www.its.caltech.edu/~feynman/plenty.html, last accessed 2023/08/01
3. NASA - National Aeronautics and Space Administration. Missions., last accessed 2023/08/01.
4. Hassan, Z., Mandal, S., Sahoo, P.K.: Traversable Wormhole Geometries in f(Q) Gravity. Fortschritte der Physik, 69(6), 2100023 (2021).
5. Harari, Y.N.: 21 Lessons for the 21st Century. Vintage (2019).

Teacher evaluation for teacher qualification. A web Platform for "differentiated homologation" of the teacher's professionalism.

Ida Verna[1]

[1]Department of Management and Business Administration,
Unversity G. d'Annunzio of Chieti-Pescara – Italy.
Ida.verna@unich.it

1 Introduction

The aim of the work is to present a web platform aimed at evaluating /self-evaluating the performanceof teachers and students for the professional qualification of the teacher with respect to the training needs of students (and other stakeholders). The work starts from the attempt to define a concept of teaching quality that represents a shareable reference, "ideal" for the development of the professionalism of the teacher with respect to his own teaching-learning context (disciplinary, social,cultural, University). To this end, a holistic approach has been developed and subsequently translatedinto a web platform, as a guide for the teacher in the evaluation and self-evaluation of the quality of his teaching, highlighting the gap between "Ideal Quality" and real quality.

1.1 "Ideal" Teaching quality concept for evaluation and improvement teaching qualification

Universities around the world are oriented towards a constant search for improvement of the qualityof teaching by focusing on the subject who learns and shifting attention from content to skills (Zaggia,2008), from training objectives to expected learning outcomes (Caspersen, Smeby & Aamodt, 2017). In Europe, the Bologna Process (1999) plays a decisive role in the reorganization of the university system and Quality Assurance (QA) guides the processes of quality assurance and assurance of teaching and research through the AVA system. The TQM, in its principles and methods, is the basisof the AVA system. Quality methods such as the PDCA cycle (Plan, Do, Check, Act) by Deming (Deming, 1951) guide the design, management, evaluation and continuous improvement of the quality of Study Courses and individual courses, considered as a whole (Verna, 2008; Verna et al., 2019). The constructive alignment of Biggs orients the actors of training in the design of curricula and teachings, in line with teaching strategies and with the evaluation of learning.
The combination of principles and methods of TQM represent the conceptual bases of the holistic model proposed in this work (web platform "L'Ascolto"). This model places the centrality on the subject in learning (listening and satisfaction of students' needs) through listening and satisfaction ofthe training needs of the teacher (professional qualification) - or those training needs that, if met, allow to fill the gap training of students. With student-centred learning, the role of the teacher and the development of his professionalism becomes an object of international interest (ENQA, 2007; OECD, 2012; EC, 2013; EHEA, 2020). Ultimately, if with the Bologna

process the predominantly normative vision of teaching has prevented a more careful reflection onthe complexityof teaching, excluding a determining factor for achieving the quality of university teaching: “a professional truly capable of teaching" (Felisatti, p.70, 2020), today literature places great interest inthis theme, while highlighting its main difficulties. The work proposes, first of all, a definition of teaching quality as a possible reference for the development of the professionalism of the teacher. The proposed concept of quality has two components: a “Static” one, i.e., linked to the theoretical bases on which the proposed platform is based (Verna, 2008; Verna, 2014; Verna et al., 2019; Verna & Verna, 2021) and a "Dynamic" that builds the teacher from experience in their own teaching learning context (Verna, 2020). The definition of a concept of quality which is onthe one hand the result of a shared approach to the continuous improvement of teaching processes (static quality) and on the other hand the result of differentiations linked to listening to the needs of the context (dynamic quality) allows to obtain significant feedback to guide the improvement of quality both from the point of view of “homologation” and “differentiation”.

1.2 The web platform “L'Ascolto”

With reference to the concept of quality proposed above, a holistic approach to university teaching has been developed, translated into a web platform (L'Ascolto), whose purpose is to guide teachers towards the knowledge of the complexity of teaching (systemic, dynamic and contextual) and the quality of their teaching through continuous processes of evaluation and self-evaluation on the qualityof their teaching. A summary scheme is proposed below (fig.1), representative of the conceptual bases of the platform. In particular, fig.1 shows how the teacher is involved in continuous cycles of design,management, evaluation and improvement of the quality of his teaching. The feedback (Check phase)deriving from these processes (PDCA) informs the teacher about their needs for "professional qualification" (communication techniques, teaching strategies, disciplinary skills) those that must bemet in order to meet the training needs of students (and other stakeholders). The aim is to develop theprofessionalism of the teacher according to the training needs of students and other stakeholders (teaching-learning context-dynamic quality), according to a uniform and coherent approach (*static quality*). The Listening platform follows the logic of figure 1 and represents the translation of a holistic approach to university teaching (through two algorithms, Verna & Verna, 2017), into a software (Verna & Verna, 2021) with a focus on the teacher, but for use by all training actors and aimed at improving and innovating all university teaching processes. The best practices deriving from this approach to teaching are organized in a systematic and structured way in the platform and shared (through a specific language) with all the teachers who are operating in the same context conditions,realizing in this sense the self-training of the teacher. The continuous feedback, offered by the Check phase, allows the teacher to collect useful informationto formulate / modify or replace the initial teaching strategies, improve the design, and activate the improvement. The innovation that arises from the continuous solicitation of teachers to experiment with new teaching strategies, guided by continuous processes of evaluation and self-evaluation of the processes in progress is "formalized" and shared (experiential learning)

through a language that allows the teacher to achieve a progressive knowledge and contextualized of the concept of quality of teaching (professional qualification).

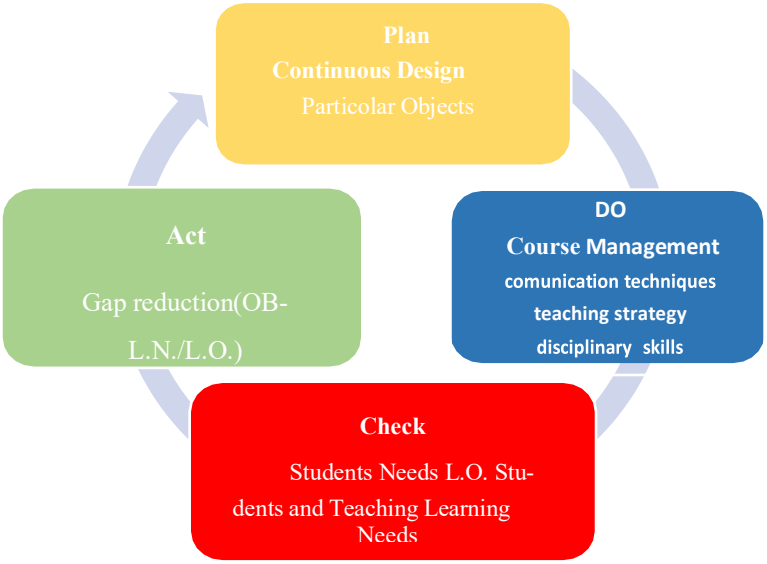


Fig. 1 Evaluation and self-evaluation of the quality of teaching for the qualification of the teacher's professionalism.

References

1. Zaggia, C.: L'Università delle Competenze. Progettazione e valutazione dei corsi di laurea nel processo di Bologna. FrancoAngeli, Milano (2008).
2. Caspersen, J., Smeby, J.C., & Olaf Aamodt, p.: Measuring learning outcomes. European lournal of Education, 52(1), pp.20-30 (2017).
3. Felisatti, E.: Verso la costruzione di una "via italiana" alla qualificazione didattica della docenza universitaria. In A. Lotti & P.A. Lampugnani, Faculty Development in Italia. Valorizzazione delle competenze didattiche dei docenti universitari, 69-79, Genova University Press, Genova, (2020).
4. Verna, I.: The Quality Function Deployment and the customer satisfaction. The case of universities". European Scientific Journal, Special Edition, 8, pp.189- 202 (2014).
5. Verna, I.: Flexibility in Learning and Teaching Styles in an Accounting Course. 'Deming Towards Kolb". International Business Research, 13, pp. 77-99 (2020).
6. Verna, I. Antonucci, G., Sargiacomo, M., Venditti, M.: Listening as 'Guiding Tool' in the Continuous Improvement of University Education: A Holistic Approach. European Scientific Journal, 15 (25), pp. 57-78 (2019).
7. Verna, I., Ianni, L., D'Andreamatteo A., & Venditti, M.: Un approccio olistico alla misurazione della performance nella formazione universitaria. Un modello sperimentale: l'Ascolto. In Paolini, A. Del Bene L. (ed), Monitorare la performance delle università statali e utilizzarne gli esiti per generare valore pubblico, GdL SIDREA, Franco Angeli, Milano (2021).

SPECIAL TRACK 1

"SMART SYSTEMS FOR CONTEXT-AWARE EDUCATION"

ORGANIZERS:

PASQUALE ARDIMENTO, UNIVERSITY OF BARI ALDO MORO, ITALY

MARIO LUCA BERNARDI, UNIVERSITY OF SANNIO, ITALY

Digital multisensory storytelling as educational-didactic methodology for emotional literacy

Elisabetta Tombolini[1][0000-0001-9935-3030] and Claudia Chierichetti[2][0000-0001-6474-6686]

[1] Niccolò Cusano University, Roma RM 00166, Italy, elisabetta.tombolini@unicusano.com
[2] Niccolò Cusano University, Roma RM 00166, Italy, claudia.chierichetti@unicusano.com

1 The digital and multisensory components in storytelling

The learning process can benefit from the role played by a functional development of socio-emotional skills, in which digital and multisensory components can support the promotion of this. Therefore, it is intended to investigate the potential effects of digital multisensory storytelling as a tool of emotional literacy.

Storytelling is a methodology that uses narration to give meaning to reality; shared reading experiences enable children to acquire language skills and develop emotional literacy. When we listen to stories, some areas of the brain, linked to cognitive control, emotions and empathy, are activated as if the subject were experiencing them (O'Byrne et al., 2018). To date, the nature of storytelling is changing due to emerging digital tools, so much so that it has given rise to digital storytelling (Di Fuccio et al., 2016). The use of technological tools creates dynamic and emotional learning contexts in which texts, recorded voices, music, sounds, images and videos are combined, helping to maintain attention and encourage student engagement (Tisza & Markopoulos, 2021). The potential inherent in digital narration can be enhanced if supplemented with additional multi-sensory stimuli: in fact, it has emerged that in learning environments where the senses are stimulated simultaneously, it shows an improvement in the acquisition of information (Matos et al., 2015). Sensory signals transmit, in addition to in-formation of a descriptive nature of the surrounding environment, important characteristics related to the emotional aspect of stimuli, enriching the process of perception. The activity of amygdala allows the integration of multisensory in-formation with those of emotional nature. The integration of emotional signals, coming from both visual and auditory modes of perception, enriches the perceptual process (Jean Ayres, 2012).

Digital multisensory storytelling showed higher ability to recall the story orally and greater emotions in five-year-old children during the retelling (Chierichetti & Tombolini, 2023).

2 Emotional literacy in learning environments

Emotions are involved in most functions related to cognitive aspects, interaction and action, and play a crucial role also in educational settings because of the sharing of the same brain networks that characterize the functioning of these complex processes (Gu

et al., 2012). It has been shown that negative contexts compromise the performance of a task: positive emotional conditions are associated with greater accuracy in acquiring information compared to neutral environments (Zhao & Guo, 2023). There is a direct link between emotions and learning: the former influence learning outcomes, playing a key role in modulating the attentive state and motivation processes, underlying the acquisition of information (Carmona-Halty et al, 2021). Emotions give greater prominence to the concepts learned and allow to keep a vivid and lasting memory over time.

Based on this evidence, the learning process must consider the individual as a human being, endowed with specific thoughts, emotions and feelings.

3 Method

The sample consists of 49 children aged between 3 and 5 years, randomly assigned. In the experimental group, digital multisensory storytelling was proposed: the story was projected and the video showed the same images as the book in animated form. To create a totally immersive environment and recreate the setting of the narrative, visual, auditory, olfactory and tactile stimuli were included, in order to stimulate the simultaneous activation of different sensory channels. In contrast, in the control group the same story was read and the illustrations of the book were shown. Later, the administration phase began in which the EMOJ software was used, which detects in real time the emotions experienced by the subject through the coding of facial expressions, and a recording protocol, de-signed on the model of "M6 -MNa" of NEPSY-II. The aim is to evaluate the narrative memory under two conditions: spontaneous and guided reconstruction. In order to assess how the context influences emotional recognition, some items investigated the children's ability to recall the emotions experienced by the protagonists of the story. The final aim is linked to the analysis of the role played by the educational-didactic context in the promotion of emotional literacy, a trans-versal and basic component in the process of learning acquisition.

4 Results and conclusion

The analysis of the data obtained in the emotional score section of the recording protocol showed how the averages of the two groups differed, as shown in Table 1, denoting a higher score in favour of the subjects who participated in the digital multisensory storytelling.

Table 1. Descriptive analysis of the data

	Methodology	N	Mancanti	Media	Mediana	SD	Minimo	Massimo
Emotive Scoring	DMS	37	0	3.16	3	0.501	2	4
	ST	12	0	2.67	3.00	0.492	2	3

Emotional activation was also detected through the EMOJ software, which recorded more positive emotions, such as joy, present in the retelling phase in the subjects of the experimental group than in the recipients of conventional storytelling.

References

1. Carmona-Halty, M., Salanova, M., Llorens, S. & Schaufeli, W.: Linking positive emotions and academic performance: The mediated role of academic psychological capital and academic engagement. Current Psychology, 40, 2938-2947 (2021).
2. Chierichetti C. & Tombolini E.: Digital multisensory storytelling as educational-didactic methodology, Italian Journal of Health Education, Sports and Inclusive Didactics, (2023).
3. Di Fuccio, R., Ponticorvo, M., Ferrara, F., Miglino, O.: Digital and Multisensory Storytelling: Narration with Smell, Taste and Touch. In K. Verbert, M. Sharples, & T. Klobucar (Eds.), EUROPEAN CONFERENCE ON TECHNOLOGY ENHANCED LEARNING, pp. 509-512. Springer (2016).
4. Gu, X., Liu, X., Van Dam, N., Hof, P. & Fan, J.: Cognition–Emotion Integration in the Anterior Insular Cortex. Cerebral Cortex, 23 (1), 20-27 (2012).
5. Jean Ayres, A., Muratori, F. & Campatelli, G.: Il bambino e l'integrazione sensoriale. Le sfide nascoste della sensorialità. Giovanni Fioriti Editore, Roma (2012).
6. Matos, A., Rocha, T., Cabral, L. & Bessa, M.: Multi-sensory storytelling to support learning for people with intellectual disability: an exploratory didactic study. Procedia Computer Science, 12-18 (2015).
7. O'Byrne, W. I., Stone, R., & White, M.: Digital Storytelling in Early Childhood: Student Illustrations Shaping Social Interactions. Frontiers in psychology, 1800 (9) (2018).
8. Tisza, G. & Markopoulos, P., FunQ: Measuring the fun experience of a learning activity with adolescents. Current Psychology, 42, 1936-1956 (2021).
9. Zhao, J. & Guo, J.: The temporal mechanism of contextual emotions' effects on novel abstract and concrete word learning. Neuroscience Letters, 805, 137227 (2023).
10. LNCS Homepage, http://www.springer.com/lncs, last accessed 2016/11/21.

Empowering Computer Engineering Education: Leveraging Cloud-Based Programming Platforms and Online Assessment Tools

Sandi Ljubic[1,2][0000−0003−3456−8369], Arian Skoki[1,2][0000−0002−7164−1994], Franko Hržić[1,2][0000−0003−1513−0337], and Alen Salkanovic[1,2][0000−0002−4892−817X]

[1] University of Rijeka, Faculty of Engineering, Vukovarska 58, 51000 Rijeka, Croatia
[2] Center for Artificial Intelligence and Cybersecurity, University of Rijeka, R. Matejcic 2, 51000 Rijeka, Croatia
{sandi.ljubic,arian.skoki,franko.hrzic,alen.salkanovic}@riteh.hr

1 Introduction

In computer engineering (CE), traditional teaching and learning methods present significant obstacles for students and instructors in foundational courses. These challenges become apparent when, for example, students need to program solutions to a specific problem, query databases for a particular data, or deal with multithreading-based issues, as they often face delayed assessment and feedback. In addition, faculty must evaluate many student submissions while coping with pen-and-paper context, subjective biases, fatigue, and lack of time. However, the CE study program at our institution has embarked on a transformative journey by integrating specialized tools into these courses. By using cloud-based programming platforms and online assessment tools, we have significantly improved the educational landscape of CE and overcame the hurdles of delayed feedback and biased evaluations. We present compelling case studies demonstrating how these tools have transformed several courses' teaching and learning experiences. Through these case studies, we highlight the practical benefits and demonstrate the power of technology in fostering the development of practical skills and comprehensive assessments in CE education.

Two prominent tools have proven influential in different contexts, Google Colab [1–4] and Online Judge [5–8], so we have used them in the course on operating systems and in courses on programming and the use of SQL.

2 Google Colab in Operating Systems Course

Google Colab, a cloud-based platform for coding and collaboration, provided us with an opportunity to enhance the teaching and learning experience in the Operating Systems course. The interactive learning environment allows students to focus on core concepts and practical applications rather than spending time on complex setup procedures. By providing a standardized and accessible platform, Google Colab ensures all students have the same opportunities to engage with the course material, regardless of hardware or software limitations.

Operating Systems course often requires students to perform experiments and analyze system behavior. Google Colab's backend allows students to run code and perform experiments in real-time, enabling a more comprehensive understanding of topics such as computer security, system calls, shell access, interprocess communication, deadlocks, threads, and memory management.

Google Colab integrates seamlessly with third-party web services, empowering educators to provide additional resources and supplemental materials easily. By sharing code templates, relevant documentation, and datasets, students can readily engage in hands-on exercises without the need for complex environment setups. A key advantage of Google Colab is its cost-effectiveness and accessibility. It runs entirely in the browser, so no high-end hardware is required.

3 Online Judge in Programming and SQL-based Courses

In the Online Judge system, a teacher can provide a diverse repertoire of problems in both programming and database domains. In programming courses, teachers can define problem sets with predefined test cases, while in database courses, expected outputs can be specified for SQL queries. Students in programming courses can develop their problem-solving skills by solving coding challenges that simulate real-world scenarios. In database courses, students can hone their SQL skills by working on problems that involve query optimization and data manipulation.

Online Judge provides immediate feedback on students' submissions. In programming courses, students receive instant feedback on the correctness and efficiency of their code, which encourages iterative learning and improvement. In database-oriented courses, students receive feedback on the correctness of SQL queries. This iterative feedback loop allows students to identify errors, optimize their solutions, and refine their SQL proficiency.

Online Judge thus facilitates the automation of the assessment process, saving instructors valuable time and effort. This automated assessment ensures fair grading and eliminates potential bias, ensuring a consistent evaluation process.

4 Conclusion

The cases presented above concisely describe the shift in foundational CE courses from standalone desktop context and pen-and-paper assessments to online learning, interactive and collaborative training, and automated, unbiased evaluations. Initially, the featured platforms were introduced to improve skill acquisition and the learning experience while enabling automated assessments and easier course management. During the pandemic, they proved even more valuable as COVID-19 response required an online context. We propose to use these tools to blend F2F and online learning to create an enriching educational environment.

Acknowledgements This work was supported in part by EU under grant agreement no. 2021-1-SE01-KA220-HED-000023166, project ERASMUS+ BLISS.

References

1. Nelson, M.J., Hoover, A.K.: Notes on Using Google Colaboratory in AI Education. In: Proc. ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE '20), pp. 533–534. ACM (2020). https://doi.org/10.1145/3341525.3393997
2. Kuroki, M.: Using Python and Google Colab to teach undergraduate microeconomic theory. International Review of Economics Education **38** (2021). https://doi.org/10.1016/j.iree.2021.100225
3. Fernández-Solas, Á., Micheli, L., Almonacid, F., Fernández, E.F.: Google Colaboratory: A Teaching Tool for PV Education. In: Proc. 2022 Congreso de Tecnología, Aprendizaje y Enseñanza de la Electrónica (XV Technologies Applied to Electronics Teaching Conference), pp. 1–7. IEEE (2022). https://doi.org/10.1109/TAEE54169.2022.9840608
4. Carneiro, T., Medeiros Da NóBrega, R.V., Nepomuceno, T., Bian, G.-B., De Albuquerque, V.H.C., Filho, P.P.R.: Performance Analysis of Google Colaboratory as a Tool for Accelerating Deep Learning Applications. IEEE Access **6**, 61677–61685 (2018). https://doi.org/10.1109/ACCESS.2018.2874767
5. Bilegjargal, D., Hsueh, N.-L.: Understanding Students' Acceptance of Online Judge System in Programming Courses: A Structural Equation Modeling Approach. IEEE Access **9**, 152606–152615 (2021). https://doi.org/10.1109/ACCESS.2021.3126896
6. Kim, S., Park, J., Jeon, S., Seo, D.: Web-Based Online Judge System for Online Programming Education. In: Proc. IEEE International Conference on Consumer Electronics (ICCE), pp. 1–3. IEEE (2022). https://doi.org/10.1109/ICCE53296.2022.9730422
7. Zhou, W., Pan, Y., Zhou, Y., Sun, G.: The framework of a new online judge system for programming education. In: Proc. ACM Turing Celebration Conference (TURC '18), pp. 9–14. ACM (2018). https://doi.org/10.1145/3210713.3210721
8. Wang, G.P., Chen, S.Y., Yang, X., Feng, R.: OJPOT: online judge & practice oriented teaching idea in programming courses. European Journal of Engineering Education **41**(3), 304–319 (2016). https://doi.org/10.1080/03043797.2015.1056105

Process Mining techniques applied to learning management systems

Pasquale Ardimento[1[0000-0001-6134-2993]] and Michele Scalera[1[0000-0002-2455-2032]]

[1] Università degli Studi di Bari Aldo Moro, Department of Informatics, Bari (Italy)
pasquale.ardimento@uniba.it, michele.scalera@uniba.it

1 Introduction

Process Mining (PM) in education, known as Educational Process Mining (EPM), aims to create a comprehensive learning process model, compare it to observed behavior, and enhance understanding of the process. The Systematic Literature Review (SLR) proposed here explores the research characteristics of applying PM techniques to Learning Management System (LMS), including study objectives, types of PM used, and tools employed. In more detail, the SLR addresses the following research question (RQ): what are the PM techniques applied to LMS?

2 Methodology and results

The methodology used is a Systematic Literature Review (SLR), based on the original guidelines as proposed by [2], consisting of five stages: 1) define the research question; 2) search process; 3) apply exclusion and inclusion criteria; 4) implement quality assessment; 5) synthesize. The evidence search process begins with defining the query string that is: "Process Mining" AND "Education" AND ("Learning Management System" OR "Massive Open Online Courses"). LMS and MOOC are the objects being examined in this literature review. MOOCs are online courses aimed at unlimited participation and accessed via the web. Journal repositories queried are ScienceDirect, IEEE Digital library, Wiley Online Library, Emerald, and ACM Digital Library. The initial search returned 77 candidate articles. The candidate articles were then screened by inclusion and exclusion criteria and rescreened for duplicate articles, leaving us with 36 candidate articles. Inclusion criteria applied are as follows: literature of English journal articles, literature published in 2017 to May 2023, literature mentioning keywords in the abstract, and Derived from the ScienceDirect, IEEE, Wiley Online Library, Emerald, and ACM databases Digital Library. As the exclusion criteria, this study excluded literature that did not discuss keywords further as described in the inclusion criteria. This study excludes all literature besides journal articles. Quality assessment was carried out on the candidate articles and resulted in 26 articles reviewed in this paper [3]. Quality assessment is conducted by perusing the articles and assessing if PM techniques are used as part of the reference and further discussed as part of the experiment. Some articles were excluded for duplication,

and most were screened for not involving PM in the experiment. The preparation of the synthesis begins with making a scheme to determine the relevant aspects to be highlighted in this research. The attributes specified in this case include title, author, year of publication, location of research associations, journal database, study objectives, PM type, algorithm, tools, LMS content appointed as case studies, and results. 13 articles from 26 articles analyzed aimed to find behavioral patterns using the discovery type of PM technique. Research with discovery type dominates as much as 50%. The most dominating data mining technique used for discovery type is the Fuzzy Miner. Fuzzy Miner from the ProM plug-in was used to compare the activity sequences among students who passed and students who failed the course and to identify infrequent variants. There are 4 articles (15.38%) implementing conformance checking type. The synthesis results conclude that no articles have carried out the PM technique for improvement. An article does not use any type of PM because the PM dataset reviews the quality comparison of clustering algorithms. The discovery type article was successfully carried out to evaluate the implementation of learning strategies, predicting performance based on student behavior, problem-solving for the preparation of class materials and activities, and comparison of student behavior. Meanwhile, conformance checking type articles succeeded in meeting the objectives of analyzing student retention factors, making performance predictions based on student behavior [1], and comparing student behavior. The most tool used in PM research in using LMS is Disco (9 articles). Disco is a commercial application for process mining also providing a full version with an academic license. Another tool widely used is ProM, written in JAVA, that provides algorithms to support process mining. Some articles combine several tools, namely KNIME, Disco, and ProM. KNIME is free, open-source software for creating data science. Another combination is Disco with Celonis. Celonis is execution management that provides companies to run business processes entirely on data and intelligence. Only 1 article uses XGBox, whereas 2 articles use R platform and pMineR. XGBoost is an optimized distributed gradient boosting library, R platform is an environment for statistical computing and graphics, and pMineR is an R library supporting PM in HealthCare.

References

1. N. Třcka and M. Pechenizkiy, “From local patterns to global models: Towards domain driven educational process mining,” ISDA 2009 - 9th Int. Conf. Intell. Syst. Des. Appl., pp. 1114– 1119, 2009, doi: 10.1109/ISDA.2009.159.
2. B. Kitchenham, O. Pearl Brereton, D. Budgen, M. Turner, J. Bailey, and S. Linkman, “Systematic literature reviews in software engineering - A systematic literature review,” Inf. Softw. Technol., vol. 51, no. 1, pp. 7–15, 2009, doi: 10.1016/j.infsof.2008.09.009.
3. List of selected papers available at https://docs.google.com/spreadsheets/d/1KqgDhfDIxMpseR7Cr0qWy6TzxZK7LSw2poI083z6COs/edit?usp=sharing

Explainable AI Tools for Educational Data

Gabriella Casalino[1 [0000−0003−0713−2260]], Giovanna Castellano[1 [0000−0002−6489−8628]], Pietro Ducange[2 [0000−0003−4510−1350]], Michela Fazzolari[3 [0000−0002−8562−6904]], Riccardo Pecori[4,5 [0000−0002−5948−5845]], and Gianluca Zaza[1 [0000−0003−3272−9739]]

[1] University of Bari, Dep. of Computer Science, Via Orabona 4, Bari, Italy
[2] University of Pisa, Dep. of Information Engineering, Largo Lazzarino 1, Pisa, Italy
[3] IIT-CNR, Via Moruzzi 1, Pisa, Italy
[4] eCampus University, Via Isimbardi 10, 22060, Novedrate (CO), Italy
[5] IMEM-CNR, Parco Area delle Scienze 37/A, 43124, Parma, Italy

1 Introduction

The use of machine learning (ML) and artificial intelligence (AI) techniques has become increasingly pervasive in the world of education. Indeed, in this context, a great amount of data is continuously being produced by the management systems of training and educational entities such as universities and schools. In recent years, there have been many applications in which educational data have been considered and analyzed through ML/AI models in different contexts, such as teaching-learning workflow personalization and evaluation, detection of early drop-out, predicting the students' outcomes, and, in general, optimization of the educational processes [1].

Even in the educational context, it has become increasingly relevant to have systems that are accountable and reliable. The various educational stakeholders (students, teachers, managers, etc.) should be able to comprehend the decisions taken by AI-based applications and the structure of the models, both in terms of parameter description and features relevance [2]. For this reason, various frameworks that exploit eXplainable Artificial Intelligence (XAI) have recently been proposed [2, 3]. There exist two main approaches for designing XAI models, namely *ante-hoc* and *post-hoc* methods [4]. In the first case, in which rule-based models and decision trees are mostly considered, models are *explainable-by-design*, because they have an intrinsically explainable structure. In the second case, *post-hoc* procedures, which include LIME and Shapley Values among the most used techniques, are used to explain classical black-box models, such as neural networks, after the generation of the models themselves.

In this abstract, we provide a snapshot of some of the most used general-purpose tools and libraries that may be used for generating and evaluating XAI models in the educational context. Particularly, we have identified five factors that could be useful to choose the most suitable solution for a specific stakeholder.

Table 1. Tools comparison.

Tool	Post-hoc	Ante-hoc	Interface	Interactive	Customizable
Expliclass [5]	✓	✓	✓	✓	-
Weka [6]	-	✓	✓	-	✓
Orange Data Mining [7]	-	✓	✓	✓	✓
ExplainerDashboard	✓	-	✓	✓	✓
ELI5	✓	-	-	-	✓
SKMoefs [8]	-	✓	-	-	✓
FuzzyML [9]	-	✓	-	-	✓
FISDeT [10]	-	✓	✓	✓	✓

2 Tools comparison

To compare the considered tools, five factors were considered: the type of supported explanations, namely 1) Ante-hoc or 2) Post-hoc, 3) the presence of an interface that makes the interaction with the tool easy-to-use, or on the contrary, the necessity for coding, 4) the possibility of interacting with the derived explanations to better investigate the results, and 5) the possibility of customization, by adding source code or modules, for example. These factors have been chosen since they are useful to discriminate the tools based on the users' needs.

Particularly, we focused on eight tools chosen among the most used ones, namely: *Expliclass*, *Weka*, *Orange*, *ExplainerDashboard*, *ELI5*, *SKMoefs*, *FuzzyML*, and *FISDeT*. Table 1 summarizes the presence (✓) or absence (-) of a given factor for each considered tool. Overall, we can observe that most of the selected tools integrate transparent algorithms able to return Ante-hoc explanations, thus not suitable to explain black-box models. Almost all the tools are customizable by adding code. This requires the knowledge of a programming language and it is not always straightforward for people working in the educational domain. In this regard, the presence of a graphical interface is crucial for non-technicians, such as students, professors, or technical staff. These final users need clear and easy interactions with the tool.

3 Conclusions and Future Work

To conclude, depending on the final stakeholders (developers or users) and their needs, different tools could be recommended. In this work, we analyzed five factors that could be useful to identify the most suitable tool.

Future research directions will better analyze the effectiveness of the derived explanations for the final users. To this aim a subset of Open University Dataset [11], containing information about students, courses, and their interactions with the University Virtual Learning Platform will be used to derive explanations from each tool. These explanations will be then evaluated by experts using, for example, the Technology Acceptance Model (TAM) [12].

Acknowledgements G. Casalino acknowledges funds from R&I 2014-2020 PON project. G. Zaza and G. Castellano thank FAIR-Future AI Research (PE13), Spoke6 Symbiotic AI (CUP H97G22000210007), by NextGenerationEU program. G. Casalino, G. Castellano, R. Pecori and G. Zaza acknowledge funds from "INdAM-GNCS Project" (CUP E53C22001930001). P. Ducange thanks PNRR-M4C2-Investimento 1.3, Partenariato Esteso PE13 "FAIR-Future Artificial Intelligence Research" Spoke1 "Human-centered AI". M. Fazzolari acknowledges SERICS project (PE14), funded by NextGenerationEU program.

References

1. Lijia Chen, Pingping Chen, and Zhijian Lin. Artificial intelligence in education: A review. *Ieee Access*, 8:75264–75278, 2020.
2. Hassan Khosravi, Simon Buckingham Shum, Guanliang Chen, Cristina Conati, Dragan Gasevic, Judy Kay, Simon Knight, Roberto Martinez-Maldonado, Shazia Sadiq, and Yi-Shan Tsai. Explainable Artificial Intelligence in education. *Computers and Education: Artificial Intelligence*, page 100074, 2022.
3. Gabriella Casalino, Pietro Ducange, Michela Fazzolari, and Riccardo Pecori. Fuzzy hoeffding decision trees for learning analytics. In *First Workshop on Online Learning from Uncertain Data Streams (OLUD 2022)*, 2022.
4. Alejandro Barredo Arrieta, Natalia Díaz-Rodríguez, Javier Del Ser, Adrien Bennetot, Siham Tabik, Alberto Barbado, Salvador García, Sergio Gil-López, Daniel Molina, Richard Benjamins, et al. Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. *Information fusion*, 58:82–115, 2020.
5. Jose M. Alonso and A. Bugarín. Expliclas: Automatic generation of explanations in natural language for weka classifiers. In *2019 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)*, pages 1–6, 2019.
6. Eibe Frank and A Mark. Hall, and ian h. witten (2016). the weka workbench. online appendix for" data mining: Practical machine learning tools and techniques, 2016.
7. Janez Demšar, Tomaž Curk, Aleš Erjavec, Črt Gorup, Tomaž Hočevar, Mitar Milutinovič, Martin Možina, Matija Polajnar, Marko Toplak, Anže Starič, et al. Orange: data mining toolbox in python. *the Journal of machine Learning research*, 14(1):2349–2353, 2013.
8. Gionatan Gallo, Vincenzo Ferrari, Francesco Marcelloni, and Pietro Ducange. Skmoefs: A library in python for designing accurate and explainable fuzzy models. In *Information Processing and Management of Uncertainty in Knowledge-Based Systems: 18th International Conference, IPMU 2020, Lisbon, Portugal, June 15–19, 2020, Proceedings, Part III 18*, pages 68–81. Springer, 2020.
9. Armando Segatori, Francesco Marcelloni, and Witold Pedrycz. On distributed fuzzy decision trees for big data. *IEEE Transactions on Fuzzy Systems*, 26(1):174–192, 2017.
10. Giovanna Castellano, Ciro Castiello, Vincenzo Pasquadibisceglie, and Gianluca Zaza. Fisdet: Fuzzy inference system development tool. *International Journal of Computational Intelligence Systems*, 10(1):13–22, 2017.
11. Gabriella Casalino, Giovanna Castellano, and Gennaro Vessio. Student oriented subset of the Open University Learning Analytics dataset, November 2020.
12. D Marikyan and S Papagiannidis. Technology acceptance model: A review. *TheoryHub Book. http://open. ncl. ac. uk*, 2022.

From Botany to Big Data: A Citizen Science Distance Education Initiative

Giorgio Delzanno, Daniele Grosso, Giovanna Guerrini, Federico Lebole, Enrica Roccotiello, Angela Sugliano, and Giovanni Adorni

Università degli Studi di Genova, Italy
{name.surname}@unige.it

A Citizen Science and Innovative Teaching Initiative. "From Botany to Big Data" is an educational initiative created as part of the activities of the Working Group for Research and Innovation on Digital Skills in Schools of the University of Genoa[1]. It started in May 2022 to support schools that won the "Edugreen" projects of the Italian Ministry of Education, aimed at the establishment of innovative and sustainable educational gardens and school gardens. In this setting, the goal of the initiative is to provide teachers -and thus their students- with perspectives and tools to make the green experience of the school garden an opportunity to exercise a plurality of skills in the STEM area, related to the emerging fields of ecological and digital transition and to be part to a citizen science initiative. An IoT/Big Data infrastructure, for transferring observation (biomass, growth, etc) and monitored data (pH, temperature, etc) from the schools to a cloud platform (the botany dashboard), plays the role of digital accelerator for the creation of a network to share data and knowledge with experts in the domain and other schools. This way, engagement is created by experimenting how to use digital devices for making the school garden a laboratory for the environment and to become a proactive agent of a citizen science experience [2].

The Diverse Skills involved. The educational proposal encompasses diverse learning outcomes for participants: 1) they learn the fundamentals of environmental and applied botany, 2) they acquire a scientific method by participating in a citizen science project, 3) they learn how to use digital devices and applications, 4) they learn how to process, interpret, and graphically represent the data from their observations.

The aspects related to environmental and applied botany focus on defining a methodological approach and an experimental design based on the themes of biomonitoring and phytoremediation, which can be carried out by school students who, following the proposed method, acquire specific knowledge about the value of scientific observation of plants as a tool for monitoring and improving environmental quality. The following practical information are shared with schools: 1) a list of plants useful for carrying out biomonitoring of environmental matrices or phytoremediation of urban soils, 2) indications on agricultural practices needed to grow plants for this purpose, 3) a list of features to be observed in plants or obtained through direct measurements to monitor their development.

[1] competenzedigitali.unige.it/pon-green

For digital monitoring, analog and digital devices to be placed in gardens have been identified to carry out automatic monitoring of environmental parameters such as pH, soil moisture, and solar radiation. In addition to sensors connected to an app that collects and displays data from the school garden on school tablets, guidance was provided for programming an Arduino board with dedicated sensors, and a program was made available that transmits data via the Internet to the university servers.

From the computer science perspective, the focus is on the Internet-of-Things technology behind the online dashboard[2], that automatically and dynamically visualizes the data transmitted by the schools (both those entered manually through digital forms and those automatically transmitted by Arduino boards) and enables the storage of historical data. The data platform is designed according the IoT architecture guidelines: edge devices are connected via the Internet protocol to web resources hosted in the University cloud servers. Moreover, specific indications for classroom activities in which the students can process data from the school gardens are provided to develop as early as primary school a *data education* [1], a skill increasingly considered fundamental for students and identified as among the fundamental ones for digital citizens.

Practical Organization and Figures. The initiative proposes to teachers a series of eight free workshops that can be attended either in-person or online to explore the topic of digital technologies to support sustainable development. In the workshops, teachers are guided through the steps needed to collect data from their school gardens either via direct plant observation (biomass, growth, etc.) or sensors (water, pH, etc.) and transmit them to the University's servers. On the dedicated portal[3], teachers find all the resources to carry on the activities in their schools: in-depth resources, video-tutorials, and recordings of the seminars. Worksheets are also made available to support the implementation of activities with students, exercising skills in the pedagogical use of digital technologies (according to the DigCompEdu[4] framework).

In terms of *community*, the initiative supports the creation of a thematic community within the Moodle portal that multiplies the value of individual experiences through discussion with researchers and among schools engaged in the implementation of the Edugreen project. The portal of the initiative counts 115 registered participants. The majority is represented by teachers from 70 Italian schools. Four schools actively contributed data to the dashboard.

Looking Forward. The actions for the forthcoming school year include: 1) consolidating the initiative, repeating the experiment focusing on biomonitoring and on a specific plant, to get easily comparable results; 2) the realization of a smart greenhouse in the University Botanical Garden, to be used to demonstrate good practices and as a reference; 3) the realization of online mini-courses to be offered to university students, as parts of an optional learning path tailored to innovation and sustainability goals.

[2] `bit.ly/botanicdashboard`

[3] `competenzedigitali.aulaweb.unige.it`

[4] `https://joint-research-centre.ec.europa.eu/digcompedu_en`

References

1. Danyluk, A., Leidig, P., Cassel, L., & Servin, C. (2019, February). ACM task force on data science education: Draft report and opportunity for feedback. In Proceedings of the 50th ACM Technical Symposium on Computer Science Education (pp. 496-497).
2. Roche, J., Bell, L., Galvão, C., Golumbic, Y. N., Kloetzer, L., Knoben, N., ... & Winter, S. (2020). Citizen science, education, and learning: challenges and opportunities. Frontiers in Sociology, 5, 613814.

Detecting the usage of Large Language Models exploiting Generative Adversarial Networks

Lerina Aversano[1 [0000−0003−2436−6835]], Mario Luca Bernardi[2 [0000−0002−3223−7032]], and Marta Cimitile[3 [0000−0003−2403−8313]]

[1] University of Sannio, Benevento, Italy
(aversano, bernardi)@unisannio.it
[2] University UnitelmaSapienza, Rome, Italy
marta.cimitile@unitelmasapienza.it

1 Introduction

Large Generative AI (LGAI) models [1] and, more specifically, Large Language Models (LLMs) such as ChatGPT [2], have a deep impact on the teaching and education process offering great support to the teacher in the preparation and implementation of education tasks and the evaluation of students' assignments. For instance they can effectively be exploited to implement scaffolding approaches providing timely feedback and support during learning tasks. However, despite LGAI offers obvious benefits, they also come with many risks [3] in the education community. For example, available LLMs can be used by cheating students to write academic content, making it extremely difficult for the teacher to evaluate the students' performance level, skills and assess the learning progress [4]. According to this, in the last years, several approaches have been proposed to detect contents produced using LLMs [5, 6]. In this work we explore a novel approach, called GGAN, to detect LLM-generated text leveraging the discriminator stage of a Generative Adversarial Network (GAN) trained on the same corpus of a large language model used to generate cheating contents. The usage of the discriminator stage of the GAN in the LGAI-generated text detection improves the detection capability with respect to prior approaches. The evaluation of the proposed approach is performed on a well-known dataset described in [5] comprised of more than 500 assignments' answers to 250 tasks and quizzes solved by Computer Science students and ChatGPT (based on GPT3.5). The preliminary results show good performance of the proposed approach to distinguish human-generated contents from the LLM-generated ones.

2 GAN Detection Approach

Similar to an image GAN, GGAN consists of the generator and the discriminator as illustrated in Figure 1. However, while an image GAN typically exploits CNN for the generator and discriminator stages, GGAN substitutes CNN with the underlying LLM. Generator and discriminator have a different architecture. The former consists on a LLM and optionally dense layers to be dimensioned while the latter is based on a RNN. They also differ in structure for inputs and outputs since they play different roles: one generates data and the other one classifies samples into fake and real. The generator takes random inputs from the predefined Gaussian latent space and generates sentences.

As depicted in Figure 1, the fake data along with real content are passed to the discriminator which become able to differentiate between real and fake samples. After each mini-batch, comprised of several real and generated samples, discriminator loss is calculated and the discriminator weights are updated using gradient descent. When the generator and discriminator are trained,

the GGAN is ready to generate coherent content. Our preliminar evaluation shows that, on the public dataset provided in [5], results are promising being able to reach, on the given corpus of training data for both the underlying LLM model and the GGAN approach, an accuracy ≈ 0.87.

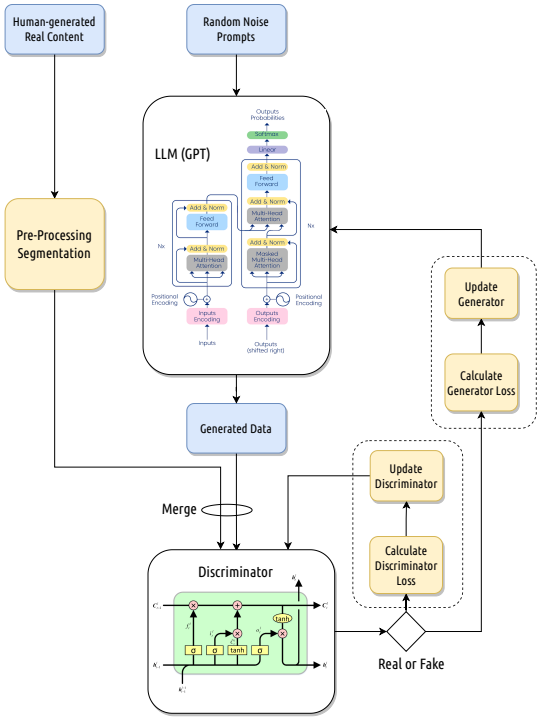


Fig. 1. Detection approach based on R-GAN jointly trained with LLM architecture

References

1. Philipp Hacker, Andreas Engel, and Marco Mauer. Regulating chatgpt and other large generative ai models, 2023.
2. Darko Kovačević. Use of chatgpt in esp teaching process. In *2023 22nd International Symposium INFOTEH-JAHORINA (INFOTEH)*, pages 1–5, 2023.
3. Moneerh Aleedy, Eric Atwell, and Souham Meshoul. Using ai chatbots in education: Recent advances challenges and use case. In Manjaree Pandit, M. K. Gaur, Prashant Singh Rana, and Akhilesh Tiwari, editors, *Artificial Intelligence and Sustainable Computing*, pages 661–675, Singapore, 2022. Springer Nature Singapore.
4. Ilker Cingillioglu. Detecting ai-generated essays: the chatgpt challenge. *The International Journal of Information and Learning Technology*, 40(3):259–268, 2023/06/20 2023.
5. Hosam Alamleh, Ali Abdullah S. AlQahtani, and AbdElRahman ElSaid. Distinguishing human-written and chatgpt-generated text using machine learning. In *2023 Systems and Information Engineering Design Symposium (SIEDS)*, pages 154–158, 2023.
6. Yao Dou, Maxwell Forbes, Rik Koncel-Kedziorski, Noah A. Smith, and Yejin Choi. Is gpt-3 text indistinguishable from human text? scarecrow: A framework for scrutinizing machine text. In *Annual Meeting of the Association for Computational Linguistics*, 2021.

How evolving textbook can support learning? A collaborative platform

Dorota Stadnicka[1[0000-0002-4516-7926]], Grzegorz Dec[2[0000-0003-1711-0452]], Paweł Litwin[1[0000-0002-4497-6553]], Francesco Lupi[3[0000-0003-4994-0215]] and Michele Lanzetta[4[0000-0002-1803-5717]]

[1] Rzeszów University of Technology (PRZ), Faculty of Mechanical Engineering and Aeronautics, Al. Powstancow Warszawy 12, 25-959 Rzeszow, Poland
[2] PRZ, Faculty of Electrical and Computer Engineering
[3] University of Pisa (UNIPI), Department of Information Engineering, 56122 Pisa, Italy
[4] UNIPI, Interdepartmental Centre for Lifelong Learning and Education Research

(dorota.stadnicka, gdec, plitwin)@prz.edu.pl; francesco.lupi@phd.unipi.it; lanzetta@unipi.it

1 Introduction

Nowadays, many projects in education and industry are based on collaboration carried out in teams [1, 2]. The pandemic has shown that online solutions can significantly facilitate cooperation enabling industry employees, teachers, and students to continue their work in situations where physical meetings were not feasible [3, 4]. During this period, work on ICT solutions supporting various areas of our lives significantly accelerated, although many of such tools were already available [5]. Implementing an evolving textbooks in the education process, will allows students and industry employees to learn by cooperating among them and with the teacher by ICT tools.

The research agenda carried out as part of the TET project ("The Evolving Textbook"), aims to review the available solutions and their functionalities and identify those that are most desired by target users for such an open access platform.

2 The Research Agenda

2.1 Research goal

Within the TET project, a group of experts will develop an online platform for writing e-textbooks characterized by the following features: frequent updates, cooperation with students in the creation process, using synergies resulting from the cooperation of people from different countries to create adaptive educational incremental materials [6]. In this work, we identify the essential functionalities and features that the platform and the e-textbooks should possess, according to a specific research methodology.

2.2 Methodology

As summarized in Figure 1, the methodology consists of four activities: (A1) to identify the types of teaching materials currently used in the teaching and learning process at selected universities; (A2) to set the features of evolving textbook; (A3) to identify the ICT tools used by teachers and students and to get their feedback on these tools; and (A4) to identify existing tools.

Fig. 1. General overview of the research methodology.

2.3 Research activities

Fig. 2. Sorting of the main identified categories.

A1. In the everyday educational process, educators and students use various teaching and learning materials to convey and acquire knowledge, and occasionally even to generate it. As part of the research agenda, it was planned to collect information on the sources of knowledge employed, starting from the expert panel's expertise on specific methods and tools, and to examine methods by which the materials are obtained, created and updated, if they are updated at all, and whether students are currently involved in the process of creating and updating. **A4** outlined the main features and their relative weight as in Figure 2. **A3** involved 22 questions among 229 students and 116 academic teachers showing which functionalities are more and less frequently used in practice and about which functionalities survey participants currently lack. **A2.** From A1, A3 and A4, the requirements and limitations for the construction of the platform are identified.

3 Conclusion

This work has two merits: (1) analysing the status of collaboration platform features both with desk and field approaches compared, especially affected after the Covid pandemic, (2) focusing on methodologies and tools able to provide an incremental collaborative output, fusing the efforts of teachers and students. It is important that the platform contains only the necessary functionalities and uses the existing user experience, thanks to which it will be easier to accept.

References

1. Marra, R.M., Steege, L., Tsai, C.L. & Tang, N.E.: Beyond “group work”: an integrated approach to support collaboration in engineering education. International Journal of STEM Education 3(1), pp.1-15 (2016). doi:10.1186/s40594-016-0050-3.
2. Bafoutsou, G., & Mentzas, G.: Review and functional classification of collaborative systems. International journal of information management 22(4), pp. 281-305 (2002).
3. Schmidtner, M., Doering, C., & Timinger, H.: Agile working during COVID-19 pandemic. IEEE Engineering Management Review 49(2), pp. 18-32 (2021).
4. Mustakim, M., Trisnaningsih, T., & Adha, M. M.: The effectiveness of online collaborative learning during Covid-19 pandemic. In Advances in Social Science, Education and Humanities Research 513(4) Sriwijaya University Learning and Education International Conference (SULE-IC 2020), pp. 256-262. Atlantis Press SARL (2021).
5. Schubert, P., & Williams, S. P.: Enterprise collaboration platforms: An empirical study of technology support for collaborative work. Procedia Computer Science 196, pp. 305-313 (2022). doi:10.1016/j.procs.2021.12.018.
6. Podržaj, P., Požrl, T., Rožman, N., & Žužek, T.: Work in Progress: Erasmus+ project: The Evolving Textbook-TET. IEEE Global Engineering Education Conference (EDUCON), pp. 1-3. IEEE (2023). doi:10.1109/EDUCON54358.2023.10125220.

Augmented Didactic: The Potential of Gesture in Mobile Learning to Enhance Learning Processes

Elèna Cipollone[0000-0002-4631-1598] Luna Lembo[0000-0003-0265-3219] Pietro Oliva[0000-0002-3572-3255] Francesco Peluso Cassese [0000-0002-6798-3668]

[1 2 3 4] Niccolò Cusano University – Heracle Lab

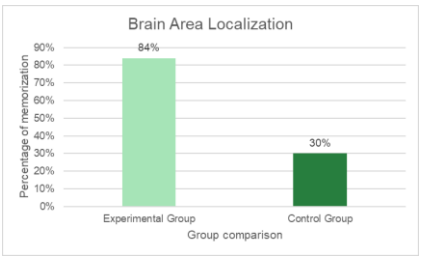
1 Mobile Learning (M-Learning) and Augmented Reality (AR): the potential of the gesture

The evolution of mobile technology and AR opens up new frontiers in the field of learning, giving rise to the need to investigate the complexity of learning processes related to the use of smartphone-mediated AR. This paper leverages the combination of mobile devices, such as smartphones, and AR, which overlays virtual elements onto the real world, to enhance the learning experience. Specifically, it aims to explore the real connection and potential implementation of manual gestures to facilitate the manipulation of the studied object, as it may contribute to a more meaningful learning process (Freitas et al., 2022). The scientific literature demonstrates the potential to steer learning styles towards the adoption of mobile technologies in order to make these processes more meaningful, relying on constructivist theories that emphasize the importance of anchoring the content to be internalized with the cultural reality of the individual (Panciroli, 2018). M-Learning allows students to access educational content through mobile devices, offering flexibility and on-demand access to education. On the other hand, AR enables students to interact with virtual content in real contexts, enriching learning with visual, audio, and interactive elements. This combination provides an engaging and intuitive learning mode that stimulates student interest and active participation (Tomassoni, 2021). Among the factors that enhance learning, the ability of students to have continuous access to sources of information, interacting with them through the use of manual gestures that enable manipulation, plays a crucial role. In this sense, smartphones have excellent potential to provide interactive and continuous access, leveraging flexibility (Crompton et al., 2018) and the ability to learn anywhere (Almaiah et al., 2022). The individual builds knowledge networks beyond the physical boundaries of the classroom structure, integrating content to be internalized with cultural reality, anchoring it to what is already inscribed in the student's neural networks and to what they have already experienced. From an Embodied Cognition perspective, the role of gesture becomes fundamental, as it seeks to harness the potential of motor acts and, consequently, brain activation at the level of the motor cortex, generating greater synaptic connection in support of the learning process. Gesture supports meaningful internalization when it is purposeful: within the learning context, a purposeful gesture refers to one aimed at a better understanding of the content to be learned (Freitas et al., 2022; Novak, 2015).

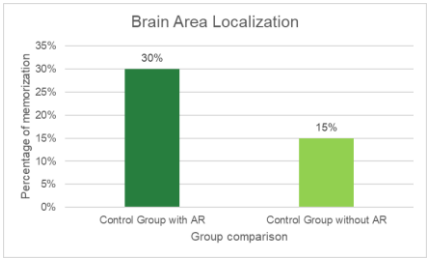
2 Research Project

This research is a part of research project called “Augmented Didactics”, whose aim is to improve the learning using AR through qr code (Lembo et al., 2023) of 108 undergraduates students of Engineering and Education Department (Cipollone et al., 2023). In the previous research, a 40% of improvement was find out thanks to AR, therefore it’s now in our interest to understand if this effect is linked to the possibility of manipulating the stimuli. The new sample was randomly divided into two groups, an experimental group of 51 subjects and a control group of 30 subjects. The proposed teaching activity included the AR brain lessons, with frontal explanation. AR was presented through qr code which, as in image 1, allowed to view the notions presented in class in 3D. The experimental group was able to manipulate the brain, touching the touchscreen to see it on different point of view. The control group, instead, was able just to see the brain, without interacting with it. At the end of the activity, we administered to the two group a spontaneous recall questionnaire aimed at investigating the level of memorization of the concepts explained. As the Graph 1 shows, the experimental group had an improvement of 53% of memorization of the brain area explained, probably due to the possibility of manipulating the stimuli. The Graph 2 shows instead a comparison of the control group of this research that joined AR without manipulating it, and the control group of the previous research, which didn’t joined the AR. In this case, we can see that the first group, even if it can’t manipulate AR, shows an improvement of 15% on the memorization, leading to the conclusion that AR, through qr code on mobile phone, is a potential strong tool for supporting an innovative methodology, as Augmented Didactic is, for the memory and learning implementation.

Figure 1. AR, via qr code, on smartphone



Graph 1. Comparison between experimental and control group



Graph 2. Comparison between AR control group and no AR control group

The Graph 3 shows the result of the Independent Sample T test where the p value, less than 0.001, affirms that we can reject the null hypothesis and confirm the alternative one, i.e. there are statistically significant differences between the two groups. The effect size reveals the percentage of overlap between the two distributions, that turn out to be greater than 0.8, so the size of the effect ranks as very large, representing barely 53% overlap between the two distributions. In light of what emerged, the research hypothesis can be defined as confirmed. Starting from this, it is necessary to continue the investigations, being aware of the need for multidisciplinarity.

Independent sample t test				
Degree of freedom	**p value**	**Average Difference**	**Standard Deviation Difference**	**Effect size (d di Cohen)**
238	< .001	0.524	0.0530	1.33

Graph 3. Independent sample t test

References

1. Almaiah MA, Ayouni S, Hajjej F, Lutfi A, Almomani O, Awad AB. Smart Mobile Learning Success Model for Higher Educational Institutions in the Context of the COVID-19 Pandemic. *Electronics*, 11(8):1278. (2022) https://doi.org/10.3390/electronics11081278
2. Chiang, T.-H.-C., Yang, S.-J.-H., & Hwang, G.-J. An Augmented Reality-Based Mobile Learning System to Improve Students' Learning Achievements and Motivations in Natural Science Inquiry Activities. *Educational Technology & Society*, 17 (4), 352–365. (2014). https://doi.org/10.4236/jss.2015.312019
3. Cipollone E., Lembo L., Monteleone S., Oliva P., Augmented Didactic: an interdisciplinary approach to assessing augmented reality in learning, preprints (2023)
4. Crompton H., Burke D., The use of mobile learning in higher education: A systematic review, *Computers & Education*, 123, 53-64. (2018) https://doi.org/10.1016/j.compedu.2018.04.007
5. Freitas, S. dos A., & Andrade Neto, A. S. Gestures in the teaching and learning process: a systematic literature review. *SciELO* Preprints.(2022) http://dx.doi.org/10.1590/0102-469839705t
6. Hung, PH, Hwang, GJ, Lin, YF, Wu, TH e Su, IH. Seamless connection between learning and assessment: applying progressive learning tasks in mmobile ecology inquiry'. *Educational Technology & Society*. 16(1), 194-205, (2013)
7. Lembo L., Cipollone E., Oliva P., Monteleone S. Augmented Didactic: wow effect for learning. Use of augmented reality through a qr code to enhance learning processes in undergraduates, *Italian Journal of Health Education, Sports and Inclusive Didactics*. Anno 7, V 2. EUR (2023) https://doi.org/10.32043/gsd.v7i2.893
8. Panciroli C., & Macauda A. Educazione al patrimonio e realtà aumentata: quali prospettive. *Italian journal of educational research*, 11(20), 47-62. (2018)
9. Tomassoni R. "The instrumental function of "augmented reality" in the processes of representation, transmission and construction of knowledge. MeTis. Mondi educativi. Temi, indagini, suggestioni 11(1), (2021)

SPECIAL TRACK 2

“EMOTIONS AND ART IN HIGHER DISTANCE EDUCATION”

ORGANIZERS:

FIORELLA VINCI, ECAMPUS UNIVERSITY, ITALY

ANTONELLA DE BLASIO, ECAMPUS UNIVERSITY, ITALY

SPECIAL TRACK 3

“PERFORMING ART-BASED METHODOLOGY TO IMPROVE ONLINE LEARNING EXPERIENCES”

ORGANIZER:

NADIA CARLOMAGNO, SUOR ORSOLA BENINCASA UNIVERSITY, ITALY

Digital Twins and E-Learning: Challenges and Opportunities

Dzintars Jankovskis[1(0009-0007-4911-0031)], Iveta Cirule[2(0000-0003-2545-7085)], and Anna Carbone[3(0000-0003-4945-9165)]

[1] Liepaja University, Liepaja, Latvia, dzintars.jankovskis@gmail.com
[2] Liepaja University, Liepaja, Latvia; BIORGANIK5 Ltd, Riga, Latvia, biorganik3@gmail.com
[3] Politecnico di Torino, Turin 10129, Italy, anna.carbone@polito.it

1 Introduction

Digital Twin (DT) has gained significant traction over the last decade, and it has been defined many times from different perspectives by the academy and industry communities. For example, NASA defined DT as "an integrated multi-physics, multiscale, probabilistic simulation of an as-built vehicle or system that uses the best available physical models, sensor updates, fleet history, etc., to mirror the life of its corresponding flying twin" [1]. Researcher and DT "father" Michael Grieves defined DT as "a digital representation of a physical entity or system, used to understand and predict the physical entity's performance characteristics and that DT model can consist of three main parts - physical products in real space, virtual products in virtual space and the connections of data and information that tie the virtual and real products together" [2]. Tao et al. have defined a five-dimension DT model – physical entities, virtual models, services, data, and connections" [3]. Although DTs are widely used in manufacturing, aerospace, and healthcare, their potential applications will soon extend and cover other domains. In this scenario, education is required to play a major role in building its own DT models for purposes ranging from academic to professional training.

The DT technology in the education context is expected to enhance the outcomes and scopes of the standard digital e-learning approaches. A particular aspect of the research includes how the DT framework will accurately monitor, analyze, and improve the online learning patterns and behavior of students [4], gamification, and virtual reality for DT learning [5]. We will present a framework for designing/building a DT for e-learning platforms, discuss its potential benefits and challenges, and provide examples of its practical applications.

2 Digital Twin technology

Recent studies have shown [6,7] that DT technology has the potential to significantly improve the well-being, retention, and overall satisfaction of e-learning platform users as well as improve the quality of such digital platforms. By creating a virtual replica of the e-learning environment and integrating it with real-time data from such a platform, DT technology enables personalized learning experiences that are tailored to the needs and preferences of individual users [8]. This can lead to increased engagement,

motivation, and enjoyment of the learning process and improved learning outcomes. Additionally, DT technology can facilitate real-time feedback and assessment, allowing learners to track their progress and adjust their learning strategies accordingly. Furthermore, this gives opportunity to platform owners to tailor their digital learning platform to meet their users' needs. This paper explores the various ways in which DT technology can be used to enhance e-learning platforms and discusses the potential implications of this technology for the future of education and training. By implementing DT technology, digital learning platform owners can improve their business sustainability and make their businesses more environmentally friendly [9].

3 Conclusion and future research direction

After briefly reviewing DT technology in e-learning, an architecture of e-learning platforms' DT is presented that would offer the opportunity to tailor the digital learning platform to meet the needs of its users in real-time and improve their retention on the platform. Architecture has to be detailed and tested in a working digital learning platform. Furthermore, based on the findings, a new terminology "DT-learning" has been brought forward, Digital Twin for e-learning platform terminology must be innovated.

References

1. Shafto, M., Conroy, M., Doyle, R., Glaessgen, E., Kemp, C., LeMoigne, J., & Wang, L. Modeling, simulation, information technology & processing roadmap. National Aeronautics and Space Administration, 32, 1-38, (2012).
2. Grieves, M. Digital Twin: manufacturing excellence through virtual factory replication. White paper, 1, 1-7, (2014).
3. Tao, F., Liu, W., Zhang, M., Hu, T. L., Qi, Q., Zhang, H., ... & Huang, Z. Five-dimension Digital Twin model and its ten applications. Computer integrated manufacturing systems, 25(1), 1-18, (2019).
4. Ambrose Azeta, Frank Agono, Adesola Falade et al. A Digital Twin Framework For Analysing Students' Behaviours Using Educational Process Mining, 05 November, PREPRINT (Version 1) available at Research Square, (2020).
5. Antonio Bucchiarone. Gamification and virtual reality for digital twin learning and training: architecture and challenges. Virtual Reality & Intelligent Hardware, 4(6): 471–486, (2022).
6. Müller-Zhang, Z., Kuhn, T., & Antonino, P. O. Towards live decision-making for service-based production: Integrated process planning and scheduling with Digital Twins and Deep-Q-Learning. Computers in Industry, 149, 103933, (2023).
7. Mashaly, M. Connecting the Twins: A Review on Digital Twin Technology & its Networking Requirements. Procedia Computer Science, 184, 299-305, (2021).
8. Johnson, J., Buckingham Shum, S., Willis, A., Bishop, S., Zamenopoulos, T., Swithenby, S., & Helbing, D. The FuturICT education accelerator. The European Physical Journal Special Topics, 214, 215-243, (2012).
9. Cirule I, Uvarova I. Open Innovation and Determinants of Technology-Driven Sustainable Value Creation in Incubated Start-Ups. Journal of Open Innovation: Technology, Market, and Complexity; 8(3):162, (2022).

Impact of the overwork and renewed work-life balance for higher education professionals after COVID-19 crisis

Scarinci Alessia[1[0000-0002-3174-7137]], Di Fuccio Raffaele[2[0000-0001-8886-3967]] , Alberto Fornasari[1], Ilenia Amati[1[0000-0003-3694-9405]] and Toto Giusi Antonia[2[0000-0001-5538-5858]]

[1] University of Bari Aldo Moro,
[2] University of Foggia, Via Arpi, 176 Foggia
raffaele.difuccio@unifg.it

1 Introduction

Higher Education professionals such as Researchers, professors, and lecturers are not constrained by a fixed number of hours as their contracts stipulate a set amount of work. However, due to the nature of their work, which requires continuous intellectual effort, they often distribute their workload throughout the entire day, including bank holidays. [2]. This situation has become even more complex in the aftermath of the COVID-19 crisis, as teleworking has blurred the boundaries between their personal and professional lives. [7].
At the same time, the European Commission delivered three frameworks for crucial skills in the 21st century and in particular the DigComp - The digital competence framework for citizens [3], EntreComp - entrepreneurship competence framework [1]; LifeComp - The European framework for personal, social and learning to learn key competence [5]. These frameworks are conceived in order to be used as a basis for the development of curricula and learning activities fostering personal, and social development, and learning to learn.

2 Materials and methods

2.1 The project

On the basis of this situation, an European-funded project called GEMMA (Game based learning for Enhancement of new skills using Micro-MOOCs for Academic staff - 2022-1-IT02-KA220-HED-000087512) aims to develop new pedagogical strategies for the lecturers, professors and researchers in a broad sense, starting from merging the three competence frameworks aiming at strengthening an informed balance work/personal life, creativity and ability to catch the opportunities in the society. A vehicle in this process is the methodology of Game Based Learning (GBL) [8].

2.2 Methodology

In this paper, the authors show the developmental process of the integrated pedagogical framework that is triggered by a co-creation approach [6] that involves the target users of the intervention. We administrated the focus group for the collection of

qualitative data regarding the impact of the overwork on the personal and professional life of the researchers. The focus group is a methodology that allows to gather information and receive feedback on a specific topic [4]. The focus takes place like a group interview guided by a moderator who, following a more or less structured track, offers stimuli to the participants. One of the characteristics that make the use of focus groups of considerable interest is precisely the interaction that is created between the participants. The participants involved in the focus groups are 40 and belongs to 5 countries (Poland, Spain, Italy, Greece, Finland).

3 Results

The paper shows the results regarding the following items:

1. Current well-being situation of researchers at work.
2. Changes associated with COVID-19 in terms of well-being and new competences.
3. Needs in terms of competences.
4. Preferences in the competence training.

References

1. Bacigalupo, M., Kampylis, P., Punie, Y., & Van den Brande, G.. EntreComp: The entrepreneurship competence framework. *Luxembourg: Publication Office of the European Union*, *10*, 593884. (2016)
2. Barriga Medina, H. R., Campoverde Aguirre, R., Coello-Montecel, D., Ochoa Pacheco, P., & Paredes-Aguirre, M. I. The influence of work–family conflict on burnout during the COVID-19 pandemic: The effect of teleworking overload. *International journal of environmental research and public health*, *18*(19), 10302. (2021)
3. Carretero, S., Vuorikari, R., & Punie, Y. DigComp 2.1. The Digital Competence Framework for Citizens. With eight proficiency levels and examples of use. Publications Office of the European Union. (2017)
4. Krueger R.A Focus groups. A practical Guide for Applied Research, Sage, Thousand Oaks. (1994)
5. Sala, A., Punie, Y., Garkov, V., & Cabrera, M. *LifeComp: The European framework for personal, social and learning to learn key competence* (No. JRC120911). Joint Research Centre. (2020)
6. Schmitt, J. B., Breuer, J., & Wulf, T. From cognitive overload to digital detox: Psychological implications of telework during the COVID-19 pandemic. *Computers in Human Behavior*, *124*, 106899. (2021)
7. Sanders, E. B. N., & Stappers, P. J. Co-creation and the new landscapes of design. *Co*-design, 4(1), 5-18. (2008)
8. Tobias, S., Fletcher, J. D., & Wind, A. P. Game-based learning. Handbook of research on educational *communications and technology*, 485-503. (2014)

On-off(line) university learning: a study on the role of emotions in didactic practices

Barpi Fabrizio [1] [0000-0001-8371-5690], Cereda Ambrogia[0000-0001-6438-0434],

De Blasio Antonella [1] [0000-0001-6438-0434], Vinci Fiorella[0000-0001-6438-0434]

[1] Politecnico di Torino, Torino, Italy
[2] Università eCampus, Novedrate, Italy
fiorella.vinci@uniecampus.it

1 Theoretical framework and research objectives

The enquiry into the role of emotions in learning and teaching has recently undergone a phase of growth. Particularly in higher education, signs are visible of increased interest in emotions, mainly due to their impact on learners' learning quality and effect.

The research describes the emotional relapses of specific teaching practices and their influences on students' educational experiences, starting from the pivotal role of the educational experience [1] and deepening the classic studies of a socio-cognitive [2,3] and pragmatic-cognitive [4,5] matrix, which attribute crucial importance to the emotions of individuals and their social and relational [6]. In line with the phenomenological approaches, Vygotsky highlights the social nature of emotions. His lesson appears current in redefining the activism of Dewey and Piaget in a double sense: from a neurophysiological perspective, it shows the biological and physiological roots of emotions [7,8] and their impact in favouring or hindering learning processes and personal development; while, in a sociological sense, it investigates the functions that relational mechanisms play in the genesis of emotions and their consequences on learning processes. In the wake of Vygoskijani's studies, the research aims to investigate the relationship between emotions and learning.

As recent studies have shown, the analysis of emotions in a didactic environment can reveal a multiplicity of issues (e.g. specific emotional states related to the subject matter; association between emotions and tests, examinations, homework, and deadlines). In this sense, specific emotions have also emerged as capable to contribute to learning success, thus favouring the internalization and memorization of knowledge and meanings, while others can create obstacles and may lead to educational failure.

As attentional and motivational components emotions can influence learning and memory. Perceptual processing is indeed enhanced by attentional components, that help select and organize salient information [9]. While curiosity is induced by motivational components, which favour a state of psychological interest in new or surprising activities and thus activate a desire for further exploration, a condition that can prepare the brain to learn and remember [10]. Adding on that, emotionally salient stimuli can elicit selective attention and thus enhance memory functions [9, 10].

In line with the theoretical approaches evoked, this research aims not only to connect emotions to learning processes, but also to investigate which didactic relationships generate them. Paraphrasing Vygotsky, one could say that the aim of the research is to understand how the emotional presence is generated in an educational relationship, whether it only characterizes learning experiences in the presence or whether it is also found in virtual teaching environments, and whether its analysis in the two environments show similar or different generative mechanisms.

2 Methodology

In order to better understand the intertwining between emotion and learning is nonetheless important to acknowledge a variety of forms in the spectrum that can be elicited in the individual experience with teacher, class, and subject matter. To shed light on these issues, a preliminary comparative research has been carried out with university students using online questionnaires and focus groups.

The comparison has concerned two courses in two different universities, a traditional university and an online university. The questionnaire administered online had an exploratory purpose, involving 80 students at the Turin Polytechnic and 80 students at eCampus telematic university. It was constructed by trying to trigger different types of emotions, organized in a typology ranging from indifference to joy, to specific behaviours of the teacher and/or students. The aim was to understand the educational relevance of specific teaching behaviours. Among the various didactic behaviours considered, those based on the inclusion of works of art among the didactic materials had a specific analytical space: some focus groups were organized to investigate further the emotional meanings attributed by the students to the use of artistic texts in the course materials and in class.

3 Research results and analysis track

The following results emerged from the analysis of the questionnaires and focus groups:

- the correspondence between some emotions and some teaching behaviours, for example, the correspondence between the appreciation that the teacher addresses to the students' interventions and a state of satisfaction and joy in the students, a very similar functioning of emotions in the face-to-face teaching environment and the online teaching environment;
- the driving function of some teaching behaviours to elicit specific sets of emotions that have a familiar feel to each other;
- the instrumental function of some artistic texts in arousing not only feelings of participation and empathy but also involvement and didactic commitment among students.

With the limits that an exploratory study entails, the research allows us nonetheless to consider the educational relationship as deeply emotional and brings to light issues related to the most suitable teaching behaviours to motivate students and solicit their participation and their commitment.

References

1. Dewey, J.: Esperienza e educazione. Cortina, Milano (2014).
2. Vygotskij L.S.: Il processo cognitivo. Bollati Boringhieri, Torino (1987).
3. Bruner, J.: Il significato dell'educazione. Armando, Roma (2012).
4. James, W.: The varieties of Religious Experience. Longmans, Green and Co., New York (1902); tr. it. Le varie forme dell'esperienza religiosa. Morcelliana, Brescia (1998).
5. Joas, H.: Come nascono i valori. Quodlibet, Macerata (2021).
6. Bruni, L.: Costruite perché scoperte insieme. Sul carattere sociale delle emozioni. Società Mutamento Politica 12(24), 117–128 (2021).
7. Panksepp, J.: Affective neuroscience: The foundations of human and animal emotions. NY: Oxford University Press, New York (2003).
8. Damasio, A.: The person within. Nature. 423(6937) 227 (2003).
9. Vuilleumier, P.: How brains beware: neural mechanisms of emotional attention. Trends Cognitiv Science 9, 585–594 (2005).
10. Schupp, H. T., Stockburger, J., Codispoti, M., Junghöfer, M., Weike, A. I., Hamm, A. O.: Selective visual attention to emotion. Journal of Neuroscience 27, 1082–1089 (2007).
11. Ng, K.-C.: Using e-mail to foster collaboration in distance education. Open Learning 16(2), 191–200 (2001).

Performing art-based methodology to improve online learning experiences

Nadia Carlomagno[1][0000-0001-8840-1113], Valeria Vadalá[2], Maria Vittoria Battaglia[3]
[1] University Suor Orsola Benincasa of Naples, Italy
[2] University Suor Orsola Benincasa of Naples, Italy
[3]University Nicolò Cusano of Rome, Italy
nadia.carlomagno@gmail.com, valeriavadala.vv@gmail.com,
mariavittoria.battaglia@unicusano.it

1 Introduction

The recent breakthroughs of Embodied Cognition Science reaffirm the centrality and inseparability of the cognitive, bodily and emotional dimension within learning processes. Considering this, the constitutive paradigms of teaching have been revisited to design distance learning within a new Umwelt [1], a spatial environment that, even in the distance and with the presence of new technologies, establishes itself as a relational environment that is capable of generating empathetic processes. The necessary properties useful for creating a learning environment capable of generating the perception of the empathic relationship reside in the quality of the atmosphere and in the consideration of almost things [2]. Much of what happens in the course of our interpersonal relationships would be the result of the ability to create a *we-centric* space, the result of the activity of *embodied simulation*. As Gallese [3] argues, when human beings observe the behavior of others they are exposed to a variety of expressions. These expressions are not resolved solely in the typology of the observed actions, but also include the emotions and sensations that accompany these actions, automatically creating an interpersonal affective bond endowed with meaning.

2 Research

This research is in continuity with previous investigations carried out on the DLaD Model (Didactic Laboratory at a Distance). The survey aims to outline the strategies of effective teaching centered on the body in action, capable of generating a virtual space that has the relational connotations essential to the teaching action. The ultimate goal is to outline the DLaD Model structured on theatrical performative techniques and practices identified in the CReAP+T approach, whose acronym stands for *Creativity-Corporeality, Relationship, emotion, Action, Performativity + Training. Technology*, in which the tool of relationship and cognition is recognized in the performative role of the body, through the dialogue between the body and technologies. The Creap+T Method confirms the importance of the relationship and cognition as an incarnate experience mediated and activated by the channels of perception, promoting the continuous solicitation of *presence*, understood as a *scenic bios and source of energy* [4], as *sense of being here and now* in connection with oneself, with the place and with others, through *training* activities [5] and *autopoetic feedback* [6] that involve students in their multiple possibilities to *be here and now* with voice, look and gestures, with the body and beyond the body. Some constitutive elements of the Model have already been investigated through the exploration of the effectiveness of bodily action even at a distance, [7]. Still with regard to this theme, further investigations were carried out to better understand what influences the relationship and the perception of interpersonal distances [8] in the teaching learning process in DLaD [9]. In particular, this exploratory study intends to examine how the

DLaD, structured on the CReAP+T Model, can influence the perception of the empathic relationship, the interaction and emotional activation of students and the perception of the other, through a specific and careful body language, gaze and tone of voice. To make improvements to the didactic Model, basic research was combined with applied research fololwing the paradigm of Anne Brown and Alan Collins' Design Based Research (DBR) [10], making use of the practices of performing arts-based research. A dual research design was adopted: a synchronic one, centered on the investigation of laboratory experiences, and a diachronic one centered on reflections elaborated on the basis of previous experiences and as a function of future ones. Starting from performing art- based methodology, this study resorts to an exploratory type of research design [11] through the administration of a self-completed questionnaire. This questionnaire consists of a semi-structured list of 5 elements for collecting personal data (gender, age, type of course attended, region of origin, method of participation in lessons) and 35 elements with dichotomous choice and 6 multiple-choice elements with the possibility of ticking off a single answer for the survey on the suspects' opinions using a Likert scale ranging from *Strongly agree* to *Strongly disagree*. The questionnaire was administered through the digital platform google forms, anonymously at the end of the training courses of the laboratories carried out in DLaD of *Performative didactic dramaturgy* and *Playing you learn: techniques for animation and theatrical communication*, of the master's degree courses in primary education sciences and education sciences at the Suor Orsola Benincasa University in Naples. The reference sample is approximately 970 students who attended the laboratories in the 2021-2022 academic year, the average age of the students ranges from twenty to twenty-two years and 76.9% of them reside in the Campania Region. The survey asked each student to express their opinions on the body training activities carried out during the laboratories, on the communicative-expressive codes, on the effects of the performative action, on the effects of the feedback, elements that characterize the CReAP+T Method. Quantitative data was collected and processed in an Excel environment and then organized in a Table showing the response frequencies as a percentage. The data that emerged from the research show that the *training activity* is a fundamental action of relaxation and awakening of the body for teachers and students before undertaking any type of teaching activity. Training is the moment that allows the body and mind to recognize each other and come into contact with each other and is essential for emotional activation and the triggering of a process of discovery of one's body. It returns greater awareness of the exercise of the voice and has the ability to influence attention towards listening to the other. Data show that *feedback* affects the ability to create new relationships with others and the establishment of an empathetic relationship with the teacher and with the class.

3 Conclusions

Despite the physical distance, the Didactic Laboratory at a Distance Model has managed to promote significant experiences capable of influencing the perception of the empathetic relationship, the interaction/activation of the learners, the perception of the other (body language, gaze, tone of voice). All these are useful elements for starting a meaningful teaching process based on a passage from an *experience-of* some object to an *experience-with* [12]. This learning experience can be considered based on distance learning but not distant.

References

1. Uexküll, Jakob von.: Mondes animaux et monde humain. Trans. Philippe Müller. Paris: Denoël,. [Théorie de la signification is included as the second part of the book.] p.59 (1965).
2. Griffero T.: Quasi-cose. La realtà dei sentimenti. Milano: Mondadori (2013).
3. Gallese V.: The Shared Manifold Hypothesis: from mirror neurons to empathy, Journal of Consciousness Studies, 8, 5-7, pp. 33-50 (2001).
4. Barba, E.: La canoa di carta, Trattato di antropologia teatrale. Mulino, Bologna (1993).
5. Carlomagno, N.: Le potenzialità didattiche delle arti sceniche. Educ. Sci. Soc. 346–359 (2020).
6. Fischer-Lichte, E.: Estetica del performativo. Una teoria del teatro e dell'arte, Carocci Editore, Roma, p. 13 (2014).
7. Carlomagno N., Cordella F.M., Minghelli V., Rivoltella P.C.: Performative Didactics in a Technological Environment, «REM», Vol. 13, N. 1, ISSN: 2037-0830, doi: 10.2478/rem-2021-0003, p. 7-16 (2021).
8. Hall, E.T.: A system for the notation of proxemics behaviour. American Anthropologist, 65, pp.1003-1026 (1963).
9. Carlomagno N., Minghelli, V.: Interpersonal Distance in CReAP+T Method in Distance Learning.The Paradigm of Space in Technology-Based Dialogues Communications In Computer And Information Science- SPRINGER ISBN 978-3-030-96059-9, 978-3-030-96060-5, pp.199-214 (2022).
10. Rivoltella, P.C., Rossi, P.G.: Il corpo e la macchina. Tecnologia, cultura, educazione. Morcelliana, Brescia (2019).
11. Trinchero R., Robasto D.: I mixed methods nella ricerca educativa. Milano: Mondadori, (2019).
12. Matteucci G.: Estetica e natura umana. La mente estesa tra percezione, emozione ed espressione. Roma: Carocci editore (2019).

SPECIAL TRACK 4

"E-LEARNING FOR PROVIDING "AUGMENTED" MATHEMATICS EDUCATION AT UNIVERSITY LEVEL"

ORGANIZERS:

MONTONE ANTONELLA, UNIVERSITY OF BARI ALDO MORO, ITALY

ALBANO GIOVANNINA, UNIVERSITY OF SALERNO, ITALY

FIORENTINO MICHELE G, UNIVERSITY OF BARI ALDO MORO, ITALY

PIERRI ANNA, UNIVERSITY OF SALERNO, ITALY

Design of an online introductory math course for engineering students

Caterina Bassi[1][0000-0002-2262-520X], Giulia Bernardi[1][0000-0001-7622-9790] and Domenico Brunetto[1][0000-0002-3969-7103]

[1] Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano , Italy
domenico.brunetto@polimi.it

In order to smooth the transition between secondary and tertiary education, universities usually offer preparatory courses to first-year students. At the Politecnico di Milano, preparatory math courses are delivered every year before the beginning of the first semester and are addressed to all first-year engineering students. Until September 2020, classes were delivered on-site, then, due to the pandemic, there was a compulsory shift to online classes. In 2022 the university decided to offer both the on-site and the fully online course. Both courses are structured in two parts: a MOOC that students are invited to attend during the summer and eight classes delivered in the two weeks before the beginning of the academic year. The pre-calculus MOOC is delivered on the POK platform (www.pok.polimi.it), where students can study videos about theory explanations and resolutions of exercises, test their basic knowledge in mathematics through quizzes and interact with other students and tutors through a forum. The MOOC course is structured in six weeks, i.e. units: arithmetics, algebra, geometry, logics, functions, and probability. The eight classes, four hours each, follow the syllabus of the MOOC course.

The scope of this work is to describe the design of the fully online format and to focus on the choice made by the tutors while planning the classes in order to guide students' work and increase the efficacy of the course The course was carried out in September 2022 and involved approximately 70 students. The eight classes were delivered in an online format in which the tutor and the students were interacting using an online platform (Webex). The course was blended in the sense that it involved both synchronous and asynchronous activities. This choice was made because different resources in mathematics education, see [1], suggest that one of the critical points in the transition between high school and university is that learning resources are perceived in a different way and that, at university, students are supposed to study and work with more independence. In our context, synchronous activities provide guidance to students, while asynchronous activities foster their independence, smoothing the transition between secondary and tertiary education.
Moreover, as Gamer and Gamer [2] pointed out, student-directed learning promotes conceptual learning more effectively if compared to teacher-directed approach. In the blended learning format, students have an active role since they have to watch videos, they have the possibility of solving exercises with self-evaluation and can use online forums and other sources to clarify their doubts. All this engages students in different mathematical activities that generate a personal production of meanings and mathematical knowledge.

In the following, we describe the course schedule. The first lesson started with an extensive explanation of the course structure provided synchronously by the tutor. Then, students were given a self-assessment quiz that lasted 30 minutes and covered the topics of the first week; a second self-assessment quiz was delivered between the fourth and the fifth lessons to cover the topics of the second week. The aim of the self-assessment quizzes was to guide students in identifying their strengths and weaknesses and, thus, to foster students' autonomy in choosing the lessons and contents more relevant to them. Each class started with asynchronous activities which lasted one hour. Through a shared Padlet students were told which part of the pre-calculus MOOC had to be studied (videos and quizzes) and they were asked to solve the task of a "warm-up" activity. With the warm-up activity, students were asked to think and reason about open problems and tasks. Afterwards, students posted their resolutions and possible questions on the MOOC forum. The second part of the class was synchronous, it lasted two hours and it was delivered through the online streaming platform Webex and a shared board (Jamboard). During the synchronous part, the tutor discussed the solution of the warm-up activity, addressed students' questions and deepened the topic. At the end of the class, students were given one hour to answer a formative-assessment test, which focused on the topics covered during the lesson.
At the end of the course, all the students were given a survey with the purpose of evaluating the effectiveness and usefulness of the two formats. As discussed in [3], the responses show that there was no significant difference between the online and on-site formats. In the survey to the final question "do you recommend this course to future first year students?", none of the students answered no, showing that the online format was as successful as the on-site one.

References

1. Kock, Zeger, J., Brunetto, D., Pepin, B.: Students' choice and perceived importance of resources in first-year university calculus and linear algebra. In: Barzel, B., Bebernik, R., Göbel, L., Pohl, M., Schacht, F., Thurm, D.E. (eds.) Proceedings of the 14th International conference on technology in mathematics teaching – ICTMT14. vol. 48, pp. 91–98. DuEPublico (2020). doi: 10.17185/duepublico/48820
2. Gamer, B.E., Gamer, L.E.: Retention of concepts and skills in traditional and reformed applied calculus. Mathematics Education Research Journal 13(3), 165–184 (2001).
3. Brunetto, D., Bernardi, G., Bassi, C.: Students' experience of blended teaching formats in pre-calculus courses. In: Proceedings of 9th International Conference on Higher Education Advances (HEAd'23), 1–8 (2023). Valencia, Spain. (in press)

Using the Moodle Quick Chat plugin to promote student online interactions and teacher's ability to monitor them

Umberto Dello Iacono[1][0000-0003-0224-1046] and Giuseppe Fiorentino[2][0000-0003-1021-3969]

[1]University of Campania "L. Vanvitelli", Viale Abramo Lincoln, 5, 81100 Caserta CE, Italy
[2]Italian Naval Academy, Corso Italia 72, 57126 Leghorn, Italy
[1]umberto.delloiacono@unicampania.it
[2]giuseppe.fiorentino@unipi.it

Educational research shows that collaborative learning, when adequately supported, promotes critical thinking and argumentative skills [1]. This is also true in computer-based environments, provided that appropriate technological tools are available. In this perspective, Vygotskian Computer Based Learning Activities (VCBLAs) [2] were designed and implemented through computer-based collaborative scripts with the aim to boost online students' interactions and thus promote collaborative learning. However, when the script grows in complexity, it may become difficult to simultaneously handle all the required tools. A new plugin for Moodle, named *Quick Chat* [3], was therefore designed to provide a better communicative environment. It allows teachers and students to handle the narrative flow and all communication channels of a VCBLA in a single browser window. The plugin impacts the graphical interface and, consequently, the effectiveness of collaboration. Indeed, an easily accessible digital environment promotes collaboration and discussion [4], and reduces the overhead on students, who can cognitively focus on the task [5]. It also increases the degree of user acceptance of the environment itself, and thus its usability [6].

A VCBLA aims to involve students in (mathematical) learning activities and to promote a learning which is first socialized among the peers and then internalized by each student [7]. A VCBLA mainly consists of a narrative flow steering the learning activity and some collaborative tools. Within a VCBLA, students work in small groups, possibly assuming predefined roles, and communicate at different levels (among peers in small groups, with the whole class, or with the teacher) using different channels, typically implemented with chats (as in [8]). VCBLAs are typically implemented using Moodle to handle all their (potentially complex) collaborative scripts. Moodle natively comes with all tools to implement and master the narrative flow, the collaboration, and all communications among the peers and with the expert/teacher [9]. Nevertheless, when many tools are required at the same time, Moodle shows some limits because the handling of the resulting interface may become so difficult to spoil the user experience. So, this may impact the implementation of a VCBLA where students and teachers are forced to open many browser windows or tabs: one for the narrative flow and one for each chat or additional tool. The main issue arises from the need to manage all the chats needed to implement the simultaneous communicating channels: the user is forced to switch among all open windows/tabs to retrieve the last message. This issue is also critical for the teacher who should follow all the conversations to be able to take any necessary action, immediately or afterwards.

To ease this, a new Moodle plugin, *Quick Chat*, was developed as part of the LIME project - Learning Interface for Mathematics Education - at the University of Campania "L. Vanvitelli". Its main goal is to overcome the above accessibility and usability limit of the platform, allowing to group the main course page and all chats where the user is involved in a single browser window.
Once installed, the plugin is available through the *Navigation* block in the course home page. By clicking on the *Quick chat* menu item therein, the browser window splits in two parts; the left one holds the current Moodle page, allowing the user to continue his experience; on the right side the plugin aggregates into a regular grid all the chats where the current user is involved according to his/her role and group within the VBCLA.

In this paper, we present some preliminary results of an experiment carried out with 16 students attending the "Mathematics education" course in the second year of a Master's degree in Mathematics at the University of Campania "L. Vanvitelli". Divided in small random groups, they were involved in an online activity organized in two tasks: the Wason selection task [10] and the variant proposed by Griggs e Cox in 1982 [11]. In both tasks, each group was asked to discuss and reach a shared solution using a group chat and then to share it on a general chat, where the members of all groups and the teacher could participate in the discussion. The *Quick Chat* plugin allowed the members of all groups to visualize the task, the group chat and the general one all in a single web page. With a similar but more complete interface, the teacher was able to follow all group chats and the general one in real time.

All data were collected using the Moodle platform and analyzed within the theoretical framework introduced by Weinberger and Fischer [12]. In particular, we focused on two of the fundamental dimensions involved in the construction of new knowledge in computer-based collaborative environments: the participation dimension and the dimension of social modes of co-construction.
The paper analyzes advantages, limits, and potentialities (to implement in future development) of the *Quick Chat* plugin from the point of view of students and teachers. Preliminary findings suggest that *Quick Chat* can really foster student collaboration and interactions; at the same time, it also allows teachers to actively follow all group interactions, enabling them to step in when necessary and prepare the final discussion in a more effective way.

References

1. Leitão, S.: The potential of argument in knowledge building. Human Development, 43, 332-360 (2000).
2. Dello Iacono, U., Amorese, T., Cuciniello, M., Mannillo, C.V.: User-friendly interfaces for Vygotskian computer-based learning activities. Journal of Systemics, Cybernetics and Informatics(JSCI), 19(2), 23-29 (2021).
3. Dello Iacono, U.: Promoting online collaborative learning on moodle platform with the "quick chat" plugin. HUMAN REVIEW. International Humanities Review/Revista Internacional de Humanidades, 11(Monográfico), 1-10 (2022).

4. Schoonenboom, J. (2008). The effect of a script and a structured interface in grounding discussions. *International Journal of Computer-Supported Collaborative Learning, 3*(3), 327-341.
5. Hron, A., & Friedrich, H.F. (2003). A review of web-based collaborative learning: factors beyond technology. *Journal of Computer Assisted Learning*, *19*(1), 70–79.
6. Esposito, A., Amorese, T., Cuciniello, M., Riviello, M. T., & Cordasco, G. (2020). How human likeness, gender and ethnicity affect Elders' Acceptance of assistive robots. In *2020 IEEE International Conference on Human-Machine Systems (ICHMS)* (pp. 1-6). IEEE.
7. Vygotsky, L. S.: Mind in society: The development of higher psychological processes. Harvard university press (1980).
8. Albano, G., Dello Iacono, U., Fiorentino, G.: A Technological Storytelling Approach to Nurture Mathematical Argumentation. In H. Chad Lane, Susan Zvacek and James Uhomoibhi (Eds.), Proceedings of the 12th International Conference on Computer Supported Education (CSEDU 2020) - Volume 1, pp. 420-427 (2020).
9. Albano, G., Coppola, C., Dello Iacono, U., Fiorentino, G., Pierri, A., Polo, M.:. Technology to enable new paradigms of teaching/learning in mathematics: the digital interactive storytelling case. Journal of E-learning and Knowledge Society, 16(1), 65-71 (2020).
10. Wason, P. C.: Reasoning. In B. Foss (Ed.), New Horizons in Psychology. Penguin Books (1966).
11. Cox, J. R., Griggs, R. A.: The effects of experience on performance in Wason's selection task. Memory & Cognition, 10(5), 496-502 (1982).
12. Weinberger, A., & Fischer, F. (2006). A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. *Computers & education*, *46*(1), 71-95.

Undergraduate mathematics student-generated videos as an inside-outside resource for meaningful learning

Annamaria Miranda [0000-0003-3210-7964]

Università di Salerno, Fisciano SA 84084, Italy
amiranda@unisa.it

1 Introduction and Research Context

Recent advances in educational technology have brought significant changes in the way students both learn and interact with their learning, such as the ease of access to the Internet, media technology, and hand-held devices. In particular, the use of video resources to enhance learning is growing and becoming more significant both for teaching and learning as it excellently integrates classical resources, providing "augmented" experiences. Videos can be interlinked with slides, supporting texts, resource links, discussion boards, and chat platforms, among others, as part of a virtual learning environment (Karppinen, 2005). According to Mayer (2009), "learning is a process of knowledge construction" and "multimedia instruction leads to better learning outcomes than just using words alone by assisting the sense-making process through the activation of verbal and visual cognitive processes". Visual processes are central to knowledge construction in geometry, especially to understand how the shape of geometric or natural objects varies. At the university level, video design is mainly used for teacher professional development (Coles, 2019; Arya, 2016) and less in university teaching and learning. Arruabarrena et al. (2021) define a novel taxonomy of academic video design styles based on the videos produced by students rather than instructors. Inspired by the characteristics of "meaningful learning" (Jonassen et al., 2003; Karppinen, 2005; Mayer, 2009), both synchronous and asynchronous (Kanetaki et al., 2022), we investigate in a university mathematics contest the learning outcomes coming from learners' generated videos for their own class and for other classes through tasks requiring them to design and produce videos in topology and from outside video users. The novelty lies in the study of video resources' intertwining learning opportunities for both creators and users. We focus on the following research questions: RQ1: *How does the creation of a video influence the creator's and users' perceptions of learning?* RQ2**:** *How does the use of video influence students' attitudes towards learning? Does using video contribute to the construction of knowledge and meaningful learning?*

2 Methodology

The experience, held during the second semester of the academic year 2022-2023, involved two consecutive undergraduate classes enrolled in two different levels of topology courses within a bachelor's degree in mathematics. In the first phase, twenty-two

third-year mathematics undergraduate students (3Y), individually or divided into small groups, created digital videos for themselves and their peers, while in the second phase they reused them as a resource for thirty-eight second year undergraduate students (2Y). The 3Y-students' task was a video-seminar on contents related to some topic covered in the course to be completed, addressed to the whole class, collectively reviewed, eventually modified, and then presented to 2Y-collegemates. Every video presentation, usually attended by the author of the video, was followed by a collective discussion and some task assignments. At the end of the activities, both classes were also required to answer a questionnaire about their personal experiences. Our data, specifically students' answers in the questionnaires, was qualitatively analysed through a systematic and objective identification of meaningful learning signs and classifying sentences relating to a single theme. We labelled what the use and reuse of the digital resource has produced in terms of students' perceived learning, changing attitudes, meaningful learning, and knowledge by looking for signs in their questionnaire's answers.

3 Preliminary findings and conclusions

We searched for sentences providing evidence about the characteristics of meaningful learning processes students experienced. A taste of these findings is given in Table 1.

Table 1. Findings emerging through some factor characterizing a meaningful learning process.

Factors	Outcomes from questionnaires (Statements related to factors)
Critical Thinking and problem-solving skills	*In a presentation by my colleague, I questioned the truth of the statements by virtue of the definitions he introduced, and we solved the problem together…(3YS'* knowledge, facts, and data to effectively solve problems)
Knowledge construction	*I used my prior knowledge about the course topics to create new knowledge for me and others (3YS'* use of known concepts to construct new knowledge*)*
Communication skills	*It's a good way to communicate knowledge, but more exciting… (3YS'* satisfaction of verbal and non-verbal communication with peers)
Creative Thinking	*In my video I felt free to insert other resource links. I imported a video on the deformation of a mug in a torus. (3YS'* thinking about new ideas and ways of doing things rather than the old way)
Reflective thinking	*I watched the video to clarify some doubt, and this was satisfying. (2YS'* asynchronous use of the video resource to reflect)
Effectiveness	*Once a video is created, it can be reused and updated as needed. I think it leaves more time for live discussions and deepens the understanding (2YS)*
Engagement	*I felt the responsibility to create a resource, as a teacher can do, and I gave more attention to my work…and while I prepared it, I both consolidated my knowledge and was exited to think that a video would serve my peers...(3YS)*

Our first findings show that video use has positive inside-classroom outcomes for 3Y-students on multiple levels, including engagement, increased motivation, communication skills, and deeper knowledge. In the outside-classroom context, the natural harmony and age closeness of 2Y-students with the video creators is beneficial for stimulating participation, enjoyment, reflective thinking, and communication skills. The ability to manage the learning process through the video, picking essential aspects to study and reviewing backward when desired, indicated higher levels of meaningful learning.

4 References

1. Karppinen, P.: Meaningful learning with digital and online videos: theoretical perspectives. AACE J. 13(3), 233–250 (2005).
2. Mayer, R. E.: Applying the science of learning: evidence-based principles for the design of multimedia instruction. Am. Psychol. 63, 760–769 (2008).
3. Coles, A.: Facilitating the use of video with teachers of mathematics: learning from staying with the detail. IJ STEM Ed 6, 5 (2019). https://doi.org/10.1186/s40594-018-0155-y
4. Arya, P., Christ, T., & Chiu, M. M.: Video use in teacher education: A survey of teacher-educators' practices across disciplines. Journal of Computing in Higher Education 28(2), 261–300 (2016). https:// doi.org/ 10. 1007/ s12528- 016- 9116-y
5. Arruabarrena, R., Sánchez, A., Domínguez, C. et al.: A novel taxonomy of student-generated video styles. International Journal of Educational Technology in Higher Education 18, 68 (2021). https://doi.org/10.1186/s41239-021-00295-6
6. Jonassen, D. H., Howland, J., Marra, J. & Marra, R.M.: Learning to solve problems with technology: A constructivist perspective (2nd Ed.). Upper Saddle River, NJ: Merrill/Prentice Hall (2003).
7. Kanetaki, Z., Stergiou, C., Bekas, G., Jacques, S., Troussas, C., Sgouropoulou, C., Ouahabi, A.: Acquiring, Analyzing and Interpreting Knowledge Data for Sustainable Engineering Education: An Experimental Study Using You Tube. Electronics 11, 2210 (2022). https://doi.org/10.3390/electronics11142210.

A workshop online to foster communicative skills through a Formative Assessment path based on the feedback

Michele Giuliano Fiorentino[1][0000-0003-1557-4878], Antonella Montone[1][0000-0002-4450-1590] and Giuditta Ricciardiello[1][0000-0001-5725-3015]

[1] University of Bari Aldo Moro, Italy
michele.fiorentino@uniba.it
antonella.montone@uniba.it
giuditta.ricciardiello@uniba.i

1 Introduction

This paper proposes the experience of teaching interventions using a particular form of Formative Assessment (FA), designed and implemented in a university pre-service training course for Primary school teachers. This study is part of a larger research, involving pre-service teachers [1]. Fundamental is the role of technology, since such interventions, conducted in an online mode, constitute a learning environment in which interaction among participants is fostered. The technology used also ensures anonymity in peer-review assessment, allows random distribution of tasks to be corrected among peers, and monitoring and sharing of peer feedback.

We assume that students taking such courses generally have already encountered specific mathematical content, but related knowledge and skills may not always be adequate, and students are often unaware of their own "inadequacies". The workshop activities follow a structure divided into various phases, in which peer feedback becomes an appropriate way to foster pre-service teachers' training. The feedback referred to, concerns the information that each student provides about the activity produced by other students and receives about his or her own activity. The aim of the work is to analyze how the communicative aspect related to solving processes of a mathematics problem by students, improves through the assessment of problem's solution produced by peers.

2 Theoretical framework

The FA processes occurs through interactions with the teacher and classmates and allows students to verify their learning levels and plan and implement the necessary strategies to achieve the pre-established learning objectives [2]. These activities also support the professional training of teachers allowing collaboration among them [3]. According to Ramaprasad [4], the FA practice becomes meaningful only if it allows the student to evolve his own performance, and so, in this practice, the feedback plays a major role.

Considering Hattie and Timperley's four types of feedback [5] we focus our experimentation especially on the feedback for self-regulation and on the execution on the task. The feedback must follow some specific criteria [6] defined by the teacher: correctness, completeness and clarity. Technology also allows to support the FA processes in its three main functions [1],[3]. The research questions we try to answer are the following (the first one is part of the larger research): 1. How does providing and receiving feedback on problem solving help improve communication and problem-solving strategies? 2. How does feedback make the future teacher more aware of their knowledge about the arithmetic properties of 10 x 10 table of the first 100 natural numbers?"

3 The workshop online: methodology, discussion and results

The designed workshop was developed in four phases [1] with the related requests to the students, starting from the resolution of a problem concerning the arithmetic properties of 10 x10 table of the first 100 natural numbers. The workshop has been carried out with 150 students, divided into 35 groups.

All the phases were carried out through a technological platform Moodle based, that allowed interactions among students in the working group, the immediate sending of feedback and the processing and analysis of the data collected during the lessons and of the protocols delivered by the students after the three phases. Each group gave feedback to the other group randomly assigned in the Moodle platform.

The review carried out by the students was revealed to be an adequate tool for the workshop. In particular it emerged a strong interdependence between feedback-based formative assessment and the development of argumentative skills in a relational approach to mathematics. Feedback have been divided for their analysis on the criteria of correctness, completeness and clarity met Hattie and Timperley's criteria related to the task and task performance. The feedback's analysis sent by each group of peer students and the analysis of the changes made after receiving the feedback highlighted that this type of activity has favoured an improvement in communication and in problem solving strategies. The peer-review mode, indeed, activated metacognitive processes of self-regulation in both the feedback giver and the feedback receiver to modify the task solution.

It is interesting to observe how the revision had a double value: on the one hand receiving the feedback improve the solution of the problem, on the other hand the revision phase itself allowed to have a greater awareness of the mathematical concepts involved and to improve own proposal both from a communicative point of view and for the mathematical contents.

References

1. Fiorentino, M.G., Montone, A. The Rational Numbers in a Pre-service Mathematics Teacher Educational Path Highlighting the Role of Feedback in the Formative Assessment. In: Fulantelli, G., Burgos, D., Casalino, G., Cimitile, M., Lo Bosco, G., Taibi, D. (eds) Higher Education Learning Methodologies and Technologies Online. HELMeTO 2022.

Communications in Computer and Information Science, vol 1779. Springer, Cham. https://doi.org/10.1007/978-3-031-29800-4_46 (2023).
2. Cusi, A., Morselli, F., Sabena, C. Promoting formative assessment in a connected classroom environment: design and implementation of digital resources. ZDM Mathematics Education, 49(5), 755–767 (2017).
3. Albano, G., Dello Iacono, U., Pierri, A. Structured online teachers' collaboration for fostering professional development. In H. Norko & D. Potari (eds): Teachers of Mathematics Working and Learning in Collaborative Groups, ICMI-25 Study Conference Proc. (pp. 573-580) February 3-7, 2020 Lisbon, Portugal. Disponibile al link: http://icmistudy25.ie.ulisboa.pt/wp-content/uploads/2020/01/1.6.2020 ICMI PreProceedings.pdf (2020).
4. Ramaprasad, A. On the definition of feedback. Behavioural Science, 28(1), 4 −13 (1983).
5. Hattie, J., & Temperley, H. The power of feedback. Review of Educational Research, 77(1), 81– 112 (2007).
6. Albano, G., Pierri, A., Sabena, C., Grasping criteria for success: engaging undergraduate students in formative feedback by means of digital peer workshops, Teaching Mathematics and its Applications: An International Journal of the IMA,1-20 (2022).

Examining the implementation of Blended Learning in the Engineering field

Roberto Sala[1[0000-0001-7671-6927]], Fabiana Pirola[1[0000-0003-4633-7568]], Giuditta Pezzotta[1[0000-0001-7983-8356]], Fredrik Enoksson[2[0000-0002-5222-970X]], Sandi Ljubić[3[0000-0003-3456-8369]], Arian Skoki[3[0000-0002-7164-1994]], Emmanuel Francalanza[4[0000-0003-0317-5909]], Joseph Paul Zammit[4[0000-0002-9271-9682]], Amberlynn Bonello[4[0009-0006-8950-5268]], Primož Podržaj[5[0000-0002-9932-9521]], Paolo Claudio Priarone[6[0000-0003-4226-7697]], Dario Antonelli[6[0000-0002-0118-0424paolo]], Paolo Minetola[6[0000-0002-5917-5273]], Antonio Maffei[2[0000-0002-0723-1712]] and Eleonora Boffa[2[0000-0003-4847-3723]]

[1] University of Bergamo, Department of Management, Information and Production Engineering, Viale Marconi, 5, Dalmine (BG), 24044, Italy
[2] Department of Production Engineering, KTH Royal Institute of Technology, 114 28 Stockholm, Sweden
[3] University of Rijeka, Faculty of Engineering, 51000 Rijeka, Croatia
[4] CERU, Department of Industrial and Manufacturing Engineering, University of Malta, Msida, MSD2080, Malta
[5] Faculty of Mechanical Engineering, University of Ljubljana, 1000 Ljubljana, Slovenia
[6] Department of Management and Production Engineering, Politecnico di Torino, 10129 Torino, Italy
roberto.sala@unibg.it

1 Introduction

Blended Learning (BL) is a pedagogical approach combining traditional in-person methods with remote activities to enhance student learning. In the Engineering field BL can be used to challenge students with demanding activities and industry-like problem-solving exercises within a controlled environment [1]. Before the COVID-19 pandemic, teachers had the freedom to consider using BL in their courses according to Constructive Alignment principles [2]. Instead, during the pandemic, teachers had to recalibrate the Intended Learning Outcomes (ILOs), i.e., expected achievements per unit of study and switch from face-to-face content to remote teaching [3]. This work explores the adoption of BL in the Engineering courses (also considering the pre, during, and post COVID-19 settings) from the technological, organizational (e.g., in presence vs remote), content (e.g., ILOs adaptation), and target (e.g., bachelor, master, PhD) point of views.

2 Methodology

A systematic literature review methodology was adopted. The research query built around the BL ("blend* learn*") and Engineering ("Engineer*") keywords, run in SCOPUS using the "AND" operator, searching the keywords in the "Title, Abstract, Keywords" fields, limiting the results to journal papers, and the Engineering Subject Area. The initial sample of 206 documents (at the beginning of 2023) was filtered

according to inclusion criteria to reach the final sample of 103 papers. Papers were classified according to six learning approaches: Face-to-Face, Rotation, Flex, Labs, Self-blend, and Online. The analysis further focused on classifying the papers according to Bloom's Taxonomy level (Remember, Understand, Apply, Analyze, Evaluate, Create) [4] based on the course ILOs.

3 Results

What emerged (Table 1) is a mix of in-person and remote activities in combination with the lower or medium levels of Bloom's taxonomy (from Remember to Analyze) but no clear pattern for in presence vs remote settings was found. There was a preference for addressing the lower and medium levels of Bloom's taxonomy. The analysis of the dataset revealed that only a small portion of the papers directly addressed the COVID-19 pandemic, with no significant increase in terms of publications compared to the general trend. A justification might be found in the time required to test the effects of the new BL setting, compare it with the old one, and publish about it.

Table 1. Table captions should be placed above the tables.

Category	Distribution
Learning approach	Rotation (31,4%); Face-to-Face (26,4%); Online (15,7%); Self-blend (9,1%); Flex (9,1%): Labs (8,3%)
Degree Level	Bachelor (67%); Master (24%); PhD (6%); Faculty (3%)
Bloom's Taxonomy (in presence)	Remember (16%); Understand (29%); Apply (34%); Analyze (13%); Evaluate (5%); Create (3%)
Bloom's Taxonomy (remote)	Remember (22%); Understand (32%); Apply (31%); Analyze (11%); Evaluate (2%); Create (2%)
COVID-related	Yes (7%); No (93%)

4 Conclusions

While a clear interest in a more comprehensive adoption of BL methods was found, only a few papers dealing with the COVID-19 pandemic were available, limiting the possibility to deepen the implication, and forcing researchers to speculate about its impact. Future research should deepen the impact that the COVID-19 pandemic had on BL adoption and the effect that this had on the post-pandemic setting.

References

1. A. Rahman, 'A blended learning approach to teach fluid mechanics in engineering', EuropeanJournal of Engineering Education, vol. 42, no. 3, pp. 252–259, May 2017.
2. J. O. H. N. Biggs, 'Enhancing teaching through constructive alignment', pp. 347–364, 1996.
3. J. Crawford, K. Butler-Henderson, J. Rudolph, and B. Malkawi, 'COVID-19: 20 countries' higher education intra-period digital pedagogy responses', JALT, vol. 3, no. 1, Apr. 2020.
4. B. S. Bloom, M. D. Englehart, E. J. Furst, W. H. Hill, and D. R. Krathwohl, Taxonomy of educational objectives: Handbook I: Cognitive domain., New York: David McKay, 1956.

Mathematics in primary school with the use of online resources for pre-service teachers' education and training

Annarosa Serpe [0000-0003-4820-1760]

University of Calabria, Department of Mathematics and Computer Science,
87036 Rende (CS), ITALY
annarosa.serpe@unical.it

1 Introduction

The current development of the Italian education system is in line with European educational standards, based on a competent educational approach, which provides for the acquisition of key competencies by future specialists. The list of key competences outlined in the Recommendations of the European Parliament and of the Council of Europe of 12 December 2006 also includes digital competence, i.e. the safe, critical, and responsible use of digital technologies and the interaction with them for learning, work, and life in society [1]. Of course, in Italy, this topic of the use of technologies for teaching is not new during teacher training. Moreover, also in the National Digital School Plan, launched by the Ministry of Public Education at the end of 2015, there are explicit references to digital skills in and for school. However, it was only in 2017 that a European reference framework was defined with the European Framework for the Digital Competence of Educators: DigCompEdu [2].
In light of the indications outlined in DigCompEdu, the issue of promoting digital skills in the incoming training path of future kindergarten and primary school teachers has been receiving increasing attention in recent years. The framework, taken as a conceptual framework, aids reflection on the numerous issues concerning the six areas of competences that each teacher should possess; for a total of 22 competencies. This framework follows the increasingly pressing need to design and implement targeted training courses, which can train teachers capable of "acting digital". In practice, this means guiding the professional practice of future teachers, who are engaged in the construction of that complex set of pedagogical-didactic, methodological and transversal skills necessary for the profession. Planning, didactic implementation and evaluation can be conceived with ICT, with the aim of containing the connected risks - such as, for example, the effects on the cognitive load - if accompanied by an appropriate critical reflection on the characteristics of the means chosen to achieve the objectives of the expected learning.

1.1 Research question

Effective and innovative mathematics instruction, in Primary schools, starts with good initial teacher-training. There has been a global trend of developing educational technology to actively engage pupils in mathematics learning by creating active learning

opportunities and personalizing the experiences. Therefore, technology has become an integral part of the training of future professionals in primary education institutions.
Online resources support the teaching-learning, as a means of education that incorporates self-motivation, communication, and efficiency, and helps the pupils to manage self-regulated learning and to establish their own learning goals until the final assessment of their own learning. However, this has remained inadequate in terms of the use of various online resources, online services for primary school teachers, and other pedagogical software tools in the process of teaching mathematics to young pupils.
This work focuses on the problem of the training of future primary school teachers whenever they use various online resources and other pedagogical software in teaching mathematics. Specifically, we propose and discuss the use of LearningApps carried out within the course of Mathematics Education I – in the Master's Degree in Primary Teacher Education, to train and qualify students concerning the teaching and learning processes managed through small interactive modules. LearningApps.org is one of the Web 2.0 services aimed to support learning that makes it easy to create online interactive exercises. Its purpose is to create a public library of independent blocks, suitable for reuse and editing. The purpose of this study is to explore students' (future teachers) experiences of mathematics teaching in the Learning App context to create interactive modules - defined as apps- as non-autonomous didactic objects to be used within educational scenarios to support mathematics learning. The approach implemented is decidedly friendly and playful and learning how to use the various tools is pleasant and simple.

It is characterized by the following phases:

1. familiarizing students with the possibilities of the Learning Apps service and the algorithm for working with it;
2. practical training for students to create interactive exercises on different platforms of the Learning Apps service;
3. creation of group or individual projects;
4. presentation and discussion of the project;
5. reflection on using LearningApp as a resource that supplements their existing curriculum to improve pupils' motivation, engagement, and learning in mathematics.

References

1. EUROPEAN COMMISSION. Proposal for a council recommendation on key competences for lifelong learning. European Commission: Brussels, Belgium, (2018). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01), last accessed 2023/06/18
2. Redecker, C.: European framework for the digital competence of educators: DigCompEdu. No. JRC107466. Joint Research Centre, Seville, Spain (2017). https://op.europa.eu/en/publication-detail/-/publication/fcc33b68-d581-11e7-a5b9-01aa75ed71a1/language-en, last accessed 2023/06/18
3. LearningApp. Web site URL: https://learningapps.org/impressum.php

Digital integrated model for mathematics interpretative tasks: a case study in pre-service primary teachers professional development

Giovannina Albano[0000-0002-5119-5413], Gemma Carotenuto[0000-0002-1586-9126], Cristina Coppola[0000-0003-2461-1722] and Marina Spadea

University of Salerno, Fisciano (SA), Italy
galbano@unisa.it

In this paper we report the implementation and the experimentation' s outcomes of the good practice 'Task interpretativi' [1], designed within the activities of DIGiMATH[1], a working group of the Unione Matematica Italiana. It has been implemented in a blended course of Mathematical Laboratory devoted to primary pre-service teachers attended the Primary Education University degree.

The practice is devoted to teacher education and it is based on two main theoretical frameworks: Interpretative Knowledge and Formative Assessment.

Interpretative Knowledge is defined as "a deep and wide mathematical knowledge that enables teachers to support students in building their mathematical knowledge starting from their own reasoning and productions, no matter how not standard or incorrect they might be" [2]. An interpretative task consists of two parts: the first one is the solving of a mathematical problem, and the second one is the interpretation of solutions actually proposed by students that have been collected on previous occasions. The second part is particularly significant because it allows the teachers to give their opinions on the students' solutions, also in terms of positive and negative evaluations and possibly discover mathematically relevant aspects they previously neglected. Thus not only the teachers' knowledge comes into play, but also their beliefs on the mathematical view [3]. The latter part is strictly linked to formative assessment.

Formative Assessment stands as a proper instructional methodology, in which teachers are not the only actors in the process but a relevant role is also held by the students and the peer group. In Formative Assessment all actors collect, interpret and use evidence of the outcomes of the current instructional process in order to be able to make decisions about next steps in a way that makes them better or better founded [4]. Structured interactions among students which allow them to verify their learning outcomes and give suggestions to move forward are typical of Formative Assessment [5].

From the technological perspective, digital peer workshops can be designed exploiting the Workshop module of the e-learning platform Moodle [6], useful also for structuring teachers professional development [7]. The added value of the digital peer workshops can be devised in various key points: the pre-service teachers are engaged in being a resource one for another, giving and receiving constructive feedback; the teacher of the course share with the pre-service teachers some pivotal steering questions

[1] www.digimath.it

aimed at fostering reflections at various levels (mathematics for solving the task, mathematics for teaching with respect the task, multiple solving strategies and representations, etc.); the teacher of the course collects all the solutions and reflections produced along the whole activity and re-used some of them as instructional resources in collective mathematical discussions; chance to use anonymity in the producing and delivery phases of the solutions and feedback in order to avoid any kind of bias.

During the experimentation, we realized two cycle of the model presented in [1] which integrates interpretative knowledge tasks and digital peer workshops. The model consists of the following steps: 1) solving the task; 2) guided reflections on the solutions proposed by some peers; 3) providing feedback to peers according to the previous step and collective discussion for comparing various solving strategies and products; 4) guided reflections on the solutions actually proposed by students at the school level to which that task is directed; 5) final collective discussion to institutionalize the pre-service teachers knowing produced during the activity.

We will present the outcomes of the analysis of the products provided along the two cycle realized and discuss the pre-service teachers' perceptions of the activities with respect to their professional development.

References

1. Albano, G., Arzarello, F., Baccaglini-Frank, A., Carotenuto, G., Cazzola, M., Coppola, C., Cusi, A., Dello Iacono, U., Fiorentino, M., Mellone, M. Miragliotta, E., Montone, A., Morselli, F. Santi, G., Taranto, E., Vincenzi, G.: Task Interpretativi. https://sites.google.com/unisa.it/digimath/prodotti/formazione01?authuser=0, last accessed 2023/06/19.
2. Di Martino, P., Mellone, M., & Ribeiro, M. Interpretative knowledge. Encyclopedia of Mathematics Education. Cham: Springer International Publishing, 1-5 (2019).
3. Di Martino, P., Zan, R.: Attitude towards mathematics: a bridge between beliefs and emotions. ZDM Mathematics Education 43, 471–482 (2011).
4. Black, P., & Wiliam, D.: Developing the theory of formative assessment. Educational Assessment, Evaluation and Accountability, 21(1), 5-31 (2009).
5. Cusi, A., Morselli, F., Sabena, C.: Promoting formative assessment in a connected classroom environment: design and implementation of digital resources. ZDM Mathematics Education, 49(5), 755–767 (2017).
6. Albano, G., Pierri, A., Sabena, C.: Grasping criteria for success: engaging undergraduate students in formative feedback by means of digital peer workshops. Teaching mathematics and its applications, 1–20 (2022).
7. Albano, G., Dello Iacono, U., Pierri, A.: Structured online teachers' collaboration for fostering professional development. In H. Norko & D. Potari (eds): Teachers of Mathematics Working and Learning in Collaborative Groups, ICMI-25 Study Conference Proc., pp. 573-580. Publisher, Lisbon, Portugal (2020).

Developing constructively aligned blended educational units in Engineering Education

Fredrik Enoksson[1[0000-0002-5222-970X]] and Antonio Maffei[1[0000-0002-0723-1712]]

[1] KTH Royal Institute of Technology, 114 28 Stockholm, Sweden

1 Introduction

Due to the covid-19 pandemic, digital opportunities for teaching and learning have gotten more attention in the last years, for example in engineering education (Graham, 2022). The pandemic forced higher education institutions to move both teaching activities and assessment online, which was often best described as Emergency Remote Teaching (Hodges et al., 2020). In the current situation it is instead possible to explore the best blend and combination of digital and face-to-face teaching and learning. This approach to designing courses is called Blended Learning, commonly defined as "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison and Kanuka, 2004). This definition implies that a thoughtful design includes or at least considers both face-to-face activities and digital opportunities, taking the thought away from it being a choice of either or.

The constructivist view sees learning as a process where the learner is active and through that process builds their own representations and incorporates new information into their pre-existing knowledge. From that point of view the role of teacher is to be the designer and facilitator of teaching and learning activities (TLA) where the learner can be active and build upon pre-existing knowledge. In constructive alignment (Biggs, 1996) the outcome for the student, of an educational unit, is the starting point for design. The outcome is commonly expressed as an intended learning outcome (ILO) to which should guide the design of both the assessment tasks (AT) and the TLAs for the unit. I.e., design ATs so that it actually assesses the ILOs and design the TLAs so that they help the students towards the ILOs in a scaffolded manner. The work presented here aims to explore how design of blended learning can be done with a CA approach for courses or educational units.

2 Constructive alignment for creating blended learning in Engineering Education

The approach proposed, on how to design blended learning for educational units, is by considering how face-to-face and online experiences are designed and combined using constructive alignment (CA). This approach is currently being used within the Erasmus+ project BLISS, where several educational units from 6 European universities will be developed in different engineering courses. The main objective of the project is

to increase efficiency and resilience of the Higher Education institutions so that a more accessible and flexible learning experience can be provided to students. This by developing a methodological approach based on the experience of developing the 6 educational units.

Each educational unit is part of a course given by one of the universities involved. The ILOs for each educational unit come from or are developed from the official course description for each university. Then, following in the lines of Biggs (2003):

1. The ILOs of each educational unit are expressed with one or more active verb(s) expressing the outcome for student, i.e., what they will be able to do after the educational unit. The active verb(s) of the ILO is mapped to the Blooms taxonomy.
2. For each ILO one or more ATs are developed, where the student is given tasks designed to assess the ILO.
3. For each ILO one or more teaching activities are developed upon what the teacher will do, with a corresponding learning activity, expressing what the students are expected to do.

Engineering education is often still taught with an approach where students become passive recipients of knowledge that the teachers transmit, e.g., in a lecture. While the lecture is still valuable a constructively aligned TLA would also include one or several elements with the student being active. In a blended learning design, utilizing CA, one approach to for the TLAs could be sequences where the students study an educational video and take a self-evaluation quiz online as preparation to attending a class focused on active participation and discussion.

3 Evaluation of the blended educational units

The blended educational units will be designed, implemented and then also evaluated. Evaluations of interventions in teaching and learning need to be carried out with several aspects in mind, or else the complexity will be lost. For example, data on the experience of the students might imply that the student got a heavier burden, but data on grades might show that the student performed better than students in previous course rounds. In the project we aim to cover as many of the relevant aspects of the interventions in the evaluation of the blended educational units. Focus will however be on how students perceive the educational experience and, when possible, a comparison of students´ performance compared with earlier course rounds. We expect both of these evaluations to show that the students' experience of the TLAs as worthwhile and that their results have improved.

References

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher education*, 32(3), 347-364. https://doi.org/10.1007/BF00138871

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, 7(2), 95-105.

Graham, R. (2022). Crisis and catalyst: *The impact of COVID-19 on global practice in engineering education*. Massachusetts Institute of Technology, USA. https://hdl.handle.net/1721.1/145955

Hodges, C. B., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning https://er.educause.edu/articles/2020/3/the-difference-between-emerge ncy-remote-teaching-and-online-learning.

Learning geometry in primary school: GGBot as an instrument of semiotic mediation

Anna Baccaglini-Frank[1][0000-0002-8116-5370] Elisa Miragliotta[2][0000-0003-3646-9065] George Santi [3][0000-0002-5898-4538]

[1] Department of Mathematics, University of Pisa, Italy
[2] Department of Mathematics, University of Pavia, Italy
[3]Department of Science Education, University of Macerata, Italy
anna.baccaglinifrank@unipi.it
elisa.miragliotta@unipv.it
george.santi@unimc.it

We present a good practice developed within the Digimath Group of the Italian Mathematical Union (UMI) (https://umi.dm.unibo.it/gruppi-umi-2/gruppo-digimath/), directed by Giovannina Albano. We cast our study in the strand of the Digimath project devoted to mathematics teacher professional development. The good practice pivots around the GGBot, a drawing robot devised by Anna Baccaglini-Frank for the teaching and learning of geometry at primary school. The implementation of the GGBot as a good practice stems from the theoretical and experimental research developed within the PerContare project (https://www.percontare.it/), directed by Anna Baccaglini-Frank, to which we refer the reader for further information. The adoption of the GGBot for an effective teaching-learning of geometry rests on three intertwining ingredients: the theoretical framework; the digital technology, i.e., the GGBot; the role of the teacher.

The theoretical framework stems from the theory of Semiotic Mediation (Bartolini Bussi & Mariotti, 2008) where the semiotic potential of an artefact links the tasks students are exposed to with pieces of mathematics knowledge. When students are given a task, they start a rich and complex semiotic activity triggered by the artefact. They produce traces (gestures, drawings, oral descriptions, written texts and so on) that the teacher collects, thereon organizing a path for their evolution towards mathematical texts connected with pieces of mathematics knowledge.

The second ingredient is the GGBot, the drawing robot at the heart of the semiotic mediation. The GGBot (short for GREATGeometryBot) builds on the convergence of physical and digital affordances, combining the well-known strengths and opportunities offered by Papert's original robotic drawing-turtle and LOGO programming with those of the block-based programming language SNAP! (Baccaglini-Frank et al., 2020; Baccaglini-Frank & Mariotti, 2022). The GGBot can hold a marker between its wheels (Fig. 1a) that draws out its path as it moves on a sheet of paper on the floor, as well as a marker at the front, on its "nose" (Fig. 1b), to highlight its movement when it changes direction.

Commands are given to the GGbot through a SNAP! interface that was customarily designed, and they can be gradually added based on the teacher's needs. The commands

are given to the GGBot by inserting sequences of blocks or codes (Fig. 1c) that are transmitted to the GGbot via a wifi module. The GGBot embodies the idea of microworld (Papert, 1980; Hoyles et al, 2002; Ratcliff & Anderson, 2011), informal but structured learning environments that embed specific knowledge domains. In the interaction with the potentials and constraints of the microworld, students recognize operational invariants that they interiorize as pieces of cultural and general mathematics knowledge. In fact, traces left by the marker as the GGBot moves provide situated signs. They can be elaborated into geometrical notions – such as segment, vertex, angle, rotation, polygon – while still carrying the situatedness given by the operational invariants emerging from real movement of the physical artefact in the microworld.

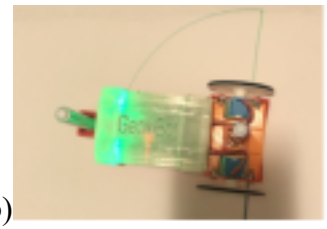
a)  b)  c) 

Fig. 1. a) back view of the GGBot; b) top view of the GGBot; c) examples of codes.

The third ingredient is the role assigned to the teacher in the semiotic mediation provided by the GGBot. The teacher is in charge of the design of activities and their realization in the classroom. The design of the activities involves the choices about the artefacts to be used, the tasks to be proposed and the pieces of mathematics knowledge at stake, according to the curricular choices. In managing the classroom activities, the teacher focuses their attention on the students' observable processes (semiotic traces), to decide how to interact with the students and support the interiorization of pieces of mathematics knowledge. The teacher collects all the semiotic traces (observing and listening to students), to analyse them and to arrange a path for their evolution towards mathematical texts that can be put in relationship with the pieces of mathematics knowledge. The teacher acts as a cultural mediator, in order to exploit, for all the students, the semiotic potential of the GGBot. The methodology proposed for the classroom process is described by Bartolini Bussi and Mariotti (2008) as the *didactical cycle* consisting of three phases: (1) Activities with the artefact; (2) Individual production of signs (situated); (3) Collective production of signs (mathematical signs). The Semiotic Mediation scheme that underpins the good practice with the GGBot has a twofold meaning. On the one hand, it is a tool for professional teacher development. On the other hand, it is a teaching practice that can be carried out in mathematics school classroom for the learning of geometry in primary school. In the presentation, we will show tangible applications of the GGBot as an instrument of semiotic mediation based on the PerContare (www.percontare.it) project, which is under the supervision of Anna Baccaglini-Frank.

References

1. Baccaglini-Frank, A., Santi, G., Del Zozzo, A., Frank, E.: Teachers' perspectives on the intertwining of tangible and digital modes of activity with a drawing robot for geometry. Education Sciences, 10(12), 387 (2020).
2. Baccaglini-Frank, A., & Mariotti, M. A.: " Doing well" in the Teaching for Robust Understanding approach revealed by the lens of the semiotic potential of tasks with the GGBot. In: Proceedings of the Twelfth Congress of the European Society for Research in Mathematics Education. CERME12 (2022)
3. Bartolini Bussi, M., Mariotti, M.A.: Semiotic mediation in the mathematics classroom: artifacts and signs after a Vygotskian perspective. In: Handbook of international research in mathematics education, pp. 746-783. Routledge/Taylor & Francis, New York and London (2008).
4. Hoyles, C., Noss, R., Adamson, R.: Rethinking the microworld idea. Journal of Educational Computing Research, 27(1-2), 29–53 (2002)
5. Papert, S.: Mindstorms: Children, computers, and powerful ideas. Basics Books, New York (1980).
6. Ratcliff, C., Anderson, S.E.: Reviving the Turtle: Exploring the Use of Logo with Students with Mild Disabilities. *Computers in the Schools, 28*(3), 241-255 (2011)

Creating Engaging STEM Learning Experiences with Python and Plotly Dash Web Apps

Renato Lombardo[1][0000−0002−3401−7180]

Università degli Studi di Palermo, Palermo, Italy
renato.lombardo@unipa.it
http://www.unipa.it/persone/docenti/l/renato.lombardo

Teaching chemistry to young students in school or at the undergraduate level, especially those who are not majoring in chemistry, can be challenging due to several factors. Firstly, the general approach used to explain complex chemical phenomena and the use of various models and tools can be difficult to understand. Secondly, chemistry is a subject that is organized into three conceptual levels, which are interconnected in a way that requires students to understand the connections between the macroscopic, sub-microscopic, and symbolic levels. This connection is often represented by the *Johnstone triangle*[3], where each vertex represents one of the above-mentioned domains, and the edges represent the connections between them.

The importance of the symbolic domain in learning chemistry cannot be overstated. It plays a critical role in enabling chemists to communicate complex concepts concisely and precisely through the use of symbols, diagrams, equations, and formulas. Mathematical models and their corresponding graphs are essential in chemistry, as well as other scientific disciplines and engineering, because they provide a precise and quantitative description and prediction of system behavior. However, understanding these models requires a complex set of skills that go beyond basic memorization, which can pose a challenge for students. As a result, models and graphs can be difficult to comprehend and apply without proper guidance and training[5].

Interactive applications, like dashboards, have the potential to simplify complex data and promote a deeper understanding of concepts, while also enhancing critical thinking and problem-solving skills [1]. However, despite the abundance of interactive applications available, it can be challenging to find one that aligns with a specific syllabus or teaching style. In such cases, it may be more effective to create a customized application that caters to the specific needs of the user.

The aim of this study was to assess the suitability of Python and Plotly Dash for the development of interactive dashboards, emphasizing their ease of use and efficiency, particularly for individuals without extensive backgrounds in ICT and programming. Python is an ideal programming language for creating educational applications, even for beginners, as it offers a range of tools and resources. Particularly, Plotly Dash [2] is a useful and efficient tool for developing customized dashboards that cater to specific teaching and learning contexts.

By leveraging Python's scientific libraries and the intuitive features of Plotly Dash, user-friendly dashboards were successfully designed and evaluated. The project underscored the accessibility and simplicity of these tools, enabling non-

experts to create engaging and interactive interfaces. The motivation for interactive dashboards was born out of a Physical Chemistry course aimed at first-year Biological Sciences students, who often struggle with mathematics and physics. These dashboards offer a way for students to experiment with complex models in a more accessible and intuitive manner, as opposed to relying on rote memorization or simple mnemonic devices. The primary objective was to provide students with an opportunity to engage with models that they found to be challenging in terms of mathematical representation. Typically, these models were approached through memory techniques rather than reasoning.

The majority of students found the dashboards to be user-friendly and beneficial for their coursework. Furthermore, tools like these have broad applicability beyond the specific case presented here. They can be effective in supporting classroom instruction and active learning strategies such as flipped classrooms or team-based learning. These tools can also foster cross-cutting skills like coding. However, the effectiveness of these tools as learning aids is contingent on their integration into the teaching process and the level of support and guidance provided by the instructor. The results highlight the potential of Python and Plotly Dash as valuable resources for developing educational dashboards, facilitating a seamless learning experience for students from various backgrounds.

References

1. Ben Ouahi, M., Ait Hou, M., Bliya, A., Hassouni, T., Al Ibrahmi, E.M.: The Effect of Using Computer Simulation on Students' Performance in Teaching and Learning Physics: Are There Any Gender and Area Gaps? Education Research International **2021**, e6646017 (Mar 2021). https://doi.org/10.1155/2021/6646017
2. Hossain, S.: Visualization of Bioinformatics Data with Dash Bio. Proceedings of the 18th Python in Science Conference pp. 126–133 (2019). https://doi.org/10.25080/Majora-7ddc1dd1-012
3. Johnstone, A.H.: Why is science difficult to learn? Things are seldom what they seem. Journal of Computer Assisted Learning **7**(2), 75–83 (1991). https://doi.org/10.1111/j.1365-2729.1991.tb00230.x
4. Liu, L., Ling, Y., Yu, J., Fu, Q.: Developing and Evaluating an Inquiry-Based Online Course with a Simulation Program of Complexometric Titration. Journal of Chemical Education **98**(5), 1636–1644 (May 2021). https://doi.org/10.1021/acs.jchemed.0c01229
5. Van den Eynde, S., Goedhart, M., Deprez, J., De Cock, M.: Role of Graphs in Blending Physical and Mathematical Meaning of Partial Derivatives in the Context of the Heat Equation. International Journal of Science and Mathematics Education (Jan 2022). https://doi.org/10.1007/s10763-021-10237-3

SPECIAL TRACK 5

“SUPERCYBERKIDS! THE IMPORTANCE OF PROMOTING CYBERSECURITY EDUCATION AMONG TEACHER EDUCATION STUDENTS”

ORGANIZERS:

ILARIA MATTEUCCI, IIT-CNR, ITALY

GIORGIA BASSI, IIT-CNR, ITALY

STEFANIA FABBRI, IIT-CNR, ITALY

MANUEL GENTILE, IIT-CNR, ITALY

FLAVIO MANGANIELLO, IIT-CNR, ITALY

ANNA VACCARELLI, IIT-CNR, ITALY

Cybersecurity for Teens (CS4T) – a project by Ludoteca of Registro .it

Bassi Giorgia[1] and Franceschi Angela[1,2]

[1] Consiglio Nazionale delle Ricerche, Istituto di Informatica e Telematica (IIT), Pisa – Italy
[2] Università degli Studi di Firenze, Dipartimento di Scienze della Formazione e Psicologia (FORLILPSI), Firenze – Italy
giorgia.bassi@iit.cnr.it, angela.franceschi@iit.cnr.it

1 Introduction

The Cybersecurity for Teens (CS4T) project was born as part of the Ludoteca del Registro .it, an educational section of Registro .it, the Italian domain registry, which operates within the CNR Institute for Informatics and Telematics (CNR-IIT). In 2021, the Ludoteca has developed a new project to promote cybersecurity in schools. The Cybersecurity for Teens (CS4T) project had the main objective of increasing the culture of information security among young people (aged 14-19) , who are very skilled in the use of digital technologies, but often unaware of the possible risks and therefore potential victims of cyber-attacks. More specifically, the objectives are:

- To study and improve the knowledge and behavior of Internet use in order to encourage the adoption of "IT hygiene" practices based on a preventive approach.
- To teach students a vertical curriculum dedicated to computer security, focusing on the following skills: protection of devices; protection of personal data and privacy; detection and deletion of the risks of cyberspace, conceived as the interaction of people, software and services through technologies, devices and networks connected to it.

2 Aim

This work aims to illustrate the Cybersecurity for Teens (CS4T) project and highlighting its efficacy. Thanks to the collaboration with the University of Florence (Department of Education, Languages, Interculture, Literature and Psychology) all these activities were subjected to evaluation of their effectiveness in educational terms.

3 Method

278 students (mean=16.45, SD=.71) from three schools in Tuscany participated in the project promoted by the Ludoteca del Registro. It. Each class attended three training sessions: the first two were theoretical, in which what is cybersecurity (i.e., attack surface; threats and vulnerabilities; technical countermeasures, best practices, manage-

ment of app permissions) was explained, the latest in laboratory style curated by researchers from the Trust, Security and Privacy Research Unit of the IIT-CNR, in which students "touched" what they had learned during the first two meetings. To evaluate the CS4T project, self-report questionnaires were prepared and administered at the beginning and end of the project. The questionnaires investigated knowledge of IT security aspects, theoretical and technical-practical, and countermeasures. In addition, there were questions about the liking of the project.

4 Results and Conclusions

The initial knowledge of the students in the field of cybersecurity is at an overall level insufficient: some concept gets a sufficient average response (e.g., “I know what an IP address is” – “I know what the dark web is”, but most of the topics seem to be poorly understood (e.g., “I know what TCP/IP is” – “I know what phishing is”). 91% of the students participated in the project following at least one meeting, and most of them have followed the entire training course, participating in all three meetings (85%). In total, they took part to the CS4T project, completing the questionnaires both in the first and second survey, 212 students. A great improvement was obtained by the students at the end of the project, confirming that this topic was very little known to them, but also of great interest, given the commitment and active participation they demonstrated during the meetings. The importance of training activities such as the one proposed, is also related to the dissemination of certain topics, and in particular in an attempt to direct young people towards the professional sector of cybersecurity: in this field, there is in fact still a shortage of experts, and development a training course of this type can also have useful repercussions for the labor market.

References

1. Haddon, L., Cino, D., Doyle, M., Livingstone, S., Mascheroni, G., & Stoilova, M. (2020). Children's and young people's digital skills: a systematic evidence review. Zenodo. 10.5281/zenodo.4274654
2. Finkelhor, D., Walsh, K., Jones, L., Mitchell, K., & Collier, A. (2021). Youth Internet Safety Education: Aligning Programs with the Evidence Base. Trauma, Violence, & Abuse, 22(5), 1233–1247. /10.1177/1524838020916257
3. Ranieri, M. (2015). Linee di ricerca emergenti nell’educational technology. Form@ re-Open Journal per la formazione in rete, 15(3), 67-83.
4. Jones, K. S. Siami Namin, A. & Armstrong, M. E. (2018). The Core Cyber-Defense Knowledge, Skills, and Abilities That Cybersecurity Students Should Learn in School: Results from Interviews with Cybersecurity Professionals. ACM Trans. Comput. Educ. 18(3). 10.1145/3152893

Learning CyberSecurity with Games: CyberTrials 2023

N. Toccafondi[1], S. Valiani[1], L. Boncinelli[2], G. Costa[1], E. Bilancini[1]

[1] IMT School For Advanced Studies Lucca
[2] Università degli Studi di Firenze, Dipartimento di Scienze per l'Economia e l'Impresa

1 Introduction

The CyberTrials project[3] is an innovative educational program designed to provide Italian high school students who identify as females with knowledge and skills in computer science and cybersecurity. The project has been conducted between February and May 2023, and it consisted of eleven lectures and nine hands-on activities. The online lectures covered security topics related to Networks, Web, OSInt, Threat Modeling, Social Engineering, Computer Forensics, Cryptography and Stenography. In addition to the lectures, the program provided nine hands-on activities in the style of a capture-the-flag (CTF)[4] event. These activities followed an immersive story-telling gamification technique with the aim of increasing the engagement of the students [1,4,2]. In the story, participants are "white hat" hackers helping an artist against an antagonist who illicitly claims authorship of some artworks and steals some of her paintings. Using CTF-based events for teaching cybersecurity is not new[3,6,5]. However, the effectiveness of combining the CTF approach with an immersive story is still debated, as determining its influence on educational outcomes is nontrivial. The main objective of this work is to examine the relationship between the educational outcome of the project and participation in CTF activities. Our analyses confirm that this approach is positively correlated with the learning experience of the students. Our analysis can be relevant to assess the validity of educational programs combining CTF-based approaches and storytelling gamification techniques.

2 Methods and Results

Participating students were asked to fill out an online survey both at the beginning (February) and at the end (April) of the training activities. These students represent the treatment group in our analysis. A second group, i.e., the control group, formed by participants' classmates that did not attend the program, were asked to fill out the same surveys. The surveys contained 35 questions. Among

[3] Link to the CyberTrials webpage
[4] Link to the CTFd webpage

them, 10 were demographic, 6 evaluated students' interest in computer science and cybersecurity, 11 evaluated students' competencies in computer science and cybersecurity, and 8 evaluated students' ludic habits and interests. The second survey included 6 additional questions regarding students' opinions on the CyberTrials Project. This additional section of the survey was administered only to the treatment group. The dependent variable for our analysis is the number of correct answers to the questions evaluating the competencies in computer science and cybersecurity, which we model as a Poisson distributed count variable. Should we make a causal assessment of the impact of the CyberTrials activities on the educational outcome, we would have to restrict the analysis sample to the students who filled out both surveys. However, only 52 female students satisfy this requirement. Hence, the statistical power to make such a claim is insufficient. Consequently, we restrict our sample of observations to the second wave of surveys, considering only the students in the treatment group, and proceed with a correlational analysis. Our final sample consists of a total of 100 observations. Table 1 reports the results of our analysis. Model (1) correlates the self-assessed measure of participation in the lectures and the activities with the educational outcome of interest. Model (2) controls for the self-assessed measure of interest for computer science and cybersecurity. In addition, it controls for the experience with a cyber attack, age, the number of family members, having participated in CyberTrials 2022, the mother's degree, the region of residence, the type of school attended and a self-assessed measure of prior knowledge in computer science. Model (3) considers the variable *Attention Checks*, which takes value 1 if the student correctly passed all the survey's attention checks. Model (4) considers the interactions between the variable *Attention checks* and the variables measuring participation in the lectures and the activities. The variable *Participation to the Activities* is positive and statistically significant in models (1) through (4). Indeed, our results suggest that an increase in participation in the activities increases the number of correct answers to the questionnaire. Instead, no correlation is found between an increase in the number of correct answers on the questionnaire and an increase in attendance to the lectures. In conclusion, we suggest that the Cybertrial activities contributed more to the educational outcome with respect to the lectures. The effect is robust enough to be statistically significant when we consider the interest in computer science and cybersecurity, hence, controlling for the self-selection bias. Further research should aim at providing a causal relationship between higher attendance to the activities and the number of correct answers.

References

1. Hamari, J., Koivisto, J., Sarsa, H.: Does gamification work? a literature review of empirical studies on gamification. In: 2014 47th Hawaii international conference on system sciences. pp. 3025–3034. Ieee (2014)
2. Kalogiannakis, M., Papadakis, S., Zourmpakis, A.I.: Gamification in science education. a systematic review of the literature. Education Sciences **11**(1), 22 (2021)

3. Leune, K., Petrilli, S.J.: Using capture-the-flag to enhance the effectiveness of cybersecurity education. In: Proceedings of the 18th Annual Conference on Information Technology Education. p. 47–52. SIGITE '17, Association for Computing Machinery, New York, NY, USA (2017). https://doi.org/10.1145/3125659.3125686, https://doi.org/10.1145/3125659.3125686
4. Manzano-León, A., Camacho-Lazarraga, P., Guerrero, M.A., Guerrero-Puerta, L., Aguilar-Parra, J.M., Trigueros, R., Alias, A.: Between level up and game over: A systematic literature review of gamification in education. Sustainability **13**(4), 2247 (2021)
5. Martorana, A.: Investigating the Experiences of Female CTF Players. Ph.D. thesis, Carnegie Mellon University (2022)
6. McDaniel, L., Talvi, E., Hay, B.: Capture the flag as cyber security introduction. In: 2016 49th hawaii international conference on system sciences (hicss). pp. 5479–5486. IEEE, IEEE Computer Society, USA (2016)

Title: Poisson regressions on the number of correct answers

	(1)	(2)	(3)	(4)
Participation to the Lectures	-0.0742	-0.0945	-0.0871	-0.0750
	(0.167)	(0.130)	(0.167)	(0.407)
Participation to the Activities	0.200**	0.190**	0.205**	0.144*
	(0.004)	(0.003)	(0.002)	(0.043)
Interest for Computer Science		-0.0453	-0.0395	-0.0664
		(0.441)	(0.492)	(0.332)
Interest for Cyber Security		0.103	0.0935	0.0955
		(0.058)	(0.079)	(0.071)
Victim of a cyber attack (Dummy) = 1		0.0842*	0.0858*	0.0934*
		(0.049)	(0.041)	(0.031)
Attention Checks (Dummy)= 1			-0.106	-0.599
			(0.162)	(0.168)
Attention Checks (Dummy)= 1 × Participation to the Lectures				-0.0686
				(0.703)
Attention Checks (Dummy)= 1 × Participation to the Activities				0.210
				(0.222)
Constant	1.329***	1.233	1.375	1.498
	(0.000)	(0.143)	(0.100)	(0.090)
Observations	100	100	100	100
Extra controls	No	Yes	Yes	Yes
VCE	Robust	Robust	Robust	Robust

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1. Results from the sample of female students in the treatment group who filled out the second questionnaire. *Attention checks* takes value 1 if the observation passed the survey's attention checks.

Toward a game-based cybersecurity training for young students: the SuperCyberKids project.*

Flavio Manganello[1][0000−0001−7584−939X], Giuseppe Città[1][0000−0002−6090−0276], Paola Denaro[1][0000−0002−9742−6096], Jeffrey Earp[1][0000−0001−7075−5992], Chiara Fante[1][0000−0001−6551−3278], Dirk Ifenthaler[3,4][0000−0002−2446−6548], Luca Janka Laszlo[5][0000−0001−5591−2793], Ilaria Matteucci[2][0000−0002−5936−8470], Salvatore Perna[1][0000−0003−2206−8172], Nicolai Plintz[3][0000−0002−5280−4997], Anna Vaccarelli[2][0000−0001−7240−4803], and Manuel Gentile[1][0000−0001−6288−0830]

[1] Institute for Educational Technology, National Research Council, Genova, Italy
[2] Institute of Informatics and Telematics, National Research Council, Pisa, Italy
[3] Learning, Design and Technology, University of Mannheim, Mannheim, BW, Germany
[4] Data Science in Higher Education Learning and Teaching, Curtin University, Bentley, WA, Australia
[5] European School Heads Association, Utrecht, Netherlands

1 Introduction

With more and more kids having easy access to the internet, there is a rising concern about their safety while they are online. Even before the rapid increase in remote schooling caused by the COVID-19 epidemic, children were already spending significant time online. However, providing effective cybersecurity education to young learners presents significant challenges for educators, from the lack of necessary knowledge and tools to the difficulty in maintaining student engagement [1]. The SuperCyberKids project, co-founded by the Erasums+ Programme of the European Union, seeks to address this issue by providing educators with the resources and strategies necessary for implementing digital game-based learning.

2 The SuperCyberKids Project

SuperCyberKids harnesses the diverse expertise of numerous partners, each contributing their unique experience in the three major domains involved in the project: digital education for teachers and schoolchildren, game-based learning and cybersecurity. The partnership covers five EU countries (Italy, Estonia, Germany, Belgium and the Netherlands) and includes: three academic and research partners (National Research Council of Italy, Tallinn University and the University of Mannheim); one expert on Cybersecurity (ECSO, European

* Co-founded by the Erasmus+ Programme of the European Union - Project No. 101087250 - ERASMUS-EDU-2022-PI-FORWARD.

Cyber Security Organisation); two learning, games and IT solutions designers/developers (Grifo Multimedia and CGI Eesti AS); one association representing school heads (ESHA, European School Heads Association). SuperCyberKids will support teacher education in cybersecurity through a gamification platform. This platform is envisioned to help teachers design, deliver, and monitor game-based learning activities for students aged 8–13. The creation of this platform will involve adapting an existing product, provided by the partner Grifo Multimedia.

2.1 The SuperCyberKids Learning Framework

Central to the gamification platform is the SuperCyberKids Learning Framework (SCKLF), the first key deliverable produced in the project. Its aim is to scaffold teachers in generating personalized learning paths, resources and tools, primarily based around digital games. The SCKLF was established on the foundation of three core pillars: a comprehensive literature review confirmed through a two-step Delphi Study, a quali-quantitative survey of existing cybersecurity education initiatives, and an in-depth analysis of digital competence frameworks. This combination of theoretical and practical elements served to ground the SCKLF firmly within the cybersecurity education landscape. The SCKLF takes the form of a competency ontology for the cybersecurity domain (SCKLF Ontology). Ontologies are an important tool for formally representing, manipulating, and sharing knowledge. An ontology can be defined as a formal, explicit specialisation of a shared conceptualisation, consisting of concepts and the relationships between them [2]. The competence ontology was constructed in accordance with the COMP2 ontology proposed by [3].

2.2 Next steps

A multi-dimensional analysis of existing applied games for cybersecurity education will be carried out to ensure comprehensive understanding of the required teaching and learning skills. Specifically, to put the theoretical approach of the SCKLF into practice, the two games ‘Spoofy’ and ‘Nabbovaldo and the Cyber Blackmail’ will be incorporated into the gamification platform. Following specific teacher education activities, these games will then be piloted in the participating partner countries, providing a practical validation of the platform and its associated teaching and learning methodologies.

3 Conclusion

SuperCyberKids aims to enhance cybersecurity education through a game-based platform to promote safer internet use among children aged 8-13. Initial pilot studies will validate the platform and methodologies, paving the way for wider implementation. This paper outlined the project’s initial plans and rationale, presenting the current state of progress, while inviting community input for ongoing refinement.

References

1. Pusey, P., Sadera, W.A.: Cyberethics, cybersafety, and cybersecurity: Preservice teacher knowledge, prepared-ness, and the need for teacher education to make a difference. Journal of Digital Learning in Teacher Education **28**(2), 82–85 (2011)
2. Gruber, T. R.: A translation approach to portable ontology specifications. Knowledge Acquisition **5**, 199–220 (1993)
3. Paquette, G., Marino, O., Bejaoui, R.: A new competency ontology for learning environments personalization. Smart Learning Environments **8**, 16 (2021). https://doi.org/10.1186/s40561-021-00160-z

SAILS –Safe & Autonomous Internet-based Learning, risk mitigation vs. risk prevention in the online space

Eszter Salamon[1[0000-0001-9504-3641]], Peter Kollar[1[0009-0005-5749-1503]], Luca Laszlo[1[0000-0001-5591-2793]]

[1] Parents International: Amsterdam, NL

1 Introduction

With the ultimate aim of developing a resource providing families, school leaders and professional educators with practical guidance on navigating a virtual context that may also include virtual learning and what the use of each tool, social network or platform implies, desk research was carried out on international and national legislation, existing research as well as inspiring practices in 2021-22.

The SAILS initiative implements a rigorous risk mitigation approach – as opposed to risk prevention. Previous research and the experiences during school closures and lockdowns have clearly shown that there is a skills gap, especially among professional educators and parents aged 45+. The aim of the research was to find ways to help increase parents' digital literacy levels and empower them for parenting in the digital age, as well as to support informed decision making for school leaders when implementing the digital transformation of their schools.

The risk mitigation approach is based on responsible digital citizenship, free, informed choices, and as little restrictions as possible. Desk research done in SAILS towards it includes supporting parents in understanding how technology works, understanding the rights of their children and their rights online (with special focus on balancing the right to safety to other equally important child rights, and implications of the GDPR), understanding the risks and benefits of online presence, clarifying confusion around screen time, and helping to develop family strategies in a way that considers cultural and individual differences.

Legislative mapping aiming at summarising the international legislation around a safe digital childhood and the national implementation of these regulations as well as other national legislative and quasi-legislative elements. Education innovation often does not consider the regulatory frameworks that education systems and institutions operate in. Furthermore, it rarely considers the UN Convention on the Rights of the Child that provides a legal basis for education innovation as long as it aims at providing better education. Our research approach considers and first analyses this context.

The key finding was that a safe and healthy digital childhood is provided for in international legislation while some national legislative regulations may be over-restrictive both violating the rights of children and 26 parents. When collecting and analysing inspiring – not surprisingly – the teams has only found very few national examples in the participating countries (Greece, Spain, Hungary and the Netherlands). Thus, the authors have included less specific inspiration, primarily from industry, the Council of Europe and the DigiLitEY COST Action that are aiming at stakeholders in all project countries.

References

1. Livingstone, S., Blum-Ross, A. (2020). Parenting for a Digital Future. Oxford University Press. Oxford, UK. DOI:10.1093/oso/9780190874698.001.0001
2. United Nations Convention on the Rights of the Child, November 20, 1989, https://www.ohchr.org/en
3. Salamon E. (2020). A New Deal between Parents and Professionals Using COVID-19 Learnings as Leverage. Social education 53, Nr. 1, p. 6–25. Vilnius, Lithuania
4. The Third Better Internet for Kids Policy Map. (2020). https://www.betterinternetforkids.eu/documents/167024/2637346/BIK+Policy+Map+2020+-+FINAL+for+publication+-+November+2020.pdf/2eb2c71f-c6b7-8e16-cbf8-224e52f9008a?t=1606326324655, last accessed 2023/06/20
5. Quinn, C. (2018, April 26). *A look at the digital kids industry with a focus on online privacy, data security & the latest trends*. PRIVO. https://www.privo.com/blog/gdpr-age-of-digital-consent, last accessed 2023/06/20

SPECIAL TRACK 6

“EFFECTS OF HIGH-PERFORMANCE ARTIFICIAL INTELLIGENCE SYSTEMS AND IMMERSIVE TECHNOLOGIES IN EDUCATION”

ORGANIZERS:

DANIELE SCHICCHI, CNR-ITD, ITALY

MARIELLA FARELLA, CNR-ITD & UNIVERSITY OF PALERMO, ITALY

TAIBI DAVIDE, CNR-ITD, PALERMO, ITALY

GIOSUÈ LO BOSCO, UNIVERSITY OF PALERMO, ITALY

MARCO ARRIGO, CNR-ITD, ITALY

Adhere to the Rubric: A Method for Building Trustworthy Short Answer Scoring Models

Yuya Asazuma[1,2], Hiroaki Funayama[1,2],
Yuichiroh Matsubayashi[1,2], Tomoya Mizumoto[2], and Kentaro Inui[1,2]

[1] Tohoku University, Sendai, Japan
{asazuma.yuya.r7, h.funa}@dc.tohoku.ac.jp, {y.m, inui}@tohoku.ac.jp
[2] RIKEN, Tokyo, Japan
tomoya.mizumoto@a.riken.jp

1 Background and Challenge

Short Answer Scoring (SAS) is a task of automatically evaluating short natural language responses to a given prompt according to its prespecified rubric [1, 14]. SAS is advantageous in that it can automatically evaluate a large number of responses, which, in the context of education, can significantly benefit educators by reducing the burden of manual grading while simultaneously benefiting students with instant, non-biased feedback.

In recent years, research has progressed in applying deep learning with neural models to SAS [10, 13, etc.], demonstrating remarkable scoring accuracy when a sufficient number of training instances are available for each prompt [5]. However, deploying neural SAS models still faces substantial challenges, particularly in ensuring the overall reliability of the results. SAS models are prone to *shortcut learning* [7], relying on *superficial cues* that are pseudo-correlated with scores in the training data, leading to deviations from the rubric. Moreover, the lack of interpretability of neural models, often considered as *black boxes* [4, 9], hampers the identification of shortcut learning, eroding trust in their reliability. To tackle this challenge, we propose a novel approach to detect and mitigate shortcut learning in neural SAS models.

2 Proposal

Our approach is based on the utilization of feature attribution techniques [11, 15], studied in the context of Explainable AI. Given a prompt and an answer, we employ such feature attribution techniques to identify the specific parts of an answer that the model focuses on for scoring and subsequently visualize the results. This visualization serves as an efficient tool for model developers, enabling them to identify instances where the model might rely on superficial cues.

Figure 1 showcases a snapshot of our system's output using the RIKEN-SAA dataset [6, 10, 12]. Each row displays a student's answer, with a red heatmap indicating the character spans attended to by the SAS model for scoring. When

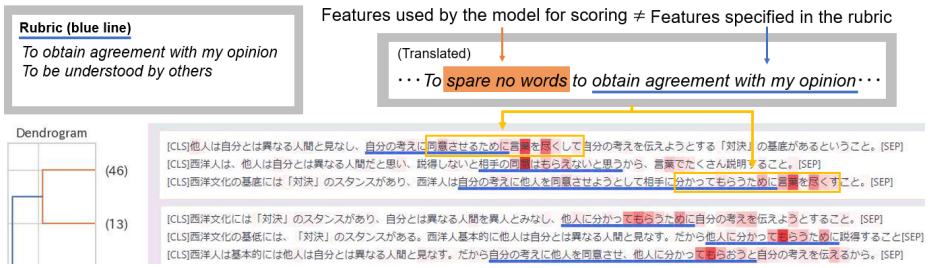


Fig. 1. An example of our system's proposed UI. Two clusters are shown, where the red heatmap in the top cluster indicates that the input feature *"To spare no words"* is used for scoring. However, this feature deviates from the predefined scoring rubrics, as shown by the blue underlines, implying the presence of unintended shortcut learning.

the model's attention aligns with the rubric, it signifies reliability. However, deviations indicate reliance on superficial cues, suggesting shortcut learning. To demonstrate this, Figure 1 includes blue underlines denoting segments aligned with the rubric, manually annotated for illustration. In the answer on the first row, for example, the blue-underlined segment "obtain agreement with my opinion" should be considered supporting evidence based on the rubric. However, the model focuses on a different segment ("spare no words") for scoring, indicating shortcut learning relying on superficial cues. Detecting such instances of superficial cue reliance allows model developers to provide additional *gold justification cues* for further supervision to rectify shortcut learning, resulting in an improved model with enhanced reliability which has the benefit of increasing the trustworthiness of SAS models.

One important research goal is determining how to detect instances of superficial cue reliance efficiently. It would be simple to detect such instances if the training data were annotated with gold justification cues such as those underlined in blue in Figure 1. However, acquiring training data with gold-labeled justification cue annotations can be costly and is often limited in practical applications. Towards addressing this issue, we propose clustering the training examples by leveraging the heatmap (i.e., the results of feature attribution), grouping semantically similar answer segments highlighted in the heatmap, where a hierarchical clustering algorithm [2] is employed. This helps facilitate efficient detection of instances of superficial cue reliance.

Our experiments are designed to address two key points: (i) evaluating the efficiency of detecting instances of superficial cue reliance using visualizations and clustering based on feature attribution (as shown in Figure 1), and (ii) assessing the effectiveness of mitigating shortcut learning by providing gold justification cues for identified instances of superficial cues. We will present detailed reports on these experimental findings at the conference and in the full paper. As part of our future research, we are intrigued by exploring how our approach to mitigating shortcut learning can enhance the model's robustness against adversarial or outlier inputs, as discussed in works such as [3, 7, 8].

References

1. Bexte, M., Horbach, A., Zesch, T.: Implicit phenomena in short-answer scoring data. In: Proceedings of the 1st Workshop on Understanding Implicit and Underspecified Language. pp. 11–19. Association for Computational Linguistics, Online (Aug 2021)
2. Bridges, C.C.: Hierarchical cluster analysis. Psychol. Rep. **18**(3), 851–854 (Jun 1966)
3. Cheng, M., Yi, J., Chen, P.Y., Zhang, H., Hsieh, C.J.: Seq2Sick: Evaluating the robustness of Sequence-to-Sequence models with adversarial examples (Mar 2018)
4. Doshi-Velez, F., Kim, B.: Towards a rigorous science of interpretable machine learning (Feb 2017)
5. Funayama, H., Asazuma, Y., Matsubayashi, Y., Mizumoto, T., Inui, K., Answer, R.: What can short answer scoring models learn from cross-prompt training data?
6. Funayama, H., Sato, T., Matsubayashi, Y., Mizumoto, T., Suzuki, J., Inui, K.: Balancing cost and quality: An exploration of Human-in-the-Loop frameworks for automated short answer scoring. In: Artificial Intelligence in Education. pp. 465–476. Springer International Publishing (2022)
7. Gao, J., Lanchantin, J., Lou Soffa, M., Qi, Y.: Black-box generation of adversarial text sequences to evade deep learning classifiers (Jan 2018)
8. Goodfellow, I.J., Shlens, J., Szegedy, C.: Explaining and harnessing adversarial examples (Dec 2014)
9. Lipton, Z.C.: The mythos of model interpretability (Jun 2016)
10. Mizumoto, T., Ouchi, H., Isobe, Y., Reisert, P., Nagata, R., Sekine, S., Inui, K.: Analytic score prediction and justification identification in automated short answer scoring pp. 316–325 (Aug 2019)
11. Ribeiro, M.T., Singh, S., Guestrin, C.: "why should I trust you?": Explaining the predictions of any classifier (Feb 2016)
12. RIKEN(2020): Riken dataset for short answer assessment (Jul 2020)
13. Riordan, B., Horbach, A., Cahill, A., Zesch, T., Lee, C.M.: Investigating neural architectures for short answer scoring. In: Proceedings of the 12th Workshop on Innovative Use of NLP for Building Educational Applications. pp. 159–168. Association for Computational Linguistics, Copenhagen, Denmark (Sep 2017)
14. Sultan, M.A., Salazar, C., Sumner, T.: Fast and easy short answer grading with high accuracy. In: Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies. pp. 1070–1075. Association for Computational Linguistics, San Diego, California (Jun 2016)
15. Sundararajan, M., Taly, A., Yan, Q.: Axiomatic attribution for deep networks (Mar 2017)

A Snapshot from the ITAL-IA 2023 AI and Education Workshop

Allegra De Filippo[1], Pietro Ducange[2], and Manuel Gentile[3]

[1] Department of Computer Science and Engineering - University of Bologna
[2] Department of Computer Engineering - University of Pisa
[3] Institute for Educational Technology - National Research Council of Italy, Palermo,

1 Introduction

In recent years, Artificial Intelligence has played a key role in education [4]. This paper reports on the AI and Education workshop held during the third CINI[4] National Conference on Artificial Intelligence (Ital-IA 2023)[5]. The annual event organised by the CINI aims to offer a space for discussion between public institutions, Italian industry and scientific research from national universities and research centres. In the Ital-IA 2023, a specific workshop on the relationship between AI and education has been organised for the first time to offer an open space to analyse existing and future challenges.

Starting from a summary of the collected contributions on research results, ideas, developments and applications of artificial intelligence and education, we will provide some insights about the exciting discussion developed among the community who attended the workshop.

2 The AI and Education Workshop

The AI and Education workshop collected submissions from 10 institutions covering different emerging topics.

Niewint-Gori [5] provided a panorama of how artificial intelligence can support education, the potential obstacles it may present, and the possible future landscapes of AI as a component of education systems. In this same perspective, Panciroli et al. [6] addressed the proper integration of AI in education by situating AI with the frameworks offered by the different literacies that emerged over the last few years. The contribution also provided a proposal for a framework to develop an AI curriculum in the school.

One theme that emerged was the opportunities offered by AI concerning the personalisation of students' learning paths. Amato et al. [1] described the use of AI techniques, specifically Deep Learning (DL), discussing the advantages and ethical concerns associated with using generative models in education, referring to a case study implemented at the University of Naples Federico II. On

[4] Consorzio Interuniversitario Nazionale per l'Informatica
[5] https://www.ital-ia2023.it/workshop

the same topic, the paper by Baldoni et al. [2] illustrates the activities of the projects SMAILE and AILEAP, devoted to fostering the growth of awareness and readiness to learn artificial intelligence in the general population. The topic of customisation was also addressed by the contribution made by Panciroli and Macauda [7], which also illustrated the research the working group of the Department of Educational Sciences of the University of Bologna is developing on AI and Robotics education.

Banno et al. [3] proposed an approach to spoken grammatical error correction (GEC) in a cascaded fashion using only publicly available training data. Specifically, the authors start from learners' utterances, investigate disfluency detection (DD) and removal, and finally explore GEC [3]. Finally, Zanellati [8] reported a method for assessing the risk of low achievement in secondary school with data collected from the Italian Ministry of Education. They trained three machine learning models on the INVALSI large-scale assessment tests dataset and compared the results in terms of predictive and descriptive performance. The promising results suggest the possibility of generalising the methodology for other school systems and teaching subjects.

References

1. Amato, F., Galli, A., Gravina, M., Marassi, L., Marrone, S., Sansone, C.: Ai-powered learning: Personalizing education for each student. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)
2. Baldoni, M., Baroglio, C., Bottrighi, A., Bucciarelli, M., Capecchi, S., Gandolfi, E., Gena, C., Iani', F., Marengo, E., Marocco, D., Micalizio, R., Piovesan, L., Ponticorvo, M., Rapp, A., Roveta, A., Terenziani, P., Ugo, F.: Fostering awareness and personalization of learning artificial intelligence. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)
3. Bannò, S., Rais, M., Matassoni, M.: Towards automatic spoken grammatical error correction of l2 learners of english. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)
4. Namatherdhala, B., Mazher, N., Sriram, G.K.: A comprehensive overview of artificial intelligence tends in education. International Research Journal of Modernization in Engineering Technology and Science **4**(7) (2022)
5. Niewint-Gori, J.: A snapshot of the evolving landscape of artificial intelligence in education. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)
6. Panciroli, C., Gentile, M., Allegra, M., Rivoltella, P.C.: Towards ai literacy: A proposal of a framework based on the episodes of situated learning. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023 (2023)
7. Panciroli, C., Macauda, A.: Artificial intelligence and robotics in education. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)
8. Zanellati, A., Zingaro, S.P., Gabbrielli, M.: Low-achievement risk assessment with machine learning. In: 3rd CINI National Conference on Artificial Intelligence (ITAL-IA 2023), in Pisa, Italy, May 29-31, 2023. CEUR-WS (2023)

A new workflow for Deep Knowledge Tracing

Gabriella Casalino[1][0000−0003−0713−2260], Mattia A. Di Gangi[2][0000−0003−4491−0025], Francesco Ranieri[3], Daniele Schicchi[4][0000−0003−0154−2736], and Davide Taibi[4][0000−0002−0785−6771]

[1] University of Bari, Dept. of Computer Science, Via Orabona 4, Bari, Italy
[2] AppTek GmbH, Theaterplatz 6-12, Aachen, Germany
[3] NTT Data Italia, Bari, Italy
[4] National Research Council of Italy, Inst. for Educational Technology, Palermo

1 Introduction

Knowledge tracing aims to model students' knowledge over time through past interactions, so to predict how students will perform in future test related to the traced topics. The continous improvement of the KT algorithms provides teachers with the ability to suggest suitable resources for individual students based on individual needs. In addition, these improvements would enable ranking the content offered to an individual student according to a predicted difficulty for him/her in solving given tasks. Topics with a high degree of difficulty can be thus skipped or delayed according to the established learning plan [1].

In the last years, probabilistic models for KT have been replaced with models based on Deep Learning (Deep Knowledge Tracing - DKT), due to their effectivess [2]. Deep Knowledge Tracing is interesting for its capability of modeling complex long-range dependencies in test sequences, resulting in better prediction quality. Interested readers could refer to this detailed survey on DKT [3].

DKT is a growing field that has seen many algorithms proposed implemented using a variety of technologies. This work proposes EasyDKT a new framework for easy development and evaluation of DKT algorithms. The framework was developed with the goal of providing its user with a high level of technological abstraction. Its structure is modular and provides infrastructure to add and combine custom datasets, data processing, evaluation metrics, and neural network models for DKT with the most common technologies, currently PyTorch [4] and TensorFlow [5], and more in the future.

2 Framework

A modular framework for DKT has been proposed. In its initial implementation it includes the first DKT algorithm by [6], and the open source ASSISTments Skillbuilder dataset[5]. It is composed of six modules for loading and preprocessing data, model creation, model training and testing, and evaluation. The

[5] `https://sites.google.com/site/assistmentsdata/datasets/2015-assistments-skill-builder-data`

modules can be expanded with interchangeable classes and functions, which can then be easily selected via a configuration file. An example of configuration file specifies what data to use for training and evaluation; which models for data loading and pre-processing, and in what order to run them; a DKT algorithm and its hyperparameters, as well as the evaluation metrics to use to keep track of the training progress and the final results.

3 Experiments and discussions

A set of experiments has been conducted by varying the model parameters, such as dropout rate, learning rate, optimizer (RMSProp e Adam), and the adopted technologies (Pythorch and TensorFlow).

The experiments were run on the ASSISTments Skillbuilder dataset [7]. It contains sequences of students' answers to mathematical "skill-builder" problems. The dataset consists of 4217 problems and a total number of 124 skills. Since a single problem can be solved by multiple students, the total number of tuples in data is 522,000. A single tuple contains: student identifier (id), skill identifier, answer to the question described in the problem. If a complex problem is related to multiple skills, multiple tuples with the same student id and answer but different skill identifier will be visible. A training set of 3361 items and a test set of 856 have been used.

Table 1. Comparisons.

#	Lib	Opt	Dropout	Hiddenunits	Batchsize	LR	TW	Epochs	AUC
1	Pytorch	RMSProp	None	200	5	0.001	100	50	0.82
2	Pytorch	RMSProp	0.6	200	5	0.001	100	50	0.82
3	Pytorch	Adam	None	200	5	0.001	100	50	0.82
4	Pytorch	Adam	None	200	5	0.01	100	50	0.78
5	**Pytorch**	**Adam**	**None**	**200**	**5**	**0.0001**	**100**	**50**	**0.84**
6	TF	RMSProp	None	200	5	0.001	100	50	0.78
7	TF	Adam	None	200	5	0.001	100	50	0.79
8	TF	Adam	None	200	5	0.0001	100	50	0.76

Table 1 shows the classification results obtained with the framework and the ASSISTtments skill-builder data, varying the model parameters and deep learning library (Tensorflow or Pytorch). The best results have been obtained using the Pytorch implementation and Adam optimizers. This suggests that an easy-to-use parameterizable workflow for DKT is crucial to easily identify the best configuration for a given problem. Our AUC of 0.84 is close to the original score of 0.86 reported in [6], which was developed with old technologies and the results are now hard to replicate. The irreproducibility of prior work is an additional point to build an extensible research tool for DKT.

References

1. Albert T Corbett and John R Anderson. Knowledge tracing: Modeling the acquisition of procedural knowledge. *User modeling and user-adapted interaction*, 4(4):253–278, 1994.
2. Gabriella Casalino, Luca Grilli, Pierpaolo Limone, Domenico Santoro, Daniele Schicchi, et al. Deep learning for knowledge tracing in learning analytics: an overview. *TeleXbe*, 2021.
3. Xiangyu Song, Jianxin Li, Taotao Cai, Shuiqiao Yang, Tingting Yang, and Chengfei Liu. A survey on deep learning based knowledge tracing. *Knowledge-Based Systems*, 258:110036, 2022.
4. Adam Paszke, Sam Gross, Francisco Massa, Adam Lerer, James Bradbury, Gregory Chanan, Trevor Killeen, Zeming Lin, Natalia Gimelshein, Luca Antiga, et al. Pytorch: An imperative style, high-performance deep learning library. *Advances in neural information processing systems*, 32, 2019.
5. Martín Abadi, Ashish Agarwal, Paul Barham, Eugene Brevdo, Zhifeng Chen, Craig Citro, Greg S. Corrado, Andy Davis, Jeffrey Dean, Matthieu Devin, Sanjay Ghemawat, Ian Goodfellow, Andrew Harp, Geoffrey Irving, Michael Isard, Yangqing Jia, Rafal Jozefowicz, Lukasz Kaiser, Manjunath Kudlur, Josh Levenberg, Dandelion Mané, Rajat Monga, Sherry Moore, Derek Murray, Chris Olah, Mike Schuster, Jonathon Shlens, Benoit Steiner, Ilya Sutskever, Kunal Talwar, Paul Tucker, Vincent Vanhoucke, Vijay Vasudevan, Fernanda Viégas, Oriol Vinyals, Pete Warden, Martin Wattenberg, Martin Wicke, Yuan Yu, and Xiaoqiang Zheng. TensorFlow: Large-scale machine learning on heterogeneous systems, 2015. Software available from tensorflow.org.
6. C. Piech, J. Bassen, J. Huang, S. Ganguli, M. Sahami, L. J. Guibas, and J. Sohl-Dickstein. Deep knowledge tracing. *Advances in Neural Information Processing Systems*, pages 505—-513, 2015.
7. Douglas Selent, Thanaporn Patikorn, and Neil Heffernan. Assistments dataset from multiple randomized controlled experiments. In *Proceedings of the Third (2016) ACM Conference on Learning@ Scale*, pages 181–184, 2016.

Towards the achievement of Sustainable Development Goal no. 4 by leveraging intelligent text complexity models*

Daniele Schicchi[1][0000−0003−0154−2736], Davide Taibi[2][0000−0002−0785−6771]

Institute for Educational Technology, National Research Council of Italy, Palermo, Italy
{daniele.schicchi,davide.taibi}@itd.cnr.it

1 Introduction

Quality education is the 4th of the 17 Sustainable Development Goals (SDGs) that aims to *"ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"*. Such a goal covers great importance in every school context, especially in developing countries where providing education is made difficult due to socioeconomic conditions leading to a rate of illiterate adults higher than 99%[1]. To meet the goals defined under Sustainable Development Goal no. 4 (SDG4)[2], access to learning opportunities and learning activities has to be facilitated.
Reading proficiency is one of the factors that influence students' engagement in learning activities. A low level can hamper content comprehension, thus acting negatively on students' motivation. In the higher education sector, students' reading proficiency is affected by different factors such as background and experiences, special educational needs, and general interests. Consequently, increasing the students' engagement needs a personalized didactic plan that includes educational material according to the reading proficiency. However, developing such a process is non-trivial and it risks weighing down the overall teaching activities. In this context, Artificial Intelligence and new technologies can revolutionize education supporting the stemming of phenomena like dropout, and illiteracy. In fact, innovative Artificial Intelligence approaches to language complexity play a crucial role in fostering inclusive education. In particular, Automatic Text Simplification (ATS) and Automatic Text Complexity Evaluation (ATCE) represent effective solutions in this context. This paper aims at introducing both ATS and ATCE research fields and their use in higher education with a specific focus on how their application might be effective to tackle the problem of inclusive education in the educational environment towards the achievement of the SDG4.

* Supported by Volkswagen Foundation.
[1] http://data.uis.unesco.org/
[2] https://sdgs.un.org/goals/goal4

2 Automatic Text Complexity Evaluation and Simplification in Education

Text simplification (TS) [1] is a process that aims at reducing the linguistic complexity of a text by carrying out operations such as word reordering, sentence splitting, lemmas substitutions, and syntax structure changes thus producing a new text that keeps the original meaning, but more easily readable and understandable by the reader. The automation of TS (ATS) is an active research area that investigates new methodologies to simplify written text without human intervention, to make the original text suitable for a specific class of readers. The combination of text complexity measures, along with the TS have led to another research area focused specifically on the creation of reliable methodologies to assess the text complexity. Automatic assessment of text complexity (ATCE) [2] can support many applications in several areas giving support to spot the class of readers to which a text is addressed to.
The ATS and ATCE research fields contribute to cope with the problem of *making the match* in both selecting or producing teaching material that makes the learning process more effective [3]. Moreover, teachers could leverage ATS and ATCE based applications to tackle the threefold problem to ensure inclusive education: a) evaluating the students' reading proficiency, b) selecting teaching material, and c) adapting the teaching material to the students' needs.

a) A precise evaluation of the linguistic needs of a student is a problem hard to deal with. There exist assessment methodologies that support teachers in such an activity [4], but they are not fully suitable to include all students' abilities. Recent advancements in AI are leading to methodologies for modeling the student's linguistic profile more accurately [5].

b) The selection of written material according to the student's needs can be done by exploiting ATCE systems. There are several ATCE systems that address different students' typologies [6], they can filter education materials out identifying only the ones that are most suitable for the student.

c) Finding appropriate educational materials that are suitable to the different students' needs might be hard to achieve. In this regard, ATS systems can be used to create different versions of the same texts according to the different reader's characteristics.

In conclusion, this paper aims at introducing how ATS and ATCS systems, by leveraging AI techniques, contribute with their potential to support teachers in promoting as much as possible inclusive learning approaches in higher education contexts.

References

1. Siddharthan, A.: A survey of research on text simplification. ITL-International Journal of Applied Linguistics 165(2), 259–298 (2014)
2. Lo Bosco, G., Pilato, G., Schicchi, D.: Deepeva: A deep neural network architecture for assessing sentence complexity in italian and english languages. Array 12, 100097 (2021)

3. Kletzien, S.B.: Strategy use by good and poor comprehenders reading expository text of differing levels. Reading research quarterly pp. 67–86 (1991)
4. Morrow, K.: Insights from the common European framework. Oxford University Press (2004)
5. Crossley, S.A.: Linguistic features in writing quality and development: An overview. Journal of Writing Research 11(3), 415–443 (2020)
6. Natova, I.: Estimating cefr reading comprehension text complexity. The Language Learning Journal pp. 1–12 (2019)

The Role of Artificial Intelligence in Personalized Learning

Vanessa Pitrella[1] [0009-0006-2977-4191] Salvatore Perna [2] [0000-0003-2206-8172], Mario Allegra[3] [0000-0002-5846-1868], Manuel Gentile[4] [0000-0001-6288-0830], Simona Ottaviano[5] [0000-0003-2278-4523], Anna Re[6] [0000-0002-9531-3637], Crispino Tosto[7] [0000-0002-0389-2804], Giuseppe Città[8] [0000-0002-6090-0276]

[1] Institute for Educational Technology - National Research Council

{vanessa.pitrella,salvatore.perna,mario.allegra,
manuel.gentile,simona.ottaviano,
anna.re,crispino.tosto,giuseppe.citta}@itd.cnr.it

1 Introduction

Personalized Learning (PL) is a multilayered concept and several definitions are currently available in existing literature [1]. PL refers to an educational approach able to meet the individual needs and interests of each student. By differentiating instruction, teachers can address various modes of learning, adapt to different skill levels, and provide appropriate challenges to each student. This approach promotes inclusiveness and ensures that all students have the opportunity to succeed. Research has indeed shown that PL fosters students' motivation, engagement, and learning outcomes as well as the development of metacognitive skills [2]. Due to its ongoing development, digital technology may provide new opportunities and relevant contributions to the design of PL experiences [3]. The aim of this paper is to provide a look at the state of the art regarding the technologies used and to how PL interventions are implemented in the school settings.

2 Digital Technology and Artificial Intelligence in Personalized Learning: State of the Art

Typically, benefits related to the use of technology in PL can be found in areas such as record-keeping, assessment, and more recently lesson planning and instruction [4]. Tools such as Massive Open Online Courses (MOOCs), for instance, allowed the implementation of methodologies such as the flipped class-room and had the main advantage of providing students with a certain degree of autonomy in the exploration of teaching resources. Moreover, they also supported teachers in organizing and managing the educational activities [5].

In this context, one of the less implemented potentials is that related to the collection of huge amounts of data collected from learners in terms of actions and behavior. Recent technological developments, and specifically those related to Artificial Intelligence tools and methods, have made it possible to better explore these aspects, shifting

the research focus to the automatic analysis of results, with improvements in assessment and evaluation, profiling and prediction, adaptive systems and intelligent tutoring [6].

One of the categories of technological tools that has benefited most from this disruptive evolution of AI technology is Intelligent Tutoring Systems (ITS). These systems represent environments in which students' behavioral data are collected in order to infer knowledge patterns and create corresponding digital profiles of students so that personal tutoring can be provided [7]. Automatic tutoring and the personalization of learning paths do not only involve automatic content selection, but also implies the monitoring of the learner's mastery [8]; in other words, freed from the spatio-temporal constraints inherently linked to the classroom setting, student's progress can be assessed by the level of proficiency demonstrated rather than by the time spent engaged in the course.

Smart classrooms can also be considered as another category of technological tools that benefits from innovations in the field of AI, and specifically Artificial Intelligence of Things (AIoT) [9]. These environments support the creation of learning systems that adapt their functioning to the real-time classroom setting through the use and integration of sensors and smart devices. Integration with the real world makes it possible not only to make the learning environment more comfortable (by automatically controlling the temperature, for example), but also allows for real-time monitoring of learners' attention, so that timely action can be taken in terms of notification to the teacher and adjustments to the content proposed to the student [10].

In general, the impact of recent technological advancements and novelties imposed by AI on the educational environment and on PL is widely reflected in the literature. The novelties bring about changes that, while innovative and necessary, can be both positive changes and challenges to the current educational infrastructure. These features will therefore be further described and discussed during the conference.

References

1. Walkington, C., Bernacki, M.L.: Appraising research on personalized learning: Definitions, theoretical alignment, advancements, and future directions. Journal of Research on Technology in Education, 52(3), pp. 235-252, (2020).
2. Major, L., Francis, G. A., Tsapali, M.: The effectiveness of technology-supported personalised learning in low-and middle-income countries: A meta-analysis. British Journal of Educational Technology, 52(5), pp. 1935-1964, (2021).
3. Schmid, R., Pauli, C., Stebler, R., Reusser, K., Petko, D.: Implementation of technology-supported personalized learning—its impact on instructional quality. The Journal of educaTional research, 115(3), pp. 187-198, (2022).
4. Lee, D., Huh, Y., Lin, C.Y., Reigeluth, C. M.: Technology functions for personalized learning in learner-centered schools. Education Tech Research Dev 66, pp. 1269–1302, (2018).
5. Tolks, D., Schäfer, C., Raupach, T., Kruse, L., Sarikas, A., Gerhardt-Szép, S., ... Hege, I: An introduction to the inverted/flipped classroom model in education and advanced

training in medicine and in the healthcare professions. GMS journal for medical education, 33(3), (2016).
6. Zawacki-Richter, O., Marín, V. I., Bond, M., Gouverneur, F.: Systematic review of research on artificial intelligence applications in higher education–where are the educators?. International Journal of Educational Technology in Higher Education, 16(1), pp. 1-27, (2019).
7. Chassignol, M., Khoroshavin, A., Klimova, A., Bilyatdinova, A.: Artificial intelligence trends in education: a narrative overview. Procedia Computer Science 136, pp. 16–24, (2018).
8. Menor, J. V.: Design, development and effectiveness of an intelligent tutoring system using neural network, In: AIP Conference Proceedings 16 May 2023, (2023).
9. Zhang, Y., Ning, Y., Li, B., Liu, Y.: An innovative classroom teaching technology assisted by artificial intelligence of things. In 2nd International Conference on Information Science and Education (ICISE-IE), pp. 1661–1664, (2021).
10. Gentile, M., Città, G., Perna, S., Allegra, M.: Do we still need teachers? Navigating the paradigm shift of the teacher's role in the AI era. In Frontiers in Education 8, (2023).

Design of a pilot study to evaluate a Question Answering model based on BERT

Mariella Farella[1,2][0000−0003−2626−0997], Daniele Schicchi[1][0000−0003−0154−2736], Giuseppe Chiazzese[1][0000−0002−0228−6204], and Giosué Lo Bosco[2][0000−0002−1602−0693]

[1] Institute for Educational Technology, National Research Council, Italy
mariella.farella@itd.cnr.it
[2] Dipartimento di Matematica e Informatica, University of Palermo, Italy

1 Introduction

The increasingly widespread use of technologies to support teaching offers the scientific community new scenarios in which they can apply and combine technologies in innovative ways, always looking to improve teaching techniques. Among these technologies, an emerging trend is the adoption of Artificial Intelligence (AI) systems combined with Extended Reality (XR) technologies. In education, the combination and correct usage of these technologies can boost the learning experience of students, leading to the acquisition of new knowledge and enhancing their skills, such as computational thinking and creativity [2–4].

One tangible example of the combination of these technologies is presented in Farella et al. [1]. The paper proposes a Virtual Reality (VR) system composed of a 3D avatar trained to answer questions posed by the user, using the BERT language model. In the abstract we present here, a pilot study of the model described in Farella et al. [1] is proposed, to evaluate the quality of the trained question-answer model and the correct functionality of the system.

2 Metrics for evaluating Question Answering Systems

The question-answering model developed and integrated with the 3D avatar can be incorporated into various virtual contexts, such as a scanned historical site, museum reconstructions, educational contexts, and so on. The virtual avatar that interfaces with the BERT model can answer questions related to the virtual context in which it is located. So if it is located inside a museum, for example, it will be able to answer questions posed by the user about a specific painting that the user is viewing at that moment. However, this system needs to be tested with a substantial number of users. In this regard, it is necessary to design a pilot study not only from the point of view of user interaction or user interface but also by searching the literature and studying the various existing metrics to assess whether the system responds correctly to the questions posed by the user. In particular, an analysis was made of the metrics for comparing two sentences [6]. One of the methods for testing if a question-answering system works correctly, is

to check if the answer given by the model (Predicted Answer), which it retrieves from a context, is equal to the answer that a human being would give based on the same context (the ground-truth Answer).

These metrics include Exact Match (EM), which is used to evaluate the accuracy of a model by observing whether the predicted answer is the same as the correct one. The F1-Score is a metric that combines the accuracy and recall of a model to estimate the performance of a natural language processing system, thus checking whether sentences are similar to each other. Among the most commonly used metrics can be found BLEU (Bilingual Evaluation Understudy), which is used to compare sequences of n consecutive words (n-grams) of the predicted sentence with the correct sentence. One of the problems with these metrics, however, is that they do not take into account the context or meaning of the words. Meteor, on the other hand, not only compares sentences but also exploits a WordNet-based similarity analysis to assign greater weight to sentences that are semantically similar to the reference sentence. Two other interesting metrics are BERTScore Vanilla and BERTScore Trained, two metrics that use the pre-trained BERT model to calculate the semantic similarity between two sentences by using cosine similarity. Lastly, recently developed metrics can be found in the literature that provide a numerical measure of how similar two answers are in terms of meaning [6][5].

3 Design of the pilot study

The idea for the design of the pilot study is to submit questions in 10 different contexts to users. These contexts are specifically related to some artworks (paintings or sculptures). The answers given by the users will be tracked and then compared with the answers given by the Question Answering model, which is configured inside a virtual reality context in which the 10 different contexts (statues and paintings) can be viewed by the user through the VR Headset Meta Quest 2. To compare the answers with each other, the above-mentioned metrics will be used, and a complete analysis between the various metrics will then be made.

References

1. Farella, M., Chiazzese, G., Lo Bosco, G.: Question answering with bert: Designing a 3d virtual avatar for cultural heritage exploration. In: 2022 IEEE 21st Mediterranean Electrotechnical Conference (MELECON). pp. 770–774. IEEE (2022)
2. Farella, M., Taibi, D., Arrigo, M., Todaro, G., Chiazzese, G.: An augmented reality mobile learning experience based on treasure hunt serious game. In: ECEL 2021 20th European Conference on e-Learning. p. 148. Academic Conferences International limited (2021)
3. Kuleto, V., Mihoreanu, L., Dinu, D.G., Ilić, M.P., Păun, D.: Artificial intelligence, machine learning and extended reality: Potential problem solvers for higher education issues. In: Augmented Reality and Artificial Intelligence: The Fusion of Advanced Technologies, pp. 123–136. Springer (2023)

4. Ma, J., Zhang, Y., Bin, H., Wang, K., Liu, J., Gao, H.: The development of students' computational thinking practices in ai course using the game-based learning: A case study. In: 2022 International Symposium on Educational Technology (ISET). pp. 273–277. IEEE (2022)
5. Reimers, N., Gurevych, I.: Sentence-bert: Sentence embeddings using siamese bert-networks. In: Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing. Association for Computational Linguistics (11 2019), https://arxiv.org/abs/1908.10084
6. Risch, J., Möller, T., Gutsch, J., Pietsch, M.: Semantic answer similarity for evaluating question answering models. arXiv preprint arXiv:2108.06130 (2021)

The use of emerging technologies for teaching human anatomy

Mariella Farella[1,2][0000−0003−2626−0997], Marco Arrigo[1], and Giosué Lo Bosco[2]

[1] Institute for Educational Technology, National Research Council, Italy
{marco.arrigo}{mariella.farella}@itd.cnr.it
[2] Dipartimento di Matematica e Informatica, University of Palermo, Italy
{giosue.lobosco}@unipa.it

1 Introduction

Augmented reality (AR) technology, particularly exploiting the features of cutting-edge devices such as Microsoft HoloLens 2, offers unprecedented opportunities in education and visualization, with immense potential to revolutionize education in human anatomy. Moreover, the convergence of AR and AI avatars presents a promising avenue for advancing human anatomy education. This paper explores the potential of this integration, highlighting the benefits of realistic visualization, personalized instruction, and adaptive learning. Furthermore, based on our previous research[1][2], we introduce advantages of the applications of these innovative devices in teaching human anatomy for interactive learning and collaborative experience.

2 Literature Review

The integration of emerging technologies has the potential to revolutionize the field of education, particularly in disciplines such as human anatomy. Among the innovative technologies gaining traction in educational settings are augmented reality (AR), HoloLens, and avatar artificial intelligence (AI). These technologies offer unique opportunities to enhance the teaching and learning of human anatomy by providing immersive, interactive, and personalized experiences for students. In the literature, the number of scientific studies and research in this area has been steadily increasing in recent years. These mainly focus on the effectiveness and impact of this combined approach on student learning outcomes, engagement and knowledge acquisition.

3 Use case

In the previous research, the system developed to support the anatomy students involved the use of structured light scanners to scan real organs in order to be able to reproduce these organs via 3D printers, allowing the students to have their own model. Once they had this organ, they were provided with an AR

system that, with the right calibrations, was able to show the original texture on the model while providing textural details of the organ itself. In addition, gamification methods were provided for the students to test their acquired skills. However, this system had limitations: besides the initial calibration problems where the model had to be aligned in a specific way and had to be placed on the work table, it was also a system that only worked on mobile devices, thus keeping the user's hands busy.

Since the Faculty of Medicine of the University of Palermo has several Hololens-type devices, the system has been updated. To overcome these limitations, object recognition libraries were used: now the user looks at the object, it is recognised by the system, which is able to overlay the texture on top of it in a precise and stable way, and the other augmented content. In this way, the student can hold the model in his hand, rotate it, and view it from multiple points of view. he is therefore able to hold the model of the organ in his hand as he has his hands free of the device, and the system provided to him uses a more advanced type of augmented reality.

To further improve the system, the integration of artificial intelligence models is being worked on, and in particular the design of a 3D avatar configured with an AI system that can answer questions posed by the user using the BERT Question Answering model[3]. This model is able to answer questions asked about a specific context, so if, for example, we are looking at the heart model and we are viewing the section about the Right Atrium, the avatar will be able to answer questions asked by the student about that specific context.

4 Conclusions

The integration of Augmented Reality, HoloLens, and AI avatars has the potential to revolutionize human anatomy education by providing immersive, personalized, and adaptive learning experiences. This synergistic approach offers realistic visualization, personalized instruction, and interactive collaboration, transforming the way learners engage with anatomical concepts. While challenges exist, the future of anatomy education lies in harnessing the power of AR, HoloLens, and AI avatars to empower learners and foster a deep understanding of the intricacies of the human body.

References

1. Argo, A., Arrigo, M., Bucchieri, F., Cappello, F., Di Paola, F., Farella, M., Fucarino, A., Lanzarone, A., Lo Bosco, G., Saguto, D., et al.: Augmented reality gamification for human anatomy. In: Games and Learning Alliance: 7th International Conference, GALA 2018, Palermo, Italy, December 5–7, 2018, Proceedings 7. pp. 409–413. Springer (2019)
2. Arrigo, M., Cappello, F., Di Paola, F., Farella, M., Lo Bosco, G., Saguto, D., Sannasardo, F.: Heart mobile learning. In: EDULEARN18 Proceedings. pp. 10899–10905. IATED (2018)

3. Farella, M., Chiazzese, G., Lo Bosco, G.: Question answering with bert: Designing a 3d virtual avatar for cultural heritage exploration. In: 2022 IEEE 21st Mediterranean Electrotechnical Conference (MELECON). pp. 770–774. IEEE (2022)

“Shall we rely on bots?” Students’ adherence to the integration of ChatGPT in the classroom

Roberto Sánchez-Reina[1] [0000−0002−6068−1229], Emily Theophilou[1] [0000−0001−8290−9944], Dimitri Ognibene[2] [0000−0002−9454−680X], Davinia Hernández-Leo[1] [0000−0003−0548−7455]

[1] Universitat Pompeu Fabra, Barcelona, Spain
[2] Dept. Psychology, Università degli Studi di Milano Bicocca, Milan, Italy
{roberto.sanchez; emily.theophilou; davinia.hernandez-leo}@upf.edu
dimitri.ognibene@unimib.it

1. Introduction

Artificial Intelligence (AI) systems have been introduced to perform routine work using large amounts of data to facilitate efficiency, accuracy, and productivity in various industries and sectors [1]. From healthcare professionals to graphic designers, AI systems support automating repetitive tasks, augmenting human capabilities, and enabling faster and more informed decision-making [2]. Moreover, in the field of education, AI systems have come to enhance administrative services, support academic teaching support, and personalize learning experiences [3]. The penetration of AI in education has brought a lot of debate about the pros and cons of technology. While the atomization and standardization of educational processes have been pointed out as factors affecting progress and performance [4, 5], the opportunities to take advantage of AI in the classroom have increased with the introduction of novel systems such as ChatGPT [6].

The introduction of ChatGPT into educational settings has sparked considerable controversy due to its exceptional performance and ability to streamline task management for both teachers and students. However, the success of ChatGPT has also given rise to apprehensions regarding the potential for AI-assisted cheating, resulting in restrictions on its usage in schools and even in certain countries. Consequently, the impact of ChatGPT in the realm of education has instigated a comprehensive discourse, primarily driven by media discussions and, to a lesser extent, research inquiries that explore its efficacy and implications [2]. To contribute to the ongoing debate surrounding ChatGPT, this study sought to examine the degree of undergraduate students' alignment with the integration of AI within society and its association with the adoption of ChatGPT in educational environments. Specifically, the research question guiding this investigation was formulated as follows: *"To what extent is the acceptance of ChatGPT in the classroom correlated with students' adherence to AI?"*

2. Methodology

This study utilizes the data from 72 undergraduate students enrolled in the first semester of the Public Relations course. The data was collected as part of a Media Literacy Lesson about “AI Society and the Current Communication Structure”. To assess the students' adherence toward AI technologies, the “General Attitudes towards Artificial Intelligence” questionnaire designed by Schepman & Rodway [7] was utilized. The items of the scale were measured with a Likert scale ranging from 1 (*Totally disagree*) to 5 (*Strongly agree*). Additionally, to assess students' acceptance of ChatGPT, the “Students’ Perceptions of ChatGPT” questionnaire designed by Shoufan [8] was implemented; these items were measured with a Likert scale ranging from 1 (*Not at all*)

to 5 (*Yes, very much*). Finally, the open-ended question *"What do you think of ChatGPT?"* was included to gather students' opinions and collect complementary quantitative data. The data analysis saw the descriptive statistics and correlations for the observed variables: AI attitudes and ChatGPT acceptance. A complementary qualitative analysis of open questions responses was conducted with an inductive approach to spot the emerging topics.

3. Results and Conclusion

The findings from this study show that students with more optimistic attitudes (*Openness/Adherence*) showed significantly more positive attitudes towards ChatGPT compared to their counterparts with negative attitudes (See Table 1). These findings provide insights into the relationship between individual attitudes and perceptions of ChatGPT, emphasizing the importance of optimism and adherence as factors influencing attitudes toward AI systems.

Table 1. Correlation between Scales: Positive and Negative attitudes towards AI; Positive and Negative attitudes towards ChatGPT.

		Mean for Positive Attitudes AI	Mean for Negative Attitudes AI	Mean for Positive Attitudes ChatGTPT	Mean dor Negative Attitudes ChatPGPT
Mean for Positive Attitudes AI		1	.054	.464**	.064
	Sig. (bilateral)		.651	.000	.591
	N	72	72	72	72
Mean for Negative Attitudes AI		.054	1	.122	.306**
	Sig. (bilateral)	.651		.305	.009
	N	72	72	72	72
Mean for Positive Attitudes ChatGTPT		.464**	.122	1	.204
	Sig. (bilateral)	.000	.305		.086
	N	72	72	72	72
Mean dor Negative Attitudes ChatPGPT		.064	.306**	.204	1
	Sig. (bilateral)	.591	.009	.086	
	N	72	72	72	72

**. The correlation is significant 0,01

Students' perceptions of ChatGPT see both positive and negative consequences. While it is seen as useful for finding information quickly and improving productivity, there are concerns about its potential to replace human thinking and jobs, as well as its accuracy and bias. It is seen as a double-edged sword that should be used wisely and not relied on completely. Some advantages observe ChatGPT: a useful tool for finding information quickly and easily, can help improve productivity and save time. It can also provide simple and concise explanations of complex concepts in the academic environment. Conversely, students also show some reflection to address negative features as ChatGPT can lead to laziness and a lack of critical thinking skills; be inaccurate and biased; be addictive and lead to over-reliance and misinform people. Privacy and security are also addressed.

While ChatGPT's presence in educational settings remains controversial, there is still a limited amount of research that comprehensively examines its impact. This study aims to fill this gap by exploring undergraduate students' attitudes towards AI and their acceptance of ChatGPT in the classroom. The findings indicate that students generally recognize the advantages of ChatGPT but also express concerns and fears regarding its potential negative effects. Consistent with previous research [9, 10], this work emphasizes the importance of promoting media education to cultivate critical thinking skills that encompass attitudes towards AI. By fostering such skills, students can navigate the complexities of AI technology more effectively and make informed decisions about its use.

Acknowledgments
This work was partially funded by the Spanish Ministry (PID2020-112584RB-C33 funded by MICIN/AEI/10.13039/501100011033), the Volkswagen Stiftung (Courage, ref. 95 566), and the Government of Catalonia (SGR 00930). DHL (Serra Húnter) acknowledges the support by ICREA under the ICREA Academia program.

References

1. Rossi, F. (2016). Artificial intelligence: Potential benefits and ethical considerations. https://shorturl.at/bgST7
2. Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. Education Sciences, 13(4), 410. https://doi.org/10.3390/educsci13040410
3. Owoc, M. L., Sawicka, A., & Weichbroth, P. (2019, August). Artificial intelligence technologies in education: benefits, challenges, and strategies of implementation. In IFIP International Workshop on Artificial Intelligence for Knowledge Management (pp. 37-58). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-85001-2_4
4. Floridi, L. (2019). What the near future of artificial intelligence could be. Philosophy & Technology, 32, 1-15. https://doi.org/10.1007/s13347-019-00345-y
5. Scribano, A., & Maria, M. V. (2021). Narratives, emotions, and artificial intelligence: a reading of artificial intelligence from emotions. SN Social Sciences, 1(9), 229. https://doi.org/10.1007/s43545-021-00237-z
6. Rahman, M. M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. Applied Sciences, 13(9), 5783. https://doi.org/10.3390/app13095783
7. Schepman, A., & Rodway, P. (2020). Initial validation of the general attitudes towards Artificial Intelligence Scale. Computers in Human Behavior Reports, 1, 100014. ISSN 2451-9588. https://doi.org/10.1016/j.chbr.2020.100014
8. Shoufan, Abdulhadi. (2023). Exploring Students' Perceptions of ChatGPT: Thematic Analysis and Follow-Up Survey. https://doi.org/10.1109/ACCESS.2023.3268224
9. Kit Ng, D. T., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. Computers and Education: Artificial Intelligence, 2, 100041. https://doi.org/10.1016/j.caeai.2021.100041
10. Sánchez Reina, J. R., & González-Lara, E. F. (2022). The COVID-19 infodemic among young people and adults: The support of critical media literacy. Comunicar. 2022; 30 (73) https://doi.org/10.3916/C73-2022-06

Innovative Approaches to University Course Design: Leveraging ChatGpt for Enhanced Educational Impact

Valeria Di Martino[1][0000-0002-9397-6226], Ylenia Falzone [1][0000-0002-0945-109X] , Elif Gulbay[1] [0000-0003-1876-4255], Alessandra La Marca[1] [0000-0003-3758-7055], Antonella Leone [2] [0009-0009-2012-3650], Leonarda Longo[1] [0000-0002-7404-3332], Dorotea Di Carlo[1] [] Federica Martino[1] [0000-0001-8339-5658]

[1] University of Palermo, Italy
[2] University of Foggia, Italy
valeria.dimartino@unipa.it

1 Introduction

OpenAI, an American company, unveiled ChatGPT in November 2022, an advanced artificial intelligence (AI) system that employs an extensive language database to generate text-based responses. Academic perspectives on the impact of ChatGPT in higher education have not reached a unanimous consensus. While AI programs existed before the introduction of ChatGPT, the remarkable quality and complexity of its outputs have given rise to substantial apprehensions concerning academic honesty. The primary concern revolves around the potential misuse of such tools by students during university learning and assessments, which could undermine the fairness and originality of their work [1]. Other studies have acknowledged that while ChatGPT may contain factual inaccuracies and biases, it has the potential to enhance student learning [2]. Accordingly, academics are encouraged to adapt their teaching and assessment methodologies to embrace the evolving reality of a world where AI is widely accessible, providing personalized and interactive learning experiences [3]. These tools offer an opportunity to shift attention towards the development of critical thinking skills [2]. Furthermore, they facilitate the comprehension of complex concepts through plain language, contributing to increased inclusivity for individuals with communication disabilities. Hence, universities and educators should prioritize teaching students how to ethically utilize ChatGPT and similar tools [4]. Since this issue is particularly relevant, this contribution aims to describe the integration of the use of ChatGpt in the instructional design of three university courses of the master degree in Primary Education Sciences of the University of Palermo.

2 Description of the instructional design process

Within the research activities conducted at the University of Palermo's Research Lab "Educational Technology", an instructional design intervention has been implemented for the Didactics, Educational Technologies, and Evaluation courses. The intervention aims to:

- Introduce clear guidelines, collaboratively negotiated with students, for the conscious and critical utilization of ChatGPT.
- Establish a connection between ChatGPT usage and the learning objectives of the courses, enabling students to understand how ChatGPT can enhance their learning experience and explicitly stating the associated expectations.
- Rethink the assessment of learning outcomes in alignment with the introduced innovations.

According to UNESCO guidelines [5] ChatGPT will be integrated into teaching and learning processes. Students will use ChatGPT to find information on specific topics, academic research or to clarify doubts about complex concepts. ChatGPT will also be used for brainstorming activities, where students will be asked to harness the potential of the tool during educational design activities. Students will be encouraged to use ChatGPT as a support to explore innovative ideas, write stories, perform guided exercises, or creatively develop educational projects. By leveraging the conversational capabilities of ChatGPT, students will be engaged in natural language dialogues, asking questions, seeking clarifications, and receiving real-time feedback based on information provided by students. Additionally, the integration of ChatGPT in assessments will offer innovative evaluation methods, such as simulated discussions or debates, enabling students to demonstrate critical thinking and communication skills in a dynamic manner.

3 Conclusion

While concerns regarding academic integrity and potential biases in AI-generated content remain valid, acknowledging the potential benefits is crucial. The integration of ChatGPT and similar AI tools in higher education enables educators to adapt teaching methodologies to a changing landscape. By prioritizing the development of critical thinking skills and providing inclusive learning experiences, universities can better prepare students for the AI-driven world.

4 References

1. Sullivan, M., Kelly, A., McLaughlan, P.: ChatGPT in higher education: Considerations for academic integrity and student learning. Journal of Applied Learning and Teaching 6(1), 3140 (2023).
2. Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J. Sun, M., Day, I., Rather, R. A., Heathcote, L.: The role of ChatGPT in higher education: Benefits, challenges, and future research directions. Journal of Applied Learning and Teaching, 6(1), 41-56 (2023).
3. Atlas, S.: ChatGPT for higher education and professional development: A guide to conversational AI. (2023). https://digitalcommons.uri.edu/cba_facpubs/548
4. Panciroli, C., Rivoltella, P. C., Gabbrielli, M., Zawacki Richter, O.: Artificial Intelligence and education: new research perspectives. Form@re 20(3), 1–12 (2020).

5. Sabzalieva, E., Valentini, A.: ChatGPT and artificial intelligence in higher education: quick start guide. (2023). https://www.iesalc.unesco.org/wp-content/uploads/2023/04/ChatGPT-and-Artificial-Intelligence-in-higher-education-Quick-Startguide_EN_FINAL.pdf

Using Conversational AI for Web Information Search in Secondary Education

Gaetano Francesco Anastasi[1], Paolo Musmarra[2], and Gennaro De Gregorio[3]

[1] ITET G. Garibaldi, Marsala (TP), Italy
gaetanofrancesco.anastasi@istruzione.it
[2] Computer Science Department - University of Salerno, Italy
pmusmarra@gmail.com
[3] University of Naples "Federico II", Napoli, Italy

1 Introduction

Artificial Intelligence (AI) is rapidly becoming essential in different working fields and in our daily lives, since it is capable of quickly automating repetitive tasks and accurately analyzing large amounts of data, allowing for an effective customization or a quick resolution of various general problems. For instance, AI can personalize the user experience when surfing the Web, improving customer satisfaction in e-commerce sites or helping addressing environmental challenges by optimizing energy usage and reducing waste. Moreover, as technology continues to advance, AI will become more sophisticated and capable of performing increasingly complex tasks and thus it will continue to play a crucial role in shaping our future. However, it's important to develop and use AI responsibly, taking into account ethical considerations and potential social impacts.

AI is gaining momentum during an era characterized by rapid technological innovations, in which technologies such as Social Networks, the Internet of Things, Virtual and Augmented Reality already emerged with disruptive implications for the education of current and future generations [1–3]. Obviously, the renewed interest in AI sparked a discussion on the importance of teaching AI concepts and computational skills to young people, including whether professionals should introduce AI at K-12 level through Computer Science (CS) education [4–6].

In our opinion, introducing AI in schools is of paramount importance for several reasons. First of all, it should be mentioned the fact that AI is expected to transform the job market in the coming years, and introducing students to AI technologies can help them in being prepared for the skills required in these future jobs. Moreover, AI can help personalizing learning experiences for students, providing them with tailored recommendations and feedback that can improve their understanding and retention of material.

Agreeing on the fact that AI should be introduced in school education, we should then discuss about the most appropriate topics. In this paper, we are interested in analyzing how AI can help students in searching for information and if we can compare AI and traditional web searching for determining how AI is changing learning approaches and which method can be more effective.

Table 1. Percentage of correct answers

Questions	AI Search	Web Search
What is Ada Lovelace famous for?	68.8%	68.9%
When was Ada Lovelace born?	96.7%	89.6%
Who did Ada collaborate with in her works?	86.8%	44.8%

2 Experiment

We conducted an experiment among 90 secondary school students, by using the life of Ada Lovelace as main topic. Students were divide in two groups: one group, composed by 29 students, conducted a traditional web search by using a web search engine, whilst the other group, composed by 61 students, used AI with Natural Language Processing, i.e. a chatbot impersonating the character of Ada Lovelace. AI introduced itself with the following statement: *Hi, I'm Ada Lovelace, daughter of the poet Lord Byron and I was born in 1815. I'm considered the first programmer in history.* The same information can be easily found in the snippet provided by state-of-the-art web search engines. The group performing AI search was allowed to asking for a maximum of 5 questions to the chatbot, whilst the other group had no limitation in searching and reading web sites. Both groups had no background knowledge about the character of Ada Lovelace.

After performing AI search or traditional Web search, all the students were asked to fill the same form, composed by three different questions, by choosing among four possible answers for each question. Table 1 shows the percentage of correct answers given by students divided in the two groups.

At a glance, results show a lower performance in the case of students performing traditional web search. Combining data with observations collected during the experiment, we justify this result with a lower engagement of students performing web search. Instead, students performing conversation with Ada chatbot were more enthusiastic and spent more time in the information searching process (in some cases they returned to the conversation after completing the questionnaire).

3 Conclusion

AI is already changing the way we search the web for information and will continue to do so in the future. By leveraging data analysis and contextual information, AI is enabling more accurate and intuitive web searches, making it easier for students to find the information they need, quickly and efficiently.

However, there are also potential downsides in relying on AI for this task. For instance, AI's lack of transparency can make it difficult to evaluate the accuracy and reliability of search results, that could be biased if AI is trained on data that reflects social biases. Moreover, students may become over-dependant: over-reliance on AI for web searching could lead to a lack of critical thinking skills and a decreased ability to evaluate information independently.

References

1. Taibi, D., Fulantelli, G., Monteleone, V., Schicchi, D., Scifo, L.: An innovative platform to promote social media literacy in school contexts (2021)
2. Anastasi, G.F., Musmarra, P.: Teaching IoT in the Classroom and Remotely. In: Casalino, G., Cimitile, M., Ducange, P., Padilla Zea, N., Pecori, R., Picerno, P., Raviolo, P. (eds.) Higher Education Learning Methodologies and Technologies Online. pp. 87–99. Springer International Publishing, Cham (2022)
3. Anastasi, G.F., Munna, E.G.: Augmented and Virtual Reality in Computer Science Education. In: Fulantelli, G., Burgos, D., Casalino, G., Cimitile, M., Lo Bosco, G., Taibi, D. (eds.) Higher Education Learning Methodologies and Technologies Online. pp. 601–612. Springer Nature Switzerland, Cham (2023)
4. Ali, S., Payne, B.H., Williams, R., Park, H.W., Breazeal, C.: Constructionism, ethics, and creativity: Developing primary and middle school artificial intelligence education. In: International workshop on education in artificial intelligence k-12 (eduai'19). vol. 2, pp. 1–4 (2019)
5. Touretzky, D., GardnerMcCune, C., Breazeal, C., Martin, F., Seehorn, D.: A year in K-12 AI education. vol. 40, pp. 88–90 (2019)
6. Wong, G.K., Ma, X., Dillenbourg, P., Huan, J.: Broadening artificial intelligence education in k-12: where to start? ACM Inroads **11**(1), 20–29 (2020)

SPECIAL TRACK 7

“THE FUTURE OF LEARNING: EXPLORING THE INTERSECTION OF POSTHUMANISM, E-HEALTH TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE IN EDUCATION INNOVATIONS”

ORGANIZERS:

LOREDANA PERLA, UNIVERSITY OF BARI ALDO MORO, ITALY

BERARDINA NADJA DE CAROLIS, UNIVERSITY OF BARI ALDO MORO, ITALY

VIVIANA VINCI, MEDITERRANEA UNIVERSITY OF REGGIO CALABRIA, ITALY

STEFANIA MASSARO, UNIVERSITY OF BARI ALDO MORO, ITALY

Educational robotics in the Early Classroom

Ilenia Amati[1[0000-1111-2222-3333]] and Alessia Scarinci[2[0000-0002-3174-7137]]

[1] University of Bari Aldo Moro, Italy
[2] Mercatorum University, Italy
ilenia.amati@uniba.it
alessia.scarinci@unimercatorum.it

1 Introduction: educational robotics in the Early classrooms

The presented study aims to provide empirical evidence to formalize specific educational evaluation methods related to the "infancy 0-6" age group. Specifically, these methods are designed to assess the impact of a coding intervention based on Computational Thinking, utilizing the Bee-Bot robot and programming software. The objective is to establish continuity between Early classroom and Kindergarten settings for children aged 2-3, both with and without disabilities. The ultimate goal is to plan Educational Robotics activities and interventions tailored to this age group and foster a reflection on the role of Educational Robotics in educational planning, with an emphasis on play-based learning.

The proposed use of Educational Robotics aligns with the constructivist epistemology and pedagogical principles of Dewey and Montessori [1] and is consistent with the guidelines outlined in the National Guidelines of 2012, as well as the integrated 0-6 system established later, which promote a playful, cognitive, and affective learning context as defined by Legislative Decree no. 65/2017. In this context, Educational Robotics serves as a tool to support play-based learning in early childhood services [2], applicable in both free play sessions and structured activities guided by educators, termed as guided play [2], center-based learning [3], purposefully framed play [4], or "activities with some level of adult involvement to embed or extend additional learning opportunities within the play itself" [2].

By providing a didactic approach that is educational, inclusive, and experiential, the study aims to ensure that children learn with awareness, making their newly acquired knowledge significant and applicable across various life contexts [5]. In order to achieve this, nursery school educators must possess both disciplinary and cross-disciplinary knowledge, as well as an understanding of the individual dynamics of each child's personality [6].

2 Exploratory investigation and research protocol

At the methodological level, an empirical investigation protocol was constructed involving two Early classrooms of 11 children, 2 of whom with disabilities.
The children were divided into two groups: an experimental one made up of 11 children (including 1 with Infantile Cerebral Palsy, resulting from head trauma), the other control made up of 11 children again (including 1 with down); both groups are homogeneous in terms of age and gender. The duration of the experimentation was 8 months, in the 2022/2023 educational year, in the period between September 2022 and May 2023. The macro-objective of the study was to design Educational Robotics activities and interventions for children aged 2-3 and to encourage reflection on the role that Educational Robotics can play in educational planning, in a play-based learning perspective. Micro objectives were then identified, such as:

- recover manual skills as a moment of learning by overcoming the habit of separating theory and practice, rules and exercise;
- develop operational autonomy;
- develop attention, concentration and motivation;
- develop curiosity and desire to participate in the proposed activity;
- experience working in a team;
- promote the inclusion of children with disabilities;
- stimulate creative thinking;
- increase decision-making skills, sense of responsibility and self-esteem;
- develop the ability to analyze and solve problems;
- acquire a programming language.

The identified purposes are:

- allow the child to approach the world of robotics through play;
- develop personalized learning processes;
- promote multidisciplinary learning;
- promote processes that allow students to become builders of their own knowledge;
- promote continuity between school orders.

The sample was divided into two groups: the Experimental Group (N=11) participated in the coding training, where coding rules were taught, and they were tested both before and after the intervention. On the other hand, the Control Group (N=11) was tested at the same time points as the experimental group but without receiving training. They received the training only after the measurements were completed. The children took part in experimental sessions lasting about 40 minutes per child, both before (T0) and after (T1) the intervention.

The evaluation tests used were as follows:

1. Scale for the Evaluation of Children's Ludic-Symbolic Abilities - SVALSI [7], combined with the Gross Motor Function Measure - GMFM [8], as they provide objective data to facilitate observation and evaluation of children's play abilities and their level of inclusion, with or without disabilities. This helps design targeted interventions to promote their enrichment and development.

2. A task of mental transformation, Children's Mental Transformation Task - CMTT, to assess children's visuo-spatial abilities based on their cognitive development.

3. An ad hoc task involving the use of Bee-Bot to investigate the strategies employed by the children to achieve a specific goal through programming sequences.

Conclusion

The results emerging from the following study indicate that before the coding intervention the two sections did not differ with respect to the cognitive processes evaluated. Subsequently, although an improvement was recorded in both sections, above all the children belonging to the experimental group had a clear improvement in the skills of sequential programming compared to the control group.

References

1. Nigris, E., Teruggi, L. A., Zuccoli, F.: Didattica generale, Pearson Italia, Milano (2016).
2. Danniels, E., & Pyle, A.: Defining Play-based Learning (2018). In *Encyclopedia on Early Childhood Development*. Online http://www.child-encyclopedia.com/sites/default/files/textes-experts/en/4978/defining-play-based-learning.pdf
3. Kotsopoulos, D., Makosz, S., Zambrzycha, J., McCarthy, K.: The effects of different pedagogical approaches on the learning of length measurement in kindergarten. Early Childhood Education Journal (2015).
4. Cutter-Mackenzie, A., Edwards, S.: Toward a model for early childhood environmental education: Foregrounding, developing, and connecting knowledge through play-based learning. The Journal of Environmental Education (2013).
5. Arduini, G.: Educazione e inclusione delle diversità. Prospettive pedagogiche. Anicia, Roma, (2020).
6. Lindsay, G.: Educational Psychology and the Effectiveness of Inclusive Education/Mainstreaming. British Journal of Educational Psychology, 77, 1-24, (2007).
7. Bondioli, S., Savio, A.: Osservare il gioco di finzione: una scala di valutazione delle abilità ludicosimboliche infantili (Svalsi), Junior, Bologna, (1994).
8. Palisano, et al.. Development of the Grass Motor Function Classification System for cerebral palsy. Developmental Medicine & Child Neurology, pp.50:249-253, (2008).

Children's theories on ChatGPT

Rosa Gallelli[1[0000-0001-7765-5628]], Loredana Perla[1[0000-0003-1520-0884]], Angela Balzotti[1[0009-0006-9295-3125]], Stefania Massaro[1[0000-0003-4695-1007]], Viviana Vinci[2[0000-0002-4091-0098]] and Pasquale Renna[1[0000-0001-8272-6814]]

[1] University of Bari Aldo Moro, Bari, Italy
[2] University of Foggia, Foggia, Italy
rosa.gallelli@uniba.it

Abstract. This research aims to build an experimenton the interaction of children, between eight and nine years old, with a tool built through artificialintelligence or a chatbot such as ChatGPT with the aim of encouraging children to develop reasoning on artificial intelligence.

Keywords: Children, Theories, ChatGPT.

1 Theoretical framework: evolution of the studies on Artificial Intelligence

Sweeping changes in artificial intelligence (AI) have been brought about in recent years, resulting in remarkable progress taking a number of forms, such as AI chatbots: artificial intelligence (AI) manages the properties of electromagnetism to process texts with extraordinary success and often in a way that is indistinguishable from how human beings would be able to do it. These are the so-called large language models (LLMs).

They do not reason or understand and they have nothing to do with the cognitive processes present in the human brain and mind, to manage semantic contents successfully. However, with the staggering growth of available data, quantity and speed of calculation, and ever better algorithms, they can do statistically – that is, working on the formal structure, and not on the meaning of the texts they deal with – what we do semantically [1].

2 ChatGPT: its potential in machine-human interactions

ChatGPT (Chat Generative Pre-trained Transformer) is a language model for dialogue. This chatbot, developed by Open AI, was released in prototype form on November 30, 2022. Since then, ChatGPT has attracted numerous users from various fields, because it can provide detailed answers and human-like responses to almost any question [2]. It has been brilliantly noted in this regard that "We have gone from being in constantcontact with animal agents and what we believed to be spiritual agents […] to

having to understand, and learn to interact with, artificial agents created by us, as new demiurges of sucha form of agency.

We have decoupled the ability to act successfully from the need to be intelligent, understand, reflect,consider or grasp anything" [1]. All this poses significant and interesting ethical and educational questions and calls for studies aimed at understanding how children interpret these new technologies and how they relate to them.

Sherry Turkle already in the early 2000s at MIT developed a series of investigations on the way in which children interpret the "relational artifacts"designed with Artificial Intelligence. Kismet and Cog, humanoid robots from the MIT ArtificialIntelligence Laboratory, are "relational artifacts", objects designed to present themselves as having "mental states" influenced by their "social" interactions with humans. Sixty children, ages8 to 13, were introduced to Kismet and Cog during the summer of 2001.

The children's first encounters with these robots provide a window into how such objects – and robots of the future inparticular – can enter the world, how children think about life, purposefulness, friendship and what is special about being a person [3].

3 Objectives and Methodology: how children interact with ChatGPT?

Our experimental research is part of a long-standing line of studies that has focused, since the last years of the twentieth century, on the interaction of children with the so-called "social media" [4].

It has two objectives: 1. to explore childhood theories about Artificial Intelligence; 2. to encourage children to reflect on the *relational media* they use and in order to learn a metacognitive mindset. It aimed to explore childhood theories about machines running on Artificial Intelligence.

We have built an experimenton the interaction of children, between eight and nine years old, with a tool built through artificialintelligence or a chatbot such as ChatGPT with the aim of encouraging children to develop reasoning on artificial intelligence.

We organized a game and exploration setting with ChatGPT inviting children to ask the chatbot questions and then reflect together on its answers. We asked the children to reflect on how ChatGPT answered the questions, if the answers were accurate andif there were unexpected answers. We stimulated children's critical reasoning on how ChatGPT works. For example with questions like: "Do you think ChatGPT has emotions?", "How do you think ChatGPT finds answers to questions?" or "Do you think ChatGPT can learn like a child?".

We will report the results of our experiment that will help us better understand the conceptions that children have of AI artifacts such as ChatGPT to implement their effective use in an educational setting.

References

1. Floridi, L.: AI as Agency Without Intelligence: on ChatGPT, Large Language Models, and Other Generative Models, Philosophy & Technology 36, 15 (2023). DOI: doi.org/10.1007/s13347-023-00621-y.
2. Chow, J., Sanders, L., Li, K.; Impact of ChatGPT on medical chatbots as a disruptive technology , Front Artif Intell. 6, 116601 (2023). DOI: doi.org/10.3389/frai.2023.1166014.
3. Turkle, S., Breazeal, C., Dasté, O., Scassellati, B. Encounters with Kismet and Cog: Children Respond to Relational Artifacts, Encounters with Kismet and Cog/9/30/04, Digital media (2006).
4. Turkle, S.: La vita sullo schermo. Apogeo, Milano (1996).

The role of Chat GPT in education

Primož Podržaj[1], Tomaž Požrl[1] and Tena Žužek[1]

[1] University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, 1000 Ljubljana, Slovenia
primoz.podrzaj@fs.uni-lj.si
tomaz.pozrl@fs.uni-lj.si
tena.zuzek@fs.uni-lj.si

1 Introduction

It is often assumed that Covid greatly influenced the speed of transition of education into digital era. The truth is however that long before it the EdTech (the term used to summarize all digital technologies and new business models in the world of education) was growing rapidly [1]. One of the hottest recent applications of artificial intelligence is the so-called ChatGPT. Wikipedia defines it in the following way: "ChatGPT is an artificial intelligence (AI) chatbot developed by OpenAI and released in November 2022. The name "ChatGPT" combines "Chat", referring to its chatbot functionality, and "GPT", which stands for Generative Pre-trained Transformer, a type of large language model (LLM)." [2]. As it enables people to chat with the system in a very human-like manner, it is expected to have a big impact on education from several points of view. This can already be seen by the length of time needed to reach one million users. ChatGPT's increase in popularity is by far the speediest of all the most popular applications / platforms launched it the last two decades and half. In this paper we will lighten some of the more pronouncing aspects of ChatGPT related to the field of education.

The discussion presented below will be made based on the analysis of some the most recent papers available. The paper itself is of conceptual nature and will not deal with the working principles of ChatGPT in any detail.

2 Discussion

This section focuses on the questions people most often ask themselves when ChatGPT is mentioned in relation with education. Some of them were directly posed in papers, whereas the others can be inferred from the discussion. The most common ones are:

- Is ChatGPT advantageous or harmful to the educational system? [3]
- Will teachers be losing jobs because of it?

In general, both advantages and drawbacks related to ChatGPT (and artificial intelligence) in education can be found. Some advantages are:

- AI could change education by making it more personalized and letting students learn at their own pace [4].
- It can help in writing programming code [5].

- It can assist students in their research by providing relevant resources, articles, and papers based on the research topic [6].
- It can assist students in proofreading and editing their essays and papers, providing feedback on grammar, sentence structure, and content. [6].
- Professors can use it to provide virtual office hours, answering students' questions and providing assistance in real time [6].
- It can be used to grade essays and other written assignments automatically. This can save teachers a lot of time and provide students with immediate feedback on their work. [7]

The drawbacks that can be found are:

- Impact on the socialization among students [8].
- ChatGPT can give different (albeit similar and correct) answers to the repetition of the same question [5]
- Losing of teachers' jobs [5] although some papers indicate that ChatGPT can only be tool and cannot replace teachers [9]
- Students stop to think critically [10]
- Overreliance on technology. There is a risk that students may become too reliant on ChatGPT and other AI tools, which could lead to a lack of critical thinking skills and independence in learning [7] as well as laziness [11]
- Plagiarism. If students use ChatGPT to generate written work without proper attribution or acknowledgement of its use, it could lead to plagiarism and academic dishonesty [7].

3 Conclusion

So, we can conclude that although we all agree that ChatGPT introduces a revolutionary approach to education, it is not so clear if the overall influence will be positive or negative. But in any case, it will have to be accepted, and it is up to the teachers to try to extract as much as possible out of advantages and limit the drawbacks.

References

1. Rousseau, H.P.: From Gutenberg to Chat GPT: The Challenge of the Digital University, CIRANO (2023).
2. https://en.wikipedia.org/wiki/ChatGPT
3. Mhlanga, D.: The Value of Open AI and Chat GPT for the Current Learning Environments and the Potential Future Uses (2023).
4. Sharma, S. and Yadav, R.: Chat GPT–A Technological Remedy or Challenge for Education System. Global Journal of Enterprise Information System, 14(4), pp.46-51 (2022).
5. Abdullah, M., Madain, A. and Jararweh, Y.: ChatGPT: Fundamentals, applications and social impacts. In 2022 Ninth International Conference on Social Networks Analysis, Management and Security (SNAMS) (pp. 1-8). (2022).

6. Biswas, S.: Role of Chat GPT in Education (2023).
7. Božić, V., Chat GPT and education (2023).
8. Baskara, F.R.: The Promises and Pitfalls of Using Chat GPT for Self-Determined Learning in Higher Education: An Argumentative Review. In Prosiding Seminar Nasional Fakultas Tarbiyah dan Ilmu Keguruan IAIM Sinjai, Vol. 2, pp. 95-101 (2023).
9. Ausat, A.M.A., Massang, B., Efendi, M., Nofirman, N. and Riady, Y.: Can Chat GPT Replace the Role of the Teacher in the Classroom: A Fundamental Analysis. Journal on Education, 5(4), pp.16100-16106 (2023).
10. Bishop, L.: A computer wrote this paper: What chatgpt means for education, research, and writing. Research, and Writing (2023).
11. Castillo, A.G.R., Silva, G.J.S., Arocutipa, J.P.F., Berrios, H.Q., Rodriguez, M.A.M., Reyes, G.Y., Lopez, H.R.P., Teves, R.M.V., Rivera, H.V.H. and Arias-Gonzáles, J.L.: Effect of Chat GPT on the digitized learning process of university students. Journal of Namibian Studies: History Politics Culture, 33, pp.1-15 (2023).

Promoting Health and Wellbeing: Harnessing the Potential of Social Robots in English L2 for Elderly Cognitive Decline prevention

Loredana Perla[1[0000-0003-1520-0884]], Berardina De Carolis[1[0000-0002-2689-137X]],

Stefania Massaro[1[0000-0003-4695-1007]] and Viviana Vinci[2[0000-0002-4091-0098]]

[1] University of Bari, Italy
[2] University of Foggia, Italy

loredana.perla@uniba.it
berardina.decarolis@uniba.it
stefania.massaro@uniba.it
viviana.vinci@unifg.it

1 Background

Within "Active ageing" World Health Organization framework [1] the use of Assistive Technologies (ATs) aims to enhance older adults' cognitive and physical condition, harnessing the potential of robotics with aims of self-care and socialization [2]. Studies have demonstrated the positive impact of social robots on psychological well-being, cognitive enhancement, physical assistance, and social engagement. In particular, they are emerging as educators and assistants in healthcare and entertainment education [3, 4]. Social robots are embodied artificial intelligence that interact in a human-like manner and display appropriate, responsive, and adaptive behaviors. They possess communication skills through natural language processing, speech synthesis, and non-verbal communication, facilitating effective and engaging interactions. They are found to be more effective than other technologies in education [5, 6] and language education [7] as unlike 2D technologies (e.g., virtual agents on computers and tablets), they can manipulate objects and make gestures to convey meaning and provide visual support.
RALL (Robot-Assisted Language Learning) is an innovative approach that combines robotics and language learning. RALL utilizes interactive robots as language tutors to enhance language acquisition and communication skills. The robots engage learners in interactive conversations, provide real-time feedback, and create a dynamic and engaging learning environment. Research studies have shown promising results in terms of increased motivation, language proficiency and learner engagement, highlighting new possibilities for personalized and immersive language education [8, 9]. RALL, particularly for L2 (second language) learning, has proved to be more effective in boosting learner performance and motivation compared with just 2D screen-based technologies [10] through robot as storyteller and robot asking questions and checking learners' answers. RALL through games has proved to be the most enjoyable and the most profitable interaction for L2 learners with the robot usually either as a peer or a teacher's

assistant. Recently, learning a foreign language has emerged as a potentially powerful tool in promoting healthy aging. As individuals age and a general cognitive decline triggers, various factors have been identified as potentially mitigating this decline, including education and engaging leisure activities [11]. Recently, the ability to speak two or more languages has gathered attention as a potential factor that may enhance cognitive reserve and reduce the functional consequences of cognitive impairment in older age. Specific effect of foreign language learning on brain structure in language- and memory-relevant regions in the old brain is unknown [12], research yet demonstrated that both short-term learning of a new language and other active cognitively stimulating activities could enhance cognitive functions and cognitively stimulating activities, as foreign language learning is a potentially effective intervention. Nonetheless, the effect of foreign language learning was larger on Alzheimer's Disease Assessment Scale–Cognitive Subscale and the training-induced benefit in the cognitive measure of linguistic function was only observed in the experimental group [13].

2 Research aims and methods

This study aims to examine the effects of foreign language training on cognitive frailty and quality of life in older adults developing a course on English language in the "cooking" domain with Alpha Mini, an intelligent humanoid robot produced by UBTECH. A total of 25 participants aged between 65 and 85 years old with mild cognitive impairment will be included within a controlled trial with a language robot-assisted training program, and a control intervention. For about 3 months subjects will undergo language training using robots 3 times a week in a group setting for 3 consecutive months with pre and post-intervention neuropsychological assessment. We will conduct a comprehensive statistical analysis on the data we have collected: mean, standard deviation and percentage concerning the test scores will be reported at baseline, end of intervention, and follow-up for all participants, by the two groups, and by strata of gender to discuss the general characteristics of the study sample and results. Secondly, we will compare demographic, psychological, and clinical scores through a t-test for continuous variables and a chi-squared test for categorical variables. Furthermore, we will employ the covariance analysis in order to confront the scores from the psychological measures also including as covariates age, gender, and education years.

3 Conclusion

We anticipate that interacting behaviorally and verbally with the robot could offer cognitive benefits, especially for individuals vulnerable to cognitive disorders. By the conclusion of this study, we will have assessed the potential impact of the second language intervention, with particular attention to the duration of exposure to the target language as a significant factor.

References

1. World Health Organization (2002). Active ageing: a policy framework. World Health Organization. https://apps.who.int/iris/handle/10665/67215.
2. Fotteler, M. L., Mühlbauer, V., Brefka, S., Mayer, S., Kohn, B., Holl, F., Swoboda, W., Gaugisch, P., Risch, B., Denkinger, M., & Dallmeier, D. (2022). The Effectiveness of Assistive Technologies for Older Adults and the Influence of Frailty: Systematic Literature Review of Randomized Controlled Trials. JMIR aging, 5(2), e31916. https://doi.org/10.2196/31916.
3. Lugrin, B., Pelachaud C., Traum D. (Eds.): The Handbook on Socially Interactive Agents: 20 years of Research on Embodied Conversational Agents, Intelligent Virtual Agents, and Social Robotics Volume 1: Methods, Behavior, Cognition (1st. ed.). ACM Books, Vol. 37. Association for Computing Machinery, New York, NY, USA (2021).
4. Pino, O., Palestra, G., Trevino, R., De Carolis, B.: The Humanoid Robot NAO as Trainer in a Memory Program for Elderly People with Mild Cognitive Impairment. Int J of Soc Robotics 12, 21–33 (2020).
5. Belpaeme, T., Kennedy, J., Ramachandran, A., Scassellati, B., Tanaka, F.: Social robots for education: a review. Sci. Robot. 3(21), eaat5954 (2018).
6. Johal, W. Research Trends in Social Robots for Learning. Curr Robot Rep 1, 75–83 (2020). https://doi.org/10.1007/s43154-020-00008-3.
7. Lee, H., & Lee, J. H.: The effects of robot-assisted language learning: A meta-analysis. Educational Research Review, 35, 100425 (2022).
8. van den Berghe R.: Social robots in a translanguaging pedagogy: A review to identify opportunities for robot-assisted (language) learning. Frontiers in robotics and AI, 9, 958624. https://doi.org/10.3389/frobt.2022.95862 (2022).
9. Geçkin, V.: Assessing the Learning Outcomes of Robot-Assisted Second Language Learning. In Handbook of Research on Perspectives in Foreign Language Assessment (pp. 71-88). IGI Global (2023).
10. Belpaeme, T., Vogt, P., van den Berghe, R. et al. Guidelines for Designing Social Robots as Second Language Tutors. Int J of Soc Robotics 10, 325–341 (2018). https://doi.org/10.1007/s12369-018-0467-6.
11. Nijmeijer, S. E., van Tol, M. J., Aleman, A., & Keijzer, M.: Foreign Language Learning as Cognitive Training to Prevent Old Age Disorders? Protocol of a randomized controlled trial of language training vs. musical training and social interaction in elderly with subjective cognitive decline. Frontiers in aging neuroscience, 13, 550180 (2021). https://doi.org/10.3389/fnagi.2021.550180.
12. Nilsson, J., Berggren, R., Garzón, B., Lebedev, A. V., & Lövdén, M.: Second Language Learning in Older Adults: Effects on Brain Structure and Predictors of Learning Success. Frontiers in aging neuroscience, 13, 666851 (2021).. https://doi.org/10.3389/fnagi.2021.666851.
13. Wong, P. C. M., Ou, J., Pang, C. W. Y., Zhang, L., Tse, C. S., Lam, L. C. W., & Antoniou, M.: Foreign language learning as potential treatment for mild cognitive impairment. Hong Kong medical journal = Xianggang yi xue za zhi, 25 Suppl 7(5), 41–43 (2019).

The digitisation of Token Economy in e-health.

Elia Guarnieri[1 [0000−0003−3461−5372]] and Marco Cremaschi[1 [0000−0001−7840−6228]]

University of Milan - Bicocca, Department of Informatics, Systems and Communication, Viale Sarca 336, Milan, 20126, Italy
{elia.guarnieri,marco.cremaschi}@unimib.it

"*Losing the coordinates of oneself*" is what, from a metaphorical point of view, happens to those affected by psychosis. It manifests through symptoms like crowded thoughts, delusions, flattened emotions, altered bodily sensations, and social withdrawal. It is a silent mental disorder, often unreported for years, causing significant emotional, physical, social, and cognitive changes.

Before the development of the full-blown disease, adolescents and young adults can pass through phases characterised by prodromic or sub-threshold symptoms, known as Ultra High Risk (UHR) and First Episode of Psychosis (FEP) [1]. Psychotic disorders generally have an early onset and a poor outcome, which can lead to the chronicity of the condition like schizophrenia, which represents the most severe extreme of schizophrenia spectrum disorders [1]. Individuals with schizophrenia experience a markedly lower quality of life and have a life expectancy 15-20 years lower than that of the general population [3] mainly due to the association of the condition with other issues, including obesity, early onset of cardiovascular disease, substance dependence, to self-destructive and suicidal behaviour.

Early onset and chronicity create the necessity for long-term medical support to "recover the coordinates". During this period, psychoeducation and Cognitive Behavioral Therapy (CBT) play a pivotal role, leading to a general improvement in the patient's condition, primarily if this occurs in the early stages of the disease. On the one hand, psychoeducation in early psychosis serves crucial purposes: increasing understanding, preventing psychosis onset in at-risk individuals, and promoting recovery for those experiencing a first episode. It supports well-being and outcomes for young individuals and families affected by psychosis [2, 4]. On the other hand, according to the cognitive model of psychosis, dysfunctional interpretations of unusual experiences play a role in the emergence and persistence of psychotic symptoms. Cognitive biases rooted in fundamental beliefs or schemas contribute to the progression from attenuated to fully developed symptoms. CBT for UHR individuals aims to identify and correct these biases using therapeutic techniques [2, 4].

These techniques often involve assigning specific daily/weekly tasks to patients, combined with a Token Economy system, reinforcing positive behaviours, reducing the risk of patient dropout, and increasing therapeutic compliance. A token economy utilises tokens (physical objects or digital units) as rewards to reinforce desired behaviours. Individuals receive tokens for completing tasks, exhibiting positive behaviours, or achieving goals. These tokens can be exchanged for predetermined rewards or incentives, motivating individuals through tangible or intangible rewards. Nevertheless, limited weekly meetings and fragmented

patient information make the reinforcement process complex, exacerbated by memory issues, mood changes, and emotional dysregulation, challenging recalling information from earlier periods.

To improve the therapeutic process, we propose the complete digitisation of every aspect related to it. Specifically, our solution consists of three highly interconnected components: (i) a patient management platform (PsitTools) accessible through a web browser, encompassing the entire therapeutic process; (ii) a predictive model and decision support system that aids professionals in diagnosis by utilising data from digitised psychodiagnostic tools; (iii) a smartphone application (Psychosis Early Intervention, a.k.a. PEnguIN) for patients to access therapy-related information, including instant communication with their therapist through a chat feature, with chatbot assistance when the therapist is unavailable.

Our approach optimises the care pathway by using evidence-based tasks, integrating content from CBT and behavioural medicine. The mobile application enables patients to perform assigned tasks, receive immediate feedback, and progress through Gamification (i.e., incorporating game-like elements, mechanics, and design principles into non-game contexts to increase engagement, motivation, and participation) and a Token Economy system developed with their therapist. The patient earns points by completing tasks through the application (e.g., filling out the daily diary), symbolising their progress in therapy. These points are displayed on a scale represented by a growing tree, from a seed to a blossoming cherry tree. The scores creatively describe the patient's position and provide reinforcement upon reaching milestones. The application allows for a personalised avatar, enhancing engagement. Points earned can be used to acquire accessories for the avatar. This interactive component actively involves patients, making the experience enjoyable, rewarding and reducing dropout risk.

This work explores the integration of e-health and the Token Economy in mental health, aiming to enhance psychiatric care. It examines how digital tools and technology can improve access to mental health services and therapy effectiveness. Additionally, it explores how the Token Economy can motivate patients to actively participate in their treatment by offering rewards and recognition for goal achievement.

References

1. Arciniegas, D.: Psychosis. Continuum (Minneapolis, Minn.) **21**, 715–36 (06 2015)
2. Calvo, A., Moreno, M., Ruiz-Sancho, A., Rapado-Castro, M., Moreno, C., Sánchez-Gutiérrez, T., Arango, C., Mayoral, M.: Intervention for adolescents with early-onset psychosis and their families: A randomized controlled trial. Journal of the American Academy of Child & Adolescent Psychiatry **53**(6), 688–696 (2014)
3. Hjorthøj, C., Stürup, A.E., McGrath, J.J., Nordentoft, M.: Years of potential life lost and life expectancy in schizophrenia: a systematic review and meta-analysis. The Lancet Psychiatry **4**(4), 295–301 (2017)
4. Pekkala, E., Merinder, L.: Psychoeducation for schizophrenia. Cochrane Database of Systematic Reviews (2) (2002)

Telemedicine innovations for obesity: connecting technologies and education for enhanced prevention and treatment

Alessandro Massaro[1,2][0000-0003-1744-783X], Stefania Massaro[3][0000-0003-4695-1007], Loredana Perla [3][0000-0003-1520-0884] and Berardina De Carolis [3] [0000-0002-2689-137X]

[1] LUM, Libera Università Mediterranea "Giuseppe Degennaro", S.S. 100-Km.18, Parco il Baricentro, 70010 Bari, Italy.
[2] LUM Enterprise Srl, S.S. 100-Km.18, Parco il Baricentro, 70010 Bari, Italy.
[3] University of Bari Aldo Moro, p.zza Umberto I 1, 70100 Bari, Italy

massaro@lum.it
stefania.massaro@uniba.it
loredana.perla@uniba.it
berardina.decarolis@uniba.it

1 Background

As obesity has reached epidemic proportions globally, posing significant challenges to public health, traditional approaches to obesity prevention and treatment have shown limited effectiveness and multidisciplinary approaches are currently being highlighted to address its clinical, psychological, physical, social and economic correlates [1,2]. Telemedicine, understood as the set of medical and IT techniques that allow remote patient care and health services, is proving to deliver obesity interventions remotely, overcoming geographical barriers and increasing accessibility to healthcare services through digital platforms [3]. Telemedicine technologies, including mobile applications, wearable devices and telemonitoring systems, play a crucial role in obesity primary, secondary and tertiary prevention as these technologies enable remote monitoring of vital signs, physical activity, and dietary behaviors, providing real-time feedback to individuals and healthcare providers [4,5]. By leveraging telemedicine, healthcare professionals can remotely assess and track patients' progress, tailor interventions, and provide timely support.

2 Aims and objectives

This paper explores the integration of telemedicine technologies and educational methodologies for the prevention and treatment of obesity (fig.1). As the main objective of the educational path is to increase the quality of life, education plays a pivotal role in obesity prevention, fostering awareness, knowledge and behavior change, beyond simple adherence to diet.

Specifically some issues will be discussed in relation to the acquisition of digital data and the use of Artificial Intelligence (AI) algorithms in modern applied telemedicine, capable of processing a large number of variables simultaneously, in order to define and experiment Diagnostic Therapeutic Care Pathways (PDTA), to provide support to predictive analysis about the risk associated with some obesity-related diseases such as diabetes, and to define guidelines and educational protocols.
Especially for primary prevention in childhood obesity, AI algorithms constitute a clear prognostic tool enabling clinical judgement concerning the evolution of obesity. The methods of reading data in a remote control application scenario will be explored as widely used technologies such as smartphones are now becoming "facilitating" means for data collection trough mobile apps and gaming and to activate personalised educational paths, even with the involvement of families.
The contribution will focus on the educational model and applied research of the Citel Centre for Research in Telemedicine at University of Bari, which is currently carrying out interdisciplinary research on e-health, connecting medicine, computer science, bioscience and education, within an inclusive perspective. In this context, the Citel research unit in Education works with the research units in information technology to develop “salutogenic” educational models through new digital technologies and social robotics aimed at promoting engagement and pro-active self-care, against the pathogenic model traditionally centred on deseases onset, treatment and prevention [6]. The diffusion of user-friendly devices currently enables the dissemination of narrative medicine practices, among the most accredited educational models as traditionally oriented to enhance personal experience in an adaptive and transformative direction of previous perspectives and patterns of meaning. This approach is explored as particularly suitable in relation to overweight/obesity as a condition often associated with stigma and prejudice linked to low adherence to the prevailing aesthetic model and urging interventions to combine health and welfare responses with attention to psychological and cultural dimensions.

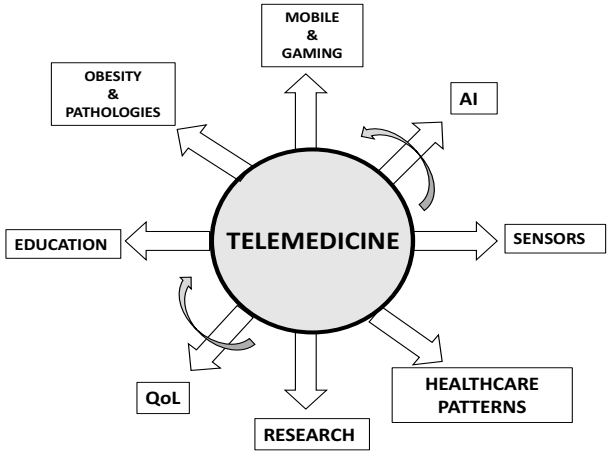


Fig. 1: correlations of telemedicine with obesity economic, social, scientific and health scenarios

References

[1] Perla, L., Massaro, S.: Virtual Patient Education Scenarios: Exploratory Step in the Study of Obesity Prevention Through Telemedicine. In: Casalino G. *et al.* Higher Education Learning Methodologies and Technologies Online. HELMeTO 2021. Communications in Computer and Information Science, vol 1542. Springer, Cham (2022). https://doi.org/10.1007/978-3-030-96060-5_19

[2] WHO European Regional Obesity Report, https://apps.who.int/iris/bitstream/handle/10665/353747/9789289057738-eng.pdf, last accessed 15/06/2023

[3] Haleem, A., Javaid, M., Singh, R. P., Suman, R.: Telemedicine for healthcare: Capabilities, features, barriers, and applications. Sensors international, *2*, 100117 (2021). https://doi.org/10.1016/j.sintl.2021.100117

[4] Massaro, A.; Maritati, V.; Giannone, D.; Convertini, D.; Galiano, A.: LSTM DSS Automatism and Dataset Optimization for Diabetes Prediction. Appl. Sci. *9*, 3532 (2019) https://doi.org/10.3390/app9173532

[5] Massaro, A., Galiano, A., Scarafile, D., Vacca, A., Frassanito, A., Melaccio, A., Solimando, A., Ria, R., Calamita, G., Bonomo, M., Vacca, F., Gallone, A., Attivissimo, F.: Telemedicine DSS-AI Multi Level Platform for Monoclonal Gammopathy Assistance. In: IEEE Proceeding of MeMeA (2020), https://doi.org/10.1109/MeMeA49120.2020.9137224.

[6] De Carolis, B., Macchiarulo, N., Palestra, G.: Soft biometrics for social adaptive robots. In: Advances and Trends in Artificial Intelligence. From Theory to Practice: 32nd International Conference on Industrial, Engineering and Other Applications of Applied Intelligent Systems, IEA/AIE 2019, Proceedings 32, pp. 687-699. Springer International Publishing (2019).

The future of tutoring. Survey on university tutor's perceptions of NPC tutors in the metaverse

Loredana Perla[1][0000-0003-1520-0884], Laura Sara Agrati[2][0000-0003-0108-5176] and Viviana Vinci[3][0000-0002-4091-0098]

[1]University of Bari Aldo Moro, Bari, Italy
[2]University of Bergamo, Bergamo, Italy
[3]University of Foggia, Foggia, Italy
loredana.perla@uniba.it
laurasara.agrati@unibg.it
viviana.vinci@unifg.it

Abstract. Artificial Intelligence and metaverse in higher education offer opportunities to be seized but also challenges to face in order to establish an equitable and quality education for all. The paper presents the ongoing study on the perceptions of student-teachers and tutors on so-called "non-player characters" (NPC tutors, peers and tutees). Quantitative and qualitative data are collected through an 'ad hoc' mixed-type questionnaire, administered within the qualifying course in 'Science of primary education' at the University of Bari, Foggia and Bergamo. The comprehensive results of the study will offer insights to teacher education leaders and research today investigating the learning effects of the metaverse as a potential professional learning environment.

Keywords: Tutoring, Metaverse, NPC tutor.

1 Artificial intelligence and Higher education

Artificial Intelligence in higher education offers opportunities to be seized but also challenges to face in order to establish an equitable and quality education for all [1]. The AI that governs the metaverse, as a teaching-learning support device, can be used to build an adaptive and personalized learning environment - thanks to the intelligent tutoring system - but also capable of profiling and prediction - thanks to the evaluation and feedback [2][3]. However, facilitating the successful entry of AI into education requires curriculum leaders and technology developers to work together in the best interests of students [4] and to share a multidimensional development model - pedagogy, technologies, content, administration (cf. AiLM - 5).

2 Metaverse and 'new' tutoring roles

The metaverse offers the learner a 'new educational environment' [6] by the overcoming of limits of time and place and the use of digital identities and wearable device. The metaverse could offer various opportunities to teachers as an emerging educa-

tional technology, especially in order to achieve good preparation - both initial and in-service [7]. Within the metaverse, the educational support would be given by the roles set by the AI – Table 1.

Table 1. Roles set by the IA in the Metaverse

Role	Definition	Function for teacher training
NPC tutor or advisor	'wise', 'expert' support, which offers advice in the solution of complex problems	trainee teacher to continue progressing of the educational program, to monitor the pace of learning of the students, without however losing sight of the timing of each student
NPC tutee/student	simulation of a student-teacher relationship, mainly involved in pre-service teacher training	trainee teacher to exercise his or her class management skills without any errors damaging the real student learning

These roles are considered both useful - as a support to one's own and students' learning processes [8] - and a source of anguish if performed without necessary educational guidance.

3 A study on tutors' perceptions of NPC 'tutor' and 'tutee'

The paper presents the ongoing study on the perceptions of student-teachers and tutors on so-called "non-player characters" (NPC tutors, peers and tutees) which posed the following research questions:

- What general utility do tutors and student-teachers perceive with regards to the NPC 'tutor' in the metaverse?
- What specific utility do school tutors and student-teachers perceive of the NPC 'tutor' for their teaching and learning?

Quantitative and qualitative data are collected through an 'ad hoc' mixed-type questionnaire, administered within the qualifying course in 'Science of primary education' at the University of Bari, Foggia and Bergamo.

The triangulated analysis of the data will be carried out at two levels: a. descriptive and inferential study of closed answers; B. emergence of categories through QDA of open answers. The triangulation on early qualitative-quantitative data is highlighting a general new look at the possibilities offered by the metaverse. Unlike what is highlighted by reflections and studies on the metaverse regarding the difficulties and disorientation by users in accessing and using technologies [9], both groups involved seem to feel no anxiety imagining what new things the metaverse will bring to teachers training. The comprehensive results of the study will offer insights to teacher education leaders and research today investigating the learning effects of the metaverse as a potential professional learning environment.

References

1. Zuboff, S. The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. Public Affairs (2019).
2. Colazzo, S., Maragliano R. *Metaverso e realtà dell'educazione*. Roma: Studium, (2022).
3. Crompton H., Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education*. 20(22).
4. UNESCO. (2019). Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development. United Nations Educational.
5. Luckin, R., Holmes, W., Griffiths, M., & Pearson, L. (2016). *Intelligence Unleashed An argument for AI in Education*. https://static.googleusercontent.com/media/edu.google.com/bg//pdfs/Intelligence-
6. Unleashed-Publication.pdf
7. Zhang, X., Chen, Y., Hu., L. and Wang Y. (2022). The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics. Front. Psychol. 13: 1016300
8. Jeon, J., and Jung, S. K. (2021). Exploring the educational applicability of Metaverse-based platforms. Korea Association of Information Education. 361-368.
9. Tlili, A. Huang, R., Shehata, B. et al. (2022). Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis. In Smart Learning Environments, 9:24.

Facilitating feedback at university using AI-based techniques

Francesca Gratani[1[0000-0003-2974-0101]], Lorenza Maria Capolla[1[0009-0008-3338-1096]], Lorella Giannandrea[1[0000-0002-1169-4795]], Laura Screpanti[2[0000-0003-4765-8427]] and David Scaradozzi[2[0000-0001-9346-2113]]

[1] Department of Education, Cultural Heritage and Tourism, University of Macerata MC 62100, Italy
[2] Department of Information Engineering, Università Politecnica delle Marche AN 60131, Italy
f.gratani@unimc.it; l.capolla@unimc.it; lorella.giannandrea@unimc.it; l.screpanti@univpm.it; d.scaradozzi@univpm.it

1 Introduction

Many recent studies highlighted the importance of feedback on the quality of learning [1; 2; 3]. It empowers students to take ownership of their learning, guides institutions in making informed decisions, ensures continuous improvement, fosters engagement and motivation, facilitates open communication, and enables personalized learning experiences [4]. However, despite its relevance, the use of feedback processes in everyday teaching often becomes unsustainable, due to the number of students and the timing of the courses. On the other hand, the expansion of ubiquitous learning in digital environments has led to an exponential growth of significant data for tracking learning. Although the use of these data can be beneficial, tools and technologies are needed for automated data collection and analysis [5].

In this direction, significant support can be provided by technologies incorporating Artificial Intelligence (AI), which include a wide collection of different technologies and algorithms [6]. Notably, Learning Analytics (LA) [7] and Educational Data Mining (EDM) [8] can be useful in developing a student-focused strategy [6; 9]. The systematic use of AI techniques and algorithms could enable new scenarios for educators, profiling and predicting learning outcomes and supporting the creation of sustainable patterns of assessment [10]. However, even though several studies aimed at integrating EDM and LA techniques in online learning environments [11], only few of them focused on applying them to real-world physical learning environments to support teachers in providing timely and quality feedback based on minimally invasive measurements [12; 13].

The present paper presents an approach aimed at addressing the feedback problem in real university classes, laying the groundwork for the development of an intelligent system that can inform and support the university teacher in delivering personalized feedback to a large group of students.

2 Context

In the training of future teachers, the ability to develop a professional vision and analyze different teaching interactions, observed through videos, is considered a key competence of teacher professionalism [14; 15]. Whenever the student makes an analysis of a teaching interaction, it is important for the teacher to provide timely and effective feedback. This could be very complex when the number of students is large. During the academic course of "Didattica Generale" at the University of Macerata in Spring 2021, 220 students attending the first year of the Master's Degree course in Primary Education Sciences participated in the lectures and took six tests. Each test required students to watch and analyze a video (10-15 minutes) which was recorded in an Italian primary school showing teacher-student interactions. After watching each video, the students filled in a questionnaire administered via Google forms (five open-ended questions related to meaning, organization, and management of the teaching action).

3 Methods

Students' understanding and learning were tested during the course at six different times thanks to the open-ended questions about the videos. This textual information was further processed by a team of researchers using a rubric, purposefully developed by the team. The team rated each indicator of the rubric by assigning a level on a rating scale from 1 to 5. The final numeric dataset was comprised of 220 cases, each of which included 13 numerical values related to the variables of the five dimensions of the rubric. The subsequent analysis was carried out using RStudio. Raw data were processed deleting incomplete or missing answers. Then, based on the evaluation provided by the team of researchers, the analysis aimed at discovering the main features and patterns in students' answers. Notably, the analysis employed the traditional methods of descriptive statistics (e.g. analysis of the distributions of the total scores), as well as correlation analysis and clustering techniques using the kmeans algorithm ('cluster' package [16]).

4 Preliminary results and conclusions

Preliminary results suggested that the use of students' answers to open-ended questions evaluated by means of rubrics can be an effective way to collect data from the process. The preliminary results showed the possibility of clustering students' behaviors. However, since the analysis is based on the researchers' assessment of a text, the results are not automated yet and may be influenced by the observers' bias. Since the ultimate goal is the development of an intelligent system to support teachers in delivering personalized feedback related to groups of students who show the same model of behavior, further developments will be needed including reducing the observer bias, exploring other descriptors of students' achievement and applying other machine learning techniques.

References

1. Carless, D.: Exploring learning-oriented assessment processes. Higher Education 69, 963-976 (2015).
2. Hattie, J., Clarke, S.: Visible learning: feedback. Routledge, London (2018).
3. Winstone, N., Carless, D.: Designing effective feedback processes in higher education: A learning-focused approach. London, Routledge (2019).
4. Henderson, M., Ajjawi, R., Boud, D., Molloy, E. (Eds.): The Impact of Feedback in Higher Education: Improving assessment outcomes for learners. Springer Nature (2019).
5. Romero, C., Ventura, S.: Educational data mining and learning analytics: An updated survey. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery (2020).
6. Guan, C., Mou, J., Jiang, Z.: Artificial intelligence innovation in education: a twenty-year data-driven historical analysis. International Journal of Innovation Studies 4(4), 134-147 (2020).
7. Krumm, A., Means, B., Bienkowski, M.: Learning analytics goes to school: A collaborative approach to improving education. Routledge (2018).
8. Fischer, C., Pardos, Z.A., Baker, R.S., Williams, J.J., Smyth, P., Yu, R., Slater, S., Baker, R., Warschauer, M.: Mining big data in education: Affordances and challenges. Review of Research in Education 44(1), 130–160 (2020).
9. Aldowah, H., Al-Samarraie, H., Fauzy, W.M.: Educational data mining and learning analytics for 21st century higher education: A review and synthesis. Telematics and Informatics 37, 13-49 (2019).
10. Mao, J., Ifenthaler, D., Fujimoto, T., Garavaglia, A., Rossi, P.G.: National policies and educational technology: A synopsis of trends and perspectives from five countries. TechTrends 63, 284-293 (2019).
11. Dogan, M.E., Goru Dogan, T., Bozkurt, A.: The use of artificial intelligence (AI) in online learning and distance education processes: A systematic review of empirical studies. Applied Sciences 13(5), 3056 (2023).
12. Scaradozzi, D., Cesaretti, L., Screpanti, L., Mangina, E.: Identification and Assessment of Educational Experiences: Utilizing Data Mining With Robotics. IEEE Robotics & Automation Magazine 28(4), 103-113 (2021).
13. Screpanti, L., Scaradozzi, D., Gulesin, R.N., Ciuccoli, N.: Control Engineering and Robotics since Primary School: an Infrastructure for creating the Digital Twin model of the Learning Class. IFAC-PapersOnLine 55(17), 267-272 (2022).
14. Santagata, R., Angelici, G.: Studying the impact of the lesson analysis framework on preservice teachers' abilities to reflect on videos of classroom teaching. Journal of Teacher Education 61(4), 339-349 (2010).
15. Seidel, T., Stürmer, K.: Modeling and measuring the structure of professional vision in preservice teachers. American Educational Research Journal 51(4), 739-771 (2014).
16. Kaufman, L., Rousseeuw, P.J.: Finding groups in data: an introduction to cluster analysis. John Wiley & Sons (2009).

Artificial Intelligence, Ethics, and Well-being: The Challenges of the Future in Education

Annamaria Di Grassi[1][0009-0004-8466-074X] and Raffaella Forliano[2][0009-0008-5620-0999]
[1]Università degli Studi di Bari "Aldo Moro". Italia, annamaria.digrassi@unifg.it
[2]Università degli Studi di Bari "Aldo Moro", Italia, raffaella.forliano@unifg.it

1 Introduction

The purpose of this article is to investigate the main reflections in the field of research regarding artificial intelligence, ethical use, and the implications and challenges in the educational sector, with particular attention to individual well-being from a human-centered perspective. In the research work, the existing literature was explored by focusing on the thematic area using the search query [("Artificial intelligence" or "AI") AND "education" AND "human centered AI" AND "ethics" AND "well-being"] to include documents with these terms in titles, keywords, or abstracts. The consulted databases were Scopus and Web of Sciences. The research was confined to articles in the English language educational research field, from 2019 (pre-COVID-19) to the present. The results were ordered by relevance. The aim of this scoping review was to integrate the current debate and identify open questions or trajectories that need to be further explored in future research. Trajectories that concern the application of Artificial Intelligence in education (AIEd) from a human-centered perspective, not neglecting ethical issues, individual well-being, and the development of study programs to ensure that future citizens have the necessary skills for the development of resilient and sustainable capabilities for the digital ecosystem [1].

2 Artificial Intelligence: towards what future?

For a long time, humanity has been questioning the interaction between man and machine. Experts in the field of innovation have predicted for decades a future in which automation and technology would have had an increasingly central role in human activities, also imagining the social and ethical consequences of this scenario, a future in which technology would have automated many human activities. However, it is important to note that these scenarios have often been presented as dystopias, inviting critical reflection on the impact of technology on humanity.
Despite dystopian concerns, the history of technology offers many positive examples of technologies created to simplify human labour and intelligent systems developed to improve the quality of human life.

3 Awareness and literacy of Artificial Intelligence

Artificial intelligence has become a key point on the agendas of governments and international agencies [2; 3; 4; 5; 6; 7; 8 ; 9] because it has now involved all sectors of human activity: from medicine to neuro-robotics, from transportation to domestic services, from art to education, from web rights to exercising citizenship. Many sectors are revolutionizing their way of thinking: the economy is increasingly driven by data science mechanisms; we are now witnessing what is called the tyranny of the algorithm [10], and concerns are emerging in the field of exercise of democracy and active citizenship [11; 12]. To deal with this, the European Commission has set up the ECAP, European Centre for Algorithmic Transparence, a center for algorithm transparency.
Ethical implications are also significant [13]. Our individual and social well-being is intimately connected to the state of our information environment and the digital technologies that mediate our interaction with it. This raises pressing ethical questions regarding the impact of digital technologies on our well-being that need to be addressed [14]. The impact on the education sector is also noteworthy. This raises various questions about possible future scenarios.

4 Challenges for education

Advancements in Artificial Intelligence (AI) are providing teachers with a wide range of new intelligent tools and services to facilitate student learning, but at the same time, the application of AI in educational contexts raises deep questions about what should be taught, how, and what is the evolving role of teachers and the social and ethical implications of AI [15], requiring changes in terms of curricula [14]. AI is an interdisciplinary field that requires interdisciplinary approaches. Understanding the possibilities and limitations of AI and ensuring the necessary human skills should be at the heart of education and training programmes at different levels. [1].
Technological evolution has created new gaps in skills in pre-service and in-service teacher training. An important element to keep in mind is that the pedagogical quality of technology application in education is determined by the knowledge and skills of teachers. The development of digital skills should become an integral part of pre-service and in-service teacher training. New educational models will need to be developed [16]. For teachers, how to skillfully apply AI in teaching and improve their AI literacy has become a necessary goal for their sustainable professional development [17]. The quality of teaching is a crucial global issue in determining the quality of our educational systems and is closely linked to technological innovations that amplify situations of stress, burnout, and generational gaps.

Equally fundamental will be to pay attention to and counteract the growing increase in mental health problems in adolescents (depression, anxiety…), which can be attributed to the increasingly massive presence of technology, such as social media, in their lives [15]. Phenomena of discomfort that must also be evaluated in relation to physical well-being, which is essential for a holistic approach to the overall well-being of the individual, with strictly educational interventions that place the person at the center [18].

References

1. Dignum, V. The role and challenges of education for responsible AI. *London Review of Education.* Vol. 19(1). (2021). DOI: 10.14324/LRE.19.1.01
2. UNIONE EUROPEA'"European Framework for the Digital Competence of Educators: DigCompEdu"(2018)
3. UNIONE EUROPEA Proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on Artificial Intelligence (artificial intelligence act) and amending certain Union legislative acts. COM/2021/206 final (2021)
4. UNIONE EUROPEA Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators 2022 dell'UE (2022)
5. OECD The Future of Education and Skills 2030 (2018)
6. MISE *Proposte per una strategia italiana per l'intelligenza artificiale* (2020)
7. EDUCAUSE Kathe Pelletier, Mark McCormack, Jamie Reeves, Jenay Robert, and Nichole Arbino, with Maha Al-Freih, Camille Dickson-Deane, Carlos Guevara, Lisa Koster, Melchor Sánchez-Mendiola, Lee Skallerup Bessette, and Jake Stine, *Horizon Report, Teaching and Learning Edition* (2022)
8. AGID *Libro Bianco sull'Intelligenza Artificiale al servizio del cittadino,* (2018) https://ia.italia.it/assets/librobianco.pdf
9. UNESCO Miao, Fengchun, Holmes, Wayne, Ronghuai Huang, Hui Zhang, *AI and education: guidance for policy-makers dell'UNESCO* (2021)
10. Benasayag, M., & Meyran, R. La tirannia dell'algoritmo: conversazioni con Régis Meyran. Vita e pensiero. (2020).
11. Buckingham, D. *Un manifesto per la media education*. Mondadori Università, Milano (2020).
12. Jenkins H. *Culture partecipative e competenze digitali*. Ed. Guerini e associati. Milano (2010).
13. Floridi, L. *Etica dell'intelligenza artificiale: Sviluppi, opportunità, sfide*. Raffaello Cortina Editore (2022).
14. Burr, C., Taddeo, M., & Floridi, L. The ethics of digital well-being: A thematic review. *Science and engineering ethics*, *26*(4), 2313-2343 (2020).
15. Adams, C., Pente, P., Lemermeyer, G., & Rockwell, G. Ethical principles for artificial intelligence in K-12 education. *Computers and Education: Artificial Intelligence*, *4*, 100131 (2023).
16. Kaminskienė, L., Järvelä, S. & Lehtinen, E. How does technology challenge teacher education?. Int J Educ Technol High Educ 19, 64. (2022) https://doi.org/10.1186/s41239-022-00375-1
17. Zhao L, Wu X, Luo H. Developing AI Literacy for Primary and Middle School Teachers in China: Based on a Structural Equation Modeling Analysis. *Sustainability*.; 14(21):14549. (2022) https://doi.org/10.3390/su142114549
18. Massaro, S., & Perla, L. Prevenire l'obesità nell'era post-covid. Il modello pedagogico del Centro di ricerca in Telemedicina UniBa. Mizar. Costellazione di pensieri, 2021(15), 155-161.

SPECIAL TRACK 8

"TECHNOLOGY-BASED LEARNING INTERVENTIONS IN HIGHER EDUCATION FOR COMBATING INEQUALITIES AND INCREASE THE PSYCHOLOGICAL WELL-BEING OF YOUNGSTERS"

ORGANIZERS:

RAFFAELE DI FUCCIO, UNIVERSITY OF FOGGIA, ITALY

FRANCESCO SULLA, UNIVERSITY OF FOGGIA, ITALY

Pre-service teachers' perception of digital competences and innovative teaching methods

Di Fuccio Raffaele[1][0000-0001-8886-3967], Maria Giovanna De Luca[2] and Clarissa Lella[2]

[1] University of Foggia, Via Arpi, 176 Foggia
[2] University of Naples Federico II, Via Porta di Massa, 1 Napoli
raffaele.difuccio@unifg.it

1 Introduction

The impact of technology is widespread and its role in educational settings is relevant [2]. Because the prominent role of technology and its way to handle, the European Commission delivered a framework called DigComp - The digital competence framework for citizens [1] and one, more specific for the educational practitioners called DigiCompEdu because it is relevant as they require a new, broader and more sophisticated set of competences than before [3].

Pre-service teachers enrolled in higher education courses are a very attractive target group for researchers because they represent the teachers of tomorrow and potentially could integrate a change in the application of digital technologies in the schools for the new generations.

Teachers' perceptions of the digital competence are studied in a significant way [4-6] and updated studies have the potential to well intercept new innovative methodologies applying ultimate technologies. In this background this study aims to investigate the application of digital storytelling (DTS) [7] and the application of Tangible User Interfaces [8] in teaching practices based on previous prototypes [9].

2 Materials and methods

2.1 The project and the TUI tool

The study was performed on the framework of the European-funded project called Blue Arrow (2020-1-IT-IT02-KA226-HE-095644) that aimed to enable the pre-service teachers to apply Tangible User Interfaces platforms in distance and blended teaching. In particular, the project has a strong accent on the special needs of students. The paper presents the teachers' reflection triggered by the tool developed in the project. It is an authoring tool for the building of digital stories where the student needs to use tangible user interfaces and then, physical objects to proceed with the scenes. The stories could be played with a smartphone that recognizes, using the NFC antenna, the tangible objects.

2.2 Participants and methods

The participants were 20 pre-service teachers for the special needs addressed for high schools (in Italian called the course TFA – Tirocinio Formativo Attivo per il sostegno) at the University of Foggia. Focus groups were performed in order to collect the perspective of pre-service teachers on the application of four topics: i) the application of storytelling and digital storytelling in educational practices, ii) the needs of digital competences for facing the new challenges in schools, iii) the specific pedagogical aspects and the reflection on the tool, iv) future applications in teaching practices of DTS with TUI methods.

3 Results

The results show a good attitude of the teachers that considers it a potential tool for the special educational needs because it is practical and involves dexterity and the senses, highlighting the sense of discovery that could motivate students in class. In the meantime, the pre-service teachers consider the application of innovative methods as the digital storytelling using TUI methodologies as a potential overload for their work.

References

1. Carretero, S., Vuorikari, R., & Punie, Y. DigComp 2.1. The Digital Competence Framework for Citizens. With eight proficiency levels and examples of use. Publications Office of the European Union. (2017)
2. Raja, R., & Nagasubramani, P. C.. Impact of modern technology in education. Journal of Applied and Advanced Research, 3(1), 33-35. (2018)
3. Punie, Y., &, Redecker, C., European Framework for the Digital Competence of Educators: DigCompEdu , EUR 28775 EN, Publications Office of the European Union, Luxembourg, 2017.
4. Suárez, A. S., & Colmenero, M. R. The challenge of incorporating digital skills in the classroom: perceptions and attitudes of Spanish Salesian teachers. International Studies in Catholic Education, 1-16. (2021)
5. Ata, R., & Yıldırım, K.. Turkish pre-service teachers' perceptions of digital citizenship in education programs. Journal of Information Technology Education. Research, 18, 419. (2019)
6. Tomczyk, Ł., Fedeli, L., Włoch, A., Limone, P., Frania, M., Guarini, P., ... & Falkowska, J. Digital competences of pre-service teachers in Italy and Poland. Technology, Knowledge and Learning, 28(2), 651-681. (2023)
7. Wu, J., & Chen, D. T. V. (2020). A systematic review of educational digital storytelling. Computers & Education, 147, 103786.
8. Ishii, H., & Ullmer, B. (1997, March). Tangible bits: towards seamless interfaces between people, bits and atoms. In Proceedings of the ACM SIGCHI Conference on Human factors in computing systems (pp. 234-241).
9. Di Fuccio, R., & Mastroberti, S. (2018). Tangible user interfaces for multisensory storytelling at school: A study of acceptability. Qwerty-Open and Interdisciplinary Journal of Technology, Culture and Education, 13(1).

Student-generated formative assessment with Kahoot! Report from a pilot study

Delio De Martino[1[0000-0003-3107-1816]], Mariasole Guerriero[1[0009-0008-7910-0886]], Sabrina Annoscia[1[0009-0004-7178-3644]], Angelo Basta[1[0009-0008-3954-997X]], Andrea Tinterri[1[0000-0001-5891-505X]], Anna Dipace[1[0001-0001-9826-076X]]

[1] Università di Foggia, Italy
delio.demartino@unifg.it, mariasole.guerriero@unifg.it, sabrina.annoscia@unifg.it, angelo.basta@unifg.it, andrea.tinterri@unifg.it, anna.dipace@unifg.it

1. Introduction

The didactic experimentation presented below is a continuation of a test at the Universities of Foggia and UniMoRe during the course 2021-2, in the time of the difficult "return to normality" after the lockdown [1]. The experimentation has been continued at Foggia during the next course when the pandemic is considered finished but its impact on teaching and learning practices in higher education is still strong.

The peculiarity of this study is the complex experimental pedagogical framework finalized to improve the effectiveness of didactics in the post pandemic era. This experimentation is based on a combination of different methodologies, well combined.

The main framework is the "formative assessment", an innovative type that is not only a classic assessment "of learning" but at the same time "for learning" and "as learning" and therefore in the end an opportunity of learning [2]. The formative assessment is realized through a digital gamification and specifically through a multiple-choice test (MCT) app that permits also a self-assessment [3, pp. 182-185]. The chosen app is Kahoot!, one of the most famous MCT app used in pandemic age too [4]. Another peculiarity is the active learning and learning by doing perspective [5]. Instead of classic tests prepared by the teacher, in this case the students have played an active role in the preparation of the tests before the classroom, always supervised by the teacher. This learning by doing process improves also the digital competence in students with a BYOD (Bring Your Own Device) strategy [6]. The general aim is to present the fists result of this pilot study in order to promote the innovation of the assessment. Furthermore the presented model could support the inclusion and psychological well-being for the involved students.

2. Methods and execution

The research activity involved a sample of students from the University of Foggia, attending two courses, one from the Education and Formation Sciences degree course

and the other from the five-year degree course in Primary Education Sciences. The sample was of 83 students for the first course and 132 in the second one. There were two subgroups, one of makers and one of users. The makers created sets of multiple-choice tests at the end of each lesson; the users and makers, using Kahoot!, answered the questions created by their peers at the beginning of the next lesson. To maximize student participation, the methodology used included the use of a facilitator tool, identified in a bonus. All students who had met the established criteria were entitled to two extra points on the final exam. For question writing, prior training was provided through the use of rubrics and online videos.

During the research activity, it appeared necessary to provide formative feedback for the realization of the set of questions in order to monitor whether, through training and feedback, the quality of the questions could improve over time. For this purpose, feedback in the form of semaphores was realized as an evaluation of the question sets. The evaluation, based on specific criteria, was carried out by two evaluators, anonymous to the students. The traffic light colors were as follows: green = question correct; yellow = question incorrect but not wrong; red = question not acceptable.

3. Preliminary observations

Regarding the analyzed results, three aspects emerge that are considered particularly indicative. Firstly, it was found that students' ability to formulate questions, i.e., the quality of their "traffic lights", improved over time. This data indicates an increasing involvement of students in the topics covered and an important acquisition of knowledge during the course. This result is consistent with the literature on active learning, which has demonstrated the importance of student involvement [7].

Secondly, it emerged that the majority of user and maker students passed the reference exam at the first call, highlighting how the strategy used had a meaningful impact on students' motivation and self-efficacy (measured with quantitative methods).

Finally, an impact on the final evaluation of user and maker students was observed, who obtained on average a higher final grade than non-participating students, net of the bonus awarded. The strategy thus produced relevant repercussions also on the acquired knowledge. This result is consistent with the literature on experiential learning, based on Kolb's [8] theory of the learning cycle, which states that learning occurs through practical experience, reflection on experience, generalization of acquired knowledge, and application of acquired knowledge. In the strategy used in the course, students were actively involved as users and makers of innovative technologies, in order to favor learning through practical experience and reflection on experience. In summary, the used strategy combined active learning, the promotion of student motivation, and experiential learning to improve participation and engagement, increased their motivation and self-efficacy, producing positive effects on the final evaluation.

References

1. De Martino, D., Tinterri, A., & Dipace, A.: "Mentimeter" e valutazione: una sperimentazione di gamification. Education Sciences & Society, 14(1), (2023) 59-68. https://doi.org/10.3280/ess1-2023oa15162
2. Trinchero, R.: Valutazione formante per l'attivazione cognitiva. Spunti per un uso efficace delle tecnologie per apprendere in classe. (2018). Available from https://iris.unito.it/bitstream/2318/1726726/1/1013-2179-1-PB.pdf
3. Bonaiuti, G., & Dipace, A.: Insegnare e apprendere in aula e in rete. Per una didattica blended efficace. Carocci, Roma (2021).
4. Toma, F., Diaconu, D. C., & Popescu, C. M.: The use of the kahoot! learning platform as a type of formative assessment in the context of pre-university education during the covid-19 pandemic period. Education Sciences, 11(10), 649 (2021). https://doi.org/10.3390/educsci11100649
5. Dozier, A. L., Gilbert, B. G., Hughes, V. W., Mathis, D. P., & Jenkins, L. J.: The Use of active learning strategies during the COVID-19 pandemic to promote critical thinking. ABNF Journal, 32(1) (2021).
6. Douligeris, C., Seralidou, E., & Gkotsiopoulos, P.: Let's learn with Kahoot!. In: 2018 IEEE Global Engineering Education Conference (EDUCON), pp. 677-685. IEEE (2018, April). https://doi.org/10.1109/EDUCON.2018.8363296
7. Freeman, S., Eddy, S.E., McDonough, M., Smith, M.K., Okoroafor, N., Jordt, H., & Wanderoth, M.P.: Active learning increases student performances in science, engineering, and mathematics. In: Proceedings of the National Academy of Science, 111(23), pp. 8410−8415 (2014). http://www.pnas.org/content/pnas/111/23/8410.full.pdf (ver. 15.12.2018).
8. Kolb, D. A.: Experiential learning. Experience as the source of learning and development. Prentice Hall, New York (1984).

Cognitive Activation with Kahoot! - A tool to Enhance Participation and Metacognition for University Students

Andrea Tinterri[1,2][0000-0001-5891-505X], Marilena di Padova[2] [0000-0002-2105-7095], Maria Clara Dicataldo[2] and Anna Dipace[3][0000-0001-9826-073X]

[1]IUL Telematic University, Via M. Buonarroti 10 - 50122 Firenze
[2] Department of Humanities, University of Foggia, 71121 Foggia, Italy
[2] Department of Medical and Surgery sciences, University of Foggia, 71121 Foggia, Italy

andrea.tinterri@unifg.it

1 Rationale of the study

The COVID-19 pandemic posed a great challenge of methodological innovation for teaching and assessment in higher education. The current, "new normal" scenario [1] calls for the reimagining and adoption of instructional models that include technologies in educational systems, giving rise to a phase of experimentation, evaluation, and permanent revision in the post-pandemic context [2]. Formative assessment (FA) can be defined as "all those activities undertaken by teachers, and/or their students, that provide information to be used as feedback to modify the teaching and learning activities in which students are engaged" [3]. This transfer of information does not only occur between teachers and students; peer and self-assessment can be important vehicles for providing feedback on students' current performance and steps to move forward [4]. Cognitive activation (CA) describes the mental stimulation of learners to engage in deeper mental investigation of the subject matter within the learning context [5]; the use of digital technologies can facilitate its use and enhance its effects and at the same time increase so-called feedback literacy [6]. There are many apps and digital tools that can be used for FA and CA, of which perhaps the best known is Kahoot!. It is an app for creating interactive question-and-answer games in the classroom, to improve student participation and performance [7]. At the University of Foggia, Kahoot! has been used since 2020/21 in select courses for CA and FA in different contexts, from remote teaching during the pandemic, to hybrid teaching during the post-pandemic transition, and in current blended and traditional forms. Each week, the teacher selected ten questions submitted by students and gave them formative feedback on the quality of their MCQs. At the beginning of each lesson, students in attendance could participate in the Kahoot! CA activity, answering the questions created by their peers using their smartphones or tablets. The same questions were then uploaded on the Moodle platform of the course to allow students to self-assess

their knowledge asynchronously. The aim of this study is to investigate whether the use of FA and CA strategies in the classroom versus asynchronous self-assessment can impact learning outcomes as well as impacting student's decision to attend classes. In particular, the research questions were:

RQ1: Did CA affect students' motivation and in-presence participation?
RQ2: Did participating in CA influence students' ability to self-assess their preparation?
RQ3: Was participating in CA with Kahoot! beneficial for learning outcomes?

2 Methods and preliminary observations

Data was collected through two anonymous questionnaires, one targeted to students that self-reported participating in the CA activity (PS) and one for those who did not participate (NPS). The items were adapted from the study by Brazeal et al. [8], based on the 5 criteria of formative assessment identified by Black & William [9]. The questionnaire included both Likert items, using a 1 to 5 scale, and open-ended questions. The questionnaire was administered in CAWI format at the beginning of the next semester. The instrument was created to investigate students' perceptions with respect to the use of cognitive activation for the following dimensions: motivation, metacognition, study method, sense of self-efficacy, and sociality. There were 73 respondents among NPS and 100 among PS. From a preliminary analysis of the two questionnaires, PS and NPS did not differ in terms of sex, residence (most of them are commuters in both groups), and previous academic achievement; however, there were more adults among NPS (18/73 were >30 years old, compared to 12/100. $X^2(3\ df, N = 173) = 14.9$, $p=0.002$. Among NPS, 22/73 did not frequent classes at all, whereas the other frequented at least in part to in-presence activities. Among PS, 75/100 would have frequented classes anyways, while for 19 students CA played a role in their participation. When asked why they did not participate in the CA activity, NPS cite lack of time (2.88 out of 5 on average) rather than not being interested (1.08/5) or the activity being too complex (1.04/5) and they considered the asynchronous activities very useful for their preparation (4.48/5). In terms of expected learning achievements, PS and NPS had similar expectations concerning the final grade ($Mdn=(3(P), 3(NP)$; $U=3323$, $p=0.299$) but there was a significant difference in the rapport between expected and actual results ($Mdn=(3(P), 1(NP)$; $U = 2205$, $p<0.001$) with NPS achieving, on average, worse results than expected and PS results in line with their expectations. These preliminary observations suggest that this gamified, easy-to-implement form of CA might be beneficial to a) encourage students to participate to in-presence classes b) help students to assess their preparation more realistically c) contribute, at least in part, to achieving better learning results.

References

[1] Eradze, M., De Martino, D., Tinterri, A., Albó, L., Bardone, E., Sunar, A.S., Dipace, A. After the Pandemic: Teacher Professional Development for the Digital Educational Innovation. *Educ. Sci.* 13, 432. https://doi.org/10.3390/educsci13050432

[2] Palacios Ortiz, F. G., Rodríguez López, W. A., Campoverde Méndez, M. R., Henríquez Antepara, E. J., & Abad Peña, G. (2022). Readaptación pospandémica y empleo de las TICS: percepciones de estudiantes de la Universidad de Guayaquil. *Revista Universidad y Sociedad*, 14(2), 8-19.

[3] Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. Granada Learning.

[4] Morris, R., Perry, T., & Wardle, L. (2021). Formative assessment and feedback for learning in higher education: A systematic review. *Review of Education*, 9(3), e3292.

[5] Groß-Mlynek, L., Graf, T., Harring, M., Gabriel-Busse, K., & Feldhoff, T. (2022). Cognitive Activation in a Close-Up View: Triggers of High Cognitive Activity in Students During Group Work Phases. *Frontiers in Education*, 7. https://www.frontiersin.org/articles/10.3389/feduc.2022.873340

[6] Trinchero, R. (2018). VALUTAZIONE FORMANTE PER L'ATTIVAZIONE COGNITIVA. SPUNTI PER UN USO EFFICACE DELLE TECNOLOGIE PER APPRENDERE IN CLASSE. *Italian Journal of Educational Technology*, 26(3). https://doi.org/10.17471/2499-4324/1013

[7] Bienvenido Huertas, J. D., Rubio Bellido, C., & León Muñoz, M. Á. (2023). Analysis of the effectiveness of using Kahoot! in university degrees in building engineering. *Journal of Technology and Science Education*, 13 (1), 288-300.

[8] Brazeal, K. R., Brown, T. L., & Couch, B. A. (2016). Characterizing student perceptions of and buy-in toward common formative assessment techniques. *CBE—Life Sciences Education*, *15*(4), ar73.

[9] Black P, Wiliam D (2009). Developing the theory of formative assessment. *Educ Assess Eval Acc* 21, 5–31

Tutoring in online university education: A Case Study from Italy

Andrea Nardi[1[0000-0001-7832-4580]] Giorgio Cecchi[2[0000-0001-6020-0547]] Massimiliano Naldini[1[0000-0002-7892-8111]]

[1] Istituto Nazionale di Documentazione Innovazione e Ricerca Educativa – INDIRE, Via M. Buonarroti 10 – 50122 Florence, Italy
[2] Università Telematica degli Studi – IUL, Via M. Buonarroti 10 – 50122 Florence, Italy
a.nardi@indire.it

Abstract

In recent years, there has been a need to strengthen and rethink the role of tutors in e-learning and online education [1], where this figure has assumed an increasing importance, particularly following the changes brought about by the COVID-19 pandemic in distance education. The tutoring function plays an essential role in online education because the online training requires that students be adequately supported by specialized professionals who can provide continuous support, guide them in their study paths, assist them in technological, methodological, and instructional aspects [2].

Several theoretical studies [3] have outlined the roles, functions, styles, and competencies of this important professional figure. The e-tutor must possess cognitive, technological, and social-emotional skills. Depending on the predominant training goals, the adopted e-learning models, and the different tutoring styles implemented, he can assume several functions as *moderator*, *facilitator,* and *instructor* [4]. Effective e-tutoring contributes to better students' performance and educational success, playing a central role in creating an effective and motivating learning environment [5]. In many online learning situations, he is the primary reference for students and effectively reduces their distance from teachers, while also serving as a fundamental support figure for the team of teachers and being at the center of educational innovation processes [6].

The educational offer of the Italian University Line (IUL) is situated within this context, and it's based on a teaching model that allows learners to approach their studies in a flexible way, either by following a linear path or by individualizing and fully personalizing their learning paths through autonomous selection. The courses on the e-learning platform are designed as a set of individual modules inserted into a networked and mapped structure. The online learning environment is based on the theoretical framework of the Community of Inquiry (COI), which reflects a collaborative-constructivist approach to learning [7]. Online support is provided by two different professional figures: *path tutors* and *discipline tutors*. The former has the task of supporting students' motivation throughout the educational course, guiding and orienting them in their academic career, and appropriately tailoring the educational path

to each student's characteristics, while the latter are qualified disciplinary experts who assist the teacher, contributing to the continuous improvement of course quality.

Here we present the preliminary results of an ongoing research project[1] conducted with the purpose to investigate the role and professional development of e-tutors to identify good practices in student support, potential difficulties and critical elements, possible areas for optimization, and future developments. Specifically, the research project aims to investigate the composition of the IUL e-tutor community, identifying the actual practices carried out by e-tutors in terms of roles and relationships with their students; in terms of teaching/support practices (e.g. instructional content management, moderation activities, classroom climate construction, workgroup management, student scaffolding, formative feedback and evaluation); in terms of platform tools usage; and in terms of orientation and guidance strategies.

This research uses a mixed method design to obtain better inferences by combining different data sources, to increase the validity of the findings and to achieve a higher level of understanding of phenomena. In this regard, the quantitative investigation - surveys, questionnaires - had the main purpose mapping the community while the qualitative investigation - focus groups, interviews - served the purpose of listening deeply to the perceptions, needs, preferences and habits of the community.

In this paper we present the results obtained from the questionnaire that was administered to a group of e-tutors (n. 57). The pre-test phase involved 7 tutors and served both for technical debugging and to validate the texts of the questions. The questionnaire investigates several elements and dimensions: interests, educational and cultural background of the e-tutor; previous professional experiences, perceptions, and expectations about one's role; disciplinary, methodological and socio-relational competencies; tutorship styles, practices and strategies. For the analysis, five sections of the questionnaire were considered to study tutoring methodologies and strategies. The five sections considered are: i) "teaching strategies", ii) "teaching practices", iii) "tools", iv) "feedback", v) and "evaluation". Each section is analyzed through various questions aimed at asking about the frequency with which tutors implement different strategies or use different tools. The responses are all expressed on a four-point Likert scale with the following labels: "Frequently", "Sometimes", "Rarely", "Never". Through an internal Spearman correlation analysis within the five sections, it emerged a strong positive correlation between the variables within each section. This allows us to state both that, on average, tutors who extensively use a methodology or tool described by one section also tend to extensively use all the other tools and methodologies described within the same section and that the considered sections are unidimensional, enabling us to aggregate the results of the variables within each section into a single indicator [8], one for each section, which synthesizes the information from the individual variables.

Once the five synthetic indicators for the considered sections were obtained, multiple regression models were implemented to study the effect of demographic variables such as age and gender, as well as variables related to the academic background of tutors (e.g., years of experience, master's degree, doctoral degree), on the scores obtained in these synthetic indicators [9]. The results are analyzed and discussed.

[1] The research group is coordinated by Paola Nencioni and composed of Greco Serena, Mori Sara, Morini Elettra, Rossi Francesca, Nardi Andrea, Naldini Massimiliano and Cecchi Giorgio.

References

1. Youde, A.: I don’t need peer support: effective tutoring in blended learning environments for part-time, adult learners. Higher Education Research & Development, 39(5), 1040–1054 (2020).
2. Ferrari, S., Mauro, I., Messina, S., Raviolo, P., Rivoltella, P. C.: E-tutoring nella didattica telematica. Pratiche di modellamento. Excellence and Innovation in Learning and Teaching - Open Access, (2021).
3. Rivoltella, P. C.: E-tutor. Profilo, metodi, strumenti. Carocci, Roma (2006).
4. Salmon, G.: E-moderating: The key to teaching and learning online. Routledge, New York (2011).
5. Raviolo, P.: Interazioni e-tutor-studenti e successo formativo: un’analisi dei dati nel contesto dell’educazione superiore online. Excellence and Innovation in Learning and Teaching - Open Access, 5(2), 56–67 (2020).
6. Vegliante, R., Sannicandro, K.: The role of the tutor in the university context and in distance learning: an exploratory research. Journal of E-Learning and Knowledge Society, 16(3), 76–85 (2020).
7. Benedetti, F.: Designing an effective and scientifically grounded e-learning environment for Initial Teacher Education: the Italian University Line Model. Journal of E-Learning and Knowledge Society, 14(2), 97–109 (2018).
8. Maggino, F.: Rilevazione e analisi statistica del dato soggettivo, Firenze University Press, Archivio E-Prints, Firenze (2007).
9. Cecchi, G., Mori, S.: Learning Analytics to Predict Students’ Social-Relational Skills in an Online University Course. In: Fulantelli, G., Burgos, D., Casalino, G., Cimitile, M., Lo Bosco, G., Taibi, D. (eds) Higher Education Learning Methodologies and Technologies Online. HELMeTO 2022. Communications in Computer and Information Science, vol 1779, pp. 84-95. Springer, Cham (2023).

A Faculty Development pathway at UNIDAV

Luca Luciani [1]

[1] University of L'Aquila

1 The design premises of the training course

As of October 2022, the Governance of the Telematic University 'Leonardo di Vinci' (UNIDAV) has identified a Faculty Deve-lopment pathway as the initial stimulus for the activation of the development of the training competences of the lecturers and e-tutors involved in the three Study Courses currently provided. The implementation of the training course also included the elaboration of a series of analysis and proposal documents aimed at the development of a didactic innovation project to be realised in the Didactic Guidelines, which the university was to adopt in a structured form for the first time. At the same time, therefore, the delivery of training was also interrelated with constant qualitative field research on the status of the overall teaching dimension of the Study Courses delivered. The design and delivery phase of the Faculty Development course, as well as the verification of the pre-existing didactic operating conditions, were carried out in constant dialogue with the Coordinator of the Course of Studies in Education and Training Sciences, Prof. Ilaria Filograsso, and with the various departments of the University Governance.

2 The didactic design of the Faculty Development pathway

The initial survey of the teaching conditions within the study courses had highlighted: 1) a recent switch to an up-to-date and efficient multimedia platform for online teaching-learning (Moodle); 2) a recent switch, partly still in progress, to the production of video lectures primarily carried out in the studio with a more unambiguous directorial approach; 3) a still uneven structuring of the online spaces of the various courses of study; 4) a structural difference between the various courses of study in the duration of the video lectures in relation to the CFUs 5) the absence of structured interactive teaching through forums and related threads; 6) the almost total use of university lecturers whose most significant experiential background is that of face-to-face teaching; 7) all the e-tutors not yet placed in their own specific online environments and not yet introduced to the collaborative and cooperative training perspective of e-learning; 8) the lack of the outlining and adoption of the University's Teaching Guidelines.
In connection with these premises and the requirements presented by the governance, it was clear from the outset that the Faculty Development didactic project would have to comprehensively address all aspects and interconnected pedagogical-didactic issues of the e-learning training modalities. A path was thus imagined that, starting with a general motivational approach to e-learning and at the same time a theoretical

discernment in relation to the media technologies of educational communication [1] [2] [3], would lead the participants through the various pedagogic-didactic dimensions concerning computer mediated communication (CMC) [4] [5] [6] [7]. The concluding moment consisted of a workshop meeting in which the knowledge and skills developed were actively experimented.

The training course, consisting of six meetings, was temporally distributed between December 2022 and June 2023. The first and last meetings were offered both in-person and online, while the others were held only remotely. The slides that accompanied each meeting were distributed by email to teachers and e-tutors as a supplementary teaching action. The stages of the course are detailed below:

1. **Efficiency and didactic effectiveness for e-Learning at Unidav**: introductory meeting on Faculty Development and the social, economic, scientific and cultural dynamics in which higher education at distance offered by Telematic Universities is currently contextualised; [8]
2. **Innovative didactic functions of ICT and psycho-pedagogical paradigms of learning**: a meeting focusing on the pedagogical relationship between media technologies and training with an in-depth study of the psycho-pedagogical paradigms of learning, declined in both interactive multimedia and cooperative and collaborative online perspectives; [9] [10] [11]
3. **The e-Tutor and his/her mediating action (orientation, facilitation, connection and didactic stimulation)**: meeting focusing on the figure and fundamental pedagogical-didactical role of the e-Tutor; [12] [13] [14] [15]
4. **e-Tivities - interactive online didactic activities oriented towards the construction of communities of practice**: meeting focusing on the educational importance and pedagogical-didactical meaning of interactive online didactic activities, their structural typology, and their edu-communicative functioning; [16] [17]
5. **The didactic delivery activities - multimedia typologies of texts for e-Learning:** meeting focusing on the outlining/definition of the typologies and pedagogical-didactical functions of the media texts produced and used in the e-Learning training proposals; [18] [19]
6. **Development of teaching skills: workshop meeting for the design of e-Learning training courses**: a meeting focused on the workshop training dimension with the aim of co-constructing in a group the didactic project of a freely chosen course to be delivered in e-Learning mode.

3 Some concluding remarks

The initial meeting of the course was attended by about fifty people. The training course then continued with an average of about twenty-five people per meeting. The introductory part of the last workshop meeting maintained the indicated average, although group work was then carried out by ten people divided into two groups. From an initial qualitative analysis of the work, both groups showed that they had taken into account all the didactic dimensions involved in e-learning courses, as well as being able to dose them

with pedagogical awareness. The Faculty Development course also contributed to the realisation of the first fully structured teaching guidelines of this university.

References

1. Galliani L.: Il processo è il messaggio. Cappelli editore, Bologna (1979).
2. Galliani L.: Tecnologie didattiche, scuola e società. In: Galliani L., Costa R., Amplatz C., Varisco B. M. (eds.), Le tecnologie didattiche, pp. 11-34. PensaMultimedia, Lecce (2000).
3. Luciani L.: I media oltre i media: l'educazione mediale nella plenitudine digitale. In: Di Pace A., Fornasari A. & De Angelis M. (eds.), Il post digitale: società, culture, didattica, pp. 161-170. Franco Angeli, Milano (2022).
4. Ardizzone P., Rivoltella P.C.: Didattiche per l'e-learning: metodi e strumenti per l'innovazione dell'insegnamento universitario. Carocci editore, Roma (2003).
5. Galliani L.: La scuola in rete. Editori Laterza, Roma-Bari (2004).
6. Trentin G.: Insegnare e apprendere in rete. Zanichelli, Bologna (1998).
7. Trentin G.: Apprendimento in rete e condivisione delle conoscenze: ruolo, dinamiche e tecnologie delle comunità professionali online. FrancoAngeli, Milano (2004).
8. Minerva, T.: Analisi delle serie storiche del flusso di studenti nelle università Italiane dal 2000 al 2022. Giornale Italiano della Ricerca Educativa XV/29, 09-22 (2022).
9. Galliani L.: Open distance learning: innovazioni pedagogiche e didattiche. In: Matteuzzi M., Banzato M. & Galliani L., Reti telematiche e open learning. Pensa MultiMedia, Lecce (1999).
10. Galliani L.: E-learning nelle università: politiche europee e strategie educative. In Galliani L. (ed.), Educazione versus formazione: processi di riforma dei sistemi educativi e innovazione universitaria, pp. 325-350. Edizioni scientifiche italiane, Napoli-Roma (2003).
11. Galliani L.: Linee di ricerca educativa sulle TIC. In: Galliani L. & Costa R. (eds.), E-learning nella didattica universitaria: modelli, ricerche ed esperienze della Facoltà di Scienze della Formazione dell'Università di Padova, pp. 21-34. Edizioni scientifiche italiane, Napoli-Roma (2005).
12. Manfredi P.: Tutor online: competenze di un insegnante esperto. In: Galliani L., La scuola in rete, pp. 196-204. Editori Laterza, Roma-Bari (2004).
13. Piazza S., Dal Corso A., Santonocito S.: Una nuova figura professionale: il tutor di rete. In: Galliani L. & Costa R. (eds.), E-learning nella didattica universitaria: modelli, ricerche ed esperienze della Facoltà di Scienze della Formazione dell'Università di Padova, pp. 65-76. Edizioni scientifiche italiane, Napoli-Roma (2005).
14. Nadin A.: Istruttore, facilitatore, moderatore: il Master in "Tutoring per la Formazione a Distanza". In: Galliani L. & Costa R. (eds.), E-learning nella didattica universitaria: modelli, ricerche ed esperienze della Facoltà di Scienze della Formazione dell'Università di Padova, pp. 287-299. Edizioni scientifiche italiane, Napoli-Roma (2005).
15. Ferrari S., Piccardi L.: Studiare la CMC: I forum di discussione. In: Cattaneo A. & Rivoltella P. C. (eds.), Tecnologie, formazione, professioni: idee e tecniche per l'innovazione, pp. 185-204. Edizioni Unicopli, Milano (2010).
16. Salmon G.: E-tivities:the key to active online learning. Kogan Page Limited, London (2002).
17. Marani M.: Gli ambienti di apprendimento WebQuest. In: Galliani L., La scuola in rete, pp. 136-153. Editori Laterza, Roma-Bari (2004).
18. Marani M.: Un approcio alla progettazione di learning object. In: Galliani L., La scuola in rete, pp. 126-135. Editori Laterza, Roma-Bari (2004).
19. La Noce F.: E-learning: la nuova frontiera della formazione, FrancoAngeli, Milano 2012.

SPECIAL TRACK 9

“INNOVATIVE INCLUSIVE UNIVERSITY”

ORGANIZERS:

GIUSI ANTONIA TOTO, UNIVERSITY OF FOGGIA, ITALY

PROF. CATIA GIACONI, UNIVERSITY OF MACERATA, ITALY

Using Technology for Inclusive Education: A Systematic Review

Giusi Antonia Toto[1[0000-0001-5538-5858]], Chiara Valeria Marinelli[1[0000-0002-8806-5655]], Valeria Cavioni[1[0000-0002-6327-3060]], Marco di Furia[1[0000-0003-4772-4383]], Luigi Traetta[1[0000-0001-7785-9751]], Salvatore Iuso[1[0000-0002-9372-1899]] and Annamaria Petito[1[0000-0001-7788-3591]]

[1]University of Foggia, Foggia FG 71122, Italy
giusi.toto@unifg.it

1 Background and research question

Higher Education (HE) for a great number of individuals represents the step immediately preceding their entry into the labor market. It is a crucial educational passage, marked by the acquisition of knowledge and skills that will permanently define the professionality of many, as well as their cultural horizon. Taking the Italian case as an example, moreover, the statistics speak clearly: among those with only an elementary school license, high school diploma holders and college graduates (aged 15-89), it is the latter who have the highest rate of employability (ISTAT, 2023). Making HE environments and content as accessible and inclusive as possible, therefore, offers the possibility for more individuals to access the world of work and achieve personal fulfillment.

Table 1. Rates of employability in Italy (data extracted on 19th Sept. 2023).

Qualification	2022	2023 (1st trimester)	2023 (2nd trimester)
none, elementary and middle school license	28.3	32.5	33.4
high school diploma	57.5	60.5	61.3
graduate, post-graduate	72.5	77.2	77.2

Certainly, among the main trajectories on which research in HE is moving is the ongoing effort in identifying strategies to ensure the quality of teaching, which can be defined by taking into consideration several parameters (Welzant et al., 2011), including purposefulness, performativity, transformativeness and reliability, in addition to the important aspect of support services for students, who at present cannot neglect the integration of technology into the structure of HE pathways. Inclusive teaching practices have gained significant attention in education, with the increasing use of technology (Cranmer & Lewin, 2022; Passey, 2013), by providing opportunities to cater to the diverse needs of learners. This systematic review aims to investigate the role and impact of new technological tools in supporting inclusive

teaching practices. It explores the reflections, best practices, and experiences related to innovative teaching methodologies.

2 Methods and results

A systematic search was conducted in Scopus, Emerald Insight, ERIC, and Google Scholar for articles published from 2013 to July 2023, following PRISMA guidelines (Page et al., 2020). A total of 32 studies were included in the systematic review. The review highlights several technological instruments employed to support inclusive teaching practices, such as Assistive Technology (Atanga et al., 2019; Kisanga & Kisanga, 2020; McNicholl et al., 2020), Augmented or Virtual Reality (Bacca et al., 2018; Bridges et al., 2020), Artificial Intelligence and Machine Learning (DeRocchis et al., 2018; Guo et al., 2019), Universal Design for Learning Softwares and Learning Management Systems (Flood & Banks, 2021; Garrad & Nolan, 2022) and Gamification and Educational Games (Jin et al., 2018). It reveals the positive impact of assistive technology on students with disabilities, the effectiveness of augmented reality and virtual reality in creating immersive learning experiences, the potential of artificial intelligence and machine learning in personalizing learning, the benefits of Universal Design for Learning (UDL) in promoting inclusive content delivery, and the success of gamification in enhancing student engagement.

3 Conclusion

The findings underscore the potential of new technological tools to foster inclusive teaching practices. By personalizing learning experiences, ensuring inclusive content delivery, providing faculty training, and strategically incorporating technological instruments, educators can create equitable and engaging learning environments (Toto & Limone, 2020; Toto & Limone, 2023). These insights pave the way for advancing inclusive teaching and promoting positive student outcomes in diverse educational settings.

References

1. Atanga, C., Jones, B. A., Krueger, L. E., Lu, S.: Teachers of Students With Learning Disabilities: Assistive Technology Knowledge, Perceptions, Interests, and Barriers. Journal of Special Education Technology, 35(4), 236-248 (2019).
2. Bacca, J., Baldiris, S., Fabregat, R.: Insights into the factors influencing student motivation in augmented reality learning experiences in vocational education and training. Frontiers in psychology, 1486 (2018).
3. Bridges, S. A., Robinson, O. P., Stewart, E. W., Kwon, D., Mutua, K.: Augmented reality: Teaching daily living skills to adults with intellectual disabilities. Journal of Special Education Technology, 35(1), 3-14 (2020).
4. Cranmer, S., Lewin, C.: Developing Inclusive Digital Pedagogies: Reflections on the Past, the Present and Future Directions. In: OCCE 2021: Digital Transformation of Education and Learning - Past, Present and Future, 17 August 2021 - 20 August 2021, Tampere, Finland (2022).

5. DeRocchis, A. M., Michalenko, A., Boucheron, L. E., Stochaj, S. J.: Extending academic analytics to engineering education. In: 2018 IEEE Frontiers in Education Conference (FIE), pp. 1-5, San Jose, CA, USA (2018).
6. Flood, M., Banks, J.: Universal Design for Learning: Is it gaining momentum in Irish education?. Education Sciences, 11(7), 341 (2021).
7. Garrad, T. A., Nolan, H.: Rethinking higher education unit design: Embedding universal design for learning in online studies. Student Success, 14(1), 1-8 (2023).
8. Guo, W., Yang, H., Gan, Z.: Improving Mandarin Chinese Learning in Tibetan Second-Language Learning by Artificial Intelligent Speech Technology. In: 2019 International Joint Conference on Information, Media and Engineering (IJCIME), pp. 368-372, Osaka, Japan (2019).
9. ISTAT, http://dati.istat.it/Index.aspx?QueryId=23242, last accessed 2023/09/19.
10. Jin, G., Tu, M., Kim, T.-H., Heffron, J., White, J.: Evaluation of Game-Based Learning in Cybersecurity Education for High School Students. Journal of Education and Learning (EduLearn), 12(1), 150 (2018).
11. Kisanga, S. E., Kisanga, D. H.: The role of assistive technology devices in fostering the participation and learning of students with visual impairment in higher education institutions in Tanzania. Disability and Rehabilitation: Assistive Technology, 1–10 (2020).
12. McNicholl, A., Desmond, D., Gallagher, P.: Assistive technologies, educational engagement and psychosocial outcomes among students with disabilities in higher education. Disability and Rehabilitation: Assistive Technology, 1–9 (2020).
13. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D.: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International journal of surgery, 88, 105906 (2021).
14. Passey, D.: Inclusive technology enhanced learning: overcoming cognitive, physical, emotional and geographic challenges. New York: Routledge (2013).
15. Schindler, L., Puls-Elvidge, S., Welzant, H., & Crawford, L.: Definitions of quality in higher education: A synthesis of the literature. Higher Learning Research Communications 5(3), 3–13 (2011).
16. Toto, G. A., Limone, P.: Hybrid digital learning environments for college student education. In: Proceedings of the Second Symposium on Psychology-Based Technologies Psychology-Based Technologies 2020, pp. 1-8, Naples, Italy (2020).
17. Toto, G. A., Limone, P.: ICT Handbook for Inclusive education. McGraw-Hill: Milano (2023).

Transforming Education in the Digital Age: Examining the Effects of the Loghat and Moodle E-Learning Platforms on Students' Learning Experiences at the Faculty of Sciences Ben M'sick, Casablanca, Morocco

Imane ELIMADI, Nadia CHAFIQ, Mohammed TALBI

Professor -researcher

Laboratory of Information and Educational Sciences and Technologies imaneel678@gmail.com

Faculty of Sciences Ben M'Sik, Hassan II University of

Casablanca, B.P 7955 Sidi Othmane, Casablanca, Morocco

imaneel678@gmail.com

Abstract

The emergence of E-learning platforms and portals is revolutionizing traditional educational paradigms in the quickly changing digital age. This article explores in depth how these online platforms, with a focus on the Loghat and Moodle platforms, have the power to transform the educational landscape.

This study was conducted at the Faculty of Sciences Ben M'sick, and it focused on the implementation and impact of two e-learning platforms, Loghat and Moodle, on student learning experiences. A mixed-methods approach was used in the study, combining qualitative and quantitative analyses.

A sample of 77 undergraduate students from a variety of faculty departments participated in the study's quantitative phase. In order to ensure representation across various academic levels and programs, stratified random sampling was used. To gather information on students' perceptions and experiences with the Loghat and Moodle platforms, a structured questionnaire created specifically for each platform was created and distributed.

The questionnaire measured the usability, support for learning effectiveness, levels of engagement, and general satisfaction of Loghat and Moodle. Additionally, it gathered data on the academic standing of the students, their comprehension of the course material, and how they perceived the effects of Moodle and Loghat on their learning outcomes.

The results showed that students believed Loghat and Moodle to be straightforward and helpful to their educational pursuits. Through the use of these platforms, students reported greater engagement, better comprehension of the course material, and improved academic performance. Students particularly appreciated Loghat's interactive elements and Moodle's extensive toolkit.

The article also examines how Moodle and Loghat affect institutions, students, and teachers. Teachers can use Moodle and Loghat to build interactive, engaging learning environments that promote student-centered learning. The interactive and individualized learning opportunities provided by these platforms are advantageous to students. Loghat and Moodle can be used by universities to improve their overall educational offerings and expand their language learning programs.

The Loghat and Moodle e-learning platforms' adoption and effects at the Faculty of Sciences Ben M'sick are both the subject of this study, which offers insightful information. This study contributes to a better understanding of the advantages and efficacy of Loghat and Moodle in higher education settings by incorporating the viewpoints of a diverse sample of students.

The Loghat and Moodle e-learning systems are two significant actors in this digital educational scene. These platforms exemplify the digital age's impact on education, each providing a distinct set of tools, resources, and interactive features aimed at improving students' learning experiences.

Loghat has gained popularity for its capacity to make language learning enjoyable and dynamic, thanks to its cutting-edge design and immersive content. Loghat aims to break down the hurdles that commonly precede language acquisition through a varied selection of multimedia assets, real-life simulations, and tailored learning paths. Loghat uses graphics, music, and interactive exercises to not only teach linguistic skills but also to create a deeper cultural awareness, improving the whole learning experience.

Moodle, a stalwart in the e-learning arena, on the other hand, provides a dynamic and extensive framework that caters to numerous educational scenarios. Moodle's open-source nature allows instructors to modify the learning experience to meet the specific needs of their students. Its collaborative features, discussion forums, and evaluation tools promote active engagement and critical thinking, creating a feeling of community among learners that transcends geographical boundaries. Moodle encourages a learner-centric approach in which students take ownership of their education and become active participants in creating their knowledge.

As we investigate the effects of these e-learning platforms on students' learning experiences, we discover a plethora of dimensions that contribute to their tremendous impact. For starters, the digital environment removes traditional schools' temporal and spatial limits, allowing students to learn at their own pace and convenience. Furthermore, the interactive nature of Loghat and Moodle encourages a more in-depth engagement with the topic. Gamified aspects such as quizzes, quick feedback, and peer interactions stimulate cognitive processes and keep learners engaged.

Furthermore, the data-driven insights supplied by these platforms provide educators with vital information on students' progress and areas of difficulty, allowing for targeted interventions that adapt to specific learning styles. This data-driven approach not only improves teaching effectiveness but also empowers students by providing them with a better grasp of their own learning paths.

To summarize, the digital age has brought about an educational renaissance, with platforms such as Loghat and Moodle playing critical roles in transforming students' learning experiences. The incorporation of multimedia, interactivity, customisation, and data-driven insights has created an environment that transcends traditional educational constraints.

Keywords: E-learning platforms, e-learning portals, Loghat platforms, Moodle platforms, student learning experiences.

Reference

1. Anderson, T., & Dron, J.:Three generations of distance education pedagogy. The International Review of Research in Open and Distributed Learning (2011).
2. Dabbagh, N., & Kitsantas, A.: Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. The Internet and Higher Education (2012)
3. Picciano, A. G.:Beyond student perceptions: Issues of interaction, presence, and performance in an online course. Journal of Asynchronous Learning Networks (2002).
4. Siemens, G., & Long, P.:Penetrating the fog: Analytics in learning and education. EDUCAUSE Review (2011).
5. Venkatesh, V., & Davis, F. D.:A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science(2000).

Inclusive Mathematics Teaching in Undergraduate Mathematics Teacher Education

Mitašíková Petra [1][0000-0002-6864-0595] Slavíčková, Mária [2][0000-0002-3357-2502]

Vodičková Barbora [3][0000-0002-2193-0405]

[1] Comenius University, Račianska 59, 813 34 Bratislava, Slovak republic
[2] Comenius University, Mlynská dolina F1, 842 48 Bratislava, Slovak republic
[3] Comenius University, Račianska 59, 813 34 Bratislava, Slovak republic
mitasikova@fedu.uniba.sk

1 Theoretical introduction

The philosophy of inclusion as an ideological concept is gradually permeating all areas of society. In education and in specific subjects - including mathematics. Roos (2019) operationalizes research on inclusion in mathematics education in two basic levels of meaning. The first is the discourse of inclusion presented in terms of social ideology and the second level is the discourse of inclusion in mathematics education in terms of practical solutions or intervention strategies. Tan and Kastberg (2017) state that all people are "mathematical thinkers and doers" including students with special educational needs. According to the social model understanding of disadvantage, the problem lies not with individuals, but rather with limited opportunities and rigid mathematics education practices (e.g., narrow forms of assessment, preference for frontal education, etc.).

The present paper is concerned with strengthening the competences of future teachers in inclusive mathematics teaching already in their undergraduate education. The starting point for our paper are studies that deal with inclusive mathematics teaching, e.g. Pais (2014); Gaffney and Faragher (2010); DeSimone and Parmar, (2006); Moreira and Manriquey (2016); Faragher, Hill and Clarce (2016) and our original qualitative research on this issue Vodičková, Mitašíková, Slavíčková, (2023), which involved mathematics teachers in Slovakia. Our research outlined several themes related to supportive factors in inclusive mathematics education from the perspective of mathematics teachers themselves and the urgent need to prepare mathematics teacher education students in this context. Research has shown that it is important to sensitise future mathematics teachers already in their pre-service training to the perception of pupil diversity, the ability to teach in a differentiated and individualised way, to reflect the unique learning needs of each pupil and to consider the specific situation in their ecosystem according to the theory of the bioecological model of child development (Bronfenbrenner and Cecci, 1994). We are continuously trying to implement the knowledge about inclusive

mathematics teaching in the undergraduate education of future mathematics teachers at the Faculty of Mathematics, Physics and Computer Science of Comenius University in Bratislava. The presented research maps the course and reflection of such conducted undergraduate training.

2 Research Methodology

In the course „Introduction to Didactics of Mathematics“ for Master's students, the lesson „Inclusive Teaching of Mathematics" has been implemented for several years. Most undergraduate students in addition to studying at university are also already teaching in mainstream primary or secondary schools. The aim of this research study is to investigate how mathematics teacher education students reflect on a specialized lesson with the theme: „Inclusive Teaching of Mathematics“ in the context of their forming teaching identity and practice. The study is designed as a qualitative descriptive study in which we used the following data collection methods: unstructured observation of the course of this specific lesson and written student reflections. For the qualitative content analysis, we used transcripts of the observations and students' written reflections.

2.1 Methodology of the Specialised Lesson in which the Research was carried out

Within the specific lessons implemented on the topic „Inclusive Mathematics Teaching", we started by mapping students' knowledge and attitudes towards inclusion. Students were then given the opportunity to experience in an experiential way what it is like to have to master a mathematical problem in a limited amount of time and under difficult conditions (e.g., a student was deliberately distracted while calculating an example, or their motor/sensory skills were partially limited - e.g., by covering their eyes). Students were then presented with information regarding a variety of student problems that may occur in a typical classroom. Students learned information about functional impairments, neurodevelopmental disorders, health impairments, as well as a variety of issues in the context of the student's overall life ecosystem (e.g., divorce situation, traumatized child, vulnerable parents, social disadvantage, migrants, etc.). Another important theme in this context was the theory of maturation and learning from a neuroscience perspective. Experiential learning also allowed students to experience a model stress situation in conjunction with an unempathetic teacher focused more on the content of the curriculum than on the experience of the student and his/her actual situation. The aim was to understand how a teacher's personality and communication can negatively interfere with a particular student's learning. We presented different typologies of teachers in relation to their personality characteristics and professional roles. The overall outcome of this lesson was the knowledge of the theoretical anchoring of inclusive mathematics teaching: the ideological and practical level of inclusion; the bio-psycho-social model of disadvantage; the ecosystem approach according to Bronfenbrenner; school support mechanisms, but also barriers to inclusion at different levels.

3 Results

Based on a qualitative research study, we found immediate positive impacts on students' knowledge and attitudes on this issue. We observed that students immediately began to associate their own teaching experiences with the knowledge and experiences gained in this special lesson. Students verbalized their perceptions of the issue through the prism of a new lens. Students began to spontaneously ask the instructor in the special lesson questions about children and students with special educational needs that were current in their teaching practice. They expressed the need to get more and deeper information on the topic so that they could immediately apply it in their practice with specific children. In the students' reflections, the following themes emerged: their ideas about inclusive mathematics teaching and the possibilities of their own self-development (not only in terms of didactics of mathematics but also in terms of their own personal development). In the longer term, we observed in about a third of the students reflecting on their work with pupils with special educational needs in the creation of lesson plans on a given topic, where they involved and processed the acquired knowledge just from our intervention.

This paper was supported by the European Union's Horizon 2020 research and inno-vation programme under grant agreement No. 951822 (MaTeK: Enhancement of re-search excellence in mathematics teacher knowledge, projectmatek.eu).

References

1. Bronfenbrenner, U., Ceci, S. J.: Nature-nurture reconceptualised: A bio-ecological model. Psychological Review 10(4), 568–586 (1994).
2. DeSimone, J., Parmar, R. S.: Middle School Mathematics Teachers' Beliefs About Inclusion of Students with Learning Disabilities. Disabil. Res. Pract. 21(2), 98–110 (2006).
3. Faragher, R., Hill, J., Clarke, B.: Inclusive Practices in Mathematics Education. In: Makar, K., Dole, S., Visnovska, J., Goos, M., Bennison, A., Fry, K. (eds.) Research in Mathematics Education in Australasia 2012–2015, pp. 119–141. Springer, Singapore (2016).
4. Gaffney, M., Faragher, R.: Sustaining improvement in numeracy: Developing pedagogical content knowledge and leadership capabilities in tandem. Math. Teach. Educ. Dev. 12(Special Issue), 72–83 (2010).
5. Moreira, G. E., Manrique, A. L.: Challenges in Inclusive Mathematics Education: Representations by Professionals Who Teach Mathematics to Students with Disabilities. Creat. Educ. 5(7), 470–483 (2014).
6. Pais, A.: Economy: The absent centre of mathematics education. ZDM Math. Educ. 46(7), 1085–1093 (2014).
7. Roos, H.: Inclusion in mathematics education: An ideology, a way of teaching, or both? Educ. Stud. Math. 100(10), 25–41 (2019).
8. Tan, P., Kastberg, S.: Calling for Research Collaborations and the Use of Disability Studies in Mathematics Education. J. Urban Math. Educ. 10(2), 25–38 (2017).
9. Vodičková, B., Mitašíková, P., Slavíčková, M.: Supportive Factors in Inclusive Mathematics Education: Mathematics Teachers' Perspective. Education Sciences. 13(5), 1-25 (2023).

Music of Nature: case study of an innovative teaching methodology

Francesca Finestrone[1[0000-0003-4105-7911]], Marco di Furia[1[0000-0003-4772-4383]], Francesco Pio Savino[1[0000-0001-9638-5002]] and Leonardo Palmisano[1[0009-0003-7439-1446]]

[1] Learning Science hub (LSh), University of Foggia, Italy
francesca.finestrone@unifg.it

The main aim of this contribution is to report the results of a research project carried out at a lower secondary school. The project was focused on Technology Enhanced Learning (TEL). In particular, authors had the aim to investigate whether, through the use of a wearable biofeedback tool capable of converting the electrical variance on plants into musical notes, it is possible to qualitatively improve the pupils' relationship with nature, increasing their connection to it and promoting the implementation of pro-environmental and inclusive behavior, as well as biophilic responses. The ex-ante/ex-post results were elaborated by comparing the answers given by participants, using validated questionnaires we administered to both the control group and the experimental group. Data were collected after a digitally and musically mediated intervention was applied with students. The intervention was designed not only for the students with Special Educational Needs (SEN), but for each student in the class who was able to participate in an active and personal way. Recent studies (Kollárová & Kačmárová, 2022) hypothesize that by mediating the experience of children with nature by artistic means, they will be more sensitive to the specific stimuli of natural environments, establishing a relationship with nature and feeling more attracted by it than before. Thus, music is configured as a channel of ecological literacy, in particular local musical practices and the sounds of nature (Shevock & Bates, 2019); furthermore, studies by Arbuthnott and Sutter (2019) about songwriting retreats held in a natural environment have shown an increase in connection with nature, as well as an improvement in emotional well-being and performance in a creative reasoning task. In a world in which disconnection with nature has become increasingly exacerbated, data (Adams & Beauchamp, 2019) suggest that the creation of music for children involves an interactivity with nature that provokes biophilic responses and this suggests that music, especially from the natural world, may constitute a connecting tool between human beings and the green world. Recent studies also show that making music outdoors, in rural landscapes, has positive effects on creativity, expressiveness and the desire to experiment.
In addition, several authors agree that the bond with nature is formed as children (Guiney and Oberhauser, 2009; Barbiero et al., 2021) and that this can be developed through continuous engagement with nature and experiences that occur during childhood.

References

1. Adams, D. & Beauchamp, G., Spiritual moments making music in nature. A study exploring the experiences of children making music outdoors, surrounded by nature. International Journal of Children's Spirituality 24.3 (2019): 260-275.

2. Arbuthnott, K. D., & Sutter, G. C. (2019). Songwriting for nature: increasing nature connection and well-being through musical creativity. Environmental Education Research, 25(9), 1300-1318.
3. Barbiero, G., Berto, R., Venturella, A., & Maculan, N. (2021). Bracing Biophilia: When biophilic design promotes pupil's attentional performance, perceived restorativeness and affiliation with Nature. Environment, Development and Sustainability, 1-15.
4. Guiney, M. S., & Oberhauser, K. S. (2009). Conservation volunteers' connection to nature. Ecopsychology, 1(4), 187-197.
5. Kollárová, D., & Kačmárová, S. (2022). Music And Drama Activities In Learning About The Forest And Its Impact On Communication With Younger Children Of Primary School Age. Ad Alta: Journal Of Interdisciplinary Research, 12(1).
6. Shevock, D. J., & Bates, V. C. (2019). A music educator's guide to saving the planet. Music Educators Journal, 105(4), 15-20.

Innovative and inclusive academia: faculty development and practices evaluation.

Tindara Addabbo[1] Maria Cristina Gamberini[2] Antonella Lotti[3] Daniela Mecugni[4] Isabella Negri[5] Barbara Pistoresi[6] Chiara Strozzi[7] Chiara Tasselli[8]

[1] University of Modena & Reggio Emilia, Emilia Romagna, Italy
[3] University of Foggia, Puglia, Italy

tindara.addabbo@unimore.it

1 Introduction

The focus of this paper is the analysis of innovative and inclusive teaching strategies, with reference to their impact on gender and intersectional inequalities and on the quality of the learning and participation processes of students with disabilities, special learning disorders and other special educational needs, and the subsequent training of university teachers in the most inclusive and effective approaches and strategies for all students. The paper reflects the results of an interdisciplinary research project in a medium-sized Northern Italy university.

The first part of the paper provides a systematic review of the literature aimed at defining an inclusive environment in tertiary education institutions and the consistent teaching approaches and strategies, to support the development of a shared culture of inclusion among university lecturers. The change of systems in an inclusive perspective is based on the development of culture by all actors (Booth, Ainscow, 2001), however, the majority of Italian universities do not offer training courses on inclusion and effective didactics for teachers, leaving them lacking the basic skills to foster real inclusion and accessibility to tertiary education.

Faculty Development initiatives, through the experimentation of innovative strategies and technologies that place students in an active and interactive position (Lotti and Lampugnani, 2020; Lotti et al. 2021), offer a valuable opportunity for the improvement of learning and participation processes.

By taking into account the students' diversity and needs in the analyzed university a semi-structured and qualitative survey on the teaching staff has been launched to map the current teaching strategies and the presence of innovative and inclusive practices. The semi-structured survey on more than 500 teaching staff allowed them to reconstruct their definition of inclusivity and the innovative and inclusive teaching strategies developed, while the qualitative survey provides a deepening of the experiences of their implementation. The interpretation of these surveys lead to the design of training modules for teaching staff on inclusive approaches that have been offered in the same university, reflecting also the increasing needs of the participants stimulated by the process of skills acquisition, to develop a community of practices and achieve higher inclusivity in the teaching and learning process.

The impact of the faculty development initiatives on the teaching staff has then been evaluated by using the Kirkpatrick's model as done by Zao et all (2023) and Rouse (2011). Parallel to the impact of faculty development, the mapping of innovative and inclusive strategies already carried out by teaching staff or stimulated by the training courses and the birth of a community of practices has been produced Attention has been paid also to the impact of new technological tools in the process. Interactive electronic platforms have been used to create polls and questionnaires in order to facilitate students' participation in classes, as well as learning platforms to improve online learning involving students with assignments, and monitoring their learning progress. Online forums have also be used to increase communication with and between students. Finally, the impact of two types of active teaching strategies on students is measured. According to Espey 2022, active learning methods engage students in deeper thinking, drawing connections and applying concepts during class hours to create greater interest, learning and retention of the material. Impact is measured not only through improvement in academic performance, but also in soft skills (European Commission 2011) and in student satisfaction with the activity (Parmelee 2009). A critical assessment of the whole project to impact the inclusive and innovative faculty development process concluded.

2 Methods & results

The methodologies of analysis are different, heterogeneous and complementary: qualitative analysis is carried out to detect the innovative and inclusive practices develop within the University analysed and descriptive analysis (t-test and anova correlations) is performed on the data collected through the Kirkpatrick model. More complex econometric analysis is structured with the pre-post setting conducted on the data collected from students.

The qualitative analysis revealed several innovative and nontraditional methodologies already used at the university analysed that would need more dissemination and systematization. The analysis of professors' satisfaction (Kirkpatrick) revealed a strong appreciation among professors, as well as a high perceived utility, for the training interventions provided. And, finally, pre-post analysis based on students who have taken innovative teaching courses microdata allows us to show the impact of the change that occurred.

3 Conclusion

Faculty training in inclusive approaches is crucial for ensuring high-quality and accessible university education. The paper highlights the significance of faculty development initiatives in enhancing student learning and participation. By implementing innovative strategies and interactive technologies, these initiatives create a more inclusive learning environment that actively engages students in their educational journey.

In conclusion, the research findings strongly emphasize the importance of inclusive teacher education in delivering accessible and high-quality college education. By

promoting an equitable and inclusive academic environment, these efforts significantly contribute to the overall success and well-being of students with diverse backgrounds and educational needs.

References

1. Technol Inform Am J Psychiatry (2018).
2. Booth, M., Ainscow T. Index for Inclusion; developing learning and participation in
3. school, CSIE; Bristol (2002).
4. Canevaro, A.,Malaguti, E., Inclusione ed educazione. Sfide contemporanee nel dibattito intorno alla pedagogia speciale, Italian Journal of Special Education for Inclusion,II, n. 2, pp. 97-108, (2014).
5. Cilliers, Francois J., and Nicoline Herman 'Impact of an Educational Development Programme on Teaching Practice of Academics at a Research-intensive University' International Journal for Academic Development 15 (3): 253–67 (2010)
6. Ilie, Marian D., Laurențiu P. Maricuțoiu, Daniel E. Iancu, Izabella G. Smarandache, Velibor Mladenovici, Dalia C.M. Stoia, and Silvia A. Toth. 'Reviewing the Research on Instructional Development Programs for Academics. Trying to Tell a Different Story: A Meta-Analysis'. Educational Research Review 30 (2020).
7. Espey M. Variation in individual engagement in team-based learning and final exam performance. International Review of Economics Education 41:100251. https://doi.org/10.1016/j.iree.2022.100251 (2022)
8. European Commission Transferability of Skills across Economic Sectors (2011).
9. Lotti A. and Lampugnani P.A. (eds) Faculty Development in in Italia. Valorizzazione
10. delle competenze didattiche dei docenti universitari. GUP Genova University Press. (2020).
11. Lotti, A., Crea G., Garbarino S., Picasso F. and Scellato E. Faculty Development e innovazione didattica universitaria, GUP Genova University Press (2021).
12. Parmelee DX, DeStephen D, Borges NJ Medical Students' Attitudes about Team-Based Learning in a Pre-Clinical Curriculum. Medical Education Online 14:4503. https://doi.org/10.3402/meo.v14i.4503 (2009).
13. Rouse D. Employing Kirkpatrick's Evaluation Framework to Determine the Effectiveness of Health Information Management Courses and Programs. Perspectives in Health Information Management 8 (2011).
14. Zhao W., Liu Z., Wang T., et al Assessment of a training project of English as a media of instruction (EMI) using Kirkpatrick model. BMC Med Educ 23:271. https://doi.org/10.1186/s12909-023-04204-5 (2023).

The "Innovative and Inclusive Academia" project: conceptual framework and lines of action

Paola Damiani1, Giacomo Guaraldi, Elisabetta Genovese and Antonella Lotti2

[1] University of Modena and Reggio Emilia-Italy
[2] University of Foggia-Italy
paola.damiani@unimore.it

1 What meaning of "Inclusive Academia"?

The proposed contribution aims to reflect on the main outcomes and consequent lines of action concerning the first phase of the research project "Innovative and Inclusive Academia," undertaken at the University of Modena and Reggio Emilia in the A.Y. 2021-2023. This phase, dedicated to the analysis of Italian and English language literature on the topic of inclusion in Higher Education, was aimed at the identification of a "mature and sustainable" inclusive model. This was made in relation to the complexity of the contexts and the phenomena in question and of coherent teaching approaches and strategies, with the goal of supporting the development of a shared culture of inclusion among university teachers. Indeed, despite the fact that the importance of equitable access to post-secondary education has been emphasized in numerous international documents since the mid-20th century, very often the actions taken have produced "cosmetic" outcomes that aren't aimed at a deeply rethinking of Higher Education systems, in connection both with earlier degrees of education and with labor and social inclusion within " flourishing" as well as productive communities (Santi, Di Masi 2017). The analysis of recent literature on inclusive cultures and practices in higher education confirms an idea of the concept of inclusion as a "universal value" and universally recognized, albeit with different declensions, in terms of intentionality, priorities and functioning, as in the case of didactics. In general, inclusive teaching is one of the indicators of a university's inclusiveness and innovativeness, even if a 'double track' remains (unresolved?).

In the Italian context, the document of the "National Conference of University Delegates for Disability" (CNUDD) expands the theme of teaching to the construct of the educational environment, which also regards aspects such as school furnishings and all materials and processes - including digital technologies and teacher training - highlighting the relationships between these aspects. In this way, the training of the teachers is an integrative part of the inclusive educational environment. Consistent with the biopsychosocial and ecological paradigm (Engel, 1980; Brofenbrenner, 1996), pedagogical research converges in identifying two interconnected directions of inclusive development-individual and collective-for the acquisition and enhancement of capabilities at the personal level (Sen, 1985; Nussbaum, 1995; 2011; Biggeri, Bellanca, 2010),

through the re-organization of living environments as "competent contexts" in terms of welcoming differences, quality of life, capacitation and participation (Canevaro, Malaguti, 2014). The model of the "inclusive university as a complex ecosystem between economy and ecology" (Santi, Di Masi, ib.) underlying our project has guided the construction of an operational framework, consistent with an integrated ecological-relational vision of the inclusive model, and the definition of a set of related indicators characterizing inclusive teaching - specialized for all (Bocci, 2021), in order to support processes that foster the collective construction of inclusive universities (Alkire, 2002; Walker, 2006; Boni and Walker, 2016).

2 Integrated development perspectives at Unimore

Within this framework, two schemes (concentric circle and inverted cone) were developed in order to define the original model of inclusion based on inclusive and special teaching which allows for integration and focalization of different elements, dimensions and levels into a single model, consistent of an idea of special and inclusive pedagogy and education (Bocci, ib.) and with the ecological-relational model. In light of this framework, the implementation of didactics as an indicator of inclusiveness represents the top of the scheme-cone. The choice was to start from the actions in place at University of Modena and Reggio Emilia (Unimore), based on the approaches of Evidence Based Education and Universal Design for learning (Rose, Meyer, 2002; Pace, Schwartz, 2008; Mangiatordi, 2014), in order to support the virtuous relationship between inclusive education and special education, in particular through the dissemination of digital technologies to foster the participation of all, constructing real learning communities (Calvani, 2005). In line with the dual-level perspective, research-training workshops targeted to all faculty members on Team Based Learning and UDL approaches have been planned and implemented with the future perspective of evaluation of the applications and outcomes of Universal Design at the inter-university level (Baumann, Melle, 2018; Mangiatordi, 2023). Digital technologies have also been introduced to facilitate reading and comprehension of written texts. More in detail, starting in January 2023, as part of Unimore's Service for Students with Disabilities and with DSA, a pilot of the "Accessible Books" project addressed to students with DSA and sensory and/or intellectual disabilities was launched, with the intention of providing textbooks and/or scientific articles in digitized and - where necessary - facilitated format, through the direct involvement of students.

3 Conclusion

The framework outlined allows to nurture a virtuous circularity between the actions in the field, while activating reflective and evaluative processes on the actual impact of the actions taken by teachers in terms of “inclusiveness”. As Mangiatordi (2017) notes, some studies have used the UDL framework as an assessment tool for instructional materials such as digital books (Parette, Blum, & Luthin, 2015).

References

1. Alkire, S.: Dimensions of Human Developmen, World Development, 30(2), 181–205. Elsevier Science Ltd (2020).
2. Baumann, T., Melle, I.: Evaluation of a digital UDL-based learning environment in inclusive chemistry education From the journal Chemistry Teacher International (2018).
3. Biggeri, M., Bellanca, N.: In (eds.). Dalla relazione di cura alla relazione di prossimità. L'approccio delle Capability alle persone con disabilità. Liguori, Napoli (2010).
4. Bocci, F.: Pedagogia speciale come pedagogia inclusiva. Guerini Editore, Milano (2021).
5. Boni, A., Walker, M.: Universities and Global Human Development: Theoretical and Empirical Insights for Social Change. Routledge, London and New York (2016).
6. Bronfenbrenner, U.: The Ecology of Human Development: Natural Experiments and Planned. Artes Médicas, Porto Alegre (1996).
7. Calvani, A.: Rete, comunità e conoscenza. Costruire e gestire dinamiche collaborative. Erickson, Trento (2005).
8. Canevaro A., Malaguti E.: Inclusione ed educazione: sfide contemporanee nel dibattito intorno alla pedagogia speciale. Italian Journal of Special Education for Inclusion, II (2), 97-108 (2014).
9. Engel, G.: The Clinical Application of the Biopsychosocial Model. American Journal of Psychiatry, 137, 535-544 (1980).
10. Mangiatordi, A.: Using universal design for learning guidelines to evaluate a computer assisted note taking software solution, In Methodologies and Intelligent Systems for Technology Enhanced Learning, 157-164. Springer, Berlin Heidelberg (2018).
11. Mangiatordi, A.: Didattica senza barriere Universal Design, tecnologie e risorse sostenibili. Edizioni ETS, Pisa (2017).
12. Mangiatordi, A., contributo presso il Convegno nazionale Società Italiana di Pedagogia Speciale (SIPeS) "Culture dell'accessibilità per un mondo inclusivo Traiettorie per gli ambienti di vita, la didattica, la tecnologia", 9 - 10 giugno 2023, Università di Bergamo.
13. Nussbaum, M.: Creating Capabilities: The Human Development Approach, Harvard University Press, Harvard (2011).
14. Nussbaum, M.: Human capabilities, female human beings. In M. Nussbaum and J. Glover Women, Culture and Development. Clarendon Press, Oxford (1995).
15. Pace, D., Schwart, D.: Accessibility in post secondary education: Application of UDL to college curriculum (2008).
16. Parette, H. P., Blum, C. H., & Luthin, K.: A quantitative features analysis of recommended no- and low-cost preschool e-books. Early Childhood Education Journal. 43(3), 181-190 (2015).
17. Rose, D. H. & Meyer, A.: Teaching every student in the digital age: Universal Design for Learning. Alexanderia, VA: Association for Supervision and Curriculum Development (2002).
18. Santi, M., Di Masi, D.: Indeep university. Un progetto di ricerca partecipata per una università inclusiva. University Press, Padova (2017).
19. Sen, A. K.: Commodities and Capabilities. North Holland, Amsterdam (1985a).

University and School: formal and non-formal education to support digital skills

Angela Maria Sugliano[1] Giovanni Adorni[2], Giorgio Delzanno[2], Giovanna Guerrini[2]

[1] Associazione EPICT Italia
[2] University of Genoa

am.sugliano@assoepict.it, adorni@unige.it,
giorgio.delzano@unige.it, giovanna.guerrini@unige.it

1 Context and method

In this period in which many cultural [1, 2] and economic [3] resources are concentrated for the development of digital culture in school, how can a university foster and support the adoption of digital practices in schools to improve the teaching potential of teachers, encourage dynamic and participatory learning of students [4], support the development of digital skills in teachers and students? Carrying out research activities, organizing training courses, making its expertise and authority available for the certification of digital skills, making its wealth of knowledge available to the school in an immediate way that can be used immediately by teachers. Above all it's necessary a single point of access so that school actors know where to go to take advantage of the opportunities made available.

To achieve these objectives, at University of Genoa a working group was set up in September 2021 [5] which defined the following work agenda for the first two years of activity: 1) build a website and a dedicated e-learning portal as a reference point for all the activities of the initiative; 2) create a mapping of researchers in university departments focused on the use of digital technology for teaching; 3) organize university higher education courses (master courses) for the professional development of teachers; 4) organize workshops held by university researchers complete with teaching activities to be carried out with students in class; 5) start a digital skills certification process; 6) connect with sector stakeholders. Above all, the goal was to reach a large number of teachers and develop a management model for all the activities described above to make them sustainable over time.

Target population are teachers of all levels and all stakeholders in the educational sector.

The resources are those of each member of the group itself, the dedicated sectors of the university (e.g.: the communication sector) and a dedicated human resource in the start-up phase of the activities for the creation of the web site and the definition of procedures for communicating with the target group.

The criteria for verifying the achievement of the objectives were the evidence of the achievement of what was foreseen, and above all the impact on the world of schools as measured by the number of teachers involved and their satisfaction.

2 Results and next steps

All the objectives have been achieved. The site has been set up and has a well-established structure suitable for supporting the next initiatives; site access statistics show 8.162 unique users and 190.600 visits to date. On the site there is a questionnaire - iteratively sent through dedicated university mailing lists - to survey research activities. Formal and non-formal training initiatives were carried out with positive results: it is running a 1st level university master's degree (2022/2023 academic year) and it is in activation the one for the academic year 2023/2024. As regards non-formal training, monthly workshops were organized which saw the participation of a total of 529 “unique” teachers, who run the activities proposed reaching quite 2100 students. The structure of the monthly workshops follow a standard format: 1) the specific topic is proposed by highlighting the underlying digital skills according to the DigCompEdu framework [6] and in relation to the syllabuses of the EPICT Certifications (European Pedagogical ICT Licence) [7], issued by the 'University of Genoa since 2005; 2) the materials presented during the workshops are available on a dedicated e-learning portal which counts 1927 users. Two of the non-formal initiatives had a particular result of impact in terms of assessment of students' digital skills [8, 9]. The initiation of the relationship with the stakeholders is evidenced by the participation 1) to the national initiative Digital Republic, 2) to the Italian translation of version 2.2. of the DigComp Framework, 3) to CINI (Consorzio Interuniversitario Nazionale per l’Informatica) working groups dedicated to Digital Competences and School. It was now running a sub-working group for the definition of digital skills certification processes with the provision of Open Badges: the first trial will start in October 2023 with the EPICT Certifications (European Pedagogical ICT Licence, until today provided at the end of training courses organized by the university) to certify the teachers' skills in the pedagogical use of digital technologies.

These first two years were dedicated to creating the structure and consolidating the methodologies of dialogue with the school; the next steps envisage a systematic survey of the digital skills of the teachers who will participate in the initiatives and the launch of digital certifications for the School.

References

1. Digital Education Action Plan (2021-2027) https://tinyurl.com/Europe-DEAP
2. Piano Nazionale Scuola Digitale (2015) - https://www.miur.gov.it/scuola-digitale
3. Scuola Futura https://pnrr.istruzione.it/ last accessed 14/7/2023
4. SITESm2, Research Design Document (2000) Qualitative Studies of Innovative Pedagogical Practices Using Technology, SITESm2 Researcher’s Handbook, November 7
5. UniGe Competenze Digitali, https://competenzedigitali.unige.it/ last accessed 14/7/2023
6. DigCompEdu - https://tinyurl.com/Europe-digcompedu last accessed 14/7/2023
7. European Pedagogical ICT Licence last accessed www.epict.it last accessed 14/7/2023
8. Adorni G., Delzanno, G., Guerrini., Sugliano, A.M., (2023) Not only coding: a model to support teachers in bringing computer science into the classroom (accepted paper ATEE Conference 2023)
9. Dalla Botanica ai Big Data, https://tinyurl.com/UniGe-BBD last accessed 14/7/2023

What model for distance learning for adult training? A case study at Mohammed V University –Rabat

Souhad Shlaka [0000-0002-3612-8853] and Khalid Berrada [0000-0001-7423-5927]

Faculty of Sciences, Mohammed V University in Rabat, Morocco
s.shlaka@um5r.ac.ma

1 Introduction

In Morocco, as everywhere else after the Covid-19, the digital has made an impressive entry on the educational field, reflecting on its positive impact in education. This "tipping point" was played in favor of the expansion of educational technologies for a real and rapid deployment of distance learning. In this work, we have tried to bring a reflection to identify the factors leading to the success of a distance training for an adult audience. In fact, and part of a Morocco-French cooperation aimed at strengthening distance education at the Moroccan university, a training of trainers on the subject of «Open Education Resources» OER entitled "Univ-Ouverte@Maroc" was conducted in November 2021. This five-week course aimed to strengthen digital skills in open education, OER, open science, copyright and open licensing. The training was conducted for the benefit of Moroccan professors, researchers and PhD students belonging to different Moroccan academic institutions.

Unlike what is usually observed in distance learning concerning the dropout rate, we noticed throughout the training, a strong commitment and perseverance by the participants and a very important rate of success obtained at the end of the training which was 73%) and in a very low drop-out rate of 20% (11 of the 51 participants selected on the final lists). Thus, those results open the debate to a reflection to understand the factors leading to the success of this training.

2 Methodology

In order to answer our question, we based our research on the tetrahedron presented by « Faeber 2003 » with an emphasis on the motivation of the learners self-determined motivation (Deci & Ryan, 2000), the roles provided by the trainers (Charlier & Peraya, 2002), the interactions within the group as well as the learning environment (platform). Based on a quantitative research methodology, we administered to the participants (n=51) a questionnaire based on two scales:1) self-determined motivation "the Adult Education Motivation Scale (EMFA)" developed by Fenouillet, Heutte and Vallerand (2015), which is based on the self-determination theory of Deci and Ryan (SDT). This is a scale for measuring motivation in adult education in the context of a distance training system, which is perfectly in line with our study. And 2) a scale about the roles of trainers which contains questions based on the four roles of tutors in a distance training made by (Charlier & Peraya, 2002).

3 Some of the obtained results

According to the obtained results from the EMFA scale, it emerges the distinction between two groups of participants: Group (1) those with intrinsic motivation (IM) which is the highest type of motivation where the choice of activity is the result of

personal reasons and pleasure without any external influence. The reasons for the behavior are related to interest in the action itself (Deci & Ryan, 2008). Follow-up by the group (2) with an identified extrinsic motivation (IEM) where the reasons for the behavior are linked to a good understanding of the defined objectives (Deci and Ryan, 2000). Indeed, the learner begins to become aware of the interest he has in this activity and that not only is it valued, but that he also finds it important to persevere and that this choice is made without external constraints. Regulation is internal: it is an autonomous motivation focused on objectives (Heutte, 2016).

Concerning the participants' perceptions about the roles of professors/tutors, precisely in coaching and tutoring in the context of "Univ-Ouverte@Maroc". The analysis show that the participants' responses are mostly between 5 and 7 (Likert scale). These results indicate that the participants believe that the professors/tutors fulfilled with success all four roles (pedagogical, socio-emotional, technical, and organizational).

4 Conclusion

Based on the results obtained from our questionnaire and the traces of participants on the platform, the main results of the research confirm that when we deal with adult training, the participants are aware of their needs and have a precise idea about what they are seeking for. In order to arouse their interest and increase their motivation, distance learning must be structured around a tutor who rethinks the usual pedagogical practices. Trainers/tutors should be engaged in a proactive, active, and adaptive approach. A unique knowledge that corresponds to the specific expectations of the participants combining their personal and professional needs. A group dynamic designed to link trainers and participants thus leading to nourish the feeling of belonging and break the feeling of loneliness and the desire for dropping out. Finally, the digital system must be designed and thought out to enable and facilitate transactions and navigation. Indeed, it is this multidimensional approach of all these elements that would define the distance learning model to be followed for an optimal learning experience.

References

1. A. Idrissi Jouicha, K. Berrada, R. Bendaouad, S. Machwate, A. Miraoui, D. Burgos, Starting MOOCs in African University: The Experience of Cadi Ayyad University, Process, Review, Recommendations, and Prospects. IEEE ACCESS, Volume 8 (2020), pp: 17477-17488. DOI:10.1109/ACCESS.2020.2966762
2. Carré (2004). Bandura : Une Psychologie Pour Le XXIème Siècle ? L'Harmattan. Récupéré de https://www.cairn.inforevue-savoirs-2004-5-page-9.htm
3. Carré, P. (2002). De la motivation à la formation. L'Harmattan. Carré, P. (2005). L'apprenance : Vers Un Nouveau Rapport Au Savoir. Paris : Dunod.
4. Chaptal, A. (2005). Eléments de comparaison des approches française et américaine d'utilisation du numérique dans l'enseignement supérieur. Paris, France. http://sif2005.mshparisnord.org/pdf/Chaptal.pdf
5. Charlier, B. & Peraya, D. (Ed.) (2003). Technologies et innovation en pédagogie. Dispositifs innovants pour l'enseignement supérieur. Bruxelles : De Boeck. Charlier, B., Deschryver, N. et Peraya, D. (2006). Apprendre en présence et à distance. Distances et savoirs, 4(4), 469–496.
6. Deci, E.L., & Ryan, R.M. (1985). Intrinsic Motivation and Self-Determination In Human Behaviour. New York: Plenum Press

7. Richard Faerber. Groupements, processus pédagogiques et quelques contraintes liés à un environnement virtuel d'apprentissage. Environnements Informatiques pour l'Apprentissage Humain 2003, Apr 2003, Strasbourg, France. pp.199-210. ⟨edutice-00000137⟩
8. Fenouillet F., Heutte J., Viau R.-J. (2015), Validation Of The Adult Education Motivation Scale, Fourth World Congress On Positive Psychology (Ippa), Orlando, Fl.
9. Idrissi, A., Margoum, S., Bendaoud, R., and Berrada, K, UC@MOOC's Effectiveness by Producing Open Educational Resource.Intern. Jour. of Interac. Multim. and Artificial Intelligence (2018). Vol.5, Nº2, pp: 58-62. http://dx.doi.org/10.9781/ijimai.2018.02.007
10. K. Berrada, R. Bendaoud, S. Machwate, A. Idrissi, A. Miraoui, UC@MOOC: Pedagogical innovation to challenges of massification at university Latine American Journal of Physics Education, Vol.11, No.1, 2017. http://www.lajpe.org
11. K. Berrada, R. Bendaoud, S. Machwate, B. Lebzar, A. Fekkari, UC@MOOC: Repository of learning objects, open courseware, platform inspired from MOOC. Opening Up Education in South Mediterranean Countries. Edited by Disruptive Media Learning Lab Coventry University, UK. Editors: Wimpenny, K., Merry, S.K., Tombs, G. & Villar–Onrubia, D. (Eds 2016). ISBN 978–1–84600–0, pp: 168-174/222.
12. Lebrun, M. (2007). Théories et méthodes pédagogiques pour enseigner et apprendre: Quelle place pour les TIC dans l'éducation ?. De Boeck Supérieur. https://doi.org/10.3917/dbu.lebru.2007.02

HOW TO ASSESS JOB SATISFACTION AND SELF-EFFICACY IN TEACHERS' PROFESSIONAL TRAINING WITH "BEST" QUESTIONNAIRE: A PERSPECTIVE ARTICLE

Andreana Lavanga[1[0009-0008-4019-6753], Roberta Baldini[1[0009-0008-9603-4577], and Piergiorgio Guarini[1[0000-0002-7281-798X]

[1] Learning Science hub, Department of Humanities, University of Foggia, via Arpi 176, Foggia, Italy

andreana.lavanga@unifg.it;
roberta.baldini@unifg.it;
piergiorgio.guarini@unifg.it;

1.1 Introduction

Teachers assume a significant role in students' lives, not only in educational terms but also in relational terms. Indeed, the literature shows that a good quality of teacher-student interaction turns out to be a protective factor for the social-emotional and cognitive development of the students themselves, resulting in positive effects on learning processes, regardless of the quality of the relationships students establish with their primary caregivers [1]. During the last century, studies focused on teaching effectiveness, dwelling on teacher characteristics, and teaching method, to observe changes in the student. Later, observation turned to the changes that the teacher brings to the whole class, as an indirect action on the pupil mediated through the class itself. Thereafter, the research focused on the analysis of the teacher's cognitive and trait variables and then focused on the teaching process as interactive [2; 3].

2 Teachers' professional identity

Teachers' professional identity is an important factor in understanding their professional life and career path. Multiple research studies in various countries have shown that teachers' professional identity is a key factor in teachers' motivation, commitment, effectiveness, satisfaction and learning results [4; 5]. The self-perception of his or her professional role can influence teacher's actions and behaviors in the career path. It can be argued that understanding teachers' professional identity, level of well-being and satisfaction is the basis of good teaching. For this reason, maintaining a high

motivational level, for the teacher, is an intervention aimed at improving student learning outcomes [6]. The higher the motivation of teachers over time, the better the commitment to the profession, on the part of the same and the positive feedback from students and the school environment. Conversely, low levels of motivation could result in negative repercussions on students' academic performance and low self-esteem for the teacher [7, 8, 9].

Thus, we can affirm the importance of the concepts described, and the need to research, and/or create ad hoc tools, to evaluate, self-assess and monitor the teaching profession and the variables, motivation, effectiveness and commitment, related to it in order to keep the teachers' career path and the students' learning process in balance [10].

Teachers' training, in a longlife learning perspective [11] is highly recommended, but there are no statutory provisions for Italian teachers [12]. Our research group has and is currently working on in-service teachers' training [13], with two aims: proposing a structured path to entice teachers to lifelong learning and certify the professional training of teachers so that they are recognized for the professional skills they have acquired.

3 How to assess Job Satisfaction and Self-Efficacy in Teachers' Professional Training: a perspective use in the University of Foggia

In this contribution, we want to propose some tools to measure teachers' satisfaction during trainings. In this way, lifelong learning proposals will not only aim to measure teachers' acquired skills, but also teachers' satisfaction with their professional role and self-perception of that role.

An example of a useful tool in this regard is the BEST- BEcome a Special education Teacher Questionnaire [14] which consists of 2 sections: the first is composed by 11 items designed to collect general data about the respondents; the second section is composed by 40 items that investigate special education teachers' self-assessment in relation to the degree of perceived self-efficacy.

The Learning Science hub has several classes in the framework of the Special Needs Specialization Teacher's Training (Tirocinio Formativo Attivo (TFA) per il sostegno) in the University of Foggia. Our team will administer the BEST questionnaire to special needs training teachers in order to collect, disseminate and discuss the results.

References

1. Ansari, A., Hofkens, T. L., & Pianta, R. C.: Teacher-student relationships across the first seven years of education and adolescent outcomes. *Journal of Applied Developmental Psychology,* 71, 101200 (2020).
2. Belacchi, C.: La relazione tra insegnante di sostegno ed allievo disabile. *Studi Urbinati, B-Scienze umane e sociali*, *74*, 105-118 (2004).
3. Hascher, T., & Waber, J. (2021). Teacher well-being: A systematic review of the research literature from the year 2000–2019. *Educational Research Review*, 34, 100411.
4. Admiraal, W., & Kittelsen Røberg, K.-I. (2023). Teachers' job demands, resources and their job satisfaction: Satisfaction with school, career choice and teaching profession of teachers in different career stages. *Teaching and Teacher Education*, 125, 104063.
5. Harrison, M. G., King, R. B., & Wang, H. (2023). Satisfied teachers are good teachers: The association between teacher job satisfaction and instructional quality. *British Educational Research Journal*, 49(3), 476–498.
6. Beauchamp, C., & Thomas, L. (2011). New teachers' identity shifts at the boundary of teacher education and initial practice. *International Journal of Educational Research*, 50(1), 6–13.
7. B. Avalos et al.: Come I giovani insegnanti vivono il loro lavoro professionale in Cile. *Insegnamento e formazione degli insegnanti* (2007).
8. S. Lasky.: A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform. *Teaching and Teacher Education: An International Journal of Research and Studies* (2005).
9. Park, S., Oliver, JS, Johnson, TS, Graham, P., & Oppong, NK: Ruoli dei colleghi nello sviluppo professionale degli insegnanti: risultati di uno studio di ricerca sulla certificazione del National Board. *Insegnamento e formazione degli insegnanti*, 23 (4), 368-389 (2007).
10. Bodenheimer, G., & Shuster, S. M. (2020). Emotional labour, teaching and burnout: Investigating complex relationships. *Educational Research*, 62(1), 63–76.
11. Guerrini, V.: Valutazione e autovalutazione degli insegnanti. Riflessioni per promuovere processi di professionalizzazione in un'ottica life long learning. *Lifelong lifewide learning*, *14*(31), 1-16 (2018).
12. Trinchero, R., Antonio, C., Antonio, M., & Giuliano, V.: Qualità degli insegnanti: formazione, reclutamento, avanzamento di carriera. Quale scenario? *Giornale italiano della ricerca educativa*, *25*, 22-34 (2020).
13. Guarini P., di Furia, M., Ragni, B.: Digital Competences and Didactic Technologies training for teachers in service: From DigCompEdu to a national Framework. NMP 22 - New Media Pedagogy (2023). (IN PRESS).
14. De Angelis, M.: Uno strumento per valutare le competenze del docente specializzato: il questionario BEST (BEcome a Special education Teacher). *Annali online della Didattica e della Formazione Docente*, *14*(23), 35-50 (2022).

SPECIAL TRACK 10

“BEYOND BORDERS: EXPLORING IMMERSIVE ENVIRONMENTS AND NEW DIDACTIC APPROACHES IN HIGHER EDUCATION”

ORGANIZERS:

BARBARA BRUSCHI, UNIVERSITY OF TURIN, ITALY

MANUELA REPETTO, UNIVERSITY OF TURIN, ITALU

SALVATORE MARIA AGLIOTI, SAPIENZA UNIVERSITY OF ROME, ITALY

AGATA MARTA SOCCINI, UNIVERSITY OF TURIN, ITALY

ENNIO BILANCINI, IMT SCHOOL FOR ADVANCED STUDIES LUCCA, ITALY

ANDREA BENASSI, INDIRE

LUCA OSTACOLI, UNIVERSITY OF TURIN, ITALY

VR4Green: an Immersive and Interactive Virtual Reality Experience for Climate Change Education *

Alessandro Clocchiatti[1], Federica Cena[1], and Agata Marta Soccini[1]

Computer Science Department, University of Torino, corso Svizzera 185, 10149, Italy
{alessandro.clocchiatti, federica.cena, agatamarta.soccini}@unito.it

1 Introduction

The climate crisis has become one of the main challenges of the 21st century [2]. One of the hardest aspects of facing global warming is the difficulty of people to perceive the importance of their personal impact on the environment due to long-term consequences. In this scenario, it is crucial to educate people to adopt pro-environmental behaviors. Virtual Reality (VR) has frequently and effectively been used as an educational tool to change people's behavior on a variety of topics, including climate change awareness. In recent years, several projects focused on promoting and teaching pro-environmental attitudes and strategies through VR. However, the majority of these projects focus on only one specific aspect of climate emergency, such as waste-sorting [4] or dietary footprint [3], or consist in 360° videos [1]. We propose a native interactive VR experience that takes place in the city of Torino, to educate and promote pro-environmental behavior in people's everyday lives. The current work presents the main outcome of analyzing which visual effects within the VR application evoke the most intense emotions in the users.

2 Project description

We defined two main scenarios in which the experience takes place. Firstly, to make the experience feel relevant and familiar to participants, we created a virtual reproduction of the city center of Torino (Figure 1a). Secondly, we modeled a virtual house with furniture and household appliances (Figure 1c). The behavior of the user in the home and their interaction with household appliances produce changes in the surrounding environment, for better or worse. We developed different visual effects in the outside virtual environment to simulate the worsening of environmental conditions (Figure 1b), which directly depend on

* The current work is part of the project "VR4Green: virtual reality solutions to promote environmental awareness and adoption of sustainable behaviors" CUP D11B21005890007. Supported by the National Operative Program (PON) on "Research and Innovation" 2014-2020 of the Italian Ministry of University and Research, and by HST Center (Human Sciences and Technologies) at University of Torino.

(a) (b) (c)

Fig. 1: Virtual reproduction of the city center of Turin in good environmental condition (1a), Turin affected by climate change (1b) and the virtual room in which user can interact with furniture and household appliances (1c)

the user's interaction with objects in the room. Specifically, we incorporated the following visual effects into the experience: *pedestrians* coughing and collapsing to the ground, a pervasive *smog* enveloping the landscape and obscuring distant buildings, scattered *trash* and garbage surrounding the city, *building* facades becoming dirtier due to smog, a gradual decrease in *river* water levels, *birds* falling to the ground and *trees* losing their leaves over time.

The aim of the project is to increase participants' awareness of their individual impact on climate change by reducing the temporal gap between their actions in the room and their corresponding consequences on the environment. As our intention is to adopt an emotional learning approach rather than a cognitive one, this paper presents a preliminary study aimed at identifying the visual effects within the application that induce stronger emotions in users.

3 Discussion and Conclusion

We recently run some preliminary user experience tests on the virtual environment of Torino, and collected positive feedback on graphics, sounds, and interaction design. We evaluated the users' perception of the visual effects that compose the dystopian environment through subjective and objective data, and defined participants' emotional responses to several critical situations (collected through PANAS questionnaire [5]). In particular, we grouped the visual effects in three different sets, categorized by their target impact: *human effects*, which impact on man (*pedestrians, smog*); *urban effects*, which relate to urban environments (*trash, buildings*); and *naturalistic effects*, which are connected to nature (*rivers, birds, trees*). We then divided PANAS questionnaire into positive and negative emotions. Results suggest that the naturalistic effect caused the highest negative emotional impact, while human effects lead to unexpected positive emotions.

We are currently testing how much the room environment affects users' attitudes towards environmental problems, and how the cause-effect relationship between actions within the room modifies perceptions of a catastrophic future.

References

1. Ferris, K., Garcia Martinez, G., Wadley, G., Williams, K.: Melbourne 2100: Dystopian virtual reality to provoke civic engagement with climate change. In: Proceedings of the 32nd Australian Conference on Human-Computer Interaction. pp. 392–402 (2020)
2. Masson-Delmotte, V., Zhai, P., Pörtner, H.O., Roberts, D., Skea, J., Shukla, P.R., et al.: Global Warming of 1.5° C: IPCC Special Report on Impacts of Global Warming of 1.5° C above Pre-industrial Levels in Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. Cambridge University Press (2022)
3. Plechatá, A., Morton, T., Perez-Cueto, F.J., Makransky, G.: A randomized trial testing the effectiveness of virtual reality as a tool for pro-environmental dietary change. Scientific Reports **12**(1), 14315 (2022)
4. Stenberdt, V.A., Makransky, G.: Mastery experiences in immersive virtual reality promote pro-environmental waste-sorting behavior. Computers & Education **198**, 104760 (2023)
5. Watson, D., Clark, L.A., Tellegen, A.: Development and validation of brief measures of positive and negative affect: the panas scales. Journal of personality and social psychology **54**(6), 1063 (1988)

Virtual reality and game-based learning: a project with primary school students

Giorgio Borla[1], Barbara Bruschi[1[0000-0002-6734-0953]], Fabiola Camandona[1], Lorenzo Denicolai[1[0000-0002-6777-8613]], Antonio Falco[1], Manuela Repetto[1[0000-0003-4685-1786]], Melania Talarico[1[0000-0001-5097-9999]],

[1] University of Turin, Italy
giorgio.borla@unito.it, barbara.bruschi@unito.it,
fabiola.camandona@unito.it, lorenzo.denicolai@unito.it,
antonio.falco@unito.it, manuela.repetto@unito.it,
melania.talarico@unito.it

1 Introduction

As is well known, virtual reality and the immersive reality experience are increasingly taking hold in the field of education and within the school context [1]. It is certainly legitimate to wonder whether these types of tools can become something more than just entertainment [2] and improve the learning process. On this front, the literature is still under development. Based on Angel-Urdinola's meta-analysis [3] and colleagues on the increase in learning with the use of virtual reality, it is evident that improvements in technical skills, cognitive processes, and the development of relational skills are actually possible. Furthermore, research shows that only through social constructivist and constructionist approaches is it possible to create truly educational environments and experiences [4]. In accordance with these research findings and following the guidelines of European Council about key competences for life of learning [5] the role of the teacher changes, with the teacher transforming from a dispenser of knowledge in an intellectualistic way to a mediator and facilitator of learning [6,7]. 3D environments, if accompanied by methodologies such as game-based learning, improve the learning experience [8]. Based on these premises, a project carried out in this last year will be presented, which saw the experimentation of virtual reality and the use of game-based learning for the creation of educational virtual escape rooms [9].

2 The project

Within the Department of Philosophy and Education Sciences at the University of Turin, the LIFE laboratory (Laboratory of Innovation in Philosophy and Education Sciences) was established, which includes a series of technologies, including virtual reality headsets that allowed for the creation of the Escape to Save The Planet project, based mainly on learning about waste sorting. This project saw the creation of a first Virtual Reality (VR) escape room by the research team, which was presented to the public for the first time at the Researchers' Night event. Given its success, it was decided to launch

a new research project based on creation of VR escape rooms with some primary schools of Turin.

3 Research design and results

A sample of 125 primary school students (fourth and fifth grades) with three different social and cultural backgrounds were engaged. A total of six classes were involved, three experimental and three control groups.

The main aim was to understand if through the building of VR escape rooms there would be an improvement of learning and an enhancement of digital skills, socio-relational skills, and cognitive competencies.

The experimental and control classes were involved in two parallel processes consisting of 8 meetings, with different final products:

- the first and second phases helped engage the children in the activity and understand their level of digital literacy;
- from third to fifth meeting there was: a) reflection process on recycling materials and their potential reuse; b) the generation of an escape room with a focus on the narrative framework and on puzzles creation;
- in the sixth and seventh meetings, the control classes implemented physical escape rooms using recycled materials, while the experimental classes built their own VR escape rooms using the Cospaces Edu platform.

The Perceived Social Competence Scale (PSCS) and the Anderson-Butcher guide were used for the self-assessment of student's social skills and for assessment by teachers for pre-test and post-test comparison; the same indicators were used for observation of students by researchers.

Preliminary results of this research show that students were able to explore and express their points of view, becoming active protagonists of their own learning process as escape room designers. They activated reflection processes related to sustainable behaviors and achieved positive effects on memorization and comprehension abilities, observation skills, emotional response control in complex situations [10] and, thanks to small group work, developed collaborative and critical thinking skills. Furthermore, students of experimental classes developed skills of VR game design and achieved significant goals in acquiring a universal coding language through Cospaces Edu.

4 Conclusion

From the preliminary research results, it appears that the VR construction of escape rooms made it possible to promote more active and collaborative forms of learning, showing an increase in motivation even among the most problematic students. The use of digital and VR environments also made it possible to approach a new but particularly inclusive tool, in which each participant was able to integrate elements of their own story and collaborate within a team. This opens perspectives with the initial teacher training in higher education, which should increasingly be based on the development of pedagogical skills and strategies to be applied within increasingly complex educational contexts.

References

1. Akman, E., Çakır, R.: The effect of educational virtual reality game on primary school students' achievement and engagement in mathematics. Interactive Learning Environments, 31(3), 1467-1484 (2023).
2. Andreoli, M.: La Realtà Virtuale al servizio della Didattica. Studi sulla Formazione, 21(1), 33-56 (2018).
3. De Simone, G., Di Tore, S., Maffei, S., Sibilio, M., & Todino, M. D.: L'utilizzo di tecnologie head-mounted display a supporto della didattica attraverso ambienti di apprendimento virtuali in contesti non formali. Italian Journal of Educational Research, 165-176 (2017).
4. Angel-Urdinola, D. F., Castillo-Castro, C., Hoyos, A.: Meta-analysis assessing the effects of virtual reality training on student learning and skills development. World Bank, Washington, DC (2021).
5. The Council of the European Union: Council Recommendation of 22 May 2018 on key competences for lifelong learning. Official Journal of the European Union, C19-P.C1-13.-4.6.2018 (2018).
6. Aiello, P., D'Elia, F., Di Tore, S., Sibilio, M.: A Constructivist approach to virtual reality for experiential learning. E-learning and Digital Media, 9(3), 317-324 (2012).
7. Cera, R.: Pedagogia del gioco e dell'apprendimento. Riflessioni teoriche sulla dimensione educativa del gioco. Franco Angeli, Milano (2009).
8. Tilhou, R., Taylor, V., Crompton, H. 3D Virtual Reality in K-12 Education: A Thematic Systematic Review. In: Yu, S., Ally, M., Tsinakos, A. (eds): Emerging Technologies and Pedagogies in the Curriculum. Bridging Human and Machine: Future Education with Intelligence. Springer, Singapore (2020).
9. Repetto, M., Bruschi, B., Talarico, M.: Key issues and pedagogical implications in the design of Digital Educational Escape rooms. Journal of e-Learning and Knowledge Society, 19(1), 67-74 (2023).
10. Jensen, L., Flemming, K.: A review of the use of virtual reality head-mounted displays in education and training. Education and Information Technologies, 23, 1515-1529 (2018).

Immersive digital interactions: the role of social touch

Martina Fusaro[1,3], Matteo P. Lisi[1,2] and Salvatore Maria Aglioti[1,2,3]

[1] Department of Psychology, Sapienza University of Rome, Italy
[2]CLNS, Fondazione Istituto Italiano di Tecnologia (IIT), Rome, Italy
[3] IRCCS, Santa Lucia Foundation, Rome, Italy
martinafusaro@gmail.com

1 Introduction

Social touch promotes physical and psychological wellbeing during the whole lifespan, supporting the establishment and strengthening of social bonds [1]. Nevertheless, due to the diffusion of Internet and social networks, a substantial amount of our social interactions takes place online, where the expression of social touch and physical proximity is severely limited [2]. Thanks to technological advancements and a substantial decrease in the devices' cost, Immersive Virtual Reality (IVR) constitutes a notable exception, allowing people to 'incorporate' digital representations of their bodies (avatars), through which interact with other agents. Psychological and neuroscientific evidence shows that mere observation from a first-person perspective (1PP; [3]) can elicit a feeling of owning a full-body humanoid avatar (illusory ownership) and being agent of its actions (illusory agency), fostering the feeling of real-life interactions. In our recent studies we also showed that seeing somatosensory stimuli (e.g., touch or pain) delivered on one's own avatar can trigger feelings of (un)pleasantness [4, 5]. Indeed, virtual caress and syringe penetration are perceived differently and can trigger feelings of pleasure and pain, respectively. Here, we present two recent studies that we conducted to demonstrate the possibility of using IVR to induce vicarious feelings of being touched.

2 Approach

2.1 Study 1

In the first study (Fig.1a), we tested 84 participants (men and women, heterosexual and non-heterosexual) who observed their virtual body through a head-mounted display receiving touches on different parts of the body. We demonstrated that virtual touches on intimate body parts (such as the genitals and the chest) are rated as more erogenous and less appropriate than those in areas coded as social (such as the hand and the face). Our results showed that virtual touches induce sensations that mirror real touches in the absence of any stimulation on the real body. Moreover, we observed that explicit (subjective ratings of the stimulus quality) and implicit (autonomic reactivity to the seen stimuli) responses were influenced by participants' gender and sexual orientation, the touched area on the virtual body as well as the gender of the avatar delivering the touches [6], suggesting that real-life preferences are projected into touch-mediated interactions with virtual agents.

2.2 Study 2

In a further study [7], we used the same paradigm developed for Study 1 and we observed how the appearance of the virtual body (i.e., the gender of the embodied avatar) can modulate responses to touches. We tested 21 heterosexual men and 21 heterosexual women, and we found that when embodying an opposite gender avatar (e.g., when men were observing a female body from 1PP, Fig.1b) sexual preferences shifted toward the opposite gender: heterosexual men, experiencing the touches from a perspective of a woman, rated as more erogenous and pleasant touches from other men. The same was true also for women embodying a male body. This evidence suggests that not only IVR can be a promising tool to investigate perspective-taking but also that our paradigm can help taking the perspective of another gender, in particular in delicate situations like when touches are received in intimate areas. Changes of cross-sex perspective-taking, provide novel tools for fostering empathy and comprehension of sex-related diversity.

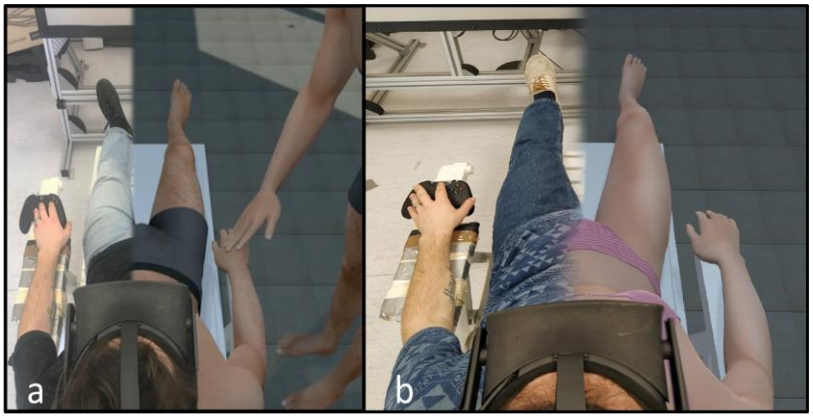


Fig 1 a) participants could observe their virtual body in the same position as the real one receiving touches from another avatar b) the body-swap paradigm allowed our participants to take the perspective of an individual with an opposite gender.

3 Conclusion

We propose that this work is foundational for understanding people's behaviours and the nature of the interactions happening in immersive digital spaces. Using IVR to explore vicarious somatosensation can serve at least to two aims. First, IVR allows to investigate in a controlled and yet ecological fashion, real people's reactions to virtual touches and painful stimuli, delivered to their embodied avatars in the absence of any actual touch on the real body. Crucially, this approach also allows to understand how different features (e.g., various ethnicities, social status, ages etc), of the touching avatar influences real body reactivity. Second, IVR constitutes a potential machine for social change, a way to modulate social preferences while living vicarious somatosensation on another's body. The study and the application of social touch in digital worlds represents a playground for "affective training" by fostering positive social encounters and promoting diversity and inclusion.

References

1. Fini, Chiara, et al. "The social roots of self-development: from a bodily to an intellectual interpersonal dialogue." Psychological Research (2023): 1-13.
2. Lomanowska, A. M., & Guitton, M. J. Online intimacy and well-being in the digital age. Internet interventions, (2016) 4, 138-144.
3. Slater, Mel, et al. "First person experience of body transfer in virtual reality." PloS one 5.5 (2010): e10564.
4. Fusaro, Martina, et al. "Seeing pain and pleasure on self and others: behavioral and psychophysiological reactivity in immersive virtual reality." Journal of Neurophysiology 116.6 (2016): 2656-2662.
5. Fusaro, Martina, et al. "Influence of cognitive stance and physical perspective on subjective and autonomic reactivity to observed pain and pleasure: An immersive virtual reality study." Consciousness and cognition 67 (2019): 86-97.
6. Fusaro, Martina, Lisi, Matteo P., et al.. Heterosexual, gay, and lesbian people's reactivity to virtual caresses on their embodied avatars' taboo zones. Scientific reports, (2021) 11(1), 1-12.
7. Mello, Manuel, et al. "Wearing same-and opposite-sex virtual bodies and seeing them caressed in intimate areas." Quarterly Journal of Experimental Psychology 75.3 (2022): 461-474.

Debating in Virtual Reality between Students of Different Schools: How to Enable a Sense of Presence from Remote to Improve Verbal and Non-Verbal Communication

Andrea Benassi[0000-0002-1622-5226]

[1] INDIRE, Firenze 50122, Italy
www.indire.it

1 Introduction

In order to deepen the potential of Virtual Reality (VR) [1,2,3] and its practical feasibility in formal educational and training contexts, in 2022 the Italian "Avanguardie Educative" school network [4] - coordinated by INDIRE - started a pilot project focused on the practice of Debate [5] in VR: students from ten secondary schools, through VR headsets, met in a virtual environment specially designed for the purpose, for a total of 20 debate sessions.

Among the potential areas of application, Debate was chosen for the opportunities it offers to test VR in terms of communication, as well as for its structured and preordered use of the space, which makes it easier to compare human behaviors between physical and virtual reality. The research question was: how is VR effective in supporting verbal and non-verbal communication and enabling a sense of presence [6] in a shared space between remotely connected teams of individuals?

2 Methodology

A special VR application was developed for the purpose by H-Farm. The application replicates the setting of a Debate competition: two teams of three students each - remotely connected through Meta Quest VR headsets from two different schools - discuss a topic from two opposing sides. Those who agree with this statement are the "Pro" team (wearing white shirts). Those who don't are the "Con" team (with blue shirts). The VR environment features a podium from which the speaker engages in their speaking turn, corners for the two teams, and the jury's console (Fig. 1). Also, the application takes care of the discussion protocol that governs the speaking turns of the two teams, the time allocated for each intervention, the number of discussion rounds and the evaluation criteria set by the jury (composed by three members).

Each of the ten schools involved participated in one challenge per week with a different school each time, for a total of four weeks between October and December 2022. To involve the entire class, not just the three team members, the meetings were broadcasted on a big screen in the classroom, allowing classmates without VR headsets to watch. A total of 200 secondary school students were involved in this pilot.

The research methodology draws on a qualitative approach using direct observations in the virtual environment, match analysis and video annotation on clips taken in the classrooms during Debate sessions, semi-structured interviews with teachers, online questionnaires administered to students, focus groups with each of the schools'students involved at the end of the pilot.

Fig. 1. Debate session in VR: one member of the "Blue team" is speaking at the podium, the three members of the "White team" are listening.

3 Results

Preliminary results indicate that the experience of Debate in VR, as designed in this experimentation, although improvable, is feasible in schools, as for technological and organizational levels, since all the 20 meetings (except one, due to a software bug in the application) were successfully managed and the matches completed. From an educational point of view, when compared with the physical setting, the virtual setting turned out to have a greater influence on the cognitive dimension (the level of concentration of the participants increases) and the potential involvement of all students during a competition session (not only the *debaters* directly involved in the match but also the rest of the classmates).

4 Conclusion

This pilot project demonstrates how the use of VR in schools, when accompanied by the design of a usage context compatible with the objectives, times, and spaces of the school, can already constitute a concrete and applicable possibility. It also highlights the potential of VR in enabling new forms of interaction among students from different schools, providing them with a cohabited space in which to communicate and collaborate. This experience pilot also confirms how the introduction of a new technology or media in schools always necessitates a phase of adapting logistical/organizational practices and development of new professional skills, as has been the case in the past with the advent of computers, the Internet, or interactive whiteboards.

References

1. Aseeri, S., & Interrante, V.: The Influence of Avatar Representation on Interpersonal Communication in Virtual Social Environments. IEEE Transactions on Visualization and Computer Graphics, 27(5), 2608-2617 (2021).
2. Benassi, A.: Didattica immersiva. In Rivista Bricks, 8(3), 106-111 (2018).
3. Kavanagh, S., Luxton-Reilly, A., Wuensche, B., Plimmer, P.: A systematic review of virtual reality in education. In Themes in Science and Technology Education, 10(2), 85-119 (2017).
4. Laici, C., Mosa, E. Orlandini, L., Panzavolta, S.: "Avanguardie Educative: a Cultural Movement for the Educational and Organizational Transformation of the Italian School". In proceedings of V Conferenza «The Future of Education» Firenze (2015).
5. Cinganotto, L., Mosa, E., Panzavolta, S.: Il Debate. Una metodologia per potenziare le competenze chiave. Carocci, Roma (2021).
6. Krassmann, A. L., Melo, M., Pinto, D., Peixoto, B., Bessa, M., & Bercht, M.: What Is the Relationship between the Sense of Presence and Learning in Virtual Reality? A 24-Year Systematic Literature Review. PRESENCE: Virtual and Augmented Reality, 28, 247-265 (2019).

Privacy-preserving multimodal learning analytics using visual animations of kinematic data

Aleksandr Epp[1], Jan Schneider[2][0000−0001−8578−6409] and Daniele Di Mitri[2][0000−0002−9331−6893]

[1] Goethe University Frankfurt, 60629 Frankfurt am Main, Germany
[2] DIPF — Leibniz Institute for Research and Information in Education, 60323 Frankfurt am Main, Germany
d.dimitri@dipf.de

1 Introduction

Privacy and ethics have a significant impact in data-intensive applications and education research, such as Learning Analytics (LA) research. Ethical aspects of data analysis have been discussed in LA since the early phase of the discipline [7]. Moving away from the log data commonly used in LA, we face multimodal data where videos are often a part of the data source. Especially in Multimodal Learning Analytics (MMLA) studies, video data is often a part of the multimodal data source, and privacy-conscious data usage and analysis are a matter of high priority [6, 3, 2].

A recent literature review by Alwahaby et al. [1] shows that ethical considerations have rarely been addressed in research that analyses multimodal data for learning purposes, e.g., Multimodal Learning Analytics (MMLA). Solutions for personal data protection in the analysis processes involving multimodal data are still rare, and the demand to fill that gap is high, especially in the EU with the obligatory nature of GDPR. Addressing ethical issues from data collection through MMLA systems is crucial for developing that field and other research fields utilising multimodal data.

The importance of video data in educational science, especially in MMLA, appears to be indisputable. Video data provide a learning possibility, allow the analysis of human behaviour to improve the learning experience, or is the source for data labelling to train machine learning models. MMLA research relies on collected user data. Thus the need for privacy-preserving handling of that data arises. The researchers face further challenges added to the classic MMLA problems of gathering the data from different sources, synchronisation, and data fusion strategies.

2 Methods and Tools

This work provides a proof of concept for a privacy-conscious multimodal data analysis approach. Specifically, this paper addresses the privacy issues arising in

the visual data analysis of kinematic body movements. We developed the *Animation Tool*, a software solution that animates kinematic data to allow the analysis of visual recordings without using video data, therefore preserving the participants' privacy. We test the Animation Tool by integrating it into the *Visual Inspection Tool* (VIT) [5], an existing MMLA research application. The original version of the VIT uses a video of a participant performing a psychomotor activity to evaluate specific properties of that activity, such as the presence of specific mistakes. This process is called data annotation. Resulting annotations are then used a.o. to train supervised machine learning models.

The test scenario consists of the data annotation process of a Cardiopulmonary Resuscitation (CPR) procedure performed by a single actor, as described in [4]. The CPR execution was evaluated using two standard CPR performance indicators, (1) the extent by which the person performing CPR was using their body weight correctly during the chest compressions (*bodyWeight*), and (2) whether their arms were correctly locked (*armsLocked*). Two groups of raters looked at recorded CPR sessions using either video recordings or animations of the same CPR recordings. To evaluate the efficiency of the Animation Tool in that use case, we consider the animation minimises personal information about the recorded person. To evaluate Animation Tool's efficiency, we answered the research question: *to what extent can we keep the quality of annotations by replacing the video with animation to satisfy privacy concerns from data protection?*

3 Results and Conclusions

The inter-rater agreement was measured by Cohen's kappa coefficient, which ranges from 0 (no agreement) to 1 (perfect agreement). The results showed that regardless of the visualisation method, the raters agreed more on *bodyWeight* than on *armsLocked*. The average cross-group agreement on *bodyWeight* was 0.91 while the average agreement on *armsLocked* was 0.72. Moreover, the agreement levels between the video and animation groups were similar, suggesting that animation is a feasible alternative to video for annotating CPR performance. Nevertheless, some challenges were faced rating the animations as a replacement for video recording, such as unnatural animation behaviour, unclear visualization of some CPR parameters, and uncertainty about how to rate some cases.

This paper is considered a starting point of the research on using animation as an anonymisation technique for multimodal data analysis. The Animation Tool is tested in a specific scenario based on a single actor's data annotation process of a *Cardiopulmonary Resuscitation* (CPR) procedure. The evaluation of the Animation Tool conducted in the context of this work presents proof of the concept of the introduced approach. The efficiency of the proposed approach is evaluated in a reference application scenario and with an existing data set on *Cardiopulmonary Resuscitation* (CPR) training. Multiple raters use the Animation Tool to compare the quality of annotations against video recordings.

References

1. Alwahaby, H., Cukurova, M., Papamitsiou, Z., Giannakos, M.: The evidence of impact and ethical considerations of multimodal learning analytics: A systematic literature review (Aug 2021), preprint on https://edarxiv.org/sd23y
2. Ciordas-Hertel, G.P., Rödling, S., Schneider, J., Di Mitri, D., Weidlich, J., Drachsler, H.: Mobile sensing with smart wearables of the physical context of distance learning students to consider its effects on learning. Sensors **21**(19) (2021). https://doi.org/10.3390/s21196649, https://www.mdpi.com/1424-8220/21/19/6649
3. Crescenzi-Lanna, L.: Multimodal learning analytics research with young children: A systematic review. British Journal of Educational Technology **51** (05 2020). https://doi.org/10.1111/bjet.12959
4. Di Mitri, D., Schneider, J., Drachsler, H.: Keep me in the loop: Real-time feedback with multimodal data. International Journal of Artificial Intelligence in Education (2021). https://doi.org/10.1007/s40593-021-00281-z
5. Di Mitri, D., Schneider, J., Klemke, R., Specht, M., Drachsler, H.: Read between the lines: An annotation tool for multimodal data for learning. In: Proceedings of the 9th International Conference on Learning Analytics & Knowledge. p. 51–60. LAK19, Association for Computing Machinery, New York, NY, USA (2019). https://doi.org/10.1145/3303772.3303776
6. Prieto, L.P., Rodriguez Triana, M.J., Kusmin, M., Laanpere, M.: Smart school multimodal dataset and challenges. vol. 1828, pp. 53–59. CEUR (2017)
7. Swenson, J.: Establishing an ethical literacy for learning analytics. In: Proceedings of the Fourth International Conference on Learning Analytics And Knowledge. p. 246–250. LAK '14, Association for Computing Machinery (2014). https://doi.org/10.1145/2567574.2567613

Virtual reality and the Metaverse as educational and technological mediators for medical and scientific education

Bonometti Stefano[1][0000-0003-4393-9002], Beatrice Peter[1][0000-0001-8331-8273], Ferri Letizia[1] and Iomini Leonardo[1]

[1] University of Insubria, Teaching and Learning Center, 21100 Varese (Italy)
stefano.bonometti@uninsubria.it

1 Real context and virtual learning

The issue of didactic innovation at every level and type of school must go hand in hand with teacher training, which plays a fundamental role in promoting change and innovation. In this regard, many reforms and interventions have been implemented in recent years, focusing on training, retraining, and recruitment of teachers [1]. A new model is emerging in the professional development of university teachers, where pedagogical-didactical competences, including technological ones, are considered equally important as research-related competences [2].

Virtual learning simulations are increasingly used in various educational and training contexts as a complement to traditional educational methods [3]. Previous research has shown that they offer significant educational benefits. For instance, virtual learning simulations provide an opportunity to use cutting-edge training equipment and learning tools that many educational institutions might not be able to provide [4]. Moreover, virtual simulations allow students to engage in realistic scenarios that may be too dangerous, time-consuming, or expensive to undertake in real life [5]. A higher level of immersion will increase student motivation [6], foster interest in science [7], and enhance learning outcomes [8]. As a result, the field of virtual learning is rapidly evolving, and there is limited current research available to support the effectiveness and efficiency of these new IVR learning tools [9].

In this context, the Centers for Teaching and Learning have assumed an increasingly important role, supporting lecturers in the development of renewed pedagogical and teaching skills [10], they could become fundamental hubs for establishing and overseeing relations be-tween secondary schools and universities, research and didactic training, especially in the didactic-technological field. For example, the TLC of the University of Insubria carries out various activities, including the activation of several research grants in the field of didactics and soft skills, some of which focus precisely on the in-depth study of new technologies [11]. Building upon this context, the experimentation in question focuses on the application of new technological devices to teaching in the university context. Specifically, after comparing different types of technological devices and emphasizing the importance of augmented reality, the

significance and relevance of using visors in secondary and higher education will be developed.

1.1 Improving biotechnology learning outcomes with immersive virtual reality labs

IVR labs were incorporated into the regular class activities to test various strategies for enhancing student learning outcomes using this learning technology. Perceived learning, theoretical knowledge, self-efficacy, and interest in biotechnology were assessed using special online questionnaires before and after the proposed activities.

When IVR labs were tested as an alternative to the teacher's face-to-face lecture we observed lower scores of theoretical knowledge in the group that attended the IVR lab compared to the group that attended the teacher's frontal lecture. When IVR labs were used as an integrative tool before attending practical labs, we found that students who participated in the IVR course scored higher on the theoretical knowledge questionnaire compared to students who did not attend the IVR course. These data suggest that IVR workshops cannot be considered a complete alternative to teacher-led lessons, but they can serve as an additional tool to enhance traditional educational methods and improve learning outcomes.

1.2 Improving Anatomy Learning Outcomes with Immersive Virtual Reality Laboratories

A second line of experimentation in virtual learning is being developed in the project to establish a virtual anatomy laboratory, accessible to students using a VR visor or through a video screen on an online platform. The project places great emphasis on creating an experience that closely resembles reality. The virtual reconstruction of the existing Human Morphology Laboratory within the University is being undertaken, preserving both its appearance and functionality, to bridge the gap between the real and virtual settings. This enhances the usability of laboratory activities, add problem solving tools. The laboratory is accessible at any time of the day with an unlimited number of users, creating virtual social interactions between students. The virtual reconstruction includes three-dimensional bone models that replicate, using photogrammetry, the real bones found in the Human Morphology Laboratory. The virtual reality aspect offers numerous possibilities and functionalities, such as zooming in on bone models, three-dimensional drawing, and a highly immersive experience.

2 Conclusions

Looking at the initial evidence that has emerged attests to the fact that virtual methodologies, however sophisticated and high-performing they may be, are not by themselves sufficient to increase better learning if not supported by a comprehensive instructional and methodological design. The experimentation with these tools will be accompanied by a reflection on their evaluation in the educational field and their

potential interactions with various existing learning methodologies. The aim is to develop an integrated and pedagogically-focused vision of a crucial aspect of the development of today's society, to assist teachers in utilizing these powerful technological tools in the most effective way for their students' learning.

References

1. (2023) Legge 10 agosto 2023 n. 112. Gazz Uff
2. Bonometti S (2023) Teaching in the lab through Virtual Reality. J Incl Methodol Technol Learn Teach 2:1–9
3. Wismer P, Lopez Cordoba A, Baceviciute S, et al (2021) Immersive virtual reality as a competitive training strategy for the biopharma industry. Nat Biotechnol 39:116–119. https://doi.org/10.1038/s41587-020-00784-5
4. Bodekaer M (2016) This virtual lab will revolutionize science class. https://www.ted.com/talks/michael_bodekaer_this_virtual_lab_will_revolutionize_science_class/transcript
5. Thisgaard M, Makransky G (2017) Virtual learning simulations in high school: Effects on cognitive and non-cognitive outcomes and implications on the development of STEM academic and career choice. Front Psychol 8:1–13. https://doi.org/10.3389/fpsyg.2017.00805
6. Makransky G, Borre-Gude S, Mayer RE (2019) Motivational and cognitive benefits of training in immersive virtual reality based on multiple assessments. J Comput Assist Learn 35:691–707. https://doi.org/10.1111/jcal.12375
7. Makransky G, Petersen GB, Klingenberg S (2020) Can an immersive virtual reality simulation increase students' interest and career aspirations in science? Br J Educ Technol 51:2079–2097. https://doi.org/10.1111/bjet.12954
8. Makransky G, Terkildsen TS, Mayer RE (2019) Adding immersive virtual reality to a science lab simulation causes more presence but less learning. Learn Instr 60:225–236. https://doi.org/10.1016/j.learninstruc.2017.12.007
9. Matovu H, Ungu DAK, Won M, et al (2022) Immersive virtual reality for science learning: Design, implementation, and evaluation. Stud Sci Educ 59:205–244. https://doi.org/10.1080/03057267.2022.2082680
10. Lotti A, Serbati A, Doria B, et al (2022) Teaching and Learning Centre: Analysis of Key Elements. Form e Insegn XX:75–88
11. Haras C, Taylor SC, Sorcinelli MD, Hoene L von (2017) Institutional commitment to teaching excellence: Assessing the Impacts and Outcomes of Faculty Development. American Council of Education

XR Blocks: A 3D Block Language for Combining Immersive and Tangible Coding

Manuela Chessa, Giorgio Delzanno, Lorenzo Gerini,
Giovanna Guerrini, and Fabio Solari

DIBRIS, Università degli Studi di Genova, Italy
{name.surname}@unige.it

Visual Programming Languages (VPL) are nowadays of widespread use in Computer Science Education. VPL used in coding tools typically provides block-based graphical objects that represent basic control structures and that can be combined to form a program. Google Blockly is probably one of the most used VPL in web-based coding tools such as MIT App Inventor and Microsoft Makecode. Scratch is another popular block coding system specifically designed to stimulate creativity. Scratch Jr, the preschool version of Scratch, provides a block language specifically intended for storytelling based on a collection of stripes. Pocketcode is a block coding system for smartphones and tablets that provides blocks for controlling virtual objects using accelerometer and gyroscope data [1]. Tangible coding projects, such as Project Bloks or CodeJumper try to combine coding tools with the physical experience of STEM games such as Lego. In [2], we recently proposed a block coding system to be used within a VR immersive experience, namely a virtual game room. The proposed coding language was based on 2D blocks that allow users to solve computational thinking challenges during the game experience.

In this paper, we extend the approach in [2] and present XRCoding, a novel eXtended Reality (XR)-based block coding system that integrates passive haptics, enabling users to interact with virtual elements corresponding to physical objects, thereby introducing tactile feedback. The system is developed using the Unity game engine, with Meta Quest 2 serving as the Head-Mounted Display (HMD). We utilize the hand-tracking capabilities of the Quest 2 to track the users' hands within the virtual environment and to visualize them in the virtual scene. This functionality allows users to interact directly with the code blocks using their hands as shown in Fig. 1.

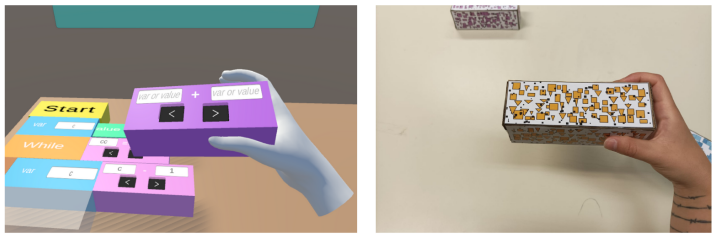


Fig. 1. XRCoding allows users to code with a block-based approach in immersive VR (left), manipulating simple textured parallelepiped (right).

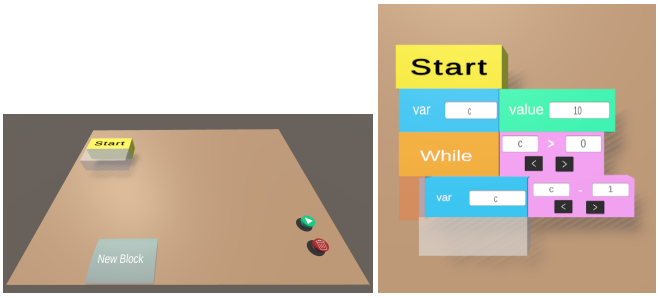


Fig. 2. The working space and a code example.

As shown in Fig. 2, the virtual environment is designed as a simple room with a table aligned with the position of its real-world counterpart, which serves as the designated working space. The *Start* block represents the initial point of a user's program. To begin constructing their program, users can drag and position a code block of their choice into the white-transparent region below the "Start" block. The green button executes the code, and the red one removes the positioned block, thus resetting the scene.

The XR block language provides commands (see Fig. 2 (right)) such as the *Var* block, used to create a new variable or to refer to an existing variable (e.g., to modify its value), the *Value* block, used to assign a value to a variable; the *If* block and *While* block, used to introduce conditional statements and iteration. When a user touches an input field, it is selected, and a virtual keyboard appears on the table, enabling the user to specify their inputs. The operational blocks also feature two buttons that allow the user to change the operation type. To interact with real objects in virtual environments, we adopt an approach based on the Multi-Targets functionality of the Vuforia Engine 10.15 to avoid using physical trackers, which can be expensive and obtrusive when interacting with small objects [3].

Preliminary tests with secondary school students, that have been asked to solve simple coding exercises with a standard monitor-based block coding environment and with the proposed XRCoding system, have gathered positive feedback concerning the sense of presence and the user experience for the XRCoding system.

References

1. M. Chessa, G. Delzanno, A. Ferrando, L. Gelati, G. Guerrini, V. Mascardi, N. Noceti, F. Odone, and F. Vitali. Smart Rogaining for computer science orientation. *Frontiers in Education*, 7, 2022.
2. M. Chessa, G. Delzanno, D. Giovannetti, G. Guerrini, F. Manini, D. Miggiano, M. Pizzo, and E. Viola. Work-in-progress - iCoding: Immersive coding in Unity. In *9th International Conference of the Immersive Learning Research Network (iLRN2023)*, 2023.
3. L. Gerini, F. Solari, and M. Chessa. A cup of coffee in mixed reality: analysis of movements' smoothness from real to virtual. In *2022 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*, pp. 566–569, 2022. doi: 10.1109/ISMAR-Adjunct57072.2022.00118

Assessment as learning. Bridging research and practice between schools and Universities

Lorella Giannandrea[1[0000-0002-1169-4795]], Pier Giuseppe Rossi[1[0000-0001-9801-6307]], Francesca Gratani[1[0000-0003-2974-0101]], Lorenza Maria Capolla[1[0009-0008-3338-1096]]

[1] Department of Education, Cultural Heritage and Tourism, University of Macerata MC 62100, Italy
lorella.giannandrea@unimc.it; piergiuseppe.rossi@unimc.it; f.gratani@unimc.it; l.capolla@unimc.it

1 Introduction

The need to innovate teaching-learning practices to enhance students' learning outcomes and promote nowadays transversal skills often clashes with the reiteration of standardized and outdated teaching and assessment methods.

Recent developments in the assessment field have highlighted the need to shift the focus of assessment from the product (or the outcome) to the learning process itself, moving from an assessment of learning and for learning to an assessment as learning [1; 2], in which the student actively participates in the process. This perspective moves toward learning-oriented assessment practices [3; 2] and involves the integration of three key elements: tasks appropriate to the approach, development of assessment competence, and student involvement in feedback processes [4]. These practices thus support self-regulated learning by leading students to take an active role, monitoring their progress through self-assessment, reflecting on the effectiveness of their learning approaches, and considering their mistakes as an opportunity to learn and improve [5; 6].

The purpose of the present study is to investigate whether the change in assessment modes affects students' ability to self-regulate their own learning path.

2 The Training and Research-Action Pathway

In the 2022-23 school year the University of Macerata (Italy) organized a research-action pathway involving several School Institutes in the Marche Region [7; 8]. Specifically, 125 teachers between kindergarten (8%), primary school (64,8%), and lower and upper secondary school (16,8% - 10,4%) enrolled in the course, involving 678 students.

The training course engaged teachers in rethinking daily teaching by introducing authentic tasks and revising their assessment practices by integrating and testing rubrics and student logbooks. It was conducted remotely and lasted 25 hours: 9 hours of webinars, 8 hours of group workshops, 8 hours of individual work (asynchronous) (see Table 1).

Table 1. Program.

Activity	Mode	Platform	Duration	Description
Webinar I	Plenary	Zoom	3 h	Preliminary meeting.
Workshop	Groups and sub-groups	Microsoft Teams	2 h	Summary of the proposal. Group work to define authentic task and rubric.
	"	"	2 h	Continuation of group work.
Webinar II	Plenary	Zoom	3 h	Alignment of group works. Analysis of sustainability and challenges.
Workshop	Groups and sub-groups	Microsoft Teams	2 h	Monitoring student logbooks. Experimentation report and feedback.
	"	"	2 h	Summary assessment.
Webinar III	Plenary	Zoom	3 h	Final assessment of the pathway. Effectiveness of tools and practices. Debate and final synthesis.
Individual work	/	/	8 h	Individual experimentation at schools.

3 Methods

The research hypothesis is that introducing an authentic assessment approach could impact students' self-regulation. Logbooks and the "Motivated Strategies for Learning Questionnaire" (MSLQ) [9] were used to trace and analyze this impact. The questionnaire was administered during the initial and final phase of the pathway to primary (from the third grade) and secondary school students via Google Forms in the two Italian versions of Bonanomi and colleagues [10; 11]. It investigated five macro-areas: intrinsic value; emotional sphere; self-efficacy; use of cognitive strategy; self-regulation.

4 Preliminary results and conclusions

Students' logbooks were analyzed qualitatively, while MSLQ data were traced and evaluated quantitatively. We collected answers from 678 students in the MSLQ pre-administration and 511 in the post-administration. From preliminary analysis, for all school orders, we note an increase in the average pre-post values of individual items, particularly in the macro-areas of motivation, self-efficacy, and use of cognitive strategies. Moreover, comparing absolute post-values for each macro-area, we detected some elements of continuity and differentiation among the three school orders. These results will be further explored and discussed in the full paper.

References

1. Earl, L.M.: Assessment as Learning: Using Classroom Assessment to Maximize Student Success (2nd edition). Corwin Press, Thousand Oaks, CA (2013).
2. Carless, D.: Exploring learning-oriented assessment processes. Higher Education 69(6), 963-976 (2015a).

3. Carless, D., Joughin, G., Mok, M.: Learning-oriented assessment: Principles and practice. Assessment and Evaluation in Higher Education 31(4), 395-398 (2006).
4. Carless, D.: Excellence in university assessment: Learning from award-winning teaching. Routledge, Abingdon (2015b).
5. Duncan, T.G., McKeachie, W.J.: The making of the Motivated Strategies for Learning Questionnaire. Educational Psychologist 40, 117-128 (2005).
6. Panadero, E., Andrade, H., Brookhart, S.: Fusing self-regulated learning and formative assessment: a roadmap of where we are, how we got here, and where we are going. The Australian Educational Researcher 45, 13-31 (2018).
7. Rossi, P.G., Giannandrea, L., Gratani, F., Laici, C., Tarantino, A., Paviotti, G.: Assessment as learning: transforming practices with secondary school teachers. In: Gómez Chova, L., López Martínez, A., Candel Torres, I. (eds.) ICERI2021 Proceedings, pp. 6543-6551. IATED Academy, Valencia (2021).
8. Gratani, F.: Towards Assessment as Learning: Findings from online courses for secondary school teachers. Education Sciences and Society, 432-433 (2021).
9. Pintrich, P., Smith, D., García, T., McKeachie, W.: A manual for the use of the motivated strategies for learning questionnaire (MSLQ). University of Michigan, Ann Arbor, MI (1991).
10. Bonanomi, A., Olivari, M. G., Mascheroni, E., Gatti, E., Confalonieri, E.: Using a multidimensional rasch analysis to evaluate the psychometric properties of the Motivated Strategies for Learning Questionnaire (MSLQ) among high school students. TPM: Testing, Psychometrics, Methodology in Applied Psychology 25(1), 83-100 (2018).
11. Bonanomi, A., Cadamuro, A., Olivari, M. G., Versari, A., Confalonieri, E.: The psychometric properties of the Motivated Strategies for Learning Questionnaire (MSLQ): Multidimensional Rasch analysis on primary school data. TPM: Testing, Psychometrics, Methodology in Applied Psychology 27(4), 511-528 (2020).

SPECIAL TRACK 11

"LEARNING TECHNOLOGIES AND FACULTY DEVELOPMENT IN THE DIGITAL FRAMEWORK"

ORGANIZERS:

PAOLO RAVIOLO, ECAMPUS UNIVERSITY, ITALY

ANTONELLA LOTTI, UNIVERSITY OF FOGGIA, ITALY

Digital teaching in faculty development programmes at University of Turin

Barbara Bruschi[1]

[1] University of Turin, Italy
barbara.bruschi@unito.it

1 Introduction

In 1987, the Interstructures Center for Information and Telematic Services for the Humanities (CISI) was established at the University of Turin, marking the beginning of a long period of experimentation in the field of what was later referred to as "digital education." Among the goals of the center was to promote the development of informatics and telematics in education through the implementation of new teaching solutions primarily based on ICT (L. Gallino, 2003). These experimental activities led to the emergence of various teacher training initiatives aimed at fostering the spread of innovative teaching approaches, not only in terms of the technologies used but also in terms of a different philosophy of university teaching and the adoption of new methodologies capable of harnessing the innovation potential introduced by technology. Since 1987, the research and implementation of innovative and digital educational environments have evolved through different phases, culminating in the most innovative approaches of our time.

In this context, we will delve into three teacher training proposals:
IRIDI - Incubator of Didactic Research for Innovation
Teaching & Learning: Strategies for Distance Education
The Great Challenge

2 IRIDI - Incubator of Didactic Research for Innovation

In 2016, at the University of Turin, the design of the Iridi faculty development program was initiated, which started its first edition in 2017. The program consists of 9 modules that address topics considered fundamental for quality teaching, including the use of technology in instruction. Until 2020, the training activities were delivered in-person, with each session lasting 3 hours. During the pandemic, it was decided not to interrupt the training activities, and it became necessary to transfer the meetings online in synchronous mode. This mode was also maintained afterwards to facilitate the participation of teachers.

In 2020, a new training program called Iridi Start was launched, targeting newly hired faculty members, distinguishing it from the initial program, which was named Iridi Full (Coggi, 2019; Coggi, Ricchiardi, Emanuel, 2022). Iridi Start is shorter, mandatory, and

conducted in-person. Participants in both programs are also offered moments of in-depth exploration on topics of particular interest.

Several elements characterize the educational proposal of Iridi:

1. The main objective is to promote innovation and the quality of teaching.
2. The program is certified through digital open badges.
3. Participants in Iridi Full are required to carry out practical activities related to the topics covered in class.
4. Iridi is not only about training but also involves research.
5. With two different delivery modes, in-person and online, it allows for interesting effectiveness evaluations for faculty development planning

3 Teaching & Learning: Strategies for Distance Education

In 2020, the pandemic imposed new educational solutions and created a new need for teacher training. For this reason, an online training program was organized to promote the improvement of digital teaching skills and facilitate the transition from emergency teaching to high-quality online teaching. The program consisted of 14 webinars, each focusing on different aspects of online teaching.

These webinars represented the first comprehensive training program dedicated entirely to digital teaching, allowing participants to discuss the practices applied during the lockdown and to enhance their acquired knowledge and experience. Several good practices emerged from these webinars, which were subsequently addressed within the framework of the initiative “The Great Challenge”

4 The Great Challenge

The initiative, dedicated to teaching staff and students, aimed to share good practices, suggestions, and ideas for educational innovation through 6 thematic groups. The main intention was to gather the best practices in terms of technology-assisted teaching, integrated teaching, and creativity in service of education that had emerged during the months of the pandemic. The 6 thematic groups formed small communities of practice that, over a couple of months, focused on the proposed topics and allowed for the creation of a reference map for digital education within the university.

Furthermore, three surveys were conducted: two aimed at students and one at teachers. The surveys targeting students aimed to evaluate the impact of educational interventions during the pandemic and measure the level of satisfaction and expectations of the students. The survey directed at teachers sought to capture their desired approach to post-pandemic teaching. It also provides a better understanding of their stance towards

online teaching based on their experiences during the pandemic and identifying potential avenues for development.

Thanks to the surveys conducted in 2022, the term "innovative teaching" was included among the activities recorded in teachers' educational portfolios. This was done to encourage teachers to systematize the quality innovations introduced during the emergency period and to recognize and value experiences of change.

References

1. Coggi, C., Ricchiardi, P., Torre, E.: Formare alla didattica e alla valutazione i docenti in servizio: un bilancio di cinque edizioni di IRIDI FULL. In: Coggi, C. (eds) Formare i docenti universitari alla didattica e alla valutazione. Temi di approfondimento ed efficacia dei percorsi IRIDI. pp. 70-121. Franco Angeli, Milano (2022).
2. Coggi, C.: Innovare la didattica e la valutazione in Università. Il progetto IRIDI per la formazione dei docenti. Franco Angeli, Milano, (2019).
3. Gallino, L.: Tecnologie della cultura, società in rete. Una sfida per la formazione universitaria. Quaderni di Sociologia 31, 66-82 (2003).

Technology-Enhanced Assessment and Feedback: from literature review and analysis of practices to the design of a MOOC to scaffold academic development processes

Federica Picasso[1], Daniele Agostini[1], Paola Venuti[1] and Anna Serbati[1]

[1] University of Trento, Trento, Italy
federica.picasso@unitn.it

1 Introduction

In the Higher Education context there is a growing focus on the development of academics' digital competencies to sustain their competences as Digital Scholars [1]. The importance of this topic is also highlighted by frameworks such as the DigCompEdu [2] with its six main areas of competence (1 Professional Engagement; 2 Digital Resources; 3 Teaching and Learning; 4 Assessment; 5 Empowering Learners; 6 Facilitating Learners' Digital Competence). This study explores the area of assessment and in particular, this work aims to describe the research process carried out during the last year in terms of Technology-Enhanced Assessment (TEA) [3] and Feedback models and practices in national and international context. Starting from the results produced by two main previously research actions - a national syllabi analysis to identify university teachers' use of technology-enhanced assessment and feedback practices and a systematic literature review process that aimed to explore the existing Academic Development actions, programs and models to scaffold TEA practices in the international scenario - the research group of the Teaching and Learning Centre of the University of Trento is now creating a Massive Open Online Course to scaffold the development of specific digital competencies connected to the field of assessment and feedback practices enhanced by the use of technology.

2 Aims and Methods

The study aims to answer to the following questions:

1. What technology-enhanced practices do university teachers implement in their assessment processes?
2. What are the types of academic development (AD) models that foster technology enhanced assessment and feedback competencies and practices within higher education teaching and learning processes?
3. What are the characteristics and what is the impact of a training model developed to support TEA practices?

In order to answer the first research question a sample of 3008 university teachers belonging to the Italian state and non-state Universities was identified through a simple

random sampling with proportional allocation. The sample analysed was constituted by a subpopulation (n=3008 teachers) of 5% of the comprehensive population (n=60158) and it was extracted by stratifying the entire population of Italian lecturers of all state and private universities. After the sample identification we randomly selected, for each lecturer, the Syllabus referred to a single teaching unit [4].
For the second research question, a systematic literature review, developed through the use of the PRISMA model, was carried out using two international online databases, the Education Resources Information Center (ERIC) and Scopus; 20 articles (tot=494) were taken into account in the systematic literature review process. We focused on articles on higher education, that identify academic development frameworks, models, key conditions, practices, programs and principles connected to the aspect of continuous and specialised professional development in higher education. As a final step, in the light of syllabi analysis and systematic review's results, we developed a training model to support TEA practices: such models start with a MOOC for UniTrento academics to be implemented in the LMS university platform, in order to scaffold the development of academics' digital competencies in the field of TEA.

3 Results and conclusion

The syllabi analysis, previously developed, highlighted that there is a low usage of TEA practices reported by Italian university teachers: in fact, on a total of 4400 assessment practices identified, only the 3,3% (n=144) represented TEA practices. In detail, 91 (63.2%) were represented by Computer Based Assessment practices (CBA) [5], 42 (29.2%) by self and peer assessment activities and formative assessment through the use of Learning Management Systems [6], 2 (1.4%) by activities proposed through semi-automated Marking systems and tools [7] and 9 (6.3%) by E-activities. The results of the literature review emphasise that there is a real and growing attention on the topic of academic development to promote digital competencies, but it appears that the area of TEA academic development models and practices is quite under investigated and then it requires future research actions. There was a scarcity of models in the literature referring to training paths and the use of good practices in TEA field. The clusters identified in the analysis were the following: academics' competencies; AD approaches; AD actors and strategies; research findings on implementation. The lack of current practices in the Italian scenario and of research on academic development models to scaffold TEA competences informed our decision to offer a MOOC on UniTrento Moodle for our academics, as a resource to cover this reduced deepening of the theme. Models found in literature - even though not many – and practices found in the syllabi analysis played a crucial role in the design of the MOOC. The formative path is composed by four self-consistent interactive modules with related self-assessment and guided design activities for participating academics. This phase will be followed by a co-design of TEA practices in actual academics' classes in order to explore the impacts of such practices on teachers' and students' satisfaction and performances.

4 References

1. Weller, M.: *The digital scholar: How technology is transforming academic practice*. A&C Black (2011).
2. Redecker, C., Punie, Y.: *Digital Competence of Educators.* Edited by Yves Punie (2017).
3. Devedzic, V. & Devedzic, M.: Technology-Enhanced Assessment at universities and in schools: An initiative. *International Journal of Learning and Teaching*. 11(3), 89-98 (2019).
4. Picasso, F., Doria, B., Grion, V., Venuti, P., Serbati, A. What Technology Enhanced Assessment and Feedback Practices do Italian Academics Declare in Their Syllabi? Analysis and Reflections to Support Academic Development. In: Fulantelli, G., Burgos, D., Casalino, G., Cimitile, M., Lo Bosco, G., Taibi, D. (eds) *Higher Education Learning Methodologies and Technologies Online.* HELMeTO 2022. Communications in Computer and Information Science, vol 1779. Springer, Cham (2023). https://doi.org/10.1007/978-3-031-29800-4_21.
5. Sim G., Holifield P., & Brown M. Implementation of computer assisted assessment: Lessons from the literature. *Research in Learning Technology*, 12(3) (2004).
6. Burrows S., & Shortis M. An evaluation of semi-automated, collaborative marking and feedback systems: Academic staff perspectives. *Australasian Journal of Educational Technology*, 27(7) (2011).
7. Shortis M. & Burrows S. A review of the status of online, semi-automated marking and feedback systems. *ATN Assessment Conference 2009: Assessment in Different Dimensions*, p. 302 (2009).

Academic staff training program for online teaching in higher education

Paolo Raviolo[0000-0002-2876-514X], Marco Rondonotti[0000-0003-1579-6737] and Laura Giulio[0009-0004-3571-0683]

University eCampus
paolo.raviolo@uniecampus.it; marco.rondonotti@uniecampus.it; laura.giulio@uniecampus.it

1 Introduction

Faculty development is a widely discussed topic in British and American academia [1][2]. Bergquist and Phillips [3] argue that it seeks to bring about change at three levels: attitudes, processes, and structures. Faculty development is designed to improve teaching and research through the professional development of academic staff. This approach has gained prominence in European academia since the implementation of the Bologna Process and the creation of the European Higher Education Area (EHEA) [4]. In addition, ANVUR has begun to pay increasing attention to the training activities of university teachers with regard to the quality of teaching and research [5]. This requires an assessment of the quality of teaching and research in higher education institutions in all European countries, while respecting national autonomy.

Online higher education has experienced significant growth, including in Italy, thanks to the development of technologies and infrastructures [7]. In the 2021-2022 academic year, online education accounted for over 15% of university course enrolments. This figure is even more significant when one considers that in 2000 it was less than 2%.

The growth of online courses poses additional challenges for faculty development. These courses require both pedagogical and technological skills, as well as the establishment of entirely new structures and processes. They also require a different dynamic between teachers and students, facilitated by technology and organisational arrangements [7].

The increase in the number of students, lecturers and tutors has underlined the central importance of faculty development for universities offering a significant number of online courses. This is particularly relevant for telematic universities, where the entire course offering is online.

In online universities, where courses are normally delivered online, lecturer and tutor training has always been a key focus in view of the very specific technological and organisational environment [8]. This paper presents an example of a strategic continuous training programme for lecturers and tutors to ensure an appropriate approach to learning design and operational skills.

2 Faculty Development in eCampus University

In 2022, eCampus University established a University Commission for Faculty Development, consisting of teaching and learning experts, professors, and senior tutors from all five faculties of the University.

The Commission has the following responsibilities:

a) Designing and implementing the university's continuing education plan.

b) Monitoring training outcomes and reporting to Quality Assurance.

c) Ensuring coordination between all functions and areas involved in the training process.

The continuous training plan is structured around collegial training meetings, followed by remote workshops that allow learners to work directly in the university's digital environment with the support of experts and tutors.

In terms of university infrastructure, an important milestone was the establishment of the eCampus Academy in August 2022. This dedicated e-learning infrastructure supports university staff, including office staff, lecturers and tutors. It provides training environments for the University's main systems (Eppi, ECCE, ESSE3) that simulate the activities carried out by lecturers for teaching purposes. These activities include uploading teaching materials, managing student communication through messaging, preparing and marking exams, and more. As a result, training and workshops no longer need to be conducted on production environments or with simple slides.

The primary role of the eCampus Academy is to support the professional development of various stakeholders within the university, ensuring their continuous growth and formal recognition of their skills.

With regard to the first results of the Faculty in eCampus work plan, from August to May 2023 (data updated on 23 May 2023), a total of 1,381 people have been trained, including lecturers, course tutors and course orientators. In addition, 352 badges have been awarded. In addition, 144 synchronous distance learning webinars totalling 564 hours and 29 face-to-face training sessions totalling 202 hours have been delivered. There are currently 352 backend users with high level profiles who can enter the names of people to be trained on the portal. In addition, there are currently 10 active courses.

The University's continuous training plan is designed for both beginners and experienced teachers, and mixed teams are formed to facilitate the exchange of experiences and best practices.

3 Results

In the near future, there will be a significant increase in the number of users and training hours involved in Faculty Development. This growth will result from the active participation of current faculty members and the recruitment of new faculty members with diverse educational backgrounds. In addition, the organisational aspect of Faculty Development will be strengthened by the introduction of mentoring figures who will provide more personalised and informal support.

Another challenge that will arise is the implementation of a systematic evaluation process, which will include the incorporation of specific indicators into the quality assurance system for teaching and research. This will require the development of an evaluation system for lecturers trained through the University Commission programmes. A comprehensive analysis of the entire faculty system on eCampus will also be carried out so as to gain insight into the positive results.

References

1. Lidolf, S., Pasco, D. Educational technology professional development in higher education: A systematic literature review of empirical research. Frontiers in Education, 5 (2020).
2. Raviolo P. Online Higher Education Teaching Practices, IC4E Tokio 2019 proceedings, Tokio (JP) 9-11 gennaio, ACM (2019).
3. Bergquist, W. H., Phillips, S. R. A handbook for faculty development. DansvilePress, New York (1975).
4. Lay, C. D., Allman, B., Cutri, R. M., Kimmons, R. Examining a decade of research in online teacher professional development. Frontiers in Education, 5 (2020).
5. ANVUR Delibera n. 40 del 25/02/2021 Oggetto: Costituzione del Gruppo di lavoro "Riconoscimento e valorizzazione delle competenze didattiche della docenza universitaria".
6. Lotti, A., Lampugnani, P. A. (eds). Faculty development in Italia: valorizzazione delle competenze didattiche dei docenti universitari. Genova University Press, Genova (2020).
7. Raviolo, P. Learning design e software design: analogie e interazioni per l'educazione superiore. In: Le Società per la società: ricerca, scenari, emergenze. SIRD, vol. 3, p. 59-66, Pensa MultiMedia, Lecce (2020).
8. Raviolo, P., Messina, S., Mauro, I., Rondonotti, M. The role of etutoring in eCampus University. In: Casalino, G., Pecori, R. (eds). Helmeto 2020 Book of Abstracts. Studium, Città di Castello (2020)

Faculty development and digital technologies: a systematic review

Paolo Raviolo[1] [0000-0002-2876-514X], Matteo Adamoli[2] [0000-0001-9149-3944], Laura Fedeli[3] [0000-0002-1509-0323], Alessia Scarinci[4] [0000-0002-3174-7137], Marco Rondonotti[5] [0000-0003-1579-6737]

[1] eCampus University (Italy); [2] IUSVE - Salesian University Institute of Venice (Italy); [3] University of Macerata (Italy); [4] Mercatorum University (Italy); [5] eCampus University (Italy)

paolo.raviolo@uniecampus.it; m.adamoli@iusve.it; laura.fedeli@unimc.it; alessia.scarinci@unimercatorum.it; marco.rondonotti@uniecampus.it

1 Introduction

In the research field of educational technology, Belt and Lowenthal's [1] literature review of scholarly articles, published from 2013 to 2018, highlighted how the integration of digital technologies into the teaching/learning processes can be a central issue for Faculty Development (FD) initiatives.

Besides, the recent pandemic emergency has encouraged a further development of studies on weaknesses and potentialities of teaching at a distance and higher education systems gained the opportunity to rethink strategic solutions at the organizational [2][3], methodological and infrastructure level in order to enhance the adoption of learning technologies and develop the related teaching skills of faculties [4].

Starting from this scenario, the SIPED work group 'Faculty Development and University Teaching'[1] planned to carry out a systematic review and investigate some central aspects of the research field of FD, including the impact of technologies on teaching methods, learning processes and evaluation systems [5]. Specifically, this contribution presents the first results of the sub-group of researchers who worked on the role of technologies both as means in the professional development of teaching approaches and methods and as disciplinary focus of faculty's training. The overall objective is to investigate the extent and implications of technology integration in FD processes (at individual, community and organizational level).

2 Review overview

The SIPED sub-working group 6 addressed FD in connection with the areas of Instructional Technologies. The review started from identifying the research question: "What are the possible interactions between instructional technologies and FD in Higher Education?". The second step, according to the Prisma framework [6], was the

[1] Società Italiana di Pedagogia (SIPED), *Faculty Development and University Teaching work group*, <https://www.siped.it/gruppi-di-lavoro/faculty-development-e-didattica-universitaria/>.

definition of the key words to be used to search the three selected databases: Scopus, Web of Science and Google Scholar. Finally, after an extensive discussion, the following key words were chosen: “faculty development”, “higher education”, “technology”, “digital”, “online”. Inclusion and exclusion criteria were agreed among the different sub-groups and a time frame of five years was set (2017-2022) when searching for published research outputs written either in Italian or English. The search was developed using the following strings, that were identified after the needed checks and refinement: (1) Scopus: (LANGUAGE(italian or english) AND TITLE-ABS-KEY ("faculty development" and "higher education") AND TITLE-ABS-KEY (digital or technology or online) AND NOT TITLE-ABS-KEY (school)) AND PUBYEAR > 2016 AND PUBYEAR < 2023 AND (LIMIT-TO (OA,"all")): (2) Web of Science: ((((PY=(2017-2022)) AND LA=(Italian OR English)) AND TS=("Faculty development" , "higher education")) OR TS=(digital, technology, online)) NOT TS=(school), (3) Scholar: "faculty development", AND "higher education", AND (technology, OR digital, OR online) –school. The search process through Scholar did not allow researchers to set the time frame within the string and we had to refine the research on the result list.

The additional inclusion criteria regarded the type of publications, that is, open access documents only (journal articles, book chapters) excluding conference proceedings and books.

The final data (as resulted on 13-02-2023) showed: 48 records on Scholar, 685 on Web of Science, 108 on Google Scholar.

The three categories proposed by Bergquist & Phillips [7] (attitudes, processes and structures) in their formalization of FD and instructional technologies were used for an initial coding process. Authors define “attitudes” as the actions or programs targeting the attitudes of the academic personnel, the “processes” deals with the change in organization connected directly to FD, while “structures” are connected to the organization asset to support FD (i.e. organization or IT assets).

The abstract screening had the objective to furtherly exclude papers/outputs not relevant to the objective of the study, and to proceed with an initial coding process for the remaining research items. The screening results show the following data organized around databases and categories (table 1):

	Scholar (108)	Scopus (48)	Web of Science (685)
Discarded	31	18	562
Full text analysis needed			
Attitudes	1	4	10
Processes	3	19	10
Structures	0	1	12
Reviews	32	2	61

In conclusion, this first screening produced as results: 15 research outputs for the category of attitudes, 32 in processes, 13 in structures, 43 papers were identified as needing further reflection and analysis and 95 were coded as reviews; the total number of items that were discarded is 643. The analysis of the full papers will engage all group

members who will triangulate their coding process and share a sub-categorization proposal in order to organize the presentation of the results.

References

1. Belt, E., & Lowenthal, P. (2019). Developing faculty to teach with technology: Themes from the literature. *TechTrends*, *64*(2), 248-259.
2. Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., ... & Lam, S. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, *3*(1), 1-20.
3. Farnell, T., Skledar Matijevic, A., & Ščukanec Schmidt, N. (2021). The Impact of COVID-19 on Higher Education: A Review of Emerging Evidence. *Analytical Report*. European Commission.
4. Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive learning environments*, 1-13.
5. Raviolo, P. (2019). Online higher education teaching practices. In *Proceedings of the 10th International Conference on E-Education, E-Business, E-Management and E-Learning*, 79-84.
6. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, R.C., Glanville J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P. & Moher, D. (2021).
   David Moher, The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Revista Espanola De Cardiologia* (English Ed.), 74(9), 790-799.
7. Bergquist, W. H., & Phillips, S. R. (1975). *A handbook for faculty development*. New York: DansvilePress.

A pre-post syllabus analysis to assess the impact of the TILD faculty development program.

Andrea Tinterri[1] [0000-0001-5891-505X], Marta De Angelis[2][0000-0003-3079-3729], Antonella Lotti[1][0000-0003-0243-5705], Isabella Loiodice[1], Anna Serbati[3][0000-0002-3528-2488], and Anna Dipace[4][0000-0003-0243-5705]

[1]Department of Humanities, University of Foggia, 71121 Foggia, Italy
[2]University of Molise, Via Francesco De Sanctis, 1 Campobasso, Italy
[3]University of Trento, via Calepina, 14 - I-38122 Trento, Italy
[4] Department of Medical and Surgery sciences, University of Foggia, 71121 Foggia, Italy

andrea.tinterri@unifg.it

1 Introduction

The goal of faculty development is to promote upskilling of the instructional competencies of university teachers. One of the most critical issues is evaluating the effectiveness of the training; to this aim, defining an evaluation plan beforehand is crucial [1]. Kirkpatrick's Four Levels of Training Evaluation [2] is a popular model to evaluate the efficacy of training within an organization. It consists of 4 levels: reaction, learning, behavior, and results, each level being measured trough different indicators defined *a priori*. The Teaching and Learning Development (TILD) project is a faculty development research-formation program that has been active from 2020 to 2022 at the University of Foggia [3]. Its main goal is to promote student-centered education and active learning and is aimed at all teachers (researchers, associate, and full professors). The scientific committee of the program planned the evaluation of the impact for all four levels. This article evaluates the effectiveness of the training at the Results level through the analysis of the syllabi of participants before and after training. The course had 14 modules, of which two were dedicated to the writing of an effective syllabus (Table 1).
RQ1: Did participants write more effective syllabi post training?
RQ2: Which parts of the syllabi were most affected by the training?

Table 1. Modules of the TILD training dedicated to writing an effective syllabus.

Module n.	Content	Duration	Teacher
2	6 Video-lessons (asynchronous)	56' total	Anna Serbati
2	1 Workshop (synchronous)	240'	Anna Serbati
2	2 Syllabus evaluation exercises (asynchronous)	30' each	Anna Serbati
3	4 Video-lessons (asynchronous)	30' total	Catherine Riley
3	1 Workshop (synchronous)	120'	Catherine Riley

2 Material and Methods

The method of choice was a pre-post analysis adopting a convenience sampling. Teachers who participated to the TILD program were invited to submit their syllabi for the current academic year (2022/23); as an incentive, a small money prize was allocated for syllabi who would pass a certain quality threshold. The syllabi of the same course for a previous academic year (2020/21) were recovered via the University platform. The syllabi were assessed according to the rubric developed and validated by Serbati et al. [4], which was slightly adapted to assign numerical values to the different indicators, up to 100. The scientific committee named seven expert evaluators, including researchers, post-docs, and PhD students, who evaluated the syllabi from October 2022 to January 2023. Several steps were taken to ensure reliability and validity of the process:

- A first training webinar held by Anna Serbati to explain the assessment instrument.
- An open meeting to discuss the rubric and its adaptation for the aims of the project.
- A preliminary phase during which 6 sample syllabi were independently evaluated, followed by an open discussion to develop common evaluation criteria.
- Six evaluators were divided in couples according to their relative evaluation criteria (Cohen's k= 0.7, 0.9 and 0.9 for the three couples). The seventh evaluator operated random triangulations with all couples to ensure internal reliability.
- Specific cases were discussed in an open meeting with the participation of members of the TILD scientific committee.

3 Results

A total of 125 syllabi (59 pre and 66 post) were analyzed; in 7 cases, the pre- syllabus was not available, as in previous years the course was not active or held by a different teacher; those cases were excluded from the analysis. Overall, the mean overall score of the syllabi went from 48.7(±11.6)/100 to 72.6(±15.5)/100 ($p<0.001$, Wilcoxon's signed-rank test). We further analyzed within the syllabi the three sections whose topic were most addressed by the TILD program: learning goals (LG), teaching methods (TM), and assessment methods (AM). All the sections presented the same, statistically significant, upwards trend in pre-post analysis. However, whereas TM was the section that shown the biggest pre-post difference, from an average of 6.02±(3.64)/20 to 13.5±(6.01)/20, AM showed the lowest net increase, from 5.62±2.10/15 to 8.67±3.04/15.

4 Conclusion

These preliminary results could partially be explained with the prevalence that teaching and learning methods had in the overall course structure compared to the topic of assessment. Therefore, a pre-post analysis of course syllabi can offer both an indication of the impact of a faculty development program at the results level as well as an indication of areas of improvement for further iterations of the training.

References

[1] Bergquist, W. H., & Phillips, S. R. (1975). Components of an effective faculty development program. *The Journal of Higher Education*, *46*(2), 177-211.

[2] Kirkpatrick, D. L. (1994). Evaluating Training Programs. The Four Levels. Berrett-Koehler Organizational Performance Series.

[3] Lotti, A., Bosco, A., Dipace, A., & Limone, P. (2022). Valutazione di un intervento online di Faculty Development: il modello del Progetto TILD dell'Università di Foggia. In *Il Post Digitale. Società, Culture, Didattica* (pp. 235-249). Franco Angeli.

[4] Serbati, A., Maniero, S., Bracale, M., & Caretta, S. (2021). Come costruire un Syllabus Learner-centred? Creazione e Validazione di una Rubrica di (Auto)valutazione del Syllabus. *Excellence and Innovation in Learning and Teaching - Open Access*, *6*(1). https://doi.org/10.3280/exioa1-2021oa12067Author, F., Author, S.: Title of a proceedings paper. In: Editor, F., Editor, S. (eds.) CONFERENCE 2016, LNCS, vol. 9999, pp. 1–13. Springer, Heidelberg (2016).

Monitoring Faculty Development: with data, beyond data

Marina de Rossi[1][0000-0002-2781-5547] Juliana E. Raffaghelli[2][0000-0002-8753-6478] and Alberto Antonello[3] [0009-0001-0996-8275]

[1 2 3] University of Padua, PD 35137, Italy
marina.derossi,juliana.raffaghelli@unipd.it
albertoantonello@icloud.com

In the pandemic aftermath, quality teaching in Higher Education gained momentum [1], [2]. In this regard, the implementation of faculty development (FD) should not be linked solely to attending courses [3],[4],[5]. Ensuring the significance of innovations in FD requires a careful initial examination of the context, a continuous monitoring of the investments made and of expected returns in terms of professional learning, motivation and effective application of techniques and resources in class. Most importantly, there is a need ~~of~~ to evaluate students' engagement, participation, satisfaction and learning achievements after supporting academic teachers to apply new teaching methods. Therefore, care should be taken to verify the validity of the training proposals and their technical management, as well as its sustainability. In such a scenario, generating educational data, as well as sharing them to improve teaching-learning processes and practices, could be part of a culture of quality [2]. While artificial intelligence (AI) technologies continue to grow, data-driven practices could integrate the academic community's efforts to understand, discuss and foster the quality of pedagogies. Nonetheless, this is a double-edged sword, since data driven practices need to be carefully connected with organizational processes and culture [6]. As a result, the adoption of data-informed systems should not be deemed as a "take out of the shelf" solution, but as a tailored instrument, incorporating new spaces for participation from the outset of such systems. Moreover, a data culture in Higher Education should promote reflection about teaching and learning practices, the quality system, and the performance of the university (What is measured? For which purposes?). Accordingly, since 2021, the University of Padua has established the Monitoring Group for the already established Faculty Development programme "Teaching4Learning@Unipd" (or T4L), which was launched in 2016. The group investigates the outcomes of the T4L programme, building on existing data points, and discussing the available sources of information~~,~~ already created by the university. This effort aims to inform stakeholders about the progress of such FD activities. The Monitoring Group is multidisciplinary and supported by multiple skills, including institutional advisors, researchers, experts of innovative teaching (change agents) and technical administrative staff of the Service Accreditation and quality of teaching.

In this paper, we report the progress of the research carried out by the Monitoring group. Following an initial report exploiting panel data to estimate the impact of innovative teaching on students' learning [7], our study focused on self-reported measures, examining students and teachers' perceptions regarding the implementation of active methods in class. We collected 241 valid responses from academic teachers (113 T4L-trained and 128 non-trained teachers) and 130 from students of trained teachers.

Through a one-way non-parametric multivariate analysis test (PERMANOVA), we found a statistically significant difference between the T4L and non-T4L teachers (in favour of the former) in the application of technology-mediated interactive methods, both in the classroom and with distance-learning (*F(1, 231) = 7.71, p < .001)*. We hypothesised a positive relationship between the perception of implementation of methods by the teacher and a corresponding perception by the students. We indeed estimate a Pearson correlation of 0.42, which is statistically different from zero with *p*-value < .0001 *(t = 9.43)*.

In addition, we ~~also~~ observed higher motivation and self-reflection on teachers' own teaching competence as well as pedagogical relationships among T4L-treated instructors (*F = 9.08, p < .001)*. Finally, consistent with other studies, we also found a perception of higher relative workload in making changes to curricula and classroom activities from an active teaching perspective~~:~~ ($\chi^2 = 4.363$, *p*-value < .05). The results are discussed in light of the monitoring approach, the sustainability of the measurements, and the forms of dissemination oriented towards a culture of quality that is both data-driven and participatory.

References

1. Cruz, L.; Grodziak, E. SoTL under Stress: Rethinking Teaching and Learning Scholarship during a Global Pandemic. *Teach. Learn. Inq. 9* (1), 3–12 (2021), https://doi.org/10.20343/teachlearninqu.9.1.2.
2. De Rossi, M. *Lo sviluppo nella qualità dell'insegnamento. Contestualizzare l'esempio virtuoso dell'Università di Padova*; T4L Report 2023; Università degli Studi di Padova; pp 8–11 (2023). https://www.unipd.it/sites/unipd.it/files/2023/T4L_report2023.pdf, last accessed 2023/08/04.
3. De Rossi, M.; Fedeli, M. *Costruire percorsi di faculty development Didattiche, Tecnologie e Media Education - Frontiere per la sostenibilità*; Pensa MultiMedia Editore: Lecce, (2022).
4. Bahar-Ozvaris, S.; Aslan, D.; Sahin-Hodoglugil, N.; Sayek, I. A Faculty Development Program Evaluation: From Needs Assessment to Long-Term Effects, of the Teaching Skills Improvement Program. *Teach. Learn. Med. 16* (4), 368–375. (2004), https://doi.org/10.1207/s15328015tlm1604_11.
5. Fernandez, N.; Audétat, M.-C. Faculty Development Program Evaluation: A Need to Embrace Complexity. *Adv. Med. Educ. Pract. 10*, 191–199 (2019) https://doi.org/10.2147/AMEP.S188164.
6. Raffaghelli, J. E.; Grion, V.; de Rossi, M. Data Practices in Quality Evaluation and Assessment: Two Universities at a Glance. *High. Educ. Q. 77* (1), 7-26, (2023) . https://doi.org/10.1111/hequ.12361.
7. Castegini, M.; Antonello, A. *Report T4L* In De Rossi, M., De Marchi, V., Series Eds.; Università degli Studi di Padova, (2023); pp 1–44. https://www.unipd.it/sites/unipd.it/files/2023/T4L_report2023.pdf. last accessed 2023/08/04

Università di Foggia

sirem

LSh

HELMeTO 2023
UNIVERSITY OF FOGGIA

5th International Conference on
Higher Education Learning Methodologies and Technologies Online

Foggia, September 13th - 15th, 2023

ISBN 978-88-99978-64-8