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**6th International Conference**

**Higher Education Learning Methodologies and Technologies Online**

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# Book of Abstracts

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The 6th International Conference on Higher Education Learning Methodologies and Technologies Online (HELMeTO 2024) showcases the increasing academic and professional interest in converging learning methodologies and educational technologies. This year's edition has once again underscored the importance of embracing an interdisciplinary approach, uniting researchers, educators, and practitioners from various fields to explore creative solutions for the future of higher education.

As HELMeTO continues to evolve, this marks the third consecutive year that the event has been organized as a full-scale conference, transitioning from its origins as a workshop. The event has experienced remarkable growth, attracting 102 submissions from over 338 authors representing 17 countries, including Italy, Malta, Germany, Ukraine, Slovakia, Austria, Canada, Argentina, the Netherlands, Greece, Sweden, Latvia, the United Kingdom, Morocco, Belgium, and Lithuania. This broad participation highlights the conference's international scope and role as a platform for exchanging ideas and best practices in online learning and education technology.

The 2024 edition, hosted through a joint collaboration between E-Campus University and Università Telematica Unipegaso and sponsored by the Società Italiana per l'Educazione Mediale, Società Italiana di Ricerca Didattica, Università Telematica Unipegaso and E-Campus Università, offered a various program. It featured dozens of high-quality contributions organized into seven special tracks and two general tracks. Participants explored the complex relationship between technology and pedagogy during the presentations and discussions. They highlighted established topics and emerging themes, such as artificial intelligence, augmented and virtual reality, learning analytics, and big data analytics in educational settings.

This volume aims to showcase the research's depth and diversity and provide a valuable resource for scholars and practitioners interested in the current state and future education directions. This volume's contributions represent the current international landscape of online education and offer insights into the ongoing transformations in higher education driven by the combination of teaching methods and technology. This editorial aims to help readers identify topics and research areas that align with their interests and to encourage further exploration and collaboration within the HELMeTO community.

Please note that rather than providing a detailed review of each paper, this editorial gives an overview of the main themes covered in the different tracks.

The main tracks of the conference are General Track 1 (GT1) - "Online Pedagogy and Learning Methodologies", and General Track 2 (GT2) - "Learning Technologies, Data Analytics, and Educational Big Data Mining". GT1 focuses on the strategies, techniques, and practices used to facilitate effective teaching and learning in digital environments. It involves adapting traditional pedagogical approaches to online platforms while leveraging digital tools. GT2 is about learning technologies, data analytics, and educational big data mining and how they are transforming education by using digital tools and large-scale data to enhance teaching, learning, and decision-making.

Special track 1, "Inclusion and immersive approaches for higher education", focuses on the transformative roles of immersive technologies in enhancing inclusion within higher education. The track covers three primary areas of focus. Firstly, it discusses Multimodal and Immersive Systems for Skills Development, highlighting the decade-long evolution of virtual and augmented reality technologies. These systems, powered by AI and sensor technologies, provide personalized, context-rich learning experiences that mirror real-world environments, aiming to transform educational paradigms. Research continues to enhance the efficacy of these technologies through improved real-time feedback and sensory data integration.
Secondly, the track emphasizes the importance of Supporting Students with Special Needs. It advocates for robust institutional support systems and e-learning technologies to ensure that all students, especially those with learning disorders or disabilities, have equal opportunities for academic success.
Lastly, It invites contributions that discuss adopting online technologies in teacher education, including innovative practices like MOOCs, mobile learning, and serious games, focused on pre-service and in-service teacher training, especially in special education contexts.

Special Track 2, "Artificial Intelligence and Innovative Technology for Special Education", focuses on how Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) are transforming education, particularly for students with Special Educational Needs (SEN). These technologies make learning more interactive, accessible, and inclusive by creating adaptive environments that cater to diverse needs.
Emphasizing a human-centered approach, this track explores how AI, AR, and VR can promote social equity and economic participation, aligning with Nussbaum's view of inclusion as a matter of justice. The contributions examine innovative ways to use these technologies to support inclusive learning, enhance special education, and improve skills for broader societal engagement.

Special track 3, "Learning Technologies and Faculty Development in the Digital Framework", focuses on the transformative impact of digital technologies in higher education. It highlights how digital frameworks are reshaping academics' professional identities and teaching competencies. The track emphasizes the need to reflect on how these technologies influence curriculum design and teaching, learning, and assessment methodologies, making such reflections critical for faculty development initiatives in the evolving educational landscape.

Special track 4, "Critical Pedagogy, Art, Affect as Method, and Performativity in Online Higher Education", explores integrating critical pedagogy, art, and performativity in online higher education. It consists of two themes: "Critical Pedagogy, Art, and Affect as Method" and "Performativity and Agentivity." The first theme focuses on the transformative potential of art in engaging students in critical reflection, while the second one reframes teaching as a performative act. The track investigates how these innovative approaches can make

online higher education more reflective, inclusive, and engaging.

Special track 5, "Intelligent Tutoring Systems and Conversational Pedagogical Agents in Higher Education", investigates the integration of intelligent tutoring systems and adaptive conversational agents within the context of higher education, with a focus on personalized learning and administrative support. Key areas of interest include personalized tutoring, which aids students, particularly in remote learning settings; automated essay grading, providing valuable feedback to both students and faculty during thesis preparation; and administrative assistance for educational institutions. Additionally, the track addresses adaptive learning systems, which tailor educational content based on individual learning progress, and interactive learning environments designed to enhance engagement and motivation.

Special track 6, "Rethink Education: The Opportunities and Challenges of Artificial Intelligence," focused on exploring the potential and challenges of integrating Artificial Intelligence in education. It aimed to identify key areas where AI can enhance learning through personalized learning systems, intelligent tutoring, chatbots, and automated assessments. It also addressed ethical considerations, data privacy, teacher training, infrastructure needs, and Explainable AI. Particular attention has been given to the application of Large Language Models in the educational environment.

Finally, Special Track 7, titled "Laboratory Teaching and Experiential Learning in Digital Environments", discusses the impact of distance learning on education. While this shift has made education more accessible, it also necessitates a rethinking of teaching methods to adapt to virtual environments. This is exemplified by the "Pedagogy-Space-Technology" (PST) model. The contributions in this special track focus on how university teaching practices are evolving towards active and effective learning strategies, aimed at enhancing professional development for both teachers and students.

In conclusion, the 6th International Conference on Higher Education Learning Methodologies and Technologies Online emphasized the dynamic intersection of educational methodologies and technology, highlighting the importance of interdisciplinary collaboration. The conference included various tracks focusing on essential themes such as AI, immersive learning, inclusion, faculty development, and innovative teaching methods. Researchers from 17 countries contributed to this edition, demonstrating the HELMeTO's role in advancing online education. By examining established and emerging trends, HELMeTO 2024 provides valuable insights into the evolving landscape of higher education.

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## General Track 1

# Online pedagogy and learning methodologies

# Exploring New Avenues in Formative Assessment for School Teachers: An Engaging, Computer-Based, and Situated Design

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## 1 Introduction

The role of teachers has become increasingly important worldwide. In most countries, researchers and policymakers acknowledge the fundamental role of teachers in society, emphasizing the importance of their professionalism and quality, which is a result of the degree structure of higher education [1, 2]. In addition, contemporary education increasingly focuses on cooperative learning to better prepare learners for the demands of the modern workforce. Thus, this expertise is particularly relevant for teachers, as they can influence collaborative skills among students [3], which is a crucial goal for the future of education [4]. The first step toward effectively improving specific skills is *assessment*, which allows a clear understanding of strengths and weaknesses and offers precise feedback to guide interventions. This study aims to investigate the acceptance and effectiveness of an online test designed to evaluate the skills and competencies of early primary education teachers in a non-evaluative setting. Specifically, the study examines whether interaction with the tool was perceived as a form of evaluation. In particular, we present a test for assessing soft skills in early primary education teachers, developed using Competence-based Knowledge Space Theory (CbKST) [5] to precisely identify the skills that teachers already master and those they are ready to learn. The formative assessment was designed to capture and maintain the interest by engaging participants in typical role-play school scenarios. This approach ensured the tool's success, making it appear neither evaluative nor stressful.

## 2 Methods and rationale

While developing the assessment tool, we faced several challenges that shaped the design of an experience to evaluate collaborative and teamwork skills in pre-primary and primary school teachers. First, the assessed skills needed to be observable in the individuals' behaviors alone, but should involve interaction with

others. Second, the test had to provide a non-evaluative context so that teachers did not feel they were being evaluated. Third, the item responses should be formatted to reduce the likelihood of socially desirable answers, and all item responses must be independent. The entire test is computer-based and based on situated action theory [6], placing teachers in realistic scenarios where they must demonstrate collaborative and teamwork skills with computer agents. The immersive narrative ensures teachers engage in team discussions, handle student interactions, and collaborate with colleagues without feeling evaluated. This approach encourages genuine responses and provides an accurate measure of skills independent of others' performances by controlling feedback from the computer agents. The test consists of 20 mandatory, sequential items where teachers must indicate their preferred behavior in various situations. Responses are multiple-choice with equally socially desirable options, or short free-form descriptions. Teachers can review and modify their answers. Items are dichotomously scored. A post-test interview was used to verify the efficacy of the assessment tool.

## 3 Results

One hundred teachers from public and private schools in Italy compiled the test. They used the Zoom platform to connect with the administrator and remained connected during the individual assessment; afterwards, they were interviewed. Overall, they found the experience unexpectedly engaging and motivating, and did not feel evaluated. All teachers struggled to grasp the true objectives of the activity. After a brief group discussion, they realized some of their answers might have been incorrect, but they insisted that their responses were spontaneous. Therefore, a potential second test administration might capture revised responses. Participants spent an average of 23 minutes on the test, perceiving the time as shorter than expected (approx. 10 min.). The interface was user-friendly, and understanding the narrative's progression posed no issues. However, three teachers noted the occasional absence of their conceived answer options.

## 4 Conclusions

In conclusion, the study highlighted several promising aspects of the online test, which effectively engaged teachers in a non-evaluative environment. Additionally, it is worth noting that teachers from the same school used the activity to facilitate a focus group on teaching professionalism. The insights gained from this initial administration can guide future improvements to the assessment tool, aiming for a more effective evaluation of teachers' skills and competencies. Moreover, the methodology's general applicability and flexibility in item identification suggest that it could be used across various educational contexts and levels, including higher education institutions. Once its validity is confirmed, the test could also be implemented in schools and higher education institutions to monitor and assess collaborative and teamwork skills, allowing for the comparison of

skill development over time. Lastly, this positions the assessment as a foundational step for formative experiences in future studies.

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# Universities as strategic hubs for teachers' training: a professional development model proposal

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## 1 Preface

Teacher training represents a crucial area in which Italy is investing to promote equitable and high-quality educational pathways across the entire national territory [1, 2, 3, 4].

Recent regulations connected to the National Recovery and Resilience Plan have confirmed this direction, particularly through the set up of Multidisciplinary Centers for Teacher Training (DPCM August 4, 2023). These Centers are strategic in strengthening the synergy between schools and universities [5, 6, 7], making both initial and in-service training an opportunity for educational research and for the promotion of best practices in teaching.

The *30 and 60 CFU Qualifying Pathways*, as outlined in the aforementioned DPCM, represent a significant challenge for Italian Universities. These Pathways have been recently implemented and will continue to require considerable effort in the design and management of training programs for a huge number of current and future secondary school teachers.

Literature has long emphasized the importance of guiding educational practices with an awareness that existing methodological-didactic models are diversified and that it is crucial to adapt them to specific contexts [8, 9, 10]. Similarly, in teacher training, it may be useful to define organizational and instructional models that the Centers can tailor to the specific needs of their target audience.

## 2 Context, objectives and methodology

This paper examines the training plan designed by eCampus Telematic University (Italy) for the first edition of the *30 CFU Qualifying Pathway (ex art. 13)*.

The main objective of the study was to evaluate the effectiveness of certain organizational and instructional strategies used, with the aim of proposing a model that could be useful for large-scale online teacher training.

Approximately 14,000 teachers from all over Italy participated in the *Pathway* offered by the Multidisciplinary Center for Teacher Training (CEMFI).

The *Pathway* took place between March and May 2024, totaling 180 hours of teaching activities, consisting of six courses in the pedagogical area and one course specific to the disciplinary field relevant to the future teaching qualification.

An online video conferencing system (OVS) was used to manage the synchronous meetings, which included both lectures and workshops. During the meetings, a shared Padlet board was used by the trainers and participants. This tool allows to share contents (text, audio, video, images…), pools, links to external apps and resources and to enable comments and reactions. Each trainer had the autonomy to choose the methods and tools for conducting activities and managing communication.

The study was carried out in three phases, primarily using qualitative data collection and analysis methods.

In the initial phase, an analysis of the training program offered by the *Qualifying Pathway* was conducted. Discussions were held with the faculty in the pedagogical area to understand how they would design the individual courses.

In the second phase, the specific methodological and didactical choices made by the trainers were mapped using a semi-structured grid to analyze the layout, content, and types of interactions planned on the Padlets.

Finally, the study gathered participants' perspectives on the organizational and instructional strategies used by the trainers. The analysis of shared feedback was based on comments posted on the Padlets and findings from questionnaires and questions boxes used in some of the courses.

## 3 Early findings and conclusions

The training program of the *30 CFU Qualifying Pathway*, in line with the directions of the DPCM, allowed the eCampus University team to design and manage teaching with flexibility.

The pedagogical team led by CEMFI was aligned in their goal to offer an educational experience that was as engaging and activating as possible for the participants.

Despite the challenge of addressing a large number of teachers and operating in a fully online environment where audio-video interaction was not possible, the decision to use a shared Padlet environment seemed effective. This tool enabled trainers to organize teaching materials and workshop outputs in a user-friendly manner, despite the varied approaches in setting up the environment. Participants provided positive feedback regarding the perceived effectiveness of the strategies used, particularly in courses that integrated a delivery approach with workshops and assignments.

The analyses conducted as part of the study confirmed the importance for Universities to serve as strategic hubs in the management of teacher training, even when targeting significant numbers and in an entirely online format.

The internal flexibility of the instructional model adopted by eCampus, along with the feedback from the teachers who participated in the *Qualifying Pathway*, indicates that this approach is effective in defining universities' roles in teacher training.

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# Assessment Design Using the MOODLE Learning Platform

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## 1 Introduction

In the process of transformation of educational paradigms, educators (both didacts, theorists, and practicing teachers) face three main questions: 1) what to assess (knowledge, skills, competencies, personal progress, ...); 2) how to evaluate (oral questioning, written work, testing, presentation, defense, ...); 3) why to evaluate (to give a current or final grade, to credit the course taken, to set a rating for students, to motivate to study, ...). Assessment is also an important factor in ensuring the quality of education, evidence of pedagogical experience and teaching excellence [1; 2]. Given the challenges of today, in particular, hostilities in Ukraine [3], the problem of assessment does not lose its scientific and practical relevance.

Modern digital learning tools are changing the technologies for assessing the educational achievements of higher education applicants. Assessment is actively used not only in formal education institutions (schools, colleges, universities, etc.) [4; 5; 6], but also in non-formal educational resources [7], in particular, massive open online courses (MOOCs) [8].

## 2 Methods and results

The construction of the content and criteria for evaluating professional training in the educational standards of higher education institutions in Great Britain, Australia, Denmark and some other countries is based on John Biggs' Constructive Alignment Theory [9; 10]. Constructive Alignment Theory takes into account the activity-based nature of learning – the constructive moment, and involves the coordination of three elements: 1) goals/expected learning outcomes and criteria for their evaluation; 2) educational material – tasks, through the solution of which the expected result will be achieved; 3) the student's activity, which will lead to the solution of problems, and the teacher's activity to create conditions for the student's cognitive activity.

These provisions form the basis of the design of assessment of students' educational achievements in the teaching of chemical disciplines at Lutsk National Technical University (Ukraine).

Programmatic Learning Outcomes (PLO), defined by the educational program, reflect the overall result for graduates and provide an agreed set of courses that ensure the implementation, development and support of the achievement of key competencies in this specialty. Each academic discipline ensures the achievement of a specific segment of PLO through the specific knowledge, cognitive and practical skills required to achieve the grade.

The next logical step is to develop evaluation criteria by which the teacher will be able to differentiate between students who have achieved PLO at the appropriate level and those who have studied unsatisfactorily. The third step – the development of methods and means of assessment – allows the teacher to show the maximum individual approach, creativity and personal qualifications.

The fourth and fifth steps are about grading and feedback. Evaluation with the help of criteria is less subjective, not only gives teachers a consistent system of arguments in support of assessment decisions, but is also a source of feedback on adjusting the educational process of students.

A functional scheme for the organization of assessment in the Moodle learning environment has been developed, which contains an information block (question bank), an operational block (entrance testing, module 1, module 2, exam), and a reflective block (reflection of teachers and students). The interrelations of the elements of the scheme and the algorithm of its implementation are determined.

The defining element is the Question Bank, which should be created in the first place. The Question Bank provides an easy way to organize and manage questions so that you can access them for future reference. It also allows you to use random questions as well as reuse questions in subsequent tests. The question bank will contain categories related to the overall assessment strategy: entrance control, module 1, module 2, examination control.

Next, the assessment is designed: introductory, formative, modular or exam. During formative assessment, the goal is to monitor student learning, so assignments should always be available, without mandatory assessment, allowing additional attempts, without passing grade (if assessed). Completing an assessment usually involves commenting on the assessment. The final task is set with clear start and end dates. Summative grades are usually set with a mandatory passing score and completion of activities related to the "grade" requirement. The final stage of the assessment is reflection, which applies to both teachers and students.

## 3 Conclusion

Thus, the design of assessment based on the theory of constructive agreement is one of the effective tools for achieving the ambitious pedagogical goal of improving student learning. Evaluation of the quality of students' educational achievements should be carried out comprehensively. Such diagnostics is necessary both for the teacher (for the correct construction of the trajectory of teaching the discipline) and for the applicant of higher education (for the real self-assessment of their own knowledge and skills).

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# Online teacher training to implement skills-based teaching

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## 1 Introduction

Online training has become an accredited and widespread practice for implementing the training of teachers in service at secondary schools. Various research [1] demonstrates how this training channel is now widespread and widely used to learn new ways of working and to reflect on one's professionalism.

Remaining in the field of online training, various research shows how the presence of a tutor makes learning easier and favors the mediation of teaching practices from theory to practice[2][3][4].

The literature also shows how peer work supports and improves learning, both for those who give feedback and for those who receive it, as this type of activity develops the critical thinking of participants with a focus on the product for both [5].

The topic of group formation remains a topic to pay attention to, even in this case the literature shows the criticality of the good functioning of working groups [6].

## 2 Context and methodology

The research starts from two fundamental questions, the first question concerns the figure of the tutor and his role as facilitator in allowing greater internalization and application of learning, the second question concerns the desire on the part of teachers to build learning communities also in the online mode.

The testing opportunity was a high-level training course organized by the Istituto Superiore di Scienze Religiose of Novara (a private university institute that issues the degree qualifying the teaching of the Catholic Religion in Italy). The sample analyzed is made up of 160 teachers, it has no relevance from a statistical point of view but is made up of teachers from Piemonte participating in the training course. 50% of respondents are between 51 and 60 years old, 34.65% are between 41 and 50; 80.8% are female while the remaining 19.2% are male. The advanced training course included 15 hours of training with academic teachers, divided into 6 meetings lasting 2 hours and 30 minutes each and 14 hours of work in subgroups led by an e-tutor. Overall, 12 groups led by 9 tutors (some tutors led 2 working groups) Each subgroup met once a week for a duration of approximately 2 hours, there were a total of 7 meetings per group over a period of approximately 2 months. The period of implementation was from April to June 2024. Absences, especially during group work due to school commitments, in

some cases made the tutors' work and the creation of online learning communities more complicated.

Carrying out research on our case study allowed us to reflect on the coherence between theory and practice, taking into account that our case study involved entirely online training in which a dual training method was combined: plenary meetings and group work. small group with e-tutor. The research aims to verify the effectiveness of this type of online training in supporting teachers to implement new ways of working in daily teaching practice.

Our project aims to recognize the possibility that to increase the effectiveness of online training it is necessary to implement two different working methods: if on the one hand expert trainers who present new working methods to the trainees are important, on the other it is essential that these meetings are accompanied by work in subgroups led by e-tutors that allow the internalization of the theoretical knowledge learned and allow the formation of learning communities. If organized in this way, online training becomes quality training that manages to bring about changes in the teaching practice of the teachers involved and favors the activation of communities of practice of teachers that make learning more significant and lasting over time.

Added to this is the fact that the training courses organized with this dual modality are not numerous and there is no substantial literature on the topic in the Italian context that helps to verify its actual validity.

From a methodological point of view, the research was carried out using 2 questionnaires: one aimed at teachers and another questionnaire for tutors.

The questionnaire assessed various dimensions: the general functioning of the course (exploring both aspects relating to plenaries and work in subgroups), the work of the tutors and the communities of practice [7]. Furthermore, a focus group was held with the tutors to examine the dynamics and problems of group work and tutoring. The questionnaires were created, administered and analyzed using the QuestionPro software from 15 June to 30 June. Overall, the responses received from the students were 115 (out of 160), those received from the tutors were 8 (out of 9).

## 3 Results

The analysis of the questionnaire allowed us to correlate the perception of the teachers enrolled in the course with the one of the tutors and to verify which were the most relevant and most critical aspects of the training course. The outcome of the questionnaires also made it possible to highlight which skills tutors need to implement to facilitate learning in the laboratories.

An initial analysis of the research results demonstrated the following aspects:
1 the presence of the tutors proved to be fundamental in the work of mediation and concretization of the educational contents transmitted in the plenaries. Without the work carried out with the tutors, the knowledge would have remained abstract and difficult to apply;

2 the desire on the part of teachers to build communities of practice also in online form is high, this data encourages the construction of training which, although demanding in terms of hours of commitment, if well conducted and facilitated by e-tutors can encourage moments of work shared and exchange of good practices.

An opportunity to rethink, this institute with a level of academic training can refocus and systematize training models like this to accompany the continuous training of teachers.

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# Teaching Vision Inspection in Industrial Engineering: a constructively aligned online educational unit design

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## 1 Introduction

Industrial Vision Inspection Systems (VIS) are defined as a subset of electro-mechanical hardware and software assets integrated within a manufacturing meta-system for the automatic identification product defects [1, 2]. These systems, introduced half a century ago, have seen growing industrial adoption and refinement over the years due to rapid advancements in performance and capability [3]. The peak has been reached in today's new wave of hype related to enabling technologies such as Computer Aided Design (CAD), Model Based Definition (MBD), and Artificial Intelligence (AI) within cyber-physical environments [4]. According to Fortune's machine vision report, the global market size was projected to grow from $9.68 billion in 2023 to $16.82 billion by 2030, at a compound annual growth rate of 8.2% during the forecasted period [5].

Modern pedagogy is shifting from traditional methods to embrace constructivist learning theory, particularly the Constructive Alignment (CA) approach [6]. The CA approach emphasizes creating a curriculum that is both aligned and outcome based [7]. Implementing CA involves designing Intended Learning Outcomes (ILOs) that incorporate context, content, and Educational Goal Verb (EGV) from Bloom's taxonomy, indicating the expected student actions upon completing the specific Educational Unit (Edu, i.e., atomic learning objective). These ILOs and their EGVs are then realized through Teaching and Learning Activities (TLAs) and evaluated using Assessment Tasks (ATs). The alignment of ILOs, TLAs, and ATs is ensured by consistently using the same EGV [8].

Teaching VIS to Industrial Engineering students is essential for equipping them with market-relevant skills in a rapidly evolving field [9]. This abstract investigates the application of CONstructively ALIgned (CONALI) 3.0 ontology, as proposed by Lupi et al. [10], to systematically re-design a laboratory Edu for online delivery. The innovative use of the CONALI 3.0 ontology in courses design, originally intended for an online collaborative platform for educational engineering knowledge management, represents a novel approach in the field that can enhance educational outcomes and provide a standardized framework, particularly suited to online environments.

The pilot study was conducted on the "Optimization of Production Processes (OPP)" course, part of the Mechanical Engineering master's program at the University of Pisa. The specific Edu under review was part of an online learning laboratory focused on the fundamentals of computer vision. The objective was to formalize and elevate the Bloom's Taxonomy level (BTlevel) of the Edu by introducing the "apply" verb, thereby achieving BTlevel = 3, while standardizing the educational framework according to the CONALI 3.0 ontology. The ILO was defined as follows: *"Apply basic computer vision operations for rule-based and ML-based defect detection in manufacturing using Python"*. The aligned TLA were developed as reported in Table 1.

**Table 1.** The designed TLA, related levels and keywords following CONALI 3.0 ontology.

| Type | Level | TLAKeywords |
|---|---|---|
| TA: the instructors give a set of guidelines to help the learners to navigate the concepts behind the computer vision in Python environment using Google Colab and Google meet/Microsoft Teams. | TLAlevel3: laboratory | -Programming environment: Google Colab<br>-Programming basics: variables, arrays, logical operators, loops, functions<br>-Image handling: Python OpenCV library<br>-Vision: pixel, RGB and HSV channels<br>-Image analysis: Regions of Interest (ROI), histogram, binarization, edges |
| LA: the learners' task is to replicate the application of specific functions, interact with peers and the instructor, ask questions and provide problem-solving instances. | LAlevel3: problem-solving | -Image operations: resize, blur, sharpen, filter<br>-Morphological operations: logical operations erosion, dilation, opening, closing<br>-Advanced analysis: blob analysis, convolutions, You Only Look Once (YOLO) |

Similarly, following the CONALI 3.0 ontology, AT were developed as follows:

- Oral discussion (formative): Questions
- Written/Oral examination (summative): Multiple choices, quiz/test, question banks, take-home examinations
- Workbook (summative): Objective records of observations and completed tasks met during the laboratory by every single student (e.g., logbook).

## 2 Conclusion

The swift progress of technology in engineering necessitates that higher education institutions continually revise their curricula to equip students with relevant skills and knowledge. This study addresses this need by employing the CA approach, guided by the CONALI 3.0 ontology, to develop a contemporary online laboratory on VIS for Industrial Engineering master's students. By focusing on a student-centered approach, the case study enhances Bloom's Taxonomy levels, ensuring that students acquire not only theoretical knowledge but also practical skills in programming VIS algorithms.

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# Integrating Collaborative Video-Based Learning for Transdisciplinary Case Work in Pedagogical and Health-Related Education

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## 1 Introduction

Communication and counseling skills are essential in both pedagogical and health-related fields. Effectively teaching these skills requires integrating theoretical knowledge with practical application. A multi-stage video-based case work approach, processed by a transdisciplinary team of students, is especially suited for this purpose [1], as videos allow students to see theories applied in real-life scenarios, making the learning experience more tangible and relatable. This method goes beyond addressing issues within a single discipline; it demands cooperative efforts across various fields. This approach also underscores the necessity of collaboration for comprehensive transdisciplinary case processing, as most scenarios in educational or health contexts cannot be resolved by one discipline alone [2].

Moreover, recent research highlights the benefits of integrating collaborative elements into video-based teaching in group settings, as opposed to individual learning efforts. For example, Brown and Lara found that collaborative learning not only enhances performance and productivity but also improves social skills, self-esteem, and strengthens relationships within the group [3]. Similarly, Laal and Ghodsi have recognized collaborative learning as a beneficial educational strategy, citing its significant social, psychological, academic, and evaluative advantages [4]. They argue that learning in groups substantially increases success throughout the educational process and in subsequent assessments.

Collaborative learning is therefore essential for creating an effective learning environment within the context of video-based case work. This can be implemented through communicative elements like chat functions and interactive features like video marking functions. Especially in pedagogical and health-related fields, where joint decision-making is often necessary, integrating interactive decision elements in the case work videos is crucial. Using these elements in video-based case work could promote close collaboration across different disciplines, making the process more dynamic and results-oriented. Additionally, they could significantly improve the learning and application of communication and counseling skills.

## 2 Collaborative Video-Based Tool

The collaborative video-based tool vGather2Learn, which has already been used during the COVID-19 pandemic [5] as a countermeasure to asynchronous teaching, is set up in a Moodle course and initially includes the processing of video-based case work from pedagogical and health-related contexts. The video-based tool has a number of features from previous deployments, such as a group selection function, video marking options and a chat for communication. For integration into case work in the pedagogical and health-related education sector, it is also necessary to implement interactive decisions for the videos in order to be able to test the theoretical knowledge on real case studies in a safe environment.

The already implemented functions are well-suited for case work scenarios in pedagogical and health-related education. With the marking functions, important and unclear points in the video can be highlighted. This is particularly advantageous in transdisciplinary case work, as different disciplines bring different prior knowledge or perspectives which must come together to work on the case. Additionally, there is a chat function where learners can discuss the video content together and exchange ideas about interactive decisions in the video regarding the case. The case itself, which is video-based, is played synchronously for all group members and can accordingly be paused, fast-forwarded, or rewound synchronously. Among the extensions of vGather2Learn are the interactive decisions that must be made in the case work. When learners need to make a decision, the video is paused and a popup appears with the question and various responses. When a group member selects a response, the case is continued accordingly. The combination of the presented functions for the use of video-based case work is intended to provide a platform to promote communication and decision-making among students.

## 3 Conclusion

This abstract presents our collaborative, video-based learning tool designed for transdisciplinary case work. Initially developed for pedagogical and health-related education within our joint project, the tool holds potential for application across various disciplines in educational contexts. Our tool enhances similar learning systems e.g., H5P through collaborative elements. We plan to conduct future studies to evaluate the learning outcomes of collaborative case work within compulsory modules of degree programs in rehabilitation pedagogy, social work, and general pedagogy. Additionally, we aim to investigate the effectiveness of collaborative learning specifically in case work contexts and its impact compared to non-collaborative case work. Looking ahead, we envision further developments such as an anonymous usage dashboard for instructors to monitor learners' progress and decision-making paths, and an authoring tool-like interface for creating interactive decision-making elements in videos. These enhancements will enable educators to use our tool for creating context-independent, interactive-enriched, and collaborative videos for their teaching purposes.

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# Are you a left or right-brain type? Persistence of neuromyths in Italian in-service teachers.

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## 1 Introduction

In recent decades, the growing interest in the study of the brain and thus neuroscience has led to the spread of neuromyths. Hughes et al. (2020) argue that neuromyths are misconceptions about learning generated by misunderstanding, reading, or misquoting scientific facts, as the Organization for Economic Cooperation and Development (OECD) defines them, and that they can push teachers to use ineffective and non-evidence-based teaching practices, with serious negative effects on educational systems (OECD, 2002). This phenomenon seems to occur because the growing interest in the education-brain relationship is not matched by proper use of research findings (Torrijos-Muelas M. et al., 2021).
The impact of neuromyths, such as the belief about different preferred learning styles (visual, auditory, kinaesthetic), the use of 10% of one's brain, or hemispheric dominance, can lead to several issues, including the development of differential lessons based on students presumed sensory preferences, despite the lack of neuroscientific evidence to support this practice (Rato et al., 2013).

Previous studies (Dekker et al., 2012) show that many teachers worldwide adopt methodologies based on such beliefs, which can negatively affect teaching effectiveness (Della Sala and Anderson, 2012). The purpose of the present study is to investigate the current prevalence of neuromyths in Italian teachers, with the overall goal of identifying avenues for prioritizing evidence-based and -informed approaches to teacher training protocols.

## 2 Methods

To this aim, a short, anonymous survey was administered in CAWI modality to a large sample of in-service teachers undergoing the 30 cfu (DPCM August 4th, 2023) teaching qualification course delivered by Pegaso Telematic University. The items present in the survey were adapted from Dekker et al., (2012) and asked the teachers to indicate whether they agreed, disagreed with or were not sure about seven well-known

neuromyths. Data was collected using Google Modules and analysed using Jamovi software.

## 3 Results

A total of 6679 teachers answered the survey on April 5th, 2024. Overall, teachers were in high agreement with the notion that people learn better when receiving information in their preferred learning style (89.7% agree), a neuromyth known for his pervasiveness (Kirschner, 2017), but the majority of them also believe that left-right hemispheric dominance can explain individual differences in learners (54.3% agree) and that short coordination exercises can promote integration of left-right hemispheric signalling (65.9% agree). Even more widely debunked myths, like the belief that we commonly use only use 10% of our brain, are still held by a significant percentage of teachers (46.7% agree). Conversely, myths that concern alimentation, like the notion that students are less attentive after eating or drinking sugar-rich foods (46.5% agree) and that drinking less than 6-8 glasses of water per day can lead to brain shrinkage (23.8% agree) are less commonly held. Finally, only about 1 out of 5 teacher believes that learning difficulties due to differences in brain development cannot be addressed through education.

## 4 Discussion

The results of the survey indicate that neuromyths that were common worldwide more than ten years ago are still well rooted among Italian teacher teachers, at least according to the sample of in-service teachers that answered the survey. In turn, this observation suggests that, despite the notable efforts that the scientific community has taken to avoid simplistic explanations and promote critically focused, evidence-based approaches to neuroscience, there is still a lot of ignorance in the teaching community concerning how the brain works at a basic level and how this informs learning processes. Since wrong beliefs about learning can lead to educational malpractice, this worrisome observation calls for a significant reflection on and how cognitive and neuroscience figure into teacher professional development and training. As the world of education is struggling to adapt its practices and methodologies to a rapidly changing world, eradicating wrong beliefs and misconceptions seems like an important starting point towards more evidence-based and effective teaching and learning practices.

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# Thoughtful thoughts before developing distance learning in medical education.

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## 1 Introduction

The E-Medic project is a research and development project within distance learning for medical education faculty development that involves several partners from across Europe, with the University of Foggia, Italy as PI. The intension is to develop a serious game using teaching scenarios with options of actions, and mini-MOOCs presenting pedagogical perspectives and methods. This will provide teachers and facilitators in medical education with an opportunity to have an easy access to pedagogical development and training. The project is financed by Erasmus+ and is expected to finish in 2025.

The E-medic serious game and mini-MOOCs are developed under co-creation processes, but before that there is a need to set the scene, to make sure that the technical development is properly informed and supported. Because of that the E-medic consortium conducted a theoretical inquiry as well as an empirical investigation.

## 2 Research design

### 2.1 Theoretical inquiry

In the theoretical inquiry we described several different teaching methods and approaches to learning and related these to the field of distance learning. The intention was to give a solid background for conducting the technical development, by providing an opportunity to reason beyond mirroring the existing and traditional face-to-face pedagogical perspectives and technics.

Selecting the pedagogical methods and approaches was guided by current research trends in educational research, with a specific focus on research in digital education. Here we detect great attention to classifications and taxonomies, the issues of combining theory and practice, and the development of supporting competencies besides the disciplinary knowledge content, that also can strike a much deeper root or change in the learner and the learning situation [1], [2], [3] and [4].

It was clear to us that the teaching methods and approaches to learning followed the development once described by Peter Kugel from an emphasis on teaching to an

empathize on learning [5]. That led us to look for what is often referred to as active learning approaches and technics. *Problem based learning*, *(Human Patient) Simulation*, *Team based learning*, *Game based learning* and finally *Competency based medical education* were the chosen approaches.

The descriptions of these five teaching methods and approaches to learning presented some theoretical definitions, some historical development and the characteristics of the method and approach. The presentations also related the method and approach to distance learning and included cases and illustrations.

### 2.2 Empirical investigation

To supplement the theoretical material and the case examples the E-medic consortium initiated focus group interviews with teachers and educators, to gain insight into their experiences and desires. Focus group interviews was conducted by five of the partners in the consortium.

The focus groups consisted of 6-10 participants. Each participant was a) tenure-track faculty member, b) taught basic science and/or clinical in medicine and/or veterinary, c) preferably had experience with distance digital teaching.

Each partner moderated their focus group interview as they found appropriate, including designing initiative and progressive questions. But all focus group interviews covered the following three issues:

1. How they perceive their role as a teacher in a traditional present face-to-face learning environment versus a distance and digital learning environment.
2. What problems do distance and digital teaching solve and what problems do distance and digital teaching create?
3. Challenges related to student engagement and performance.

Preliminary analyses were conducted by each partner, where the answers to the issues, either as examples (quotations) or as themes, was explored and described. A combined analysis was conducted by Aalborg University, evaluated by the PI (University of Foggia) and also discussed by the consortium.

## 3 Conclusion

The combination of relating active learning theories to distance learning, including the description of different examples of distance learning within the frame of pedagogical approach, and the focus group interviews resulted in an issue of wonder, and three themes to further pursue.

The issue that we found perplex was the lack of explicit or visible reasoning for the development, application, and implementation of forms of distance learning. These thoughts and reasons are necessary for the success of distance learning, and the theoretical deliberations are vital for creating coherence, not just alignment, between knowledge (what to learn), learning (how to learn) and acknowledgement (how to recognize that learning has taken place).

The analysis exposed a lot of points made about usability considered through a contrast between distance and physical learning. But this is always with the traditional face to face as the baseline for the distance to match. When we look beyond or beneath that immediate 1 to 1 comparing, other issues become visible. The obstacles and difficulties, as well as the opportunities becomes attached to values of good and bad teaching, and to the integrity of the educators. Here especially three themes emerge. These were: *Relations*, *Time* and *Trust*.

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# Student-teachers' assessment competences in higher education. Documental analysis of Moodle's tools

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### 1.1 Student-teachers' assessment competences

In recent years, teacher training in assessment has received increasing attention in literature and research [1,2], recognising its crucial role in the educational context. Teachers' competence in educational assessment is indeed considered a fundamental characteristic of teachers' professionalism [3,4].

Despite the fact that this represents a contemporary and evolving challenge [5], especially because training on the topic is often relegated to a later stage in the process, leading student-teachers to perceive it as an 'addition' [6], the importance of teachers' assessment skills is widely acknowledged [7,8]. This importance is clearly reflected in the curriculum of the cds in Primary Education Sciences, which confers the qualification for teaching in kindergarten and primary school (easily identifiable from a reading of university curricula).

### 1.2 Use of Moodle in higher education

With the advent of the Covid-19 pandemic, the use of online learning management software has increased considerably, given the need for universities to keep education active on the one hand, and due to the ease of use, openness, sharing and accumulation of knowledge on the other [9, 10].

Since 2001, when creator Dougiamas launched the first Moodle course, more than 167,000 university courses have been created on this platform, involving nearly 400 million users worldwide [11]. These numbers testify to the effectiveness and wide adoption of Moodle as a tool for online learning management and planning [12] or as a support for face-to-face education [10]. Furthermore, although the number of studies on the subject is still limited [13] and the potential of the tool has not yet been fully analysed [14], some research has examined the impact of online course adaptation on the development of assessment skills in future teachers [15]. These studies highlight two main aspects: on the one hand, "using the online resources fo-ster the student teachers' ability to design assessment tools" [15]; on the other hand, the need for careful planning of the learning environment and the technologies and online resources employed emerges [14].

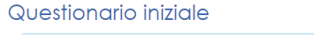
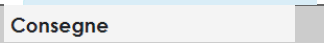
## 2 Documental analysis of Moodle's tool

This paper aims to:

- Describe the structure of the course "Problems and Techniques of Assessment" set up at the CDS Science of Primary Education at the University of Bergamo, through the use of the Moodle platform, paying particular attention to the selection and construction of the online materials inserted and used with about 160 students (and future teachers);
- Present the course methodology and the analysis of the documents produced by the teachers and students enrolled on the platform. The analysis process aims to develop an understanding of students' learning experiences with Moodle and to derive useful information regarding the development of assessment skills in student-teachers.

The Moodle platform of the course is divided into several sections corresponding to the lessons on the different topics. Each section (e.g. 'Lecture I, 22 February, 9.00-12.00') includes a 'Materials' folder containing all the PowerPoints, articles and other materials used during the lecture or provided as further reading. For the academic year 2023-2024, 11 lectures and 3 accompanying workshops were included, held from February to April (Table 1).

**Table 1.** Elements in the Moodle "Problemi e tecniche della valutazione" - UniBg.

| Type of materials | Number | Graphical example |
|---|---|---|
| **Lessons** | 11 |   |
| **Materials uploaded by the teacher** | 27 |   |
| **Workshops** | 4 |   |
| **Assignments given to students** | 7 |   |
| **Final evaluations** | 12 |   |
| **Initial/final questionnaire** | 2 |   |
| **Total works submitted by students** | 43 |   |
| **Access** | 142 |   |

The teaching methods, course design and structure is based on a close connection between theories and practical cases, aiming of stimulating inductive discovery of experience-based knowledge in students. This aim is pursued both through discussion with texts, lecturer, experts and colleagues and through the realisation of authentic tasks, individual and group activities and practical exercises that will be the focus of document analysis. Subsections dedicated to 'Tasks' are created within the Moodle platform. In these sections, each student can find the operating instructions, materials to use and the space to upload their work and subsequently receive feedback and assessment. This 'Task' mode is also used to assess the competences acquired by the students for the final examination.

In conclusion, this research highlights how the use of Moodle has contributed to the development of student teachers' assessment skills by providing a structured

environment for practical, reflective learning. The findings suggest that careful planning of online resources and activities can significantly enhance the effectiveness of teacher training.

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## General Track 2

# Learning technologies, data analytics and educational big data mining

# Enhancing Reflective Practices in Pre-Service Educators: A Case Study on the Role of GenAI in Assessment as Learning

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## 1 Introduction

The advent of generative artificial intelligence (AI) has introduced transformative potential in various educational contexts, promising enhanced learning experiences and novel assessment methodologies[1–3]. Research highlights the concern that generative AI can compromise the integrity of current assessment methods, creating challenges that must be addressed through policy development, ethical guidelines, and innovative assessment strategies[4–6].This paper explores the challenges and opportunities presented by generative AI in education, with a specific focus on student assessment.

Assessment in education is a critical component that serves multiple purposes, ranging from measuring student achievement to enhancing the learning process. There are three primary types of assessment commonly used in educational settings: Assessment of Learning (AoL), Assessment for Learning (AfL), and Assessment as Learning (AaL). Each type of assessment plays a unique role in the educational landscape and serves distinct functions [7–9].

The literature underscores the effectiveness of AaL in cultivating students' metacognitive abilities and encouraging active participation in their educational journeys. This is achieved through methods such as self-assessment and peer assessment, which not only provide insights into individual learning processes but also promote a collaborative learning environment.

This research explores the potential of generative AI tools in enhancing the learning and reflective practices of pre-service educators within an Assessment as Learning (AaL) framework. The study investigates how AI-generated lesson plans, created using tools like ChatGPT, can improve the development of effective teaching strategies for specialised subjects. Additionally, it examines the perceived strengths and limitations of using AI tools in the lesson planning and reflective processes, aiming to understand their practical applications and implications in educational settings..

## 2 Methodology

This study involved 63 pre-service educators enrolled in a master's degree programme aimed at pre-service educators. These participants were engaged in a unit focusing on

digital technologies in education, which included a section on the use of generative AI tools for teachers. Data collection centred on the reflective practices of these pre-service educators as they engaged with lesson plans generated by ChatGPT. Participants were tasked with using ChatGPT to develop a lesson plan aligned with a specific learning outcome in a subject they were teaching. They were instructed to specify the subject and learning outcome they were targeting and to document the prompt(s) used to direct ChatGPT in creating the lesson plan and associated resources. Following the generation of these materials, participants were required to evaluate the effectiveness of the lesson plan and resources, focusing on their practicality and potential enhancements.

The analysis of the collected data focused exclusively on qualitative methods to gain insights into the use of AI-generated lesson plans. The reflective assessments provided by the participants were analysed using thematic analysis, following the approach outlined by Braun and Clarke [10]. This data-driven, inductive process allowed for the identification of key themes related to the strengths and limitations of using ChatGPT for lesson planning, providing an understanding of the practicalities and perceived value of AI-generated lesson plans.

## 3 Preliminary Results

The initial thematic analysis of pre-service educators' reflections on ChatGPT-generated lesson plans reveals significant insights into the utility of such tools in teacher training. Key themes identified include the need for plans to align with typical class durations, accommodate different classroom contexts, and focus on real-world applicability and resource availability. The importance of engaging students through interactive and group activities was emphasised. Diverse assessment techniques were praised, though clarity and specificity in instructions were noted as necessary improvements. Adaptability and inclusivity were critical for tailoring lesson plans to various student needs. Additionally, incorporating modern resources and addressing practical implementation challenges were highlighted. These findings suggest that ChatGPT is a helpful assistant in the planning process, engaging students in higher levels of Bloom's Taxonomy during their assessment task.

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# Engagement Habits: Visualisation of Longitudinal Learner Analytics with Frequency Heatmaps

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## 1 Introduction

Learning analytics comes with the promise to enhance visibility, providing greater self-awareness and more informed learning support [1]. A common approach is to track different activities from the learner experiences over time. Such longitudinal data represents the learner's habits, difficulties or progresses, and how these develop in time. One of the main challenges related to longitudinal data is its variety in terms of frequency and duration. It reflects the individuality of learner experiences, but makes them very difficult to put in a common form that allows for meaningful comparison. Yet, a comparison of individual learner behaviours, would allows for the implementation and reuse of effective learning interventions. In this paper, we propose a technique to visually present longitudinal data with a focus on periodic patterns exhibiting the development of habits.

Starting from the consideration that timing of activities is of particular relevance to the learning process, we propose an intuitive visualisation of individual learning actions on a frequency heatmap with time of day and weekday as dimensions, as illustrated on Fig 1. Related visualisations have been used for other purposes, such as to measure user engagement with apps [2]. However, usage analytics do not inform what exactly the user is doing with the app, thus engagement is not a direct indicator for learning. In another example, the Germany Mobility Survey, an annual nationwide study of commuting behaviours, uses a visual representation called Graphical diagnosis of individual travel behavior (GraDiV).

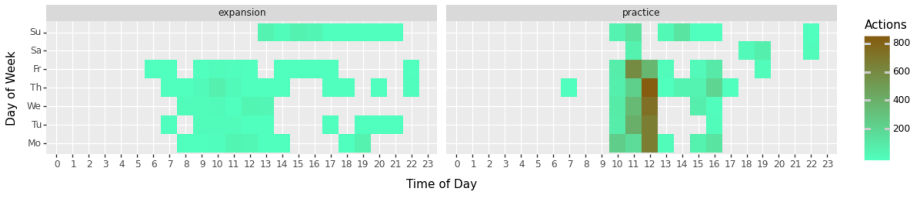


**Fig. 1.** An illustrative example of the proposed visualisation.

This visualisation shows one-off self-reported commuter behaviour on a graphic that plots day of week vs time of day. GraDiV is also used to derive aggregated heatmaps across similar users [3], but this is over a fixed period of one week, which is only a sample of overall activity. In a third example [4], a similar aggregation over users is do to map the hourly behaviour over days of the entire year, instead of days of week. However, the latter two approaches are used to generalise over different users. As a consequence they are less personal visualisation, and not a dedicated representation for an individual.

## 2 Method

As a case study, we consider data from a multiplatform app designed to support individuals anywhere in their learning of language vocabulary. This makes the app convenient for situations of both formal (such as in the classroom or in the office) and informal (in transit, when idle, or even without internet connection) learning. Two key user activities are supported in the app: i) expanding vocabulary – looking up words in an online dictionary and saving them in a personalised and annotated vocabulary, and ii) practicing vocabulary – exercising these words through a simple flash-cards quiz, supported by a spaced repetition algorithm [5, 6]. Both of these datapoint types are indicative of effective learning activities, and not simply of app usage. Also, the activities are not time-demanding, so the challenge to learners is to develop a habit, rather than to be able to allocate time or dedicate oneself.

We analyse the longitudinal data from 200 active language learners, without knowing their demographics, or whether they engaged as part of a class or informally. Each of the users in our sample used the app for at least two weeks, added at least 20 words to their vocabulary, and practiced the quiz. We plot the activity on a heatmap juxtaposing daily vs weekly behaviour.

We study the usability of different variations of this representation. While, as seen in Fig 1, variants optimised for human readability focus on simplicity and interpretability, others focus on precision for potential machine learning applications. We conduct interviews with 25 of the learners, exposing them to the diagrams, in order to explore how these reflect learner experiences, what information are they able to extract themselves from the graphics, and what they might find surprising. We also suggest behavioural recommendations, derived from the visualisations, and ask learners to evaluate the usefulness of these.

## 3 Discussion

In our study, we demonstrate that this visualisation technique not only satisfies the main requirement to be an intuitively interpretable and uniform representation, but also provides valuable insights about learner habits and potentials. To illustrate this, we comment on Fig 1. This learner has engaged with the app over a longer period, which is not a given [6]. From the data we can deduct that this person dedicates time to learning both in office hours (be it professionally or in

an educational journey), and in their free time, particularly over the weekend. From the heatmap we can see that on weekdays our learner is more active in the first half of the day with a culmination around noon. While vocabulary expansion activities are not concentrated in particular hours, e.g. are not related to a specific recurring activity, such as a lesson, the learner has managed to develop a pattern of regular exercise with the quiz on weekdays. This is more prominent around lunchtime, but also visible at the end of work hours.

The proposed heatmaps provide a synchronic snapshot that is agnostic to development over time. Yet, they also allow the study of diachronic change in behaviour over time by splitting one longitudinal data sample into several periods and comparing how they differ. A range of machine learning and computer vision techniques, like convolutional neural networks could be used to perform further analysis on the generated heatmaps for purposes like learner classification, recommendations and anomaly identification.

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# Comparing the outcomes of students and ChatGPT in distance learning courses about Computer and Network Security

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## 1 Introduction

The use of Artificial Intelligence (AI) techniques is becoming increasingly pervasive in the world of education. On one hand, educational institutions, such as universities and schools, both in presence and online, generate daily a large amount of data through their virtual learning environments [1, 2], which can be analyzed using different Machine Learning (ML) models. Such a usage of AI techniques can be very useful, for example to create models able to personalize teaching-learning workflows, detect early drop-outs, predict student outcomes, or even optimize educational processes [3, 4]. On the other hand, the usage of Large Language Models (LLMs) [5], such as ChatGPT- or LLaMA-based models, is becoming pervasive among students in the educational scenario as well [6]. These tools can turn to be both a positive help for students and a negative replacement of personal involvement in learning activities, as a shortcut to automatically create assessments or answer to questions without any real reasoning or understanding. In this abstract, we aim to answer the following research question: "*To what extent can ChatGPT replace students in answering the questions of an online university test?*". For this purpose, we provide a summary of a comparison between students' responses and ChatGPT's results in answering both multiple-choice and open-ended questions related to the courses of "Computer Security" and "Network Security" of an online university. Moreover, we have also performed a qualitative analysis for the results of the open-ended questions.

## 2 Educational Scenario

The courses we considered for this experimentation are some of those provided by eCampus University, one of the largest online university in Italy. In particular, we considered the "Computer Security" (CS) and "Network Security" (NS) online

**Table 1.** Examples of questions provided to both the students and ChatGPT.

| Question | Type | Course | Answer 1 | Answer 2 | Answer 3 |
|---|---|---|---|---|---|
| HTTP is a protocol | MC | NS | of binary type | of textual type | based on bytes |
| SSH was born to replace | MC | NS | HTTPS | TELNET | RTPS |
| What is a DMZ? | OE | NS | - | - | - |
| What is a DHT? | OE | NS | - | - | - |
| When was the first worm born? | MC | CS | 1985 | 1996 | 1998 |
| S-boxes are components of | MC | CS | DES | RSA | DH |
| What are suppress-replay attacks? | OE | CS | - | - | - |
| What are the differences between CMAC and DAA? | OE | CS | - | - | - |

courses and we extracted, from each of their teaching materials, 45 open-ended questions (OE) and 45 multiple-choice (MC) questions. Some examples of the considered questions, which the students are asked to answer while they attend the online courses, are reported in Table 1.

## 3 Analyses and Results

A cohort of 10 students was asked to answer the selected questions during the study of both online courses during 2023. Thus, the students had just learned the proper context of the specific course. The same questions were prompted to ChatGPT version 3.5 in the first months of 2024, without any fine-tuning or specific contextualization technique such as RAG [7]. For the MC questions, ChatGPT was forced to select one out of the three provided answers. The results are quite similar for both the considered online courses. As for the MC questions, both ChatGPT and the students correctly answered a similar percentage of questions (67.78% for ChatGPT and 71.11% for the students). As for the OE questions, we compared the answers provided by the students and by ChatGPT by leveraging the cosine similarity. For both courses we obtained a diagonal cosine-similarity matrix, with only some sparse spots due to similar contexts.

## 4 Conclusions and Future Work

We verified that ChatGPT 3.5, without any fine-tuning or specific contextualization, can achieve, in the considered scenario, results which can be considered very similar to those obtained by students that have been trained on specific online courses. It would be interesting to extend the analyses to other online courses or to also train ChatGPT with the specific course materials to see if it would be able to surpass the students' performance.

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# Pathways to guidance through sustainability: a case study.

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## 1 Lifelong learning as leading framework

The concept of Lifelong learning can be read one of the first times in the words of Faure's UNESCO report "Learning to be" that states: "We should no longer assiduously acquire knowledge once and for all, but learn how to build up a continually evolving body of knowledge all through life-'learn to be'." (Faure, 1972). The importance of this assumption has grown this much within time, until it became the aim to which the eight key competences identified in 2018 by the Council Recommendation are oriented to.

The wide-ranging debate that develops the concept of LLL highlights occasionally also elements of poverty, as a matter of fact as Di Renzo describes, Lifelong learning can be read in a reductive and ambiguous way when its logic is meant in a purely functionalist and essentially mercantilist dimension (Di Renzo, 2013).

## 2 Sustainability education through land use: technologies, territories and ecological footprint

In these pages the aim of the authors is to recall the Lifelong learning concept in its orientation dimension, as intended by Härtel "lifelong guidance" (in Traverso, 2016): the LLL thus becomes the horizon for a formative device that represents a possible path for learning and for quality education in its widest meaning.

The research plan is two groups quasi-experimental, it has been used a non-probabilistic samples of accidental type. The approach is attributable to the mixed method (Creswell, 2015), in connection to the close interdependence of qualitative and quantitative moments of the research plan, according to a strategy of complementary parallel research (Trinchero, in Mortari and Ghirotto, 2019).

In the cut through these lines, it is inserted the presented proposal: allow fourth grade of secondary schools' students to orient their choices through a rather indirect action, with active and strongly contextualized teaching organized in six macro-phases, aimed at recognizing the peculiarities of the context within which each student lives. A distinctive feature of the whole project is the strong connection between the different

modules and the realization of a tangible output at the end of each activity, through the mixing of the technological tools and the experience on the field.

The first part of the path introduces the issue of sustainability, functional to the field observation of a specific territorial phenomenon (land consumption). Therefore, students starting from the calculation of their ecological footprint (https://www.footprint-calculator.org/home/en), had the opportunity to understand the impact of their lifestyle on the earth system. The next step was then to initiate students to a conscious look at the environment: reading a familiar context with different and specific posture can in fact open to countless looks and themes, not least to make permeable and communicating school and proximity areas.

From physical places we move then to virtual places thanks to the use of the civic Social Network FirstLife (https://www.firstlife.org/), that has let students experience the use of social network platforms as places of creation, consultation and sharing of trustworthy information and knowledge. Precisely this approach has led pupils to confront data, big data and to relate to the issue of sources reliability. Subsequently, the pupils were personally engaged in the creation of solutions to improve their territories, and therefore imagine the planning of more sustainable areas in relation to the dimension of their ecological value within the concept of the planetary boundaries (Rockström, 2023). Finally, students were asked to define their personal commitment as well as the community engagement to contribute to the pursuit of a sustainable system, through the creation of their specific manifestos. The chance to explore spaces outside the school within the school time has the dual function of contamination of spaces and acquisition of skills through direct experience.

The idea of proposing situated learning episodes (Rivoltella, 2013) is also functional to the possibility of further replication by the student in different times and contexts.

The experience of active participation is supported by technologies and the exploration of big data, that is furthermore aimed at students' data literacy. The proposed activities according to a complementary way, aim to contribute to the learners' development where the virtual and the real exploration of the places are both supported. Technologies and databases offer the possibility to identify and analyze different points of view, including the institutional and official ones.

The reflections and self-reflections resulting from the comparison of data and the experiences carried out by the students represent the final element of the path and have the aim of enhancing processes and actions dedicated to "in depth" exploration. In fact, the experiences realized within this path have the twofold function to open to different awareness and to spread various approaches to the students' course of studies and personal growth. In other words, this course is a way through which achieving synthesis skills and combine and recombine knowledge towards the construction of students' personal path towards higher education.

The structure of the activity is such as to bring together different educational approaches and experiences, with the aim of developing greater awareness in students of the potential and limits of their actions.

The guidance and orientation element is represented as an implicit driver in all the conducted activities. Education and orientation can be defined as ecosystems as characterized by "persistence [...]. An ecosystem, in fact, can persist over time while

undergoing certain changes and perturbations" (Casetta, 2023), the same changes and perturbations that students encounter on their way for a successful educational pathway.

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# A Machine Learning Stacked Classifiers Role in Higher Education Student Retention and Academic Success

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## 1 Higher Education Dropout Globally impact

AI's rapid growth is causing substantial changes in several areas, including transportation, financial services, and healthcare [1]. One field that will experience a big upheaval with the rise of AI is education [2]. Unfortunately, it is also unequivocally proven that attaining the cultural enrichment aim is a university failure and dropout rate [3]. No, doubt dropout has emerged as a key concern in higher education, with far-reaching effects on individuals as well as institutions [4] and society [5] and become the largest concern nowadays due to the unavailability of skilled and graduate persons [6]. This issue is not restricted to one place in particular; it has been looked into internationally [7] and it has also been reported that many European nations do not regularly track their higher education achievement rates. Few European countries report retention, dropout, and time to degree completion statistics [8]. However, by enabling teachers to identify students' areas of weakness and offer learning materials at any point in the educational process, Machine Learning (ML) techniques, and modeling can potentially increase student retention [9]. Many comparative studies have already been done to investigate different approaches for predicting student success and dropout in higher education institutions; however, the percentage of higher education dropouts remains alarming [10], and this presents a significant obstacle to achieving one of the strategic objectives of the European Education Area (EU 2022) [11], which is to have at least 45% of the 25–34-year- old population hold a higher education degree by 2030. To attain the objective of the European Union, it is imperative to comprehend and monitor university dropout rates. Early university dropout prediction is necessary, according to researchers [12]. Thus, considering this early prediction, one important component of the success of contemporary learning systems is learner feedback rather than holding off on the final exam results [13]. Consequently, selecting the optimal attributes and approaches, considering the importance of various critical factors is required to achieve optimal results and reduce the overall impact of dropout using Machine Learning. Firstly, existing Machine Learning models may create factually inaccurate results and this situation does not provide excellent techniques for verifying outputs against empirical data [14]. Secondly,

higher education institutions should specify their dropout and academic success goals, and then ML models should be aligned with their training. These features might help get higher results and reduce dropout levels [15].Thirdly, the model's suitability depends on the proportion of students graduating in a given time corresponding to the time to get the degree; and the second one is just the number of students who drop out of their studies [16].

## 2 Methods

From Tinto's Dropout Theory with EVT holistic approach, our main focus is on finalized attributes that can improve control and responsiveness in Machine Learning Stacked Classifiers, allowing for the development of a more reliable, controllable, and effective dropout model and framework for future use by policymakers and administration. To explore the effective utilization of the machine learning stacked classifier, this ensemble learning technique consisting of multiple models is used to improve overall performance for optimum results. For machine learning stacked classifier, the first layer is the Support Vector Machine (SVM), a base model that is used to capture complex, non-linear decision boundaries with the second layer XG Boost, a meta-model for high predictive performance and ability to handle complex relationships and interactions that also learn to combine the base model's predictions best. This proposed Machine Learning stacked classifiers are in higher education dropout research, a series of experiments involved using higher education publicly available different European universities datasets. These experiments and implementations using Machine Learning stacked classifiers are aimed at co-creating strategies for scientific discovery, and scientific communication and, to analyze the factors of university and student usage before and after Tinto's Dropout Theory with EVT, additionally consider the Self-Determination model [17] and the Hadre & Reeve Model [18].

## 3 Conclusion

Our work in this area is crucial because it can give a leading and novelty approach due to considering multiple theories for feature selection of higher education dropouts and academics across research (various countries, universities, and their respective departments). This study highlights the potential of Machine Learning with various advanced stacked classifiers for the base layer and second layer to improve accuracy and provide outcomes based on rules using advanced stacked classifiers specifically keeping given European Union targets [11]. Furthermore, this solid research helps provide a new framework for adoption in this rising issue of dropouts in their studies according to their departments and university administrative requirements. Finally, a solid framework is a dire need in Europe due to this rising trend of dropouts and students unable to finalize their degrees.

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# Setting the Stage for Innovation: Developing the Study Framework for the enhancement of the CONALI Ontology in Education

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## 1 Introduction

The educational sphere is undergoing rapid transformations, driven by the increasing complexity of educational systems and the expansive macro-environment in which they operate. Educators are compelled to continuously adopt innovative paradigms, as continuous professional development is essential for effective teaching practices [1]. The adaptation of teaching methodologies is critical for maintaining relevance in education [2], necessitating the design of educational activities that offer individualized and personalized learning experiences for contemporary learners [3]. Despite these advancements, many educators lack the skills to create well-organized courses due to inadequate tools and frameworks, as highlighted by Maffei [4]. These limitations point to the need for updated methodologies and rigorous frameworks to improve instructional design.

## 2 Research challenge and methodology

The CONALI ontology has been instrumental in structuring instructional design, aligning intended learning outcomes with the educational goal verbs (EGVs) of Bloom's taxonomy, teaching and learning activities (TLAs), and assessment tasks (ATs) to verify student achievement, as identified by Maffei et al. [5] and operativized in Maffei et al. [6]. Despite its effectiveness, the evolving nature of educational methods and assessments necessitates ongoing updates to the ontology to incorporate new and effective practices.

This systematic review is designed to address these updates by exploring additional teaching methodologies and assessment strategies that could be integrated into the CONALI ontology, thus enhancing its applicability in modern educational settings. The guiding research questions for this review are:

- **RQ1**: *What new teaching and learning activities (TLA) and assessment tasks (AT), aligned with the educational goal verbs of Bloom's taxonomy, are relevant to contemporary educational contexts?*
- **RQ2**: *How can the identified TLA and AT be integrated into the CONALI ontology to enhance its relevance in contemporary educational contexts?*

To answer these questions, the review will extract new teaching methodologies and assessment tasks from the included studies, focusing on those aligned with the levels of Bloom's taxonomy. These TLAs and ATs will be analyzed in relation to their EGVs, enabling their subsequent integration into the CONALI ontology. This process ensures that the updated ontology incorporates contemporary and effective educational practices, grounded in empirical evidence, and adapted to the evolving needs of modern educational settings.

The inclusion and exclusion criteria for this review are as follows:

**Inclusion Criteria:**

- Articles in English published from 2019 to June 2024.
- Studies addressing the application of educational objectives compatible with Bloom's Taxonomy or other comparable taxonomies, including TLAs and ATs.
- Empirical studies (qualitative and quantitative) analyzing the application of EGVs, TLAs, and ATs in educational settings.

**Exclusion Criteria:**

- Grey literature.
- Meta-analyses and systematic reviews.
- Studies not including educators or students in an educational context.
- Articles not available in full text.

The significance of updating the CONALI ontology lies in providing educators with a robust and adaptable tool that supports comprehensive educational planning. By integrating innovative evaluation methodologies and teaching techniques, the CONALI ontology will enable educators to develop more effective and pertinent educational interventions, better preparing them to meet the diverse challenges of today's educational environments. Recent examples of application of this framework are available in Sala et al. [7], which used it to investigate Blended Learning, and Lupi et al. [8], which leveraged it to define engineering archetypes.

The review process, based on the method illustrated in Tricco et al. [9], involves a detailed examination of recent literature to identify emerging trends and effective practices that can be incorporated into the ontology. The aim is to ensure that the updated ontology reflects the latest advances and best practices in the field.

## 3 Expected results and conclusion

By integrating new evidence into the updated CONALI ontology, we can offer a framework that better aligns with contemporary educational demands. The CONALI ontology, combined with Artificial Intelligence, is currently being applied to help

pre-service teachers acquire the skills needed to design more inclusive learning pathways. Promising results from studies by Lombardi et al. [10] suggest this approach is effective in personalizing instruction and addressing diverse student needs.

The integration of new TLAs and ATs through this review is crucial. It will provide educators with a wider range of aligned methodologies and assessments, supporting personalized learning and enhancing inclusive education. These updates will help educators more effectively design inclusive, accessible learning experiences for all students.

This underscores the importance of continuous professional development, enabling educators to improve instructional design and student outcomes through tools like the updated CONALI ontology.

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# An Entropy-based Federated Learning approach for the student's dropout prediction

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## 1 Introduction

In today's world, student learning analytics has become a particular area of focus in educational settings like universities. It is crucial as it paves the way for the creation of effective strategies that can improve academic results and prevent setbacks. In this context Artificial Intelligence (AI) has the potential to play a crucial role in identifying novel elements that influence students' performance [1]. However, educational data come from different educational centers and require dealing with the legal and ethical issues linked to the processing of sensitive data [2]. This encourages the adoption of Federated learning methodologies [4–6] for the training of machine learning models on decentralized datasets without centralizing the data [2]. Existing studies [4–6] show good performance in education analytics, but the obtained accuracy decreases in contexts characterized by high variability in feature, label distribution, differences in feature-label mapping, and quantity skew. [3]. This study introduces, in the context of learning analytics, a new Federated Learning approach (it is called DQFed), that consists in aggregating the local models on the basis of their weights computed according to a quality-driven model. In this way, higher importance is given to the academic center that produces high-quality data. The proposed strategy is evaluated on free available datasets and the results will be compared with alternative approaches.

## 2 Proposed approach and related work

The proposed approach is described in Figure.1. The framework involves N educational institutes, each acting as a client within a cross-silo federated learning environment. Each university maintains its own local dataset and training model, ensuring that student data remains secure and private by not leaving the institution's premises. To maintain data privacy and security, all student data is kept locally at each educational institute. Each client performs local training on its dataset using a locally defined model. This decentralization ensures that sensitive data is not exposed or transmitted across the network. During the initial training round, we calculate the entropy of each dataset. Entropy, in this

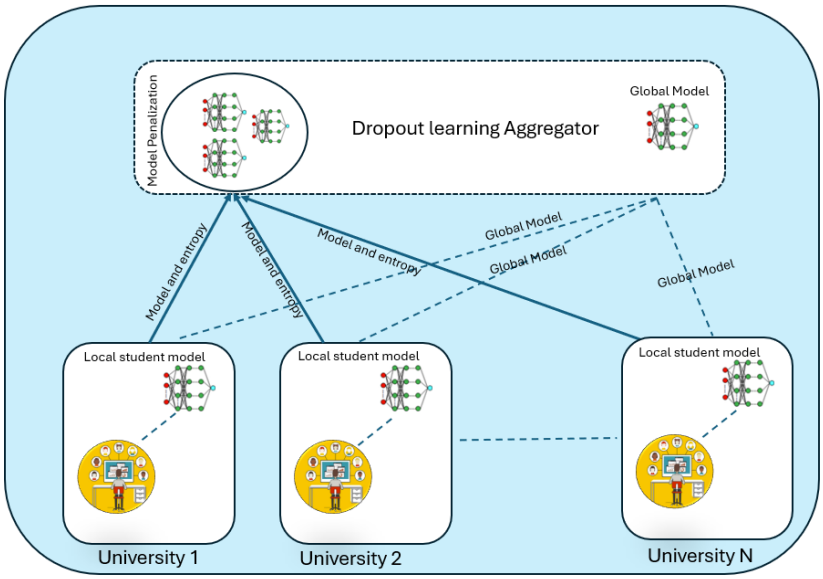


**Fig. 1.** Proposed system architecture.

context, measures the uncertainty or variability in the data, providing insights into the diversity and complexity of the dataset. These entropy values are then grouped together with the model parameters from each client. Once the local training is complete, the local model parameters, along with the calculated entropy values, are aggregated at a global level. This aggregation process involves collecting model updates from each client and combining them to form a global model.

The Entropy based aggregator algorithm is employed to aggregate the model parameters efficiently. All models are fused together to evaluate the overall learning outcomes based on the aggregated learning parameters. This fusion process helps in assessing the performance of the global model and ensures that the contributions from different clients are integrated effectively. The global model then analyses the educational institutes, identifying those with fewer parameters or suboptimal performance metrics. Clients that exhibit lower performance are penalized based on their entropy values, reflecting the variability and uncertainty in their data. This penalization aims to ensure that the global model accounts for the quality and reliability of data from different clients. After the evaluation and penalization steps, the final global model is aggregated and optimized. This refined global model is then sent back to the clients for the prediction of student dropouts. The clients utilize the global model to make informed predictions, leveraging the collective insights gained from the federated learning process.

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# Special Track 1

# Inclusion and immersive approaches for higher education

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# I'm in Tales MOOC on Tangible User Interfaces and the UDL model: a case study design

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## 1 Introduction

This study presents the design and implementation of a MOOC focused on integrating Tangible User Interfaces (TUIs) with Universal Design for Learning (UDL) principles. Developed through the Erasmus+ project I'm in Tales, it brings together partners from various European countries to enhance inclusive education. TUIs are gaining popularity for their ability to engage students through physical interaction with digital content [1][2]. The MOOC introduces educators to the basics of TUIs and their use in storytelling, offering both theoretical and practical elements [4][5]. Educators learn to select, design, and implement TUIs to create accessible and engaging learning experiences, particularly for students with disabilities. By aligning with UDL, the course emphasizes creating learning environments that cater to all students, regardless of ability or learning style. The use of TUIs in education fosters interactive, hands-on learning, enhancing creativity, critical thinking, and collaboration. Through this MOOC, educators are equipped with the skills to adapt storytelling techniques to diverse learners, creating more inclusive and engaging classrooms.

## 2 Methods

The MOOC offers a flexible, self-paced learning structure based on UDL principles, promoting active, contextual, social, and reflective learning [3]. Active learning involves discovery, project-based, and collaborative methods to enhance creativity and problem-solving. Modules are organized around real-world projects with practical guidance through readings and videos. Contextual learning aligns inquiries with local

educational contexts, applying skills to classroom challenges using case studies. Social learning integrates collaborative tools for peer interaction, fostering a learning community. Reflective learning emphasizes early childhood practices, incorporating activities like online journals and personal reflections to connect theory with classroom applications. These methodologies create a dynamic environment, blending theory, practice, and collaboration to equip participants to effectively integrate TUIs into education. For the I'm in Tales MOOC, partners designed a TUI-focused curriculum, defining training goals, developing multilingual modules, and seeking validation, with feedback from learners shaping the course's future iterations.

## 3 Results

This study highlights the importance of adopting the UDL framework in online courses like the I'm in Tales MOOC, which focuses on TUIs for inclusive education. Initial evaluations have been conducted, and future efforts will apply active methods to assess the MOOC's impact on educators' understanding and use of TUIs for storytelling with diverse learners [4]. Feedback will be key to determining how well the course equips educators with the skills to design and implement TUIs, empowering them to create accessible and engaging storytelling environments for all learners, including those with disabilities. A practical use case in the MOOC demonstrates how TUIs are integrated into UDL experiences, showcasing their role in inclusive education. Both quantitative and qualitative data will be collected through surveys, analytics, and interviews to assess the MOOC's effectiveness. This comprehensive evaluation will provide valuable insights into how MOOCs can enhance educators' understanding of TUIs and support the creation of inclusive learning environments.

## 4 Conclusions

In conclusion, advancements in educational technology, particularly TUIs, provide new opportunities for enhancing learning experiences. The MOOC serves as a robust platform for educators to gain a thorough understanding of TUIs' potential in storytelling for inclusive education. By equipping teachers with necessary skills and knowledge, the MOOC empowers them to create engaging and inclusive learning environments for all learners, as illustrated through a practical UDL-aligned use case [9]. This endeavor underscores TUIs' transformative potential in enriching engagement and understanding across diverse educational settings.

## Acknowledgement:

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# ‘Touching’ Stories: Towards the Development of Tangible User Interfaces Story-Building Authoring Tool for Inclusive Education

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## 1 Introduction

Technology in early education is not just a support tool, but fosters creativity, exploration, and collaboration. It enhances children's skills in learning, social interaction, and plays a crucial role in digital literacy and inclusion, particularly for children with disabilities. Technology supports diverse learning needs, reducing barriers and promoting inclusivity through both mainstream and assistive technologies [1][2]. Tangible User Interfaces (TUIs) allow interaction through physical objects, bridging physical and digital worlds [3]. These interfaces enhance learning by facilitating interaction with digital feedback, supporting social skills through collaboration [4]. TUIs are particularly useful in storytelling and narration, offering personalized, multisensory learning environments for children, including those with disabilities. Challenges remain in translating TUIs into educational practice due to a lack of guidance for teachers on inclusive education [5]. The I’M IN TALES project addresses these needs, providing methodologies for developing TUIs in storytelling to foster inclusive education.

## 2 Methods

The authoring tool was developed through collaboration with educators and researchers from Europe. Feedback from teachers informed its design during living lab sessions [data not presented]. Validation involved public events where educators

interacted with the tool, providing feedback through the System Usability Scale (SUS) [6] and the Technology Acceptance Model (TAM) Questionnaire [7]. The SUS evaluates usability on a scale of 0-100, with scores above 68 deemed above average [6]. The TAM explores perceived usefulness, with higher scores indicating greater acceptance [7].

## 3 Results

A total of 74 professionals participated in hands-on sessions across Italy, Cyprus, and Belgium. Participants included 30 assistive technology and education professionals in Italy, 20 early childhood education experts in Cyprus, and 24 special education professionals in Belgium. From the 57 who completed the questionnaire, 50 valid responses were analyzed—42 females and six males, with an average age of 40. Most (82%) had never used a TUI before. The System Usability Scale (SUS) had an average score of 68.02 (SD = 12.8). About half rated below the acceptability threshold (M = 58.4), while others rated well above (M = 78.4). A negative correlation (r = 0.32) between age and SUS scores indicated lower perceived usability with increased age. Participants' comments related to usability were aligned with Nielsen's heuristics for interaction design. Although feedback was positive, the need for clearer system visibility and function identification was noted. Error notifications were requested, acknowledging that non-experts would often use the tool. The Technology Acceptance Model (TAM) assessed perceived usefulness with an average score of 3.3 (SD = 0.8), unrelated to age.

## 4 Conclusions

The first working concept of the I'M IN TALES authoring tool has produced positive feedback from the interested stakeholders. Further development of the system is however needed to make it easier to use and more intuitive. The next steps of the project will involve further iterations of usability evaluations and system's revision. Such activities will take place with the active involvement of students with and without disabilities along with their teachers.

## Acknowledgement:

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# Students with Special Needs at University: E-learning as a contribute to inclusion

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## 1 Introduction and aims

Students with disabilities and special learning needs, unlike other students, face greater difficulties during university study, including due to physical, behavioral, technological, organizational and economic concerns [1-2]. Universities should ensure equal opportunities and inclusive education for all students, especially those with disabilities and special learning needs [3-4]. Institutions have an important role, not only in promoting inclusive opportunities for students, but also in minimizing the impact of factors that may be barriers [5]. Therefore, to ensure academic success and inclusion [6-7], it is necessary to implement measures to support these students. E-learning can be an effective educational approach for people with disabilities and special learning needs as a vehicle for acquiring self-determination and empowerment, which improves students' access and engagement in academic activities [8-9-10].
This study aims to describe the services provided by the e-Campus University Commission for Students with Special Needs (CABES) targeting students with disabilities and special learning needs, and to investigate how satisfied students are with the services provided and to gather their suggestions on how to improve them.

## 2 Method and results

Data were collected using an internet-based self-administered survey, from the 1st May till the 31th May 2024. The survey was spread via email by the e-Campus University Commission for Students with Special Needs (CABES). All students who accessed the CABES' services were asked to answer some questions of a satisfaction questionnaire specifically designed for research purposes. Participants received information about the aim and procedures of the survey and were asked for informed consent before starting the survey. Participation was completely voluntary, and students could withdraw from the research at any time.
A total of 227 students completed the online survey, 71.4% were female with a mean age of 28.9 years old. Most of the sample (46.3%) said they attended the University's Special Educational Needs Committee because they had a specific learning difficulty (i.e. dyslexia, dysorthography, dyscalculia, dysgraphia). Moreover, 36.5% reported a motor, sensory, mental or intellectual disability; 13.2% fell into the Special Educational

Needs (SEN) category; 4% reported both a motor, sensory, mental or intellectual disability and a Specific Learning Difficulty.
In general, most of the sample is satisfied with the service provided by the University. 59.5% declared that they are very or extremely satisfied, only 4.8% say they are not at all satisfied. Reflecting on their own academic experience, 60.4% declared that they have experienced "enough" or "few" difficulties related to their condition (disability, SLD or SEN). Only 11% have experienced "many" or "very many" difficulties. Finally, most of the sample (71.4%) consider that the telematic mode of the university is functional regarding the needs related to their disability. Only 4.4% did not consider it to be functional. Compared with the results obtained in previous years, there is a slight improvement in the values, partly due to the implementation of some services, such as the welcome service for the monitoring of students' university path.

## 3 Conclusion

The research describes some features of the eCampus organizational model that allow for individualized teaching assistance through an extensive network of tutors around Italy. The eCampus Virtual Learning Environment offers a broad range of services and tools supporting students with disabilities and special learning needs. Next, an aggregate picture of eCampus students with disabilities is provided, based on a comparison of data collected in previous years. The analysis considers various characteristics of the sample, such as gender, type of disability and degree of satisfaction. Particular attention is paid to the use of personalized support measures. This refers to the different categories of tutoring, adaptation of examination formats, compensatory tools, and dispensatory measures. Based on this data and on some of the suggestions made by the students, some conclusions can be drawn that will be useful in improving the quality of services offered to students with disabilities.

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# Fortnite Creative: A Platform for Video Game Usability Research

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Video games present unique challenges and opportunities in the realm of interface design. As the digital landscape evolves, so do the interests and priorities of students and faculty within this academic discipline. Recent qualitative data collected from discussions with students and academic staff indicate a burgeoning enthusiasm for the study of video game interfaces. This shift in interest aligns with broader trends in digital media consumption and the increasing recognition of video games as complex, multifaceted mediums for entertainment and education. A recent review [3] of works from 2005 to 2019 highlights this evolution, supported by earlier studies [1,2]. Given the growing focus on video game interfaces within academic settings, the role of prototyping as an educational tool becomes particularly significant. A prototype created with Figma[1] can effectively simulate a website, but the same cannot be achieved for video games. In this context, Fortnite Creative[2] can be considered an ideal prototyping tool for video games. It offers an environment where users can design and customise maps and interfaces, allowing for experimentation and evaluation of usability and user engagement. The main alternative is Minecraft Education Edition[3], a specialised version of the sandbox game Minecraft, tailored specifically for educational purposes. It includes features that support classroom learning, such as lesson plans, interactive tutorials, and various tools designed to teach subjects like mathematics, science, and history through immersive, hands-on activities. While Minecraft Education Edition is ideal for teaching various subjects, customising the interface extensively requires programming skills beyond those taught in an introductory interface design course. In contrast, Fortnite provides a complete set of tools usable within the game, but also on a PC[4], which is a direct translation of the Unreal Engine[5] (a game engine also developed by Epic Games owner and developer of Fortnite game). Both platforms have recently been deeply analysed [4] regarding design creativity research, highlighting their potential in educational contexts.

The primary challenge in this emerging field of study is the development of reliable methods to measure the effectiveness of video game interfaces. In web

[1] www.figma.com
[2] www.fortnite.com/create
[3] education.minecraft.net
[4] www.unrealengine.com/en-US/uses/uefn-unreal-editor-for-fortnite
[5] www.unrealengine.com

design, usability testing methodologies are well-established. They employ a mix of heuristic evaluations, user testing, and analytics, mostly carried out using prototypes that are more or less representative of the final product. Prototyping involves creating simplified and interactive models of the proposed design interface; the prototypes can range from low-fidelity sketches to high-fidelity digital simulations, allowing designers to visualise and test the user interface and interactions. After prototyping, usability testing is conducted to gather feedback from real users, identifying issues and areas for improvement in the design and usability of the interface. Usually, many iterations are made based on this feedback, refining the design for better usability and user satisfaction. Following usability tests, the final design is made and developed.

As previously mentioned, specific tools exist for creating interactive prototypes that can nearly perfectly simulate the functionality of a fully developed web page. Conversely, creating concepts without a game engine is not feasible in video game development. Although modern game engines offer many predefined assets to help sketch out a game and test its logic, some components still require the creation of essential functionalities from scratch, such as object interactions within the game world and physics management.

This work presents a case study within a thesis that uses Fortnite's creative mode for rapid prototyping, enabling the fast setup of gaming interface research studies (Fig. 1).


**Fig. 1.** Diagram represents the UX/HUD definition process proposed in this work.

The use of Fortnite Creative to develop an immersive HUD within a university project has demonstrated the tool's significant educational value. Specifically, during a thesis project, the objective was to measure the effectiveness of video game interfaces by integrating biometric data with self-assessed questionnaires. Devices such as the Unicorn[6] and Shimmer 3[7] were used to collect this data. The successful implementation and evaluation of this case study underscore its potential as a valuable resource in the field of interface design. Consequently, this game design methodology will be incorporated into the curriculum of the Visual Communication and Interface Design course at the University of Milan - Bicocca University in the Master's Degree in Theory and Technology of Communication. This integration aims to provide students with hands-on experience and a deeper understanding of innovative interface design techniques within the context of video game environments.

[6] www.gtec.at/product/unicorn-hybrid-black/
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# Playing and learning in the blink of an eye: integrating eye-tracking technologies into game-based special needs education

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## 1 Introduction

The exponential growth of the video game industry has led to new questions in the already remarkably complex and varied field of education and skill development. This rapid evolution has caught the attention of educators, psychologists, and researchers, who have begun to explore the potential of video games as educational tools. In particular, the intersection of video game technology and pedagogy has opened new frontiers in the field of special needs education, an area that has long sought innovative approaches to meet the unique needs of students with disabilities or learning difficulties.

This article aims to examine the potential of integrating video games into special needs education through the use of innovative software and hardware tools, such as eye trackers. The goal is to explore how these technologies can be leveraged to achieve better results in terms of learning outcomes and skill development for students withspecial needs.

## 2 Playing and learning through adaptive hardware and Eye tracking technologies

Eye tracking technologies are emerging as promising tools for increasing the immersiveness of video games and enhancing learning processes. Chan and colleagues [1] have highlighted how the use of Eye tracking can be conducive to skill acquisition and increased engagement of individuals with learning disabilities. These technologies offer new possibilities for monitoring and analyzing gameplay and students' cognitive processes during game-based learning activities, providing valuable information for both educators, to optimize instructional strategies, and developers, to adopt inclusive design from the earliest stages of game design. As pointed out by Lai and colleagues [2], Eye tracking can be used to assess the visual attention and cognitive load of players and learners, allowing play and educational content to be dynamically adapted to their needs.

Several companies and organizations are exploring the use of this innovative tool in video games to improve their accessibility: the Eye Asteroids project by Microsoft

Research, for example, has demonstrated how Eye tracking can be implemented in a classic arcade game, providing an immersive gaming experience for players with motor disabilities [3]. In addition, the British organization Special Effect, has developed EyeMine software, which allows gamers with motor disabilities or limited mobility to play Minecraft using eye movements alone [4].

However, the implementation of these technologies also raises important ethical and practical issues. Privacy concerns associated with the use of Eye tracking data [5] require careful consideration. The types of gazes and pupil dilation, for example, can be unique to each individual, and can allow identification and tracking across different games or platforms [5]. Furthermore, this data can reveal sensitive information about gamers' interests and preferences, which could be improperly used for creating targeted advertising or for other purposes, without the player's explicit consent [6]. To address these issues, it would be desirable for game designers and industry stakeholders to develop clear privacy policies and terms of service that describe how eye tracking data is collected, used, and shared.

The development of innovative hardware devices, such as the Xbox Adaptive Controller and the PlayStation Access Controller, has greatly affected the accessibility of video games too. These tools, which are characterized by a modular and flexible architecture [7] [8], allow for the customization of the gaming experience, adapting it to the specific needs of each user.

## 3 Eye-opening Gameplay: Tracking the Future of Inclusive Education

Because of these considerations, we argue that eye-trackers, adaptive controllers and similar accessibility-promoting technologies could be further integrated into classrooms, specifically in game-based activities aimed at special needs students.

Such experiments have been conducted, for example, by Donmez and Cagiltay [9], who developed education games based on eye movement for students with low vision; or by Vessoyan and colleagues [10], who effectively utilized eye-tracking technologies to help students affected by Rett syndrome to achieve individualized communication goals. Vickers and colleagues [11], meanwhile, have observed how an adaptive eye-tracking interface can be leveraged to let students perform locomotion tasks in immersive computer games.

The aim of this paper is to assess these existing examples through a literature review, extrapolating good practices, evaluating their pedagogical results and reflecting on the possibility of utilizing state-of-the-art technologies to thrust future developments, while addressing the privacy and ethical concerns cited previously.

## 4 Conclusion

In conclusion, the integration of eye-tracking technologies and adaptive hardware into game-based special needs education presents a promising frontier for enhancing

learning outcomes and accessibility. This innovative approach offers unique opportunities to create immersive, personalized learning experiences that cater to the diverse needs of students with disabilities.

Moving forward, collaborative efforts between educators, game developers, and researchers will be essential to refine these technologies and develop best practices for their implementation.

Ultimately, the thoughtful integration of eye-tracking and adaptive technologies in game-based learning environments has the potential to revolutionize special needs education, fostering more inclusive, engaging, and effective learning experiences for all students.

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# Extended Educational Environments for Past, Present and Future Students of Design & Computation

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## 1 Context

Our research project emerged in the context of a joint master study program "Design & Computation" (D&C), affiliated to Berlin Art and Technical Universities. The innovative nature of the curriculum allows for the development of new teaching and research formats that leverage the strengths of both human and artificial intelligence (AI). Students and researchers have access to extensive resources and expertise from a wide range of disciplines, facilitating investigation and study tasks through an immersive and interactive multi-sensory experience using Extended Reality (XR) technologies in educational settings.

We use the curriculum as a case study to fine-tune custom, open source Large Language Models (LLMs) based on data collected from students, including descriptions of their personal histories, projects, skills, habits, and external data sources relevant to the program's topics. Aggregating and curating this data fosters personalized, engaging, and context-aware learning spaces for all program participants. XR technologies play a crucial role in enhancing information acquisition and visual perception by incorporating sounds, videos, and graphics, which engage learners more deeply in both educational and social contexts.

## 2 Challenge

The primary challenge addressed by this proposal is to establish an inclusive, trustful, and multifunctional learning environment that bridges the gap in communication and knowledge transfer among individuals from diverse academic and socio-cultural backgrounds. Furthermore, significant fluctuations and the loss of knowledge over time necessitate the development of archives, systems or more complex learning environment that effectively preserve and seamlessly transfer knowledge across different domains and academic generations. This brings us to Extended Educational Environment.

## 3 Extended Educational Environment

We define an Extended Educational Environment (EEE or E3) as an *immersive and interactive XR* [4] [1, 2] *learning environment enriched with AI-coupled zones, artifacts and avatars*, supporting flexible configurations and multifunctional use to facilitate diverse educational experiences. These zones, avatars and artifacts, created by means of tools like Unreal Engine and MetaHuman possess distinct "personalities" or "characters" reflecting underlying machine learning models. They serve as an interface between the data corpora and human users. XR integration offers students a wider array of information through immersive, multisensory experiences, enhancing audiovisual engagement and deepening their immersion in learning activities for better retention and understanding of complex concepts.[3, 4]

In our prototype, a set of virtual zones is coupled both with regions in both physical as well as with semantic space. It is populated by avatars inhabiting the EEE of D&C study program has a unique Low Rank Adaptation (LoRa, [5] large-language model (LLM) neural network adapter associated to it. These adaptors are trained from corpora provided and self-curated by different D&C stake-holders. In order to reduce the amount of false information and "hallucinations" to minimum, LLM2Vec [6] and Retrieval Augmented methodologies (RAGs) [7] are used there, where necessary. Additionally, diverse avatars are enriched with specific text-to-speech (TTS,[8]), face expression or stylized audio-driven [9] face generator models.

## 4 Human-Machine Peer Learning

Didactic method with which we teach diverse visitors of our EEE is based on concept of "Human-Machine Peer Learning" (HMPL) [10, 11]. In HMPL, humans and AIs learn from and with each other, resulting for a win-win situation for both parties alike.

In our prototype, new colleagues enter into diverse zones types where they encounter existing avatars and artefacts ([12]). During such encounters, knowledge of human as well as artificial cognitive agents is gradually increased by nothing else than interaction, communication and exchange.

## 5 Roadmap

In the current phase, we generate LORA-adapters and LLM2Vec datasets from corpora curated by core teacher and assistant affiliates. In the subsequent phase, the dataset will be extended with contributions from ten current and alumni student volunteers. In the final "deployment" phase, the teacher-archivist Avatar will independently collect data, *inhabiting* its XR space to engage with students, alumni, and researchers for advice and guidance.

[4] Extended Reality (XR) is a generic concept including Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR).

## 6 Acknowledgments

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# Does using ChatGpt for educational purposes require information on students' learning styles? An exploratory study conducted with learning tutors for students with special educational needs

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## 1 Background

In recent years, technological advances have revolutionized the educational environment, generating significant impact on teaching and learning. Numerous research studies have shown how Artificial Intelligence (AI) can improve educational outcomes (Zalte, 2023), highlighting the shortcomings that traditional education systems often have in meeting students' specific needs and adapting to their learning styles. The use of AI in the educational context allows for the development of personalized and adaptive learning approaches, tailoring learning content to the individual needs of students to maximize their potential and address challenges more efficiently (Liriwati, 2023). Among the AI-based tools that are gaining a big resonance in the educational context,Intelligent Tutoring Systems (ITS) deserve special mention. These systems aim to make learning more meaningful and effective by using various information technologies, in close relationship with cognitive theories of learning and instructional design (Rega & Frolli,2022). Among intelligent tutoring systems, it is worth mentioning ChatGPT, a platform that allows users to send text queries receiving responses based on knowledge accumulated during the training phase (Pavlik, 2023). ChatGPT is gaining massive adoption in the educational context as AI-powered conversational models can generate human-like texts that are useful in curriculum design, as part of teaching methodologies, and create personalized learning resources (Epstein & Dexter, 2023). These capabilities facilitate the teaching of complex concepts and help learning professionals monitor and refine their pedagogical approaches. To take full advantage of the capabilities of a GPT model, effective "prompts," i.e., texts that best describe the model's personalization and improvement instructions, must be used (Liu et al., 2023).

## 2 Materials and methos

Our research starts from the consideration that to be effective, the prompts that people use for LLMs (Large Languages Models) like ChatGPT must be clear, precise and contain contextual information, however, it should be emphasized that writing effective prompts can be complicated for non-technical users, requiring creativity, intuition and sophistication (Lo, 2023) and this fact is even more true and important if generative

models are used for educational purposes. Therefore, our research question concerns the investigation of how prompt engineering is a crucial tool for the effective use of ChatGPT in the personalization of teaching materials and, above all, whether it was necessary to know the learning style of a student, before preparing a prompt that generates study materials for the student. The assessment of learning styles allows to know the specific preferences of each student, using them to develop, design and provide educational programs and resources that motivate and stimulate the acquisition and application of information and knowledge by students, making them more harmonious with their desires, in an attempt to improve their learning (Federico, 2000). The present study arises from the need to explore the effectiveness of integrating information related to learning styles in the formulation of prompts provided to ChatGPT to develop teaching materials to be used to improve the learning of students with special educational needs (SEN).

The study involves the use of an application designed to allow practitioners to assess students' learning styles using a structured questionnaire (Mariani, 2000) and, from that information, provide a detailed prompt to ChatGPT in order to generate customized learning materials for use with each student. The target sample we intend to consider involves about 30 psychologists and teachers who specialize in enhancing learning with SEN children. In order to evaluate the effectiveness of using the application to generate personalized learning materials, it is necessary to develop and test two different prompts: the first consisting only of information about the student's class, subject, and topic to be explored, and the second enriched with detailed information regarding the student's learning style, assessed through the use of the application.

## 3 Preliminary data

Preliminary data, which we will present in full form in the final version of the paper, suggest that the use of prompts enriched with details regarding learning styles generates a significant improvement in terms of the effectiveness of educational materials produced by ChatGPT. In particular, it is expected that the professionals involved in the study will report an improvement in terms of content comprehension and an increase in student interest and participation, as well as better adaptability of the educational content to the individual needs of the students themselves, thus achieving better support for the professionals' work practice as well.

## 4 Conclusions

In conclusion, preliminary data suggest that the integration of information regarding learning styles in the generation of prompts to be provided to ChatGPT to produce personalized educational materials will prove to be an effective strategy for personalizing the educational experience for both students and teachers. This approach, and the achievement of the expected results, could enable optimal use of AI tools, such as ChatGPT, by providing content that is more targeted and relevant to the specific needs of each student, also those with special educational needs.

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## Special Track 2

# Artificial Intelligence and Innovative Technology for Special Education

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# Applying Artificial intelligence to virtual reality to support Special Educational Needs

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## 1 Introduction

This paper explores the integration of Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) into educational practices for students with Special Educational Needs (SEN). It draws from interventions within the Computational Thinking Laboratory at ASPOCollege and is grounded in Nussbaum's capabilities approach [1]. The paper highlights how these emerging technologies foster inclusivity and equity in learning by examining the technical and pedagogical dimensions. Experimental data, combined with insights from the International Classification of Functioning (ICF) framework and Universal Design for Learning (UDL), demonstrate the potential of AI, AR, and VR to personalize learning experiences for students with disabilities [2]. A critical reflection on the current prioritization of systems over individuals calls for a reorientation of technological innovation toward human-centered goals, particularly for vulnerable populations [3]. By tailoring learning environments to individual needs, these tools enhance accessibility, adaptability, and inclusivity, which are essential for the educational advancement of SEN students [4]. This research draws on Nussbaum's capabilities approach [1] to argue that inclusion is not only a matter of rights but also of justice and social equity. We explore the pedagogical and technical aspects of these tools, considering their potential to transform education by aligning learning with human development goals [5].

## 2 Theoretical Framework: Nussbaum's Capabilities Approach

Nussbaum's capabilities approach posits that fostering human capabilities is essential for achieving social equity [1]. This perspective emphasizes the importance of creating opportunities for individuals to engage fully in society, both economically and culturally. In the context of education, promoting inclusion is key to enhancing the capabilities of SEN students, enabling them to participate meaningfully in academic and social spheres. Technological innovations like AI, AR, and VR can play a critical role in this process by facilitating personalized learning experiences that cater to the unique needs

of SEN students. However, as discussed by Hill et al. [6], the increasing focus on systems over individuals in technological development threatens to overlook the human-centered goals that these innovations should support. This paper calls for a reorientation of AI and related technologies to prioritize inclusivity, particularly for vulnerable populations [5].

### 2.1 Artificial Intelligence in Education

AI has become an integral part of modern education, providing adaptive learning systems that respond to individual student needs. AI-powered tools can assess students' learning progress, recommend personalized learning paths, and offer real-time feedback [7]. For SEN students, AI applications can help create more accessible and tailored learning environments, allowing them to overcome barriers to education. Research by Khan et al. [8] indicates that AI can enhance cognitive skills and improve educational outcomes for all students. These technologies allow students to interact with virtual environments that simulate real-world scenarios, which can be particularly beneficial for children with disabilities [9]. For instance, AR applications can enhance visual learning and support cognitive development, while VR environments can provide safe spaces for students to practice social and communication skills [10]. UDL provides guidelines for creating educational experiences that are accessible to all students.By integrating AI, AR, and VR into UDL-based pedagogies, educators can offer SEN students personalized learning experiences that enhance their participation and success [2].

## 3 Methodology

This paper utilizes a multidisciplinary approach to investigate the integration of AI, AR, and VR in SEN education. Data were collected through experimental studies conducted within the Computational Thinking Laboratory at ASPOCollege, involving students with various disabilities. The methodology employed both qualitative and quantitative research techniques. The study also employed a framework based on the International Classification of Functioning (ICF) by the World Health Organization (WHO), which provides a comprehensive model for assessing the impact of disability on learning [11]. This framework was combined with UDL principles to evaluate the effectiveness of AI, AR, and VR interventions in promoting inclusion and personalization in educational settings [2].

## 4 Results and Discussions

The experimental data demonstrated that AI and VR interventions significantly enhanced cognitive and social skills of SEN students. Additionally, AI-powered adaptive learning platforms helped SEN students progress at their own pace, reinforcing the personalized nature of these technologies [7]. The results also indicated that AI, AR, and VR can bridge the gap between SEN students and their peers by providing tailored learning experiences. Teachers reported that these technologies enabled them to better

meet the diverse needs of their students, fostering a more inclusive classroom environment and promoting equity and participation for SEN students [12]. Despite the positive outcomes, the study identified several challenges in implementing these technologies. These include the high cost of VR equipment, limited access to AI tools in some educational settings, and a lack of teacher training in using these technologies effectively. Moreover, there remains a general perception that accessibility is primarily a technical issue rather than a pedagogical one, which hinders the adoption of inclusive practices [13]. These technologies not only enhance cognitive and social skills in SEN students but also contribute to greater inclusion and equity. However, the challenges identified in this study highlight the need for more comprehensive teacher training and greater awareness of the pedagogical potential of these tools.

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# Integration of Artificial Intelligence and Design Thinking in Education 4.0-7.0 from a Philological Perspective

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## 1 Artificial Intelligence (AI) and Design Thinking in Educational Process

In the realm of modern education, the convergence of artificial intelligence (AI) and design thinking and has emerged as a significant catalyst for transformation, particularly within the frameworks of Education 4.0 to 7.0 [1]. This paper investigates the intersection of these concepts from a philological standpoint, examining their implications, synergies, and challenges.

Design thinking, renowned for its human-centered approach to problem-solving, emphasizes empathy, creativity, and iterative ideation. Meanwhile, AI offers unprecedented opportunities for personalized learning, data-driven decision-making, and adaptive systems. The integration of these methodologies holds immense potential to revolutionize pedagogy, curriculum development, and educational technologies [2].

The relevance of this research lies in its exploration of the integration of philological perspectives, design thinking, and AI within the evolving educational paradigms of Education 4.0 to 7.0. By combining human-centered design with advanced AI technologies, the study aims to enhance student outcomes and engagement through personalized and adaptive learning experiences. This research provides valuable insights for policymakers and educators in developing inclusive and effective curricula, using modern educational methodologies preparing students for future challenges and careers, and contributing to the global discourse on educational innovation [3].

An interdisciplinary framework merges philological insights with design thinking and AI within the context of Education 4.0 to 7.0. It pioneers the examination of linguistic and cultural dimensions in design thinking methodologies enhanced by AI,

offering novel perspectives on creating personalized, adaptive learning experiences. By bridging human-centered design with intelligent systems, the study proposes innovative approaches to curriculum development and pedagogy, laying the groundwork for future educational innovations [4].

## 2 Artificial Intelligence (AI) in Linguistics

Drawing from philology, the study of language in historical and literary contexts, this paper explores how design thinking and AI intersect with language acquisition, textual analysis, and cultural interpretation in education. It investigates the role of language in shaping learning environments, communication strategies, and knowledge dissemination processes in the digital age [5]. Additionally, this paper explores the ethical implications of AI in education, focusing on crucial issues such as data privacy, algorithmic bias, and the protection of linguistic diversity. It underscores the importance of a nuanced understanding of the cultural and social aspects of language within AI-driven educational systems, advocating for inclusivity, equity, and the promotion of ethical literacy [5].

The methodology involves a comprehensive literature review on cognitive differences, contextual elements, and recent innovations in education, alongside academic papers, books, and articles on philology, design thinking, AI in education, and the evolution of Education 4.0 to 7.0. The study also includes the analysis of case studies from educational institutions implementing AI and design thinking methodologies. Qualitative analysis methods such as thematic analysis and content analysis are used to identify common themes and insights from literature and case studies regarding the integration of philology, design thinking, and AI in education.

Through a multidisciplinary approach it is possible to inform educators, researchers, and policymakers about the transformative potential of integrating design thinking and AI in education. By embracing philological perspectives, it lines up with fostering critical inquiry, interdisciplinary collaboration, and human-centered innovation in the Education 4.0-7.0 era, emphasizing STEM education and continuous professional development, providing ongoing training and support for teachers to integrate new technologies and teaching methods [6].

## 3 Conclusion

In the realm of modern integration of design thinking and AI within Education 4.0-7.0 presents a transformative approach to modern education. By leveraging the strengths of both methodologies, educators can create more personalized, adaptive, and engaging learning environments [7]. The philological perspective offers valuable

insights into the linguistic and cultural dimensions of this integration, contributing to the development of more inclusive and effective educational frameworks. Future educational models should explore advanced AI, AR, VR, and other immersive technologies to further enhance learning experiences, fostering creativity, clearer communication, and increased accessibility of information in the era of Education 4.0 to 7.0 [7].

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# The role of AR, VR, and AI for students with motor and communication disabilities: a literature review

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## 1 Introduction

The integration of students with motor and communication disabilities in education remains a significant challenge. The International Classification of Functioning, Disability and Health (ICF) defines disability as the interaction between an individual's health and contextual factors [1], highlighting the importance of appropriate technological tools. Assistive technologies are crucial in facilitating school, social, and work inclusion, enhancing students' quality of life [2]. The emergence of innovative technologies such as augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) presents new possibilities for enhancing traditional assistive technologies like eye tracking [3]. These technologies have the potential to eliminate learning barriers, increase student autonomy, and improve accessibility to educational resources [4]. Evaluating the impact of AI-supported AR/VR on instructional methods for students with motor and communication disabilities, compared to traditional approaches [5; 6], is crucial in determining whether these emerging technologies can facilitate greater inclusion and academic achievement than established assistive technologies.

## 2 The research

### 2.1 Methodology

This study employed a systematic literature review using the PICOC method [7]. The population included students with motor and communication disabilities with sufficient cognitive abilities. The intervention focused on assistive technologies, particularly AR/VR with AI, compared to traditional tools. Outcomes measured were teaching effectiveness, academic achievement, school inclusion, and social-relational development, within the context of secondary education. The review included peer-reviewed studies on assistive technologies for the target population, published between 2004-2024. Searches were conducted in Scopus, PubMed, Google Scholar, Web of Science, and ProQuest, using keywords related to assistive technologies, disabilities, school level, emerging technologies, and efficacy outcomes. Following PRISMA guidelines [8], 66 articles were initially identified. After removing duplicates and screening, 31 studies were included in the final synthesis. The methodological quality was evaluated

using tools such as AMSTAR-2 for systematic reviews and the Cochrane Risk of Bias Tool for experimental studies, assisted by an AI LLM system based on ChatGPT's GPT "Systematic Literature Review using PRISMA method".

### 2.2 Preliminary results

The review demonstrated a predominantly positive influence of assistive technologies on the educational efficacy and quality of life of students with motor and communication disabilities. Key improvements were observed in several interconnected domains:

1. Communication and Access to Learning: Augmentative and Alternative Communication (AAC) technologies, brain-computer interfaces (BCIs), and eye-tracking devices significantly enhanced communication abilities [3; 5], while also improving students' access to educational content, promoting increased participation and independence [4; 9].
2. Cognitive and Social Development: Assistive technology-based programs showed positive outcomes in advancing cognitive processes and facilitated social inclusion and participation in both academic and extracurricular activities [10].

Regarding AR/VR and AI, preliminary results are encouraging. Dudley et al. [6] highlighted how these technologies enhance the accessibility and inclusivity of learning experiences, with immersive environments showing potential to improve student engagement and comprehension of complex concepts. However, while numerous studies documented short-term benefits, the long-term efficacy of assistive technologies requires further investigation [11]. The findings indicate that assistive technologies, particularly those incorporating AR/VR and AI, have the potential to significantly enhance instructional methods for students with motor and communication disabilities, though further research is needed to optimize their implementation.

## 3 Conclusion

This review underscores the transformative potential of assistive technologies, particularly AR/VR and AI, in special education. Their efficacy in enhancing communication, learning access, and social inclusion indicates their pivotal role in overcoming conventional obstacles faced by students with motor and communication disabilities [12]. The findings highlight the need for a more integrated approach to incorporating advanced assistive technologies within the school curriculum. This necessitates not only implementing novel technologies but also training educators and developing innovative pedagogical methodologies.

Future research directions should include:

1. Longitudinal studies to evaluate long-term effectiveness of assistive technologies [11].
2. Research on optimizing personalization and social-emotional aspects of assistive technology use.
3. Studies on effective integration of AR/VR and AI into everyday teaching practices [6].

These areas of focus will be crucial in fully realizing the potential of assistive technologies to enhance educational outcomes and quality of life for students with motor and communication disabilities.

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# Business Schools and teaching practices: an online survey

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## 1 Introduction

### 1.1 Theoretical framework

Business and management education must account for an ever changing, dynamic and unpredictable global economy characterized by volatility, uncertainty, complexity, ambiguity. In this scenario, Business Schools (BSs), and universities in general, have the duty to train students and equip them with the necessary skills to face the challenges of today's world, drive innovation and succeed in their professional career (Baldegger et al, 2022; Riashchenko, 2023). There is increasing concern from employers worldwide about graduates' inability to match current and future work's needs (Azevedo et al., 2012; Mantai & Calma, 2022).

At this purpose, Business Schools (BSs) should adopt innovative approaches that support creativity, critical thinking, and adaptability (Baldegger et al, 2022; Riashchenko, 2023), and commit to empowering faculty members competences (Ghasemi et al., 2023; Askari, 2017; Sorcinelli, 2020). In fact, according to Kowang et al. (2020), quality teaching and learning process is positively correlated with students' performance, including student's employability; furthermore, "technology has the potential to make teaching and learning processes more intensive, improve student self-regulation and self-efficacy, increase participation and involvement, and predict increased student engagement" (Bond et al., 2020, p. 2); and "faculty members' empowerment might be an approach to changing the teachers' efficacy, which indirectly affects the students' learning" (Ghasemi et al., 2023, p. 2).

BSs are considered specialized institutions in providing business and management education (Kaplan, 2018) and "organizations that operate according to market principles, management theory, and profit orientation" (Randerson, 2023, p. 2); while MBA is considered the flagship program of BSs worldwide (Muposhi et al. 2019) and provides professional competencies to graduates (Marino, Rivero & Dabos, 2019).

The present theoretical framework outlines the following research question:

RQ: How an effective and appropriate use of: Teaching approaches; Educational technologies, and Faculty Development (FD) programs (development of instructors' teaching competences particularly) can enhance students' employability skills and reduce the skill gap between university and the labor market in the specific context of business education?

To answer this question, the present research integrates two approaches:

- Website content analysis aimed at defining the three concepts in the context of Top 100 Business Schools, identifying current state of the art and good practices.
- A questionnaire intended to gain instructors and managers' insights concerning effectiveness of current practices with respect to the research questions.

## 2 Preliminary findings

On the basis of this research question has been carried out a conceptual content analysis on the websites of the top 100 BSs in the world (according to the Financial Times Ranking, listed according to their MBA courses) with the aim to detect the existence of such themes (Teaching approaches; Educational technologies; Faculty Development programs) and define which of them are the most used and commonly implemented in the BSs' courses.

Preliminary findings from the analysis reveal that experiential learning is the most ever used Teaching approach which in turn includes other approaches like problem-based learning, collaborative learning and reflective learning. Also the case study, even though it's one of the most ancient teaching approach is still the most used and relevant for all the BSs analyzed. For the Educational technologies theme, the Learning tools (such as online pooling tools, generative AI tools, online assessment tools, etc…) and Learning environment (such as Zoom, Canvas, Brightspace, etc…) resulted the most rated codes. Lastly, the Faculty Development programs theme reported faculty awards (Teaching and research excellence) and support activates to the didactics (faculty guidelines, teaching plan, inclusive teaching strategies) as the most rated codes.

## 3 Further research

The present study intends to further investigate the abovementioned themes and the results coming from the websites' conceptual content analysis by constructing a questionnaire. The questionnaire is intended to gain instructors and managers' perceptions, insights, considerations about the effectiveness of the analyzed themes and how much/how often they apply and use them in their courses/schools. The questionnaire will be structured in 3 sections (one section per theme), containing 5 questions per section for a total of 15 questions. It will be submitted online and, in case of a low response rate, it will be extended to the top 200 BSs in the world.

After having concluded both the content analysis and the survey's data analysis, it will be possible to specifically define the study's variables and their potential relation.

## 4 Conclusion

The present research can help to understand the state of the art, current best practices in the field and future directions for responding to the challenge posed in introduction, that is students' employability and matching market and training needs.

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# Digital transformation of Initial Teacher Training: an exploratory study on eTwinning experimentation

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## 1 Theoretical framework

European policy have long emphasised the importance of integrating educational technologies into teaching practices and innovating education systems through the promotion of digital, entrepreneurial, sustainability, personal, social and learning-to-learn skills [1-4]. Continuing professional development models of teachers are based, in particular, on the construct of co-design and *teacher as designer* [5], engaged in the innovation of learning environments [6-7] also under the increasing impetus of information and communication technologies [8]. Within this cultural scenario, the eTwinning approach to teacher training uses situated and informal learning models and tools, based on the continuous exchange of information/resources and differing from the traditional in-service training offer that is often sporadic and decontextualised from normal teaching practice: it represents a "third space" [9] of active negotiation of situated learning between the first space of informal learning and the second space of formal learning, in which learner agency is enhanced. One of the distinctive elements of the experience is the documentation and sharing of projects that aim to innovate teaching methodologies and curricular approaches in a creative and flexible way, exploiting in particular digital transformation and internationalisation [10]. eTwinning is characterised by a multilevel governance of education [11] in which the following interact: the European eTwinning Unit, on the instructions of the European Commission; the National Units; the local units, through collaboration between the Regional School Offices and the network of eTwinning ambassadors; and the schools, which can commit to innovating teaching through digital practice and obtain an eTwinning school certification. Through multi-level governance [12], eTwinning allows for moving beyond strictly individual learning approaches and aims to promote shared leadership and teamwork.

## 2 Methods

This study describes the results of a research carried out in 2024 with an exploratory purpose, involving 250 pre-service teachers (*target population*) attending the Qualification in '*Scienze della Formazione Primaria*' (Primary Education Teaching Sciences) at the University of Foggia (Italy), involved in the initial teacher training initiative called eTwinning for Future Teachers (ITE). The University of Foggia welcomed the ITE initiative since its early years, in 2016, as part of the compulsory seminars within

the so called Active Training Internship (TFA) aimed at future secondary school teachers, held by ambassador Brigida Clemente. The primary goal of this inquiry is to analyze the representation of the effectiveness of the eTwinning experimentation. In particular, the study aimed to understand what meanings do trainee teachers attribute to the eTwinning experience and the development of related competences to manage innovative learning environments; understand how eTwinning interacts with teachers' continuous professional development; rethink current models centered on media education. The research utilized mixed methods, combining qualitative and quantitative data collection and analysis techniques. Two phases of inquiry took place: 1) during the course, pre-service teachers (N. 204; *Response Rate*: 81,6%) completed a submitting a Computer Assisted Web Interviewing (CAWI) questionnaire including multiple choice and open questions; 2) in the second phase, 39 technological artifacts developed and analyzed from online workgroups on the Moodle platform (all 204 participants in Phase 1 participated in the working groups on Moodle).

## 3 Results and conclusion

From the analysis of the data, it emerged that students perceive the eTwinning platform as an innovative online learning environment capable of enhancing collaboration and networking among European schools, methodologies integrating diverse cultural perspectives, inclusive and accessible teaching materials, and promoting practical and experiential teaching approaches. Specifically, have emerged: a) *weaknesses and challenges*, such as: technical difficulties, language barriers, challenges in communication and collaboration, complex and time management, lack of tutorials; b) *strengths and opportunities*: international collaboration, development of digital skills, educational innovation; sharing and exchange; creativity; teacher support; adaptability and resilience. The responses highlight a significant interest among participants in advancing and enriching e-Twinning experimentation, encompassing several key areas of focus, for example: integrate e-Twinning into student internship programs; increase participation in collaborative projects with other European schools; deepen digital skills through practical experiences and innovative projects; receive continuous support and training to enhance the use of e-Twinning; engage in workshops and training courses to deepen the use of e-Twinning and educational technologies. The 2023 monitoring report [13] shows that eTwinning is integrated into initial teacher training programmes in different formats, adapting to the needs and contextual factors of training institutions. This shows that eTwinning allows for some flexibility and customisation for participating universities. The exploratory study conducted at the University of Foggia will reflect on the role of eTwinning in initial teacher education and, in particular, its inclusion in student traineeships [14]. The analysis of artifacts (during the second phase of survey) revealed how the use of specific web tools and AI devices enhances content personalization and creativity. Results show the need for specific training designed to support teachers' knowledge and skills in adapting teaching materials for augmented learning environments. There is a significant need to enhance the use of technology – especially AI and augmented learning tools – in innovative learning environments within teacher

qualification training courses, highlighting its role as a powerful facilitator and inclusive mediator. This exploratory study underscores the importance of supporting teachers with specific training and promoting awareness of the strategic role of technology and personalization in education.

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## Special Track 3

# Learning Technologies and Faculty Development in the digital framework

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# Faculty Development in the online university setting: academic staff perceptions

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## 1 Introduction

Efforts to promote Faculty professional development have gained significant importance in European Academia with the implementation of the Bologna Process and the creation of the European Higher Education Area (EHEA) [1, 2].

In the Italian context, the increasing number of students, lecturers and tutors in online universities underscores the centrality of Faculty Development [3, 4]. Designing and delivering online courses requires both pedagogical and technological skills, as well as the creation of innovative structures and processes.

In recent years, the research group at *eCampus University* has developed a comprehensive reflection on Faculty Development, inspired by the framework of Bergquist & Phillips, which posits that effective Faculty Development aims to bring about changes at three levels: attitudes, processes and structures [5].

In the unique environment of online universities, the training of lecturers and tutors has always been a focal point due to the very specific technological and organizational requirements [6].

Additionally, the interaction between teachers and students in online settings is greatly facilitated by technology and well-designed organizational arrangements.

This contribution delves into the initial outcomes of a strategic continuous training program offered by *eCampus University* for its new lecturers and tutors.

## 2 Context, Objectives and Methodology

A key milestone in the University's infrastructure was the creation of the *eCampus Academy* in August 2022 [7].

The primary function of the *eCampus Academy* is to foster the professional development of different university stakeholders, promoting their continuous growth and the formal recognition of their skills. This ensures that Faculty members adopt an appropriate approach to learning design and develop the necessary operational skills to succeed in an online teaching environment.

The program includes an initial individual self-training phase, through a pathway organized into 16 units, containing a variety of learning objects.

The next phase consists of a plenary meeting and four online workshops. These workshops, involving groups of up to 15 teachers from different faculties, are dedicated to key themes of *eCampus* online teaching:

- designing online courses;
- producing and uploading teaching materials;
- preparing exams, evaluating and recording results;
- managing degree completion processes and student communication through messaging.

With the hiring of new professionals, including tenured and contract faculty, 19 training cycles scheduled for the 2023/2024 academic year have been delivered between November 2023 and July 2024. A total of 159 people have been trained, including lecturers and tutors.

The main objective of the study was to collect the level of satisfaction with the workshops attended, with the aim of implementing potential adjustments to workshops delivery methods and contents. Additionally, the study aims to gather the Faculty's views regarding the potential activation of Communities of Practice.

A semistructured, anonymous questionnaire was administered using Computer Assisted Web Interviewing methodology (CAWI).

The questionnaire consisted of 33 questions, organized into three areas: personal information, customer satisfaction, and interest in the activation of Communities of Practice.

## 3 Results

The recruitment of new faculty members from diverse educational backgrounds required this academic year a significant investment in the organization and management of training by *eCampus Academy*.

The analysis conducted as part of the study showed a good level of overall satisfaction from respondents (“totally satisfied”: 33.33%; “very satisfied”: 51.11%).

In online universities, in which typical informal opportunities to meet colleagues are limited, the opportunities for face to face discussion promoted by the institution became strategic. In particular, the small group discussion and experimentation during the Workshops were appreciated (“totally satisfied”: 35.56%; “very satisfied”: 40.00%).

Given the strong need to explore topics related to digital education, enhancing *eCampus Academy* training offerings (design and management of interactive teaching, production of multimedia teaching materials, use of apps, design and management of virtual intensive weeks...) may be considered. In fact, 44.19% and 39.53% expressed they were “very interested” and “quite interested” in receiving training on digital education topics.

Similarly, given the interest in collaboratively developing working materials and tools, along with sharing experiences and practices, it is important to consider the most effective ways to foster the emergence of Communities of Practice [8, 9].

Another focus will be on strengthening the monitoring system with qualitative-quantitative tools.

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# A.T.E.N.A. : Augmented Tools for Enhancement of Neural Activation. 3D Models in Didactics for Qualitative and Quantitative Learning

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## 1 Enhancing Educational Outcomes through Augmented Reality

Augmented Tools for Enhancement of Neural Activation (A.T.E.N.A.) is a comprehensive research project that began in January 2023, aimed at investigating the impact of augmented reality (AR) on variables that play crucial roles in education, targeting a sample of university and primary school students.

Previous studies have extensively demonstrated how integrating AR into education is functional for improving learning processes, positively impacting memory com-ponents, emotional intelligence, and motivation to learn, thus generating a cascade improvement in performance [1] [2] [3] [4].

Building on the theoretical framework upon which it was developed, A.T.E.N.A. incorporates the core principles of Constructivism and Embodied Cognition. Constructivism posits that individuals construct the meaning of what they learn through experiences and interactions, learning more effectively when it resonates with their cultural reality [5] [6]. As an innovative technology, A.T.E.N.A. particularly when accessible via smartphones, makes AR potentially effective in creating stronger engagement for today's digital-native students.

From an Embodied Cognition perspective, A.T.E.N.A. allows students to manipulate AR models, leveraging motor cortex activation and generating greater synaptic connections to support the learning process [7][8]. In this learning phase, consistent with the dual coding principle, students internalize educational content by activating not only the verbal channel but also the visual and motor channels, facilitating subsequent recall due to the acquisition of information through multiple sensory channels [9].

This study aims to investigate the importance of purposeful gestures in relation to the choice of topics for AR model integration. A comparison was made on the impact of AR on the topic of neural correlates, using 3D models depicting different brain areas, and on the topic of prehistory, using 3D models of dinosaurs, hominids, tools, and fossils.

The research hypothesis states that AR has a more significant impact on student learning when gestures performed on the AR model are aimed at acquiring a greater amount of information that would not be possible from a two-dimensional image.

This led to the choice of comparing the integration of AR models of brain areas and prehistoric models in education. Manipulating a 3D brain model is aimed at acquiring information about the visuospatial relationships between various areas and gaining awareness of the synergistic neural activation of brain areas during motor, linguistic, mnemonic, and emotional processes. Such insights cannot be obtained with traditional education. Conversely, the chosen prehistoric models, though manipulable, do not add information to traditional education, but enhance engagement and motivation by anchoring to the student's cultural reality.

## 2 A.T.E.N.A: the Research project

Based on these premises, the present project aimed to determine the impact of AR on the learning processes of a sample of 50 students, including 27 university students from the Faculty of Education Sciences and 23 primary school students.

The experimentation took place during the 2023-2024 academic year, conducted separately at Niccolò Cusano University and a primary school in Rome. Before starting the experiment, a study of the learning curve was conducted to establish a baseline for academic progress.

Subsequently, AR was integrated into daily didactics, with lessons involving both traditional materials and 3D models over six months, both in the university course "General Didactics and Neurodidactics" and in history classes in primary school.

Progress was assessed through a structured questionnaire similar to school tests and academic exams, showing improvement due to AR integration in both student groups. Specifically, results showed a 6% improvement for the primary school sample and a 21% improvement for university students in learning explained concepts, compared to a control group that showed no improvement in memorization. Statistical analysis, conducted using Jamovi (version 2.3.28), revealed a violation of Levene's test and Shapiro-Wilk's test, leading to the use of Welch's t-test to verify the research hypothesis. The analysis revealed a p-value of less than 0.001 and an effect size categorized as very large.

These data confirm once again that AR integrated into education can benefit learning processes. Furthermore, the difference between the two student groups suggests that AR is more effective when it adds information that cannot be obtained from a simple 2D image. Clearly, brain models provide additional information related to the arrangement of brain areas, while a 3D hominid image is evocative and clarifies the concept but does not provide additional information over the drawings usually presented in textbooks. Thus, A.T.E.N.A. continues to ensure a high level of learning, particularly when consciously employed to convey complete and complex concepts, providing high-quality learning processes. However, this research involved a small sample, necessitating replication to establish a more stable relationship between the examined variables.

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# A systematic review of Faculty Development and digital technologies in Higher Education

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## 1 Introduction

Two years ago, the SIPED working group "Faculty Development and University Teaching[1]" initiated a systematic review to delve deeper into the central aspects of the Faculty Development research field. As part of the SIPED initiative, the sub-working group 6 focused on the intersection of Faculty Development (FD) and Instructional Technologies. This focus aimed to explore the dynamic relationship between these two domains, seeking to understand how instructional technologies can shape and be shaped by Faculty Development initiatives within the context of Higher Education.

In the field of educational technology research, Belt and Lowenthal's literature review [1], covering scholarly articles from 2013 to 2018, emphasized the pivotal role of integrating digital technologies into teaching and learning processes. This integration emerges as a core concern for Faculty Development (FD) initiatives, underlining the need for educators to adapt to the evolving digital landscape and effectively leverage technology to enhance pedagogical practices. The COVID-19 pandemic has accelerated the integration of digital technologies in Higher Education, underscoring the importance of continuous Faculty Development to adapt to this change [2][3][4].

This initiative aimed to investigate the profound impact of technologies on teaching methods, learning processes, and evaluation systems in Higher Education. By doing so, the group sought to provide valuable insights into the evolving landscape of Faculty Development and its intersection with digital advancements [5]. This paper builds upon findings presented last year by a subgroup of researchers who explored the multifaceted role of technologies in Faculty Development [6]. Specifically, this systematic literature review examines the intersection of professional development and digital technologies within the context of Higher Education. By analyzing existing research, the review aims to identify effective training strategies, uncover challenges faced by institutions and educators, and highlight emerging opportunities for leveraging digital tools to enhance Faculty Development initiatives.

[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/>.

## 2 Review overview

According to the Prisma framework [7], the methodology employed in this phase of the research mirrored that used in the initial analysis of systematic reviews. This ensures a rigorous and transparent approach, facilitating the reproducibility and reliability of the findings [8].

The search strategy was developed using the same strings adopted in previous work [8]. The searching process through Google Scholar did not permit researchers to set the time frame within the string, so we had to refine the results manually.

Additional inclusion criteria concerned the type of publications, specifically selecting only open access documents (journal articles, book chapters) and excluding conference proceedings and books.

The final data (as of July 1, 2024) included: 112 records from Scholar, 54 from Scopus and 692 from Web of Science. For the initial coding process, we used the three categories delineated by Bergquist & Phillips [9] (attitudes, processes and structures) in their conceptualization of FD and instructional technologies. Authors define "attitudes" as the actions or programs targeting the attitudes of academic personnel, "processes" as changes in organization directly connected to FD, and "structures" as the organization asset supporting FD (i.e. organization or IT assets).

The purpose of abstract screening was to further exclude papers/outputs not relevant to the study's objective and to proceed with an initial coding process for the remaining research items. The screening results, organized by databases and categories, are shown in Table 1.

**Table 1.** Results

| | Scholar (n = 112) | Scopus (n = 54) | Web of Sciences (n = 692) |
|---|---|---|---|
| Discarded | 112 | 40 | 671 |
| *Full text analysis needed* | | | |
| Attitudes | 0 | 2* | 7* |
| Processes | 0 | 10* | 6* |
| Structures | 0 | 2* | 8* |
| Articles | 0 | 14 | 21 |

In conclusion, the initial screening yielded the following results: 9 articles fell into the category of attitudes, 16 into processes, and 10 into structures. A total of 858 items were discarded. Some items (marked with an asterisk) appeared in multiple databases. The final number of articles selected for analysis is 31. The full papers analysis will involve all group members, who will triangulate their coding processes and propose sub-categorizations to organize the presentation of the results.

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# The impact of online teaching and the perception of digital skills among secondary school teachers

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## 1 Framework

Faced with the multiplication of online professional and training courses and the possibility of implementing their teaching skills in technological environments and with the use of digital technology in all phases of learning [1], secondary school teachers often demonstrate contradictory postures: on the one hand a certain resistance to the changes introduced by the increasingly widespread use of digital technologies [2] and on the other the perception of the need to rework teaching activities in a logic of innovation and openness to the future [3].

## 2 Context

To contribute to this debate and investigate the perception of teaching innovation, we built and submitted an exploratory questionnaire to a sample of 100 teachers who participated in the qualification course for the achievement of 30 ECTS credits in 2024 (art. 13 of the Prime Ministerial Decree of 4 August 2023) organized by the eCampus University. The training course, entirely online in synchronous mode, lasting a total of 180 hours, saw the participation of teachers from all over Italy and of all levels, enrolled to obtain the teaching qualification by changing school or competition class. The questionnaire was prepared as an initial testing, to start verifying the results, and subsequently to be validated to be used for the teachers who will participate in the online qualification courses in the fall, which will be thousands.

### 2.1 Methodology

The survey used this representative sample of the professional community of teachers to verify how they approach the use of digital technologies in teaching.
The questionnaire was uploaded and processed on QuestionPro, after online administration in the final module of the course. Semi-structured, it is made up of 18 items

which in some cases allow multiple choice responses and in other cases positioning on a Likert scale.
The questionnaire submitted is structured into three sections, which translate the research design. The first, with personal data, allows to identify, in addition to age and gender, school level and length of service. The second section includes a battery of questions with a Likert scale or multiple choice in a defined set of possible choices, which investigates the perception and interest towards online learning methods. The third section focuses on the concrete experience of the online course they attended, through a series of questions, with a Likert scale, which focus on the effectiveness, usefulness and possibility of using what they learned in the future.

### 2.2 Objectives

The research has a dual value. On the one hand it aims to allow teachers an initial re-elaboration of their training experience carried out entirely online, to obtain not so much an opinion of satisfaction or a certification of learning, but rather an initial assessment of their posture in the face of professional training carried out entirely online [4].
On the other hand, the survey also examined in depth the perception of teachers in relation to their different possibilities to reflect on their own disciplinary knowledge and teaching practices in relation to the knowledge and practice of the new possibilities of using digital technology in teaching, in a learning design logic [5], which updates the concept of Media Education in a broader and more contemporary perspective [6; 7].

## 3 Results

The study reflects on the acquisition of digital skills within the main tasks that are usually assigned to teachers relating to expertise [8] and delves into the analysis of the perception of the teaching and technical affordances of digital [9], in reference to the widespread need to innovate teaching [10]. The research also analyzes the potential for using digital technologies in the teaching environment in the logic of Community Technologies [11] and in the perspective of developing communities of practice [12] between colleagues, not necessarily located in the same physical places of teaching and in an interdisciplinary logic, also from a perspective of social integration and not just teaching [13].
The research also highlights some traits that can be traced back to the concept of digital educational poverty [14], which in this case refers not so much to the lack of skills and capabilities of students, but rather to the need for further training needs of teachers.

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# Technologies can support learning in Higher Education: teachers' practices and perceptions

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## 1 Context

Educational research is drawing increasingly more precise forms, boundaries, structures, actors and good practices for integrating technologies into teaching processes [5,8,9,19,21]. Using technological devices does not automatically improve student learning [2,18,20]. Numerous studies have demonstrated the effect of digital technologies on learning outcomes [15] in all educational cycles [23]; this depends on numerous factors. In particular, the types of tools chosen, the methodologies used by teachers and the digital learning environments organised [13,18].
In higher education, technology can be a valuable support in meeting today's challenges. The Italian university context has a very heterogeneous range of students (study background, age, language and culture), and for this reason, faculties should adapt their educational offerings to meet their needs [10,7], integrating active and student-centred learning experiences with traditional teaching methods. Ardizzone & Rivoltella [2] propose five forces that are reshaping higher education at the international level: increased access to university; the new profile of the typical student (more adult and often working); marketing developments in university policies; increased investment in the private education sector; and convergence among knowledge producing organisations. European indications require university teaching to activate meaningful learning in students to promote the acquisition of lifelong learning skills [12] necessary for professional life. Technologies can be a particularly significant tool for supporting active student learning in the direction of lifelong learning, especially regarding creating collaborative learning contexts. [1,6,16]. Digital is a space to manipulate, structure and organise artefacts, and through it, the student can be at the centre of his learning process [3]. Italian universities are moving through Faculty Development strategies to make learning more effective and meaningful, investing in the professional development of teachers [17,4,22] and, by doing so, improving students learning.

## 2 Research design and results

This study moved in this direction. It aimed to investigate whether and how technologies can support teaching practices in higher education. The research questions were: How do the university professors use technology in their teaching activities? Which tools are most commonly used? Can technological tools also support assessment

practices? University teachers working at the University of Genoa were involved in the study.

Participants were selected from teachers who, during the academic years 2020/2021, 2021/2022, 2022/2023 and 2023/2024, carried out innovative teaching activities with the support of the Teaching and Learning Centre. Thirty teachers decided to participate: 12 were male, and 18 were female. Eight of them were full professors, 13 associate professors and nine researchers. Seven were aged between 35 and 44, 9 were between 45 and 54, 13 were 55 and 64, and 1 was over 64. Six lecturers came from the mathematics area, two from physics 2, 1 from chemistry, two from earth sciences, two from biology, three from civil engineering and archaeology, five from industrial engineering, four from antiquity and philology, two from history and education and three from law. Eight of them teach in the Polytechnic School, 5 in the School of Social Sciences, 12 in the School of Mathematical, Physical and Natural Sciences and 5 in the School of Social Sciences. The sample cannot be said to be representative of the reference population. However, the origin of the different subject areas provides an opportunity to reflect on the use of educational technologies in different contexts.

Participants were involved in a semi-structured interview to answer the research questions. The interview questions investigated the teachers' opinions about the effectiveness of the devices in supporting the teaching process, the types of technologies used, the strengths and critical points, the learning these tools promote, and whether and how they can support assessing practices.

The interviews were held remotely on the university platform, recorded, and transcribed. Once transcribed, they were analysed following the analysis methods of the grounded theory formulated by Glaser and Strauss [14], using the technique based on the three-step coding process presented by Corbin and Strauss [11]: open encoding, axial encoding, and selective coding. This qualitative analysis process was conducted with the Nvivo12 software.

The data analysis revealed which tools teachers use (multimedia presentations, clickers, quizzes, recordings, university platforms, repositories, videos, annotation tools, professional-specific tools) and through which activities (flipped classroom, collaborative learning, project-based learning, debate). In addition, interesting categories emerged regarding the devices' affordances, such as the availability of materials, simplicity of use, interaction, engagement, reinforcement, collaboration, visual aspects, responsiveness and the possibility of overcoming shyness and anxiety.

The critical points were: lack of teacher preparation, communication and socialisation, the need for face-to-face workshop activities, organisational issues, time, student difficulties and lack of efficient infrastructure. Teachers agreed to recognise the effectiveness of technologies, particularly the critical role they played during the Covid pandemic. Regarding student learning, the main categories emerged: motivation, clarification of concepts, deepening, preparation, support, understanding, critical thinking, experimentation and soft skills. One element shared by the teachers was the recognition of the increasing need to develop digital literacy in students, future workers and citizens. Among the interviewed teachers, 13 have never used technological devices to conduct the assessment practices, while the others did. These, in particular, are through quizzes, simulations, micro-credentials, and formative assessment activities (self-assessment, peer assessment, and exchange of feedback between peers). Data analysis has revealed a growing need for reflection on the issue, and the study will

continue to experiment in different degree courses of peer assessment activities with technological devices.

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# Evaluation and impact of the Artificial Intelligence transversal skills Course: student feedback and progress in Faculty Development

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## 1 Introduction

This paper seeks to evaluate the efficacy of incorporating a cross-skills course on artificial intelligence into the academic development programme for doctoral students. The course, which was designed to integrate technical knowledge with analytical and ethical skills, had the main objective of enabling doctoral and postgraduate students to understand the tools needed to deal with the complex challenges posed by AI and to reflect on the responsible, conscious and ethical use of such technologies in their own fields and research paths from a human-centered perspective. This was to be achieved by encouraging critical thinking, creativity and problem-solving skills.
The article employs a detailed analysis of the teaching methodologies deployed and the feedback obtained from participants to assess the impact of the course on PhD students' research capabilities. It discusses the teaching methodologies, the results obtained and the challenges faced in integrating this course into the university curriculum. It also reflects on the role of AI in the future of scientific research, highlighting how AI can be an effective tool for innovation and progress in the contemporary research landscape.

## 2 Background

The application of AI in education is the subject of considerable interest. Nevertheless, in order to achieve a sustainable society, it is not sufficient to merely facilitate the application of AI in education; it is also imperative to promote and enhance AI teaching and AI education. It is imperative that students and citizens are equipped with the requisite digital skills, including what could be termed 'AI literacy', in order to comprehend, support and contribute to the realization of a sustainable future society [1].
The university context is pivotal in the development of reliable and sustainable educational and training models that can fully leverage the potential of AI [2]. Research on

faculty development [3;4;5] plays a pivotal role in this process, as it drives methodological innovations. It is of the utmost importance to evaluate the influence of novel applications based on artificial intelligence within the academic [6;7;8] and social milieu, particularly in view of the European Union's recent AI ACT [9] and international frameworks [10;11]. Consequently, there is a pressing need for universities to formulate a policy to advance AI literacy [12], which encompasses the fostering of competencies pertaining to the effective, critical and conscious utilization of AI.

## 3 Analysis and discussion

In response to this identified need, the Department of Education, Psychology and Communication Sciences at the University of Bari has initiated an experimental programme with the objective of enhancing the training provision through the introduction of a course on the transversal skills associated with artificial intelligence. The course, which lasts for 42 hours, is entitled "AI Beyond the Code". The course, entitled "Transversal Skills with Artificial Intelligence", was led by Professor Loredana Perla and was designed for doctoral and postgraduate students at the University of Bari and its partner universities. The course was attended by a number of experts in the field and comprised four thematic modules, each of which explored topics from both a pedagogical and a computer science perspective, with the inclusion of workshop activities and case studies. A total of 36 PhD students from a range of humanities programmes participated in the course.
The programme explored a range of topics related to AI, offering advanced training in areas such as machine learning, natural language processing, data management and computer vision. Furthermore, the programme placed an emphasis on the development of soft skills, including critical thinking and an understanding of the ethical principles related to the use of AI. This approach enabled participants to gain a comprehensive and interdisciplinary understanding of the field, equipping them with the ability to contribute constructively and thoughtfully to future technological and social developments in artificial intelligence.

## 4 Conclusion

In conclusion, the detailed analysis of the teaching methodologies and the participants' feedback made it possible to assess the significant impact of the course on the PhD students' research paths. The results obtained demonstrate both the advantages offered by innovative teaching methodologies and the considerations and challenges that arise in integrating such courses into university curricula.
This initiative permitted the delivery of training that was not constrained to the technical aspects of AI; rather, it encompassed the cultivation of interdisciplinary competencies that are indispensable for surmounting prospective challenges in the domain of

research and innovation. This enables a conscious, responsible, and ethical utilization of AI within the academic milieu.

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# MOOC Courses as an Element of Blended Learning

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## 1 Introduction

Since the beginning of the 21st century, blended learning has been the subject of active research by scientists and educators [1; 2]. Back in 2003, the American Society for Training and Development identified blended learning as one of the top ten trends in the education industry. The forecast included a rapid increase in the number of hybrid (blended) courses in higher education institutions, possibly up to 80-90% of all courses. Today, students are «…the first generation to live and breathe technology without trepidation» [3]. The large-scale success of free open educational resources has led to their widespread use not only for non-formal education, but also in the formalized educational process [4; 5; 6].

Quarantine restrictions related to the COVID-19 coronavirus pandemic have actualized the process of rapid implementation of distance learning in educational institutions. The process of translating knowledge into innovation capability has accelerated for students, teachers and administration of educational institutions [7]. After the restrictions are over, students returned to classroom learning, but the experience gained is successfully implemented through blended learning technologies [8]. In Ukraine, blended learning is relevant due to the restrictions of martial law in force from February 2022 to the present day [9].

There are three main scenarios for the implementation of blended learning [10]: (1) combination of learning tools (or media for the delivery of educational content); (2) combination of teaching methods; (3) A combination of online learning and face-to-face learning. The third model has been introduced at Lutsk National Technical University (LNTU) (Ukraine). The article analyzes the results of the use of MOOC courses in the 2023-2024 academic year.

## 2 Methods and results

246 bachelor's students of the Faculty of Digital, Educational and Social Technologies and the Faculty of Computer and Information Technologies of the Lutsk National Technical University (Ukraine) took part in the project. As part of the study of the normative disciplines "Applied and Web Programming", "Python Programming", "Organization of Databases and Knowledge", "Operating Systems", it was proposed to choose one or more distance courses, take distance learning and receive a certificate. Access

to the courses was provided by the Sector of Distance Education and Web Technologies of LNTU as part of the implementation of the Project "Digital Services for Education in Ukraine".

62.0% of students chose courses on Udemy (23.0 % successfully completed), 38.0% on Coursera (65.0 % successfully completed). Table 1 shows the MOOC courses most often chosen by students. However, the ranking of completed courses differs slightly: some selected courses proved to be too difficult for students. Another reason is that the chosen courses were large and required more time than the student could spend.

**Table 1.** The results of the choice of MOOC by LNTU students in the 2023-2024 academic year.

| Rank | TOP-5 courses by registration | TOP-5 completed courses |
|---|---|---|
| | **Udemy** | |
| 1 | Surviving Digital Forensics: Resolving Attached USBs | Surviving Digital Forensics: Resolving Attached USBs |
| 2 | Design Patterns in Modern C++ | Using SOLID Principles to Write Better Code - A Crash Course |
| 3 | Using SOLID Principles to Write Better Code - A Crash Course | Pyramid of Refactoring derived from Legacy Code cleaning |
| 4 | Pyramid of Refactoring derived from Legacy Code cleaning | Design Patterns in Modern C++ |
| 5 | React - The Complete Guide 2024 (incl. Next.js; Redux) | Introduction to Business Process Modeling |
| | **Coursera** | |
| 1 | Applied Text Mining in Python | Distributed Programming in Java |
| 2 | Distributed Programming in Java | Applied Text Mining in Python |
| 3 | Linux OS | Linux OS |
| 4 | Select Topics in Python: Natural Language Processing | Text Mining and Analytics |
| 5 | Text Mining and Analytics | Foundations of Cybersecurity |

Credits in non-formal education were credited to students as part of the disciplines provided by the educational plan. 100% of students who completed the MOOC course received high scores (75-96) in the relevant discipline. The teachers analyzed the content and structure of open courses and adjusted the educational components in accordance with global educational trends.

## 3 Conclusion

The inclusion of the best massive online courses in the traditional offline educational process provides a solution to a number of problems of the educational institution related to insufficient funding or a lack of highly qualified teaching staff. This format of education will allow you to quickly integrate the educational institution into the global educational space at the personal and institutional levels.

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# Museum education and new technologies for innovative teaching: impacts on teacher training.

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## 1 Introduction

In the era of digitisation, higher education is undergoing profound and significant transformations, especially in the field of teacher training and the integration of emerging technologies, such as the application of virtual reality or NFC to museum education [1]. New technologies for innovative education have the potential to revolutionise the way teachers and students interact with educational material, creating highly engaging and interactive learning experiences. This article aims to explore the future prospects of teacher education by analysing how new technologies can be used to enrich the educational experience in museum settings, going beyond traditional methods and opening up new possibilities for engagement and learning [2].

Analysing the impact of digital technologies on curriculum design through the analysis of case studies, the article explores how new technologies can transform teaching, learning and assessment methods, profoundly affecting teachers' professional identity. Indeed, new technologies do not merely offer advanced technological tools, but require an overall rethinking of teaching strategies, favouring more student-centred approaches and experiential learning. However, the effective implementation of these technologies is hindered by some risk factors, including the lack of specific training of teachers and educators, resistance to change and the lack of adequate resources and funds in schools [3]. Lack of funds often limits the purchase of advanced technologies and ongoing staff training, making it difficult to keep up with technological innovations.

It emphasises the importance of developing advanced digital skills among teachers to fully exploit the potential of new technologies in museum education. These competences include not only the mastery of technological tools, but also the ability to design engaging learning experiences and to integrate new technologies (VR or NFC) in an effective and meaningful way in the development of life skills. In this context, the article proposes strategies for the effective implementation of new technologies in teacher education programmes, highlighting the need for investment in in-service training, access to adequate resources and institutional support. Among the strategies suggested are the inclusion of specific courses in the curricula of education faculties, the organisation of workshops and practical laboratories, and the creation of support networks among teachers to foster the exchange of experiences and good practices [4].

The role of educational institutions and museums in facilitating access to technological resources and promoting a culture of innovation is also discussed [5]. However, it becomes clear that the effectiveness of these strategies depends on addressing systemic barriers, such as limited funding and fragmented educational policies, that hinder the diffusion of digital technologies in broader educational settings.

## 2 Methodology and research

By adopting a qualitative methodology, this study aims to assess the impact of new technologies in museum education and teacher training. The first step of this research consists of a systematic review of the existing literature, with the aim of mapping the current state of knowledge on the subject and identifying the most effective practices documented in varied educational contexts. This process is crucial to build a robust theoretical foundation and to guide the subsequent steps of the investigation, offering a comprehensive overview of currently available educational technologies, innovative pedagogical models used and empirical results obtained in various educational contexts [6; 7].

In parallel, the qualitative approach is implemented through semi-structured interviews with trainee teachers and educational professionals. This method allows for an in-depth exploration of their practical experiences, personal perceptions and level of digital competence, offering a more nuanced and contextualised understanding of the dynamics at play. The qualitative data collected in this way are then analysed by means of a thematic analysis assisted by the T-Lab software, which allows for the identification of recurring themes, critical factors and key challenges related to the implementation of emerging technologies in educational contexts.

## 3 Conclusion

The results aim to demonstrate how the integration of new technologies can significantly improve pedagogical effectiveness and student engagement, but requires ongoing support and appropriate teacher training. New technologies can contribute to making learning more dynamic and stimulating, allowing students to explore virtual environments, interact with objects and simulated situations and develop skills in a more hands-on and direct way. However, to fully exploit this potential, it is essential that teachers are adequately trained and supported in the use of these technologies [8; 9].

In conclusion, it reflects on the future of higher education and the need for continuous adaptation of teaching practices to integrate digital learning technologies, ensuring that future teachers are prepared for the demands of an increasingly technological world. This contribution aims to provide a comprehensive and innovative view of the potential offered by new technologies, helping to outline new avenues for teacher training and the enrichment of the educational experience in museums. The hope is that through these innovations education can become increasingly inclusive, accessible and capable of meeting the challenges of the 21st century [10].

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# Empowering Future Teachers: The Role of Active Breaks and Technologies in Initial Teacher Training

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## 1 Introduction

In the current information society, comprehensive training is necessary to provide a response to the presence of technologies and processes of social transformation (SáezLópez et al., 2020).

Therefore, it is necessary to highlight the importance of the initial training of future teachers, because to carry out these changes requires the development of training activities that include the most suitable spaces and strategies for the proper acquisition of teaching skills (Esteve Mon et al., 2014).

It is essential that future teachers have adequate training for the challenges of the 21st century, as well as knowledge of emerging technologies in educational contexts to acquire the necessary skills to be able to design and develop educational activities to exploit the potential of the technologies (Barnes et al., 2017, pp. 107-116; Cochran-Smith & Zeichner, 2009; Darling-Hammond & Bransford, 2007).

In the age of information and continuous learning, the role of the teacher has evolved from a transmitter of knowledge to a facilitator of learning. Initial teacher training is, therefore, crucial not only for the acquisition of disciplinary content, but also for the development of digital and metacognitive skills that enable them to manage increasingly heterogeneous classes and to respond to the diverse needs of students. In the context of initial teacher training, maintaining a high level of attention and engagement during teaching sessions is crucial (Daly-Smith et al., 2018).

Active breaks, defined as short intervals of physical or mental activity that interrupt the monotony of the traditional lesson, emerge as powerful tools for improving teaching effectiveness. These intervals not only promote physical and mental well-being, but also enhance attention and learning (Coco et al., 2020, pp. 29-44).

Taylor et al. (2014) clarified the benefits of active breaks, such as positive mindset, improving health and feelings of companionship. According to a recent review (Watson, Timperio, Brown, & Heskethet, 2018), the ways with which active breaks are currently proposed, in relation to timing, objectives and organisational arrangements are as follows:

- active breaks as an interval/break between two successive lessons;
- active breaks within the lesson itself;
- physically active lessons, with integration of physical activity into other subject areas.

## 2 Exploring the Impact of Active Breaks in Initial Teacher Training: A Questionnaire Study

Active breaks represent a promising innovation in initial teacher education. Systematically implementing these practices in curricula can significantly improve the effectiveness of pedagogical training by preparing future teachers to create more interactive and stimulating learning environments.

This study aims to examine how active breaks can positively influence the training of future teachers, helping to develop critical metacognitive skills and promoting more dynamic and inclusive learning environments.

The main objective of this study is to explore the effectiveness of active breaks in initial teacher education. We want to determine how these practices can improve student engagement, facilitate the acquisition of metacognitive skills and promote a more interactive and engaging approach to teaching.

The study presents a questionnaire administered to 1300 future teachers enrolled in university initial teacher training courses for secondary schools.

The questionnaire was designed to assess participants' attitudes towards active breaks and to collect data on the use of technology as a support tool for such breaks. Questions covered a range of topics, including the frequency and duration of active breaks, preferences for different types of activities, and the perceived effectiveness of technologies (such as mobile applications, online videos and interactive software) in facilitating these breaks.

Incorporating active breaks into the daily routines of faculty members can significantly enhance their physical health, cognitive function, and overall well-being. As part of faculty development programs, teaching the importance of these breaks can lead to more effective teaching, research, and academic leadership, while also promoting a healthier and more balanced lifestyle.

## 3 Conclusion

This research aims to provide a detailed overview of how active breaks can be used effectively in initial teacher training, emphasising the role of digital technologies in enriching such experiences. The potential findings of this study could help develop guidelines for the integration of active breaks in teacher training and provide recommendations on how best to use technologies to support well-being and teaching effectiveness.

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# Developing a questionnaire for measuring future teacher anxiety: with insights from initial observations and interviews

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## 1 Introduction

Research on teacher emotion is an increasing area of interest due to its significant impact on the classroom environment. The importance of teacher emotion extends beyond teacher occupational mental wellbeing [1], to also the students' wellbeing [2] and learning outcomes [3]. High levels of teacher stress and the increasing prevalence of teacher burnout contribute to educators leaving the profession [4]. Regarding the use of technology for supporting and measuring emotions, research tends to focus more on the students, exploring wearable devices for the measure and predictions of student engagement [5] and behaviours [6]. However, the use of these innovative devices and interventions within samples of teachers is lacking, despite the importance of regulated teachers for positive student-teacher interactions and environments which foster co-regulation [7, 8]. These tools also have the potential to enhance faculty training by providing objective measures of teacher stress and anxiety, which can lead to more targeted support strategies, facilitating professional development.

Electrodermal activity (EDA), also referred to as galvanic skin response (GSR), detects changes in skin conductance that depict the activity of the sympathetic branch of the autonomic nervous system [9]. It is a validated measure of physiological and emotional arousal [10, 11]. Advances in technology are allowing for EDA data to be collected through non-invasive wearable devices [12]. Researchers are advancing the use of EDA into more mainstream applications, thus rendering it feasible for classroom and educational settings. Results from studies measuring emotion have suggested that a triangulation method, which combines objective physiological data (such as EDA) with subjective measures (such as self-reports and interviews) [13], provides a more robust approach to measuring emotions. The present study acts as a foundational step to the wider project aims which involve comparing self-reported and observed data with objective EDA measurements, employing a triangulation method [14]. This approach, which integrates multiple data sources, is suggested as the most effective for measuring teacher emotions, as it combines the strengths of both data types: the objectivity and precision of physiological measurements and the personal insights offered by subjective

reports. This allows for more accurate results, especially in situations where emotions may not always be visible, such as during teacher observations or self-reports.

## 2 Pilot study: a foundational step for the triangulation of questionnaire and EDA data

The present study, which is part of the Samothrace Spoke 3 'S2- COMMs - Micro and Nanotechnologies for Smart & Sustainable Communities Project', serves as a pilot study aimed at developing a questionnaire designed to measure future teacher emotions, with a focus on anxiety. The questionnaire will be tailored to address the unique challenges of classroom contexts by building on concepts from existing tools for measuring teacher anxiety, as well as our own observations of and interviews with 62 future teachers during a stimulated lesson activity. Identified indicators such as body language, fidgeting, and other physical manifestations of anxiety observed will be translated into questionnaire items to assess underlying emotions and cognitive experiences accurately. Methodological limitations include self-report and observer bias in interviews and observations. To address these issues, the wider project aims to triangulate the questionnaire data with EDA data in future studies to enhance the validity and reliability of the tool. This multi-source approach, which will be tested in future validation studies, aims to provide a more comprehensive measure of teacher emotions, contributing to a broader understanding of their emotional experiences with increased accuracy across diverse educational contexts. The findings and the developed questionnaire will inform practical interventions in educational settings, guiding targeted support interventions for future teachers, and helping them identify and manage anxiety during their training and subsequent teaching careers. This research is pivotal for Faculty Development in Higher Education, as it provides institutions with tools to better prepare educators for the emotional challenges of teaching, ultimately enhancing their effectiveness and well-being in the academic environment.

## 3 Conclusion

Considering the evidence for the impact of teacher emotion, it is crucial to understand this area further using more objective measures. Understanding these emotions can ensure classrooms are inclusive, safe spaces with emotionally regulated teachers, as well as offer valuable insights into the challenges and stressors faced by teachers, thereby informing strategies to enhance their well-being and professional performance. The development of this questionnaire establishes the basis for employing the triangulation method, which will enhance the validity and reliability of the findings, offering deeper insights into the challenges and stressors faced by teachers.

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# *LookAIHed:* a comprehensive Faculty Development approach to integrate AI in Higher Education

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Until recently, AIEd has been a matter of lab development, with a very slow spread to daily practices in teaching and learning. However, the launch of ChaptGPT [1] in November 2022 led to mass media hype and widespread usage of the word "AI" for any purpose. . Although Higher Ed initially banned the usage of GenAI-powered chatbots due to concerns about academic integrity, the debate evolved to focus on the verifiability and veracity of student and researcher products, aligning with the ongoing debate on "academic integrity"

[2]. Nonetheless, educational practice quickly moved in the opposite direction, namely, exploring and understanding of potential uses of GenAI. A critique of prohibitionism, this movement deemed that the problem lay not in the instrument, but in a teaching anchored to the transmission and repetition of abstract notions, now completely anachronistic [3]. Both trends failed to acknowledge the technological complexity and relational nature, where the “social life” of AI needed to be situated [4], [5]. Moreover, the invisible algorithmic structure underlying such an effect was not new. Spotted in the research on social media platforms like Google suite, Amazon or Netflix, such a digital assemblage had been criticised in the literature for its insidious effects (surveillance, bias, epistemic injustice) [6]. Though the “ethical” stance was integrated into the debate, after the publication of UNESCO and the EU ethical guidelines to work with GenAI in education [7], [8], the issue of “responsible use” was translated into checklists to complete before passing to action, ignoring structural social factors or the critical impact of the automated generativity [9], [10]. We might assume that HE institutions are struggling to implement holistic, critical, and comprehensive approaches to AI, with most offers based on describing the possibilities of ChatGPT and other GenAI-driven tools [11]. In this article, the authors present a case that situates the institutional efforts to integrate AI into an existing organizational and faculty development culture [12]. The activity proposed to all the HE academics (who participated voluntarily) was aimed at understanding the evolving trends of GenAI to respond through an agentic and situated pedagogical and institutional practice. The approach encompasses: five phases of interaction with a Faculty Development team (Explore, Understand, Collaborate, Design, Implement/ document/share), two perspectives on AI (educational or teaching and learning with AI; and promoting AI literacy, or learning about AI); and six areas of pedagogical intervention with AI, from the teacher and the student side (Curriculum Design, Learning Design, Content development, Communication, Collaboration and Assessment). The faculty development programme was tactically organized through a blended approach, with

three workshops opening the working phases and assessing the prior work. We collected data from the trainers' reflection upon the process (6 months); students' artifacts and narratives and a final survey from the participants (N=43) with quantitative and quantitative data. Simple linear regression analysis including Teaching, Pedagogical Approach, Topic, Time and Organisation, indicated that Topic ($\beta = 1.7359$, $p < .001$) and Organisation ($\beta = -1.8542$, $p < .005$) were significant predictors of further usage. Teaching ($\beta = 0.7917$, $p < .001$) and Organisation ($\beta = -0.3619$, $p < .05$) were significant predictors of recommendation to other colleagues. We also analysed qualitative responses, which support the interpretation of such results. We conclude that though the concatenated, blended activity was positive to raise awareness and engagement in a wider institutional activity, traditional approaches to teaching might lead participants to be rather focused on the instrumental usage of AI. However, our faculty development approach supported understanding about the relevance of institutional strategies, to embrace both a specific, disciplinary perspective and a wider picture on GenAI in HE institutions.

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# Teaching and Learning Center and development of teacher professionalism: the case of an Italian university

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## 1 Introduction

European universities are currently grappling with new challenges concerning the recognition, promotion, and certification of pedagogical, design, and evaluation competencies among university educators [1]. In this context of rapid change and deep cultural transformation, Teaching and Learning Centers (TLCs) can play a pivotal strategic role. Their establishment and proliferation are deemed crucial for enhancing and cultivating professionalism among educators, fostering student-centered learning, and promoting a culture of quality in teaching and learning. In the specific Italian national context, initiatives and commendable practices aimed at enhancing teacher professionalism and improving teaching quality do exist. Nevertheless, there remains a necessity to reconcile accreditation and quality certification models with frameworks and practices that elevate the educational context and its stakeholders [2]. This entails overcoming dichotomies between quality assurance and enhancement models, as well as top-down versus bottom-up approaches [3]. Hence, the establishment of TLCs assumes fundamental significance, as these centers serve as potent tools, both nationally and internationally, to advance, acknowledge, and enhance educator professionalism, thereby aiming for educational excellence.

The present study contributes towards addressing this imperative and seeks to explore the following question: Can a strategic response to continuously enhance the quality of university teaching be collectively offered by Italian (and foreign) universities, grounded in a holistic approach that listens to both top-down and bottom-up needs? The study commences with an initial survey into the goals and strategic methodologies employed globally to improve TLC-driven teaching quality. International regulatory frameworks and the applications of TLCs across diverse regions such as Oceania, the Americas, Asia, and Europe underscore their critical role in advancing teaching quality, aligning with global educational standards, and fostering a culture of ongoing improvement in higher education. However, strategic approaches that effectively cater to and satisfy both top-down and bottom-up needs in a unified systemic manner, and utilize the knowledge system derived from this comprehensive teaching approach to enhance educator professionalism (systemic, dynamic, and contextual), remain underdeveloped.

Building on these findings, the article examines a case study of an Italian university that recently established a TLC based on an innovative experimental holistic approach to university teaching, supported by a web platform named "L'Ascolto".

## 2 The L'Ascolto Project and the Case of TLC-UNICH

L'Ascolto derives its name from its core mission of listening to the needs of educational stakeholders (both top-down and bottom-up) and addressing those needs. The L'Ascolto project is grounded in a framework [4] [5] [6] [7] that integrates the Deming cycle with Quality Function Deployment, alongside Kolb's experiential learning theory and Biggs' constructive alignment [4] [6] [7]. The AVA system is rooted in principles of Total Quality, specifically the Deming cycle and Biggs' constructive alignment. Consequently, L'Ascolto facilitates responses to accreditation and quality certification requirements, adhering to both national and supranational guidelines [8]. Moreover, within the framework, the unique fusion of the Deming Cycle with Kolb's experiential learning allows for the listening and fulfillment of specific teaching and learning contexts (bottom-up). This framework forms the conceptual basis of the L'Ascolto platform, providing educational stakeholders with a unified strategic tool for designing, managing, evaluating, and enhancing overall teaching processes. Simultaneously, the platform empowers stakeholders to generate knowledge based on teaching-learning experiences (following the "Deming/Kolb" cycle, Verna, 2020). Notably, L'Ascolto fosters the professional growth of educators in response to student-expressed needs, in real-time during course delivery (bottom-up). Ultimately, this approach supports educators' continuous self-improvement through reflective processes, addressing areas that define the quality of university teaching at both international and national levels [9] [3].

## 3 The Experimentation of the L'Ascolto Project and Key Findings

The experimentation conducted across several degree programs at the University of Chieti-Pescara aimed to evaluate the impact of the holistic L'Ascolto approach on enhancing student learning, advancing educator professionalism, promoting educational innovation, and catalyzing research in education. The experimentation followed multiple phases (Plan, Do, Check, Act). Results highlighted the tangible potential for Italian universities to implement a teaching quality improvement strategy capable of meeting transparency, certification, and quality assurance needs (both international and national/top-down guidelines). Moreover, it concurrently listens to and fulfills the needs of stakeholders (educators, students, institutional bodies, and others) within specific teaching and learning contexts (bottom-up). Based on these outcomes and to further advance and institutionalize the L'Ascolto approach across all its degree programs, the University of Chieti-Pescara has opted to establish a TLC. Through this TLC, grounded in the L'Ascolto project, the university aims to promote a unified, shared culture of quality linked to a strategic teaching approach that effectively meets the requirements of quality assurance and certification (top-down needs). Simultaneously, it seeks to offer educators, students, and institutional bodies a holistic approach to enhancing all educational processes, rooted in listening to and addressing stakeholders' needs within

their unique contexts (bottom-up needs). Following the experimentation, students were surveyed on their satisfaction with the new teaching approach, L'Ascolto. The results indicated high levels of student satisfaction, particularly highlighting enhanced learning ease attributed to clear course objectives (design, syllabus) aligned with learning assessments (J. Biggs' constructive alignment). This clarity facilitated addressing ongoing learning challenges during course delivery. Students also appreciated the varied teaching strategies employed by educators, catering to diverse learning needs (flexibility in teaching styles). Overall, the implementation yielded knowledge creation, management, and sharing (best practices), empowering stakeholders for continuous educator self-improvement, fostering educational research, driving innovation, and perpetually enhancing all teaching processes, ultimately culminating in heightened student learning outcomes. The experimentation's most significant revelation was the unified stakeholder approach, affirming the feasibility of a collaborative strategic approach to improving university teaching quality, validated through joint experimentation among Italian universities.

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## Special Track 4

# Critical pedagogy, art, affect as method and performativity in Online Higher Education

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# AI and personalization of Mindfulness in higher education: emotions at stake for the reaching of well-being

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## 1. Introduction

The practice of Mindfulness, a term that means "to remember", embraces the concept of Embodied Cognition [1]. It underscores the centrality of embodied cognition for transformative learning [2]. This approach recognizes the interconnectedness of mind, body, and emotions, highlighting their role as fundamental aspects of human existence. Mindfulness involves mental and cognitive processes closely linked to emotional regulation, sensory perception of the body and elements related to sensations, the mind, and mental objects [3]. In an educational context, mindfulness entails the careful observation of thoughts, emotions, physical sensations, and the surrounding environment, which is increasingly shaped by digital media. In the proposed research, artificial intelligence played a crucial role by personalizing and transforming meditation experiences through a digital app, making them more accessible and tailored to the class group involved. This allowed everyone to experience their educational journey in an optimal state of physical and emotional well-being [4]. Meditative practices can indeed integrate the educational dimension, emphasizing the importance of living in the present moment and being in the *here* and *now*. The experience of "knowledge" is situated in that "space of encounter" [...] [and interaction], and is structured, as in the theatrical artistic experience, *hic* et *nunc*, in corporeal and spatial co-presence [5].

## 2. Research

The research, conducted as an exploratory study, utilizes Arts-Based Research [6], to analyze the impact of Mindfulness on students' mental health. The study builds on previous experiments that highlighted the importance of incorporating Mindfulness into educational contexts, which were primarily based on quantitative data analysis [7]. This practice restores uniqueness to the individual student, emphasizes their state of well-being, highlights the performative role of the body, and promotes the creation of intelligent and personalized learning environments. Methodologically, the study is oriented towards creating personalized learning paths where adaptive AI analyzes students' progress, adjusts content and mindfulness practices according to their individual needs and provides real-time feedback to recognize and respond to everyone's specific requirements. Mindfulness can help students develop metacognitive skills, fostering greater self-awareness and improving their learning strategies.

Designed with a Mixed Methods approach [8], the study primarily focuses on analyzing qualitative data manually extracted from students' journals, collected at the end of each laboratory session. This approach aims to further emphasize the importance of integrating Mindfulness with AI-based applications [9] in educational settings. The pilot research, conducted during the *Learning through Play: Techniques for Theatrical Animation and Communication*" laboratory as part of the degree "Eucational Sciences" degree program (L-19) at Suor Orsola Benincasa University of Naples during the 2023-2024 academic year, utilized the English digital application "Headspace" to explored students' moods and emotions before engaging in Mindfulness. Following the administration of an introductory questionnaire via the AI, tailored meditation paths were created based on the students' needs. This led to a significant increase in relaxation levels, from 10.6% before mindufulness to 67.4% after, while reducing feelings of stress, anxiety, boredom, and inattention. The study involved 44 female students and 2 male students with an average age of 21, representing the number of students enrolled in the compulsory university laboratory. Analysis of logbooks and questionnaires administered at the end of the laboratory showed a significant improvement in their mental and emotional state, as well as their concentration levels. Meditative practices, considering the difference between a mind full and a well-made [10], should become a daily routine in educational contexts, as is already several other countries. The practice of mindfulness, integrated with AI, allows students to live in a positive and relaxed way their own educational experience, encourages each subject to take an active and equal role in their own learning process, developing autonomy and the ability to reflect on oneself. This fosters the formation of a specific ecosystem that allows students to detach from their immediate surroundings and visualize themselves in a perceptual space called 'Umwelt' [11].

## 3. Conclusion

The qualitative results from the pilot research further reinforce the concept of the embodied mind [12], where the mind is embodied in physical, social, and technological relationships. Mindfulness enables students to connect with themselves, others, and their environment, facilitating significant improvements in their mental and emotional states. This leads to more meaningful teaching and learning processes [13]. The future goal is to develop a digital application that guides students through Mindfulness exercises, utilizing intelligent algorithms to adapt interventions promptly based on their emotional responses and progress over time.

By fully leveraging the transformative power of technology [14], this approach aims to promote student well-being in Italian schools.

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# Chances for accessibility: a case study on media education and contemporary art

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## 1 Introduction

The abstract addresses the topic of art and inference from Dewey's perspective and through a contemporary artwork. It will ask whether or not 'availability' and 'accessibility' are taken for granted in art fruition. Some suggestions on contemporary art will also be given, probing questions on its understanding and opportunities, even in media education.

## 2 The art experience by media

Art has always had a social function and in the contemporary era assumes increasable elite connotation; is democratic, free and emancipating but poses itself veiledly accessible. Art as a mediator of meaning and culture achievement. Fulchignoni claims that the culture cannot and should not have a "museographic" character, it cannot only be conceived as an "economic income" and it cannot be limited to disclosures as "conservation". If culture do not advance with technology, it declines [7]. Sixty years ago, the author related technology and art. Technology was to play a leading role in cultural progress and the conveyance of art through mass media. It would enable progress and a new popular form of art.

In fact, media could be meaning and end (conclusive or implementation) [3] which needs art to engage the audience. But is it cognitively available? Does it create inference? The online environment increases the accessibility of fruition, participation and communications and learning experience, such as installation [15] or digitized artwork already in place in offline environments. Digital tools raise the informative and training potential [10]. As we will be in the successive paragraph are necessary skills of Media Education: Critic (access and comprehension), Ethic (resistance and responsibility) and Aesthetic (Creativity) [18, 19]. Any artwork hides visible and not visible contents, or rather the expressive intention between how the authors want explicit, non-explicit or disguise [6]. The study conducted by Panciroli and Macauda examined five cases study to demonstrate the effectiveness of online training environments [16]. Art may create inference and educational processes, according to Dewey's theory of learning by doing. Experience spreads around and this may lead to inference; inference is the product of the reflective thinking and consciousness, which

depends on experience itself [3, 4, 2]. The aesthetic experience starts with experiencing art [17, 12]. Perception following this first interaction becomes a “cognitive” process thanks to active and thoughtful thinking [12, 3]. Learning only takes place if perception becomes cognitive and the experience over action makes use of the process of thought and reflection [3, 4, 20].
Given the above, we asked ourselves: do artworks always produce inference? And if yes, is it always available and accessible?

## 3 Hints on availability and accessibility

“Open to public” [8] is what ICOM states about museums. Today is taken for granted that ‘open’ refers both to the physical and the digital environment. The latter can precede and follow the first; sometimes it can replace it, with features that belong precisely to this experience [9]. The same is for contemporary art, which takes advantage of ongoing communication processes shaped by its primary stakeholders: artists, institutions and who involved in commercial purposes. Speaking on the availability of information, contemporary art benefits the fact of being 'current', a chance surely enriched by these times. However, not everything available is accessible in the strict sense. Talking about accessibility, contemporary art carries out other matters. It is a niche field by definition which takes times and spaces [10]. The question is if what we mean by availability and accessibility today allows them.

Eva & Franco Mattes (Brescia, Italy 1976) are an artist duo living in New York and Milan. They work with the Internet to reflect on human behaviour there: “We try to make art wherever there is an audience that is not ready for, as happens in video games (…) and that's why they react as they want to” [14], declared already in 2012. They were among the first to use the Internet as media. *The Bots – Italian, Turkish and Spanish Market* (2020-21) is a series of videos conceived with the investigative journalist Adrian Chen [21, pp. 18-19]. Between tips on how to use the blush and the best make-up fixer, we hear sentences like “whatever Facebook considered violating or non-violating” [5]. We see people (actors actually) dissimulating political topics as fake make-up tips to bypass censorship. Censorship on the Internet *is* their job: they are ‘the bots’, forbidden from speaking to the press or anyone, warned there might be ‘spies’ in their midst [5]. The investigation is based on anonymous testimonies from content moderators. This entails two important issues: they do not know who they work for and Big Tech remain anonymous, eventually minimizing legal responsibilities.

## 4 Conclusion

This work has a precise exhibition shape, but it also lives in the digital one; as a videoart work. For this reason, it can be a concrete case study for pedagogical issues. First, it raises issues on media transparency and therefore media education in the light of Critic, Etic, and Aesthetics. Being available online makes it suitable for different learning

methods. These are reasons why this work can be a concrete case study for its pedagogical potential of integrating artistic materials into teaching. One should define how, given the issues of 'openness' and 'accessibility' mentioned above and those specifically related to contemporary art. Artists will be then be involved in an interview, focusing on educational issues: what we (they) intend by availability, openness and accessibility regarding art and its educational chance.

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Structure of the paper: 1 Minna, Rocchi; 2 Rocchi; 3. Minna; 4 Minna, Rocchi

# Aesthetic experience as class engagement: a study on the intersection between emotions and art in e-learning

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## 1. Theoretical framework and research objectives

The study of emotions' impact on learning and teaching is increasingly growing, especially in higher education. The interest in emotion seems not only due to their effect on students' learning capacity but also to the need to better understand how effective approaches can be identified to enhance learning experiences and explore the connections between emotions and teaching practices in an academic context.

Several studies have examined the emotional impact of specific teaching practices and their influence on students' educational experiences, starting with the pivotal role of the educational experience and delving into traditional studies of a socio-cognitive and pragmatic-cognitive approach.

Cognitive models of learning, such as the cognitive theory of multimedia learning proposed by Mayer [1,2], emphasize that when a learner is presented with instructional information, it triggers cognitive processing, leading to a learning outcome. However, other studies suggest the need to broaden these models to include the impact of emotional processing on learning, as cognitive processing alone does not fully capture the learner's internal activities during learning [3,4,5,6]. Affective-cognitive models of learning aim to integrate the learner's emotional state during the learning process as part of the causal chain that contributes to the learning outcome. Emotion, in this context, refers to short-term, intense affects induced by specific objects or events [7].

Among the stimuli that activate forms of emotional intelligence, art holds a prominent place, as it fosters emotional connections, allowing us to remember concepts by linking them to an emotion. It captures the student's attention by creating the memory of a pleasant moment, thus facilitating learning while also stimulating expressiveness and creativity.

This research provides evidence on the types of emotions that can be activated in e-learning contexts and, based on the interviewees' responses, highlights the crucial role of artistic expression and emotional intelligence in capturing students' attention, facilitating comprehension, and promoting creativity. In particular, this research aims

to understand the relationship between emotions, artistic texts, and learning processes in two distinct academic contexts: a traditional university context and an online context.

## 2. Methodology

This research is part of a broader comparative study aimed at understanding the social roots of emotions in two distinct university courses, the first conducted in a traditional academic context at Politecnico di Torino, and the second in an online context at eCampus online University. From this research, conducted during the 2022-2023 academic year, which we could define as the main research, an unexpected element emerged: the correspondence between positive emotions and teaching techniques that use artistic texts. Building on this correspondence, this study is configured as a secondlevel research. It aims to understand, on the one hand, the social fabric in which artistic texts can activate positive emotions and, on the other, the consequences, cognitive and normative social mechanisms that the artistic text can activate. The research is developed in two interdependent steps. The first consists of a cross-analysis of data extracted from the questionnaires already administered during the first research on the exploration of emotions. This step aims to connect the recurrence of the artistic element with the results emerging from the section of the questionnaire dedicated to the analysis of social interaction and with the exploration of the artistic forms emerging from the responses dedicated to questions about the artistic text (enjoyment of a text, involvement in its production, design). The aim is to bring out the social environment in which artistic texts generate positive emotions and to explore their most recurrent forms. The second step, of a more qualitative nature, consists of focus group discussions on the themes emerged via the cross-analysis with the participation of students and teachers, aimed at exploring more deeply the aesthetic experience, its social roots, its multiple expressions, the emotional involvement generated, and its consequences on learning.

## 3. Research results and analysis track

The research highlights two main findings. The first concerns the social quality of the aesthetic experience. The latter does not in itself generate positive emotions but becomes so when placed in a social atmosphere and more specifically in an affective educational atmosphere. Its ability to positively engage students in the learning process is not taken for granted but is instead connected to the activation of attentive educational relationships. The second concerns the differences between traditional and online learning environments.

The aesthetic experience, far from being configured as an intellectual experience, is configured as a physical experience. Consequently, it requires especially flexible and customizable educational environments where one can not only enjoy artistic texts and share their creations but, above all, experience the human qualities of teach-

ers and colleagues. Both of these results, although emerging from exploratory research and consequently still being avenues of analysis, appear fundamental both in the design of educational environments and in the innovation of teaching techniques.

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# I AM – I DO – I DREAM
# Relational Dynamics in Self-Perception through Artistic Research

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## 1 Introducion

This project explores how art-based research methodologies can enhance relational dynamics and identity perception in online higher education. By examining the role of relationships in the construction of student identity, it explores how theater and cinema can facilitate a deeper understanding of the self and others, assessing the effectiveness of Art-Based Research (ABR) in bridging the fragmentation of online interactions. The importance of relational dynamics in identity perception is well documented in social and psychological theories. G.H. Mead, with his symbolic interactionism [1], and Jacques Lacan, with his theory of the mirror stage [2], highlight how self-perception is influenced by the perception of others. Judith Butler has extensively addressed the theme of identity and its symbolic resources [3], introducing the concept of performativity and using the concept of interpellation to explain how identities are called into being through recognition by others [4].

## 2 Research

Relationships with others are mediated through the body, a fundamental element in the construction of identity and the understanding of the self. In higher education, creative approaches are crucial tools for personal growth, particularly in fostering relational connections. Art-Based Research (ABR), which uses artistic processes as the primary mode of inquiry [5], was the adopted research methodology, with a particular focus on theater and cinema. This methodology encourages active participation, reflection, and critical thinking, bridging the fragmentation of online interactions by creating shared experiences that foster a sense of community and mutual recognition. Students, by engaging in artistic practices, can explore different facets of their identity and see themselves through the eyes of others [6]. The use of storytelling as a way to revisit personal experiences, especially for individuals in training, can be an important element in self-perception work. By recounting their experiences, the narrator reflects on what happened in specific circumstances, facilitating a clearer understanding of themselves

[7]. Cinema, in particular, allows students to see themselves through the screen, take on the role of spectators, or become "the other" to identify and recognize themselves. Seeing oneself from an external perspective fuels a process of self-observation that can activate mirror neurons, enhancing empathy and understanding of one's emotions and behaviors [8]. This approach is widely explored in the theory of Embodied Cognition, which posits that all forms of human cognition are embodied, meaning they are rooted in bodily experience. Through an *enactive pedagogy*, cognition emerges from the dynamic and reciprocally influential interactions between body and environment [9]. In this context, the use of cinema facilitates an immersive and multisensory experience that strengthens the connection between perception, action, and self-awareness. The results obtained come from field experience in the "Techniques and Languages of Performance" course within the master's program "Languages, Interpretation, and Visions of Reality (LIVRE)" at the Department of Educational, Psychological, and Communication Sciences at Suor Orsola Benincasa University. The course adheres to the CReAP+T method: *An acronym for Corporeality, Creativity, Relationship, Emotion, Action, Performativity + Technology/Training* [8]. During the course, which was conducted online during and after the pandemic, innovative solutions were necessary to ensure full student engagement and the achievement of educational objectives. The course's project phases included: *1)Self-Definition*: Students defined themselves using the predicates "I am. I do. I dream." through words and poetry. 2)*Family Interviews:* Students interviewed a parent about their birth. 3) *Interviews with Siblings and Friends:* Students interviewed a sibling or a friend. 4) *Personal Reflections:* Students shared photos, songs, poems, and paintings that represented them. 5) *Course Feedback:* Students completed questionnaires and wrote reports about their experiences, providing feedback on the course and personal reflections. These phases allowed students to explore and document their self-perception through interviews, logbooks, and video projects, demonstrating how the integration of art-based research methodologies can lead to transformative learning, despite the challenges imposed by the online environment during the pandemic.

## 3 Conclusion

The course provided an ideal context for this research. Student feedback was mostly positive. The videos produced were a testament to the vast creativity of the learners. Some students used clips from films that reflectively and memetically represented their identities, while others took on the role of director-actor, using personal archival materials and becoming the complete protagonists of their own narratives. Others represented themselves through an audiovisual documentation of a theatrical performance (as performance), creating a blend of performativity and technology [11]. This project demonstrates how art-based research methodologies, such as theater and cinema, can be effectively implemented to promote a deeper understanding of the self and others.

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# Reading Dewey:
# Art and Democracy in an Academic Online Environment

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## 1 Introduction

In recent years, research that includes texts or artistic practices in teaching techniques has multiplied [1]. Art seems to be an extraordinary medium in promoting the learning of educational content, and its use is becoming increasingly common even in university courses [2]. Historically, art, in addition to its disciplinary effectiveness, has also always played a political role [3]. Dewey, in the early 1900s, deepened the theme of the relationship between art and democracy by advancing the thesis that democracy, understood as a social system rather than just an institutional architecture, can be learned through art [4,5]. This study, building upon Dewey's thesis, attempts to clarify the conception of art proposed by the pragmatist philosopher. It explores the logical-practical connection between art and democracy and highlights the institutional conditions that, in an online university context, could promote democratic ways of thinking through the activation of artistic and aesthetic experiences.

The study is divided into two parts. The first is dedicated to understanding the fundamental elements of J. Dewey's conception of art. This section explores the complementarity between art and science and the functions of art in knowledge and in the development of democratic thoughts and behaviors. The second focuses instead on the institutional conditions which, in a peculiar context such as the online academic one, could favor an *aesthetic education* generating democratic thoughts and actions.

## 2 Theoretical framework and research objectives

The theoretical framework is offered by J. Dewey's theory of art and its sociological-political appropriation [6]. In particular, the cognitive sociology of pragmatist inspiration, with the attention offered to the complex rationality that justifies the choices of social actors, offers tools and categories of analysis useful for the development of the study [7,8].

In J. Dewey's conception, art and science are complementary, both are aimed at exploring man's potential and matching them with a development project that transcends his historicity [9]. The novelty of this theory is above all methodological. The means to achieve this result is the *reflexivity* as a privileged instrument of knowledge of a self that is not *concluded*, as Dewey writes, but in *progress, working on the possibilities of discovering one's humanity* [8].

Openness to the world, the union of theory and practice, the meeting with those different from oneself and the critical enhancement of the forms of development already achieved constitute the main elements of both scientific and artistic reflexivity. Art, however, differs from science because it offers scientific knowledge a fuller meaning, a new temporality, an experience of the limits of man full of plurality, of multiple expressiveness and complex rationality. The artistic experience is not only a cognitive experience like the scientific one, but it is a personal experience, *a sort of call* of the subject invited to discover his interiority and connect it with the world. Expressiveness, creativity, the enhancement of differences, acquire in this theory the sense of a political participation to the life, a participation suitable for generating a democratic citizenship. Democratic, because it is not guaranteed exclusively to some people and for its form, for its logical structure which is that of the enhancement of human differences and pluralism.

What institutional conditions can ensure the realization of this type of artistic and aesthetic educational experiences in an online university context?

In order to answer this question, an empirical action research was carried out in an online university context. The qualitative research, carried out through in-depth interviews, has involved ten teachers and thirty students, all engaged in a professional online internship, during the 2022-2023 academic year. The in-depth interviews investigated the ways and tools through which teachers and students transformed the enjoyment of artistic content into learning experiences. In an online university context, three institutional conditions appear to be necessary. The first concerns the possibility of activating personal teaching through the aesthetic education that allows both students and teachers a human knowledge of the self, the discovery of the person beyond the professional role. The second concerns technological innovation and the possibility that the online teaching environment does not transform into a platform for the provision of standardized teaching content but always allows both teachers and students freedom of expression. The third concerns the purpose of the artistic and aesthetic didactic experience and the possibility that it reveals, in the students' choice to attend an online university, the partiality of some instrumental motivations.

## 3 Results

The study helps to reveal some clichés and illuminates the institutional conditions which, in different university contexts, could promote aesthetic education. The first commonplace concerns the opposition of science and art which, far from presenting themselves as opposite, have very similar objectives. Both can legitimate the formation of a democratic theory of society. They can contribute to weakening an identitarian construction of individuals and promoting a social and moral construction of the self. But why? Countering the hyper-specialization of university courses, promoting the meeting of university professors and experts, transforming the scientific or artistic experience into an educational experience. The latter is configured as an experience that allows individuals to discover the plurality of ways of being human and, beyond the cultural differences, the possibility of man to understand the choices of other man.

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# Models and Practices for inclusion: Artificial Intelligence and Heritage Education

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## 1 Introduction

Since its inception, special education has played a significant role in rethinking educational, cultural, and social contexts by emphasizing the importance of caring educationally for children, adolescents, and adults with special needs. This is achieved through targeted, timely, competent, and scientifically grounded educational interventions [1]. Within this perspective, the capability approach serves as the theoretical framework, embodying a vision of quality of life or well-being connected to the matter of human rights. According to Sen [2] well-being depends not so much on the resources available to an individual, but rather on the ability to trans-form these resources into actual achievements. In other words, emphasis is placed on the real possibility of choosing which actions to undertake, which goals to achieve, and which life plans to pursue [3]. The capability approach has the potential to revolutionize the approach to disability by highlighting the role of an individual's functioning within their living environment. It also recognizes the importance of the interaction between individual characteristics and social and contextual restrictions that may affect one's life. This approach does not focus on conforming to a predefined "normality" but assesses success and effectiveness in terms of expanding choices and individual freedoms [4]. Thus, adopting the idea of inclusion essentially means normalizing the condition of exceptionality, mobilizing all the resources of the context, and exercising hospitality towards everyone equally.

## 2 Heritage Education and inclusion: a case study

According to literature, cultural and creative activities serve as powerful educational and teaching tools and promote the well-being of all individuals, offering everyone the opportunity to develop and utilize their potential [5,6]. The arts also positively impact inequalities, create inclusive social bonds, and support the development of open and plural collective identities [7].

Accessibility (physical, sensory, cultural, and cognitive) is a cultural principle that pertains to various aspects of daily life for every person with different needs and abilities (motor, sensory, cognitive, and emotional), both permanent and temporary. It

guarantees everyone the right to access places and use services or products independently and safely [8]. In the context of cultural heritage enjoyment, the accessibility of places, services, and infrastructures is a right, an opportunity for social growth, and a duty to which institutions, particularly cultural venues, must aspire given the educational, social, and economic significance of cultural heritage. It is also essential for investment in tourism and the regeneration of territories [9,10]. Thus, there is a need to offer new services in the field of cultural enjoyment by establishing common quality standards and networks with surrounding systems, aided by technological innovation. Artificial intelligence and its subsystems (cognitive computing, computer vision, machine learning, natural language processing, deep learning, neural networks) have the potential to transform special pedagogy and find applications in many sectors, including Cultural Heritage, where it is used in various research areas [11,12].

An accessible museum thus becomes fertile ground for innovating practices. Based on these premises, the following contribution presents a case study promoted by the Observatory on Governance for Education in Cultural, Artistic, and Land-scape Heritage OGEP3 Unina, active at the Department of Humanities of the University of Naples Federico II. The study focuses on the application of AI devices to de-sign inclusive learning environments within museum exhibitions. Specifically, it involves the experimentation conducted during the "Spellbound" exhibition, which centred on the scenery created by Salvador Dalí in 1945 for Alfred Hitchcock's film of the same name. The exhibition, held at the Philharmonic of Munich, aimed to structure an accessible museum path using immersive devices such as VR, AR, MR, interactive tours, 3D models, and simulations.

## 3 Conclusion

Museums have the potential to become or transform into places of collective reflection and social inclusion. In the context of museum accessibility, significant attention has been given to overcoming architectural barriers to ensure full and quality accessibility, in line with the new museum definition approved by ICOM. The experience in these environments is multisensory, allowing visitors to establish an emotional and cognitive connection with the artworks. This ensures that differences and neurodiversity do not result in maladaptation but are addressed continuously and coordinately within the relationship between the individual and the social context in which the museum is situated. Designing a museum's accessibility means making it a safe, comfortable, and qualitatively better place for all potential users.

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# Special Track 5

# Intelligent tutoring systems and conversational pedagogical agents in higher education

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# Instructional Design and Disability:

# Empowering Inclusive Education with CONALI & AI

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## 1 Introduction

Artificial intelligence (AI) has demonstrated its utility in various educational contexts, particularly in providing feedback, personalised learning paths, and reducing educational costs [1].

Despite the significant potential of AI in teaching [2; 3], there is a notable gap in the literature regarding how AI can contribute to inclusive educational planning and the compilation of the Individualised Education Plan (IEP) [4].

For these reasons, this paper presents the results of a series of interventions aimed at assessing the perceived usefulness of AI and the CONALI Ontology by trainee special education teachers during the compilation of the IEP.

This study was conducted with teachers from all educational levels to determine if the combination of AI and CONALI is perceived as beneficial for compiling IEPs for students of all ages.

The study aims to verify the effectiveness of AI in combination with the CONALI Ontological framework by Maffei [5; 6], providing teachers with guidance that adheres to established educational principles and ensures the identification of Specific, Measurable, Achievable, Realistic, and Time-bound (SMART) educational goals during the drafting of the IEP.

## 2 Methodology

To assess the perceived usefulness of AI and the CONALI Ontology, exercises were conducted and validated questionnaires were administered to 391 teachers from

early childhood, primary, lower secondary, and upper secondary education. The methodology initially involved presenting the IEP's section 5 and emphasising the importance of identifying SMART learning objectives during its compilation. Subsequently, the teachers completed section 5 of the IEP for a hypothetical student with disabilities without any support.

Following this, the CONALI Ontology was introduced and explained, highlighting its utility in identifying educational objectives aligned with teaching and learning activities, as well as available assessment methods. In particular, the ontology's framework facilitates the alignment of Intended Learning Outcomes (ILOs), Teaching and Learning Activities (TLAs), and Assessment Tasks (ATs) by using the Educational Goal Verb (EGV) as the common denominator. This verb serves as the pivotal element connecting objectives, instructional strategies, and assessment, ensuring coherence across these components [5; 7].

After this phase, the teachers completed a second IEP supported by the Ontology and completed a questionnaire to evaluate their perception of the design experience. Finally, the AI tool ChatGPT was introduced and presented to them, which they then used, in conjunction with the CONALI Ontology, to compile a final IEP.

## 3 Results and Conclusions

The results revealed that teachers of all educational levels perceived the implementation of ChatGPT and the CONALI Ontology as useful and effective during the compilation of the IEP.

The Ontology was confirmed as a suitable tool for identifying SMART objectives aligned with intervention strategies and assessment methods in the IEP.

AI, supported by CONALI, was seen as an effective tool for instructional design, accelerating the IEP compilation process and promoting engagement, motivation, and learning quality.

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# “AI as an Ally?” : supporting argumentative skills in undergraduate students

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## 1 Introduction

Argumentative skills are indispensable both personally and professionally to process complex information (CoI) relating to the critical reconstruction of meaning through critical thinking (CT) [1], [2]. This is particularly relevant, especially in the social media and artificial intelligence-mediated information era, where having a critical perspective on information and the technology that conveys it to different audiences is crucial [3], [4].

To complicate things, the public spread of what has been called generative AI (GenAI), with the particular example of ChatGPT [5], encompasses superficial, uncritical usage and production of false information [6]. Not knowing how to approach them consciously increases the difficulty of navigating the abundance of complex information [7], [8]. In this context, argument maps (AM), are commonly used to develop argumentative skills and critical thinking. Traditionally applied to analyze analog and static texts, their effects have recently been observed also to visualise, understand, and reprocess multimodal and dynamic arguments and information, [9], [10], [11].

However, it is unclear how their use might interact with training using GenAI to compare, analyse, and revise argumentative texts produced. An assumption adopted with AMs is that devising a space for understanding, fixing, and reconstructing information is a key element in developing argumentative skills. Similarly, a critical and functional interaction with an intelligent agent could foster a new and comprehensive process to develop argumentative skills while cultivating a deeper understanding of intelligent agents [12].

This idea is based on the ongoing debate about AI literacy, which includes information literacy, data literacy, and prompting skills [13], [14]. Aligning with Ferrarelli [15], the approach is not to solely “use” the chatbot to get information, but to think about a process of interaction with the intelligent "companion" or a "peer" to generate more specific outputs and responses closer to what is needed. Effective prompts are crucial for accurate, relevant, and appropriate outputs, especially with AI models [16]. In this scenario, AMs and argumentative texts become objects of activity that provide substance to multimodal and dynamic interactions.

## 2 Research Design

Our study was based on a two-group quasi-experiment with 27 students from the "Research Methods in Education" course, to explore the role of AMs in supporting multimodal information reprocessing. In addition, by predicting the use of the intelligent chatbot ChatGPT, one of the most widely used GenAI technologies, we investigated how students' perceptions evolved regarding its potential role as a "study companion" for information comprehension and reprocessing activities with a path to build a good prompt.

Our research questions investigated three objectives:

1. to investigate whether AMs enhance students' CoI and critical processing (CT) of multimodal and dynamic information;
2. whether after interacting with the ChatGPT artificial agent, students perceive greater usefulness of the agent in their reworking information (related to CoI) and their critical integration of different viewpoints (related to CT);
3. finally, if there is an initial response on the effectiveness of a guided path to creating a good prompt for improving interaction with ChatGPT and argumentative reworking.

The students were placed into a control group (G1), using analog texts, and an experimental group (G2), exposed to multimodal and dynamic texts. Students read and analyzed argumentation structures, shared thoughts on the issue, and interacted with ChatGPT during an asynchronous activity on Moodle using H5P. The activity guided them in comparing their previous analysis of text and creating better prompts for interacting with ChatGPT.

Preliminary analyses showed that AMs increased both groups' CoI and CT levels. Inferential analyses, however, showed that G1, working with analog information, outperformed G2, especially in text comprehension and information reprocessing. While G2 displayed a more reflective approach despite cognitive overload from multimodality. Data collected on chatbot interaction revealed an initial positive reflection of ChatGPT's potential. Notably, students increased confidence in interacting with IA after acquiring and practicing prompt-building techniques. G1 used ChatGPT for confirmation and correction, while G2 adopted a more autonomous, reflective, and integrated approach, suggesting that guided pathways can enhance interaction with AI tools.

Further analysis will explore the declinations of interaction with the artificial agent, to give answers about how guided prompt construction and critical use of AI as ChatGPT can improve students' argumentative skills.

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# Pedagogical Agents for Supportive Learning Instruction

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## 1 Theoretical Background and Problem Statement

As technology advances, pedagogical agents (PAs), anthropomorphic virtual characters embedded in online learning environments for instructional purposes [1], are becoming more functional and realistic. PAs are now capable of human-like interactions and of effective mimicking of social cues that engage learners more deeply [2]. Accordingly, PAs are integrated in more and more educational systems to support learners in a way that previously only one-to-one tutoring could enable.

Historically, research on pedagogical agents has predominantly focused on their technical features and anthropomorphic characteristics [3, 4]. However, there is an evolving recognition of the importance of relational and affective dimensions in enhancing the effectiveness of PAs within learning environments. Recent studies highlight this shift, indicating a growing interest in how these emotional and relational aspects significantly enhance learning experiences [5]. Therefore, our research is driven by a keen interest in investigating how people react to PAs, aiming to understand to which extent human-PA-interactions mirror traditional teacher-student interactions.

In the realm of traditional education, the personalized support provided by teachers is deemed crucial for student success. The transition to incorporating pedagogical agents into educational settings has been guided by several theoretical frameworks that attempt to integrate the supportive role traditionally played by human teachers with the capabilities of PAs. Notably, the Computers Are Social Actors (CASA) paradigm proposes that users perceive computers, and by extension PAs, as social entities capable of engaging in social interactions [6]. Additionally, the social-cognitive theory suggests that PAs can emulate human-like supportive roles by fostering social relationships, modeling appropriate behaviors and attitudes, and facilitating empathetic connections with learners [7]. The social agency theory further advances this concept by highlighting the importance of sensory cues from PAs, such as sounds and visual signals, which can elicit social responses from learners, thus enhancing engagement and mimicking the dynamics of human-to-human interactions [8].

Despite these theoretical underpinnings, the practical application of PAs in educational environments reveals some challenges. Research from the field of human-machine communication indicates a more complex interaction dynamic between humans and machines, which brings forth unique aspects of communication not covered by traditional theories on human-to-human instruction [9, 10]. For instance, it has been noted that interactions with PAs often display a less rich vocabulary and a

higher degree of profanity compared to human interactions [11]. Furthermore, empirical findings suggest that although users might engage with PAs under the disguise of social interaction, they frequently report lower feelings of social presence and affection towards these agents compared to interactions with human instructors [12]. This discrepancy between the theoretical capabilities of PAs and their perceived effectiveness in real-world educational settings underscores the need for ongoing research and development to better align the functions of PAs with the expectations and needs of learners.

Given these varied perspectives, this study aims to interrogate how supportive characteristics in PAs, such as emotional support – an element traditionally associated with effective human teachers [13, 14]—alter perceptions of these agents among learners.

## 2 Research Question and Emphasis

In our study we address the following research question: how do adult learners perceive a pedagogical agent with supportive characteristics compared to one without these characteristics?

To ascertain whether pedagogical agents can be perceived as social entities, our research focuses on adult learners' perceptions of a pedagogical agent characterised by supportive features. We provide learners with two different versions of an agent presenting the same learning content. Between these different versions we vary the extent to which the facets of support are implemented. We assess the learners' perceptions of the agent and the learners' interest in the delivered learning content. The findings will help delineate further applications and enhancements for pedagogical agents in educational settings. Preliminary findings show that learners' perception of the supportiveness of the PA clearly differs between the versions.

## 3 Conclusion

In conclusion, the importance of robust student support systems in higher education cannot be overstated, especially as interactions between students and digital teachers become more integral [10, 15]. As we evolve towards treating technology as a communicative partner [16], the effectiveness of traditional support strategies applied to pedagogical agents remains uncertain. Our research addresses this exact issue by exploring the learners' interest and perceptions of support in PAs.

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# AI-Powered Chatbot: Teaching Assistant for Course Organization

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## 1 Introduction

Chatbots are computer software systems designed to interact in a natural conversation style with humans, to facilitate a wide range of tasks. With the aid of Natural Language Processing they have been improved in simulating a human conversational style and improving customer service. Conversational agents found their way into schools and universities enabling a scaling up of good teaching practices [1] and allowing an equal access to learning material to all students [2]. Chatbots are used to assist, mentor or aid learning and they are often a supplement to the already existing educational practices [3–5]. Though chatbots are useful not only for knowledge acquisition. They can also help in administrative tasks such as scheduling, answering queries about school policies, and assisting with enrollment processes [6]. This type of application is spreading very rapidly, and many institutions are implementing various technological solutions. At the same time, the scientific literature is developing with the aim of evaluating the effectiveness of chatbots in higher education [7, 8].

## 2 Method

We developed a chatbot specifically for the “Economia Politica" undergraduate course offered by the Economics Department at the University of Florence, with the primary aim of assisting students in accessing course information in an efficient way. The type of information on which the chatbot focused on can be divided into five main categories: general information about the course, books and material used, course program, didactic calendar and exams information.

The chatbot was designed using the Landbot platform, which allows an AI based and rule based design of the conversational agent. In our case, we used gpt4 services through OpenAI APIs for middle chat conversation, while greetings at the start and at the end of the conversation were rule based scripts. To lower costs, we decided not to insert the whole corpus of text entirely, but we broke it

down into two phases: recognition of the argument and argument text to answer the query. The chatbot was available through the course and it could provide real-time responses with a 24/7 availability.

## 3 Results

At the conclusion of the course, we conducted a survey to evaluate the effectiveness and ease of use of the chatbot. This survey included both quantitative metrics and two open questions for a personal feedback, allowing students to express their personal experiences and suggestions for improvement. A total of 133 completed interactions occurred with the chatbot and 35 students participated in the post-course survey, consisting of nine likert scale questions and two open questions, providing valuable insights into the chatbot's performance and its impact on the course organization.

From the results of the survey we can clearly see that students appreciated the use of the chatbot while there are still few areas of improvement. Overall, the chatbot has been useful and it provided a quick and reliable way to answer students' queries about the course information; though its range of application should be widened and sometimes it did not live up to expectations. All answers of the questionnaire have a mean greater than 4 in a scale out of 7. The chatbot was very easy to use (mean = 5.31), could answer quickly (mean = 5.11) and it was reliable (mean = 5.06). Perceived usefulness though was not high (mean = 4.17). Expectations (mean = 4.74), level of understanding (mean = 4.46) and adequacy in answers (mean = 4.91) had good overall values but also great variance, with the majority of answers being either 3, 6 or 7. This could entail a different approach from different users, with some of them capable of gaining the most out of such technology while others more disappointed by it. Finally, students preferred the chatbot over the traditional way of getting information through the official website (mean = 4.94).

Regarding the open feedback, results are very clear: speed and ease of use has been cited openly by the majority of students (18 and 8 respectively) as the best aspect of the chatbot. On the other hand, the majority of students (21 out of 35) pointed out that answers were limited only to a few issues of the course.

The implementation of such a chatbot assistant in university courses could significantly reduce the time spent by professors on routine administrative tasks like repetitive student queries, thereby allowing them to focus more on course content and personalized student engagement. Also, this kind of implementation could potentially be extended to other administrative tasks in Universities that interact with students and provide information to them.

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# Special Track 6

# Rethink Education: The Opportunities and Challenges of Artificial Intelligence

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# Educational Architecture of Artificial Systems

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## 1 Pedagogical epistemology and AI

The study of artificial intelligence seems to progress in parallel with its increasing direct use through research and analysis. This is taking place without any benchmarks, and above all without the two worlds (research and practical application) communicating with each other. We thus see a twofold need on the part of the pedagogical community: the first investigating and systematizing the new technological approaches with the tools proper to disciplinary epistemology, the second chasing data on use, either by photographing how AI is implemented in the educational sphere, or by experimenting with approaches, methods, and indications that take up or attempt to anticipate possible experiences and uses. The search for a mediator between epistemology and artificial intelligence is not a novel idea. Wheeler and Pereira (2004) document a mirror-like correlation between the knowledge functions that connect AI and analytical epistemology. Both acts are aimed at finding justification and formal coherence of knowledge [1]. Three orientations stand out when analyzing the current relationship between research and practice in education for AI:

• The first one concerns ex-ante conceptual systematization.
• The second point pertains to the use of software systems without intermediaries that direct the use of their services, which is both indirectly and directly encouraged by companies.
• In this third attempt, we aim to systematize AI conceptually by observing how it is utilized and appreciated ex-post.

## 2 The task of educational research

The initial objective is to provide guidance on how to work with a complex and elusive technological system. The second and third approaches are at risk of becoming simple descriptive approaches that cannot effectively affect the operational-conceptual processes underlying AI in education, and, most importantly, may be influenced by a reductionist utilitarianism. The task of educational research is to conceptually connect these three horizons (epistemology, practice, and reflection on practice). Attempting to redefine systematic, critical, conscious, and functional approaches to AI without excluding the exclusive emergence of naive theories from their simple' realization. Today, having overcome skepticism, the theological stage, and the ludic dimension - which have always accompanied the massive introduction of new technologies - an initial

form of awareness of the phenomenon and its practical results seems to have been defined [2].
In the processes of didactic personalization, two formulas for the use of AI can already be highlighted: direct (producing targeted materials according to the specific prompts typed in directly by users) or indirect (design by teachers and trainers of pathways, curricula, activities based on the characteristics of the individual or groups).

## 3 Educational design and AI

The core questions surrounding generative AI continue to be about the intrinsic nature of these technologies: are they just tools? Complex tools that serve users, but still have their own shortcomings. Are they able to guide users towards specific partial perspectives based on specific functional logics, or can we consider them as epistemic algorithmic complexes? According to Pasquinelli and Joler's (2021) view, AI would be nothing more than a tool for knowing and exploring knowledge and they define it by the term Nooscope (from the Greek skopein 'to examine, look' and noose 'knowledge'). This exploratory instrumentality of AIs would not shelter them from the hallucinatory effects that are: Historical Biases, predating the invention of machines and belonging to the historical cultural production of the mankind they are training with; Dataset Bias, determined by the bad composition of data; and Algorithmic Biases, produced by technical problems in the algorithmic sequences of machine learning. At the same time, the idea of AIs as 'knowledge magnifiers' [3], while connoting them as tools, would not resolve and clarify the predominant role and represented the interests of the producing companies that connote them as instruments of 'cognitive extractivism' and/or 'epistemic colonialism'. A further perspective is one that gives AIs a much more oriented value, going beyond the mere instrumental perspective. These conceptions describe them as new epistemic subjects who are capable of super-human' positions. In some cases, there is a strong belief in Deep Learning systems to analyze data that can be used for research, which is also represented in the scientific sphere [4]. Duede identifies a new form of 'belief' characterised by the trust that scientists have in AI that cannot be justified by the categories of the reliability of scientific instruments or the reliability of advice or analysis by other experts. The categories of philosophy of science may be rewritten by a new concept of trust in AI that is being developed [4]. Our idea is that AIs can have a dual nature: the first is that which relegates them to hyper-technological tools useful for synthesizing complexity and tailoring the information we need, the other is that which identifies them as active and oriented epistemic subjects. The need for human cognitive control over the responses produced remains unchanged in this perspective. The less control we exercise with our prior knowledge, the greater the risk that the information may be wrong, partial, biased; the more we use it as an active complement to our actual knowledge, the more AI can become a powerful emphasis on our capabilities.

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# Explaining stress level predictions in higher education students through machine learning algorithms

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## 1 Introduction

Stress is a common response to the demands and pressures of academic life, often arising from coursework, exams, and balancing personal commitments. It can significantly impact students' well-being and academic performance. Stress is commonly diagnosed through self-report questionnaires and assessments that evaluate symptoms such as anxiety, irritability, sleep disturbances, and physical complaints [3]. Artificial intelligence, particularly machine learning methods, could be useful in processing this information to predict students' stress levels for early recognition and intervention [2]. In this work, we analyze a dataset containing 1,100 examples, each described by 20 features representing the main factors causing stress in students, such as psychological, physiological, social, environmental, and academic. The target variable represents three stress levels low (0), medium (1), and high (2).

Our work aims to answer three research questions:

- Are machine learning methods effective in predicting students' stress levels?
- Do different classification methods derive the same factor to predict stress levels?
- Is the SHAP (SHapley Additive exPlanations) post-hoc explainable method effective in selecting the N most influential factors for a given classification model?

## 2 Experiments

To answer the three research questions, we conducted two sets of experiments. In the first set, we used five classifiers: Logistic Regression, Decision Tree, Random Forest, Nearest Neighbors, and XGBoost. These classifiers processed our data, and we collected standard classification performance metrics such as accuracy, precision, recall, and F1 score. Additionally, we used SHAP to derive explanations of the classifier behavior in terms of the features' contributions to the model [1].

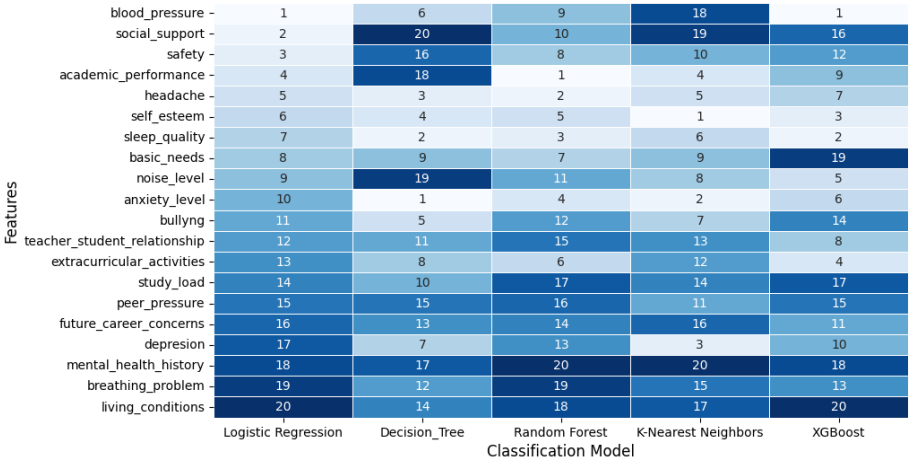


**Fig. 1.** Feature importance analysis.

To summarize the quantitative results of this first phase of experiments, Figure 1 shows the rank of each feature for each classifier, as determined by SHAP. We can observe that the most important features vary significantly depending on the classifier used.

In the second set of experiments, we used SHAP as a feature selection method by selecting the top five most important features for each classifier. We then compared the classification performance of models trained on the whole dataset, on the data with features selected through SHAP, and using seven other feature selection methods: Chi-Square, Forward Selection, Backward Selection, Exhaustive Search, ANOVA F-value, Mutual Information, Tree-based Feature Selection. The performance comparison was based on standard classification metrics. We aimed to determine the effectiveness of SHAP in selecting the most influential features and how it compares to other established feature selection methods.

## 3 Discussion and Conclusions

For space reasons, we cannot report all the results. We report the main findings. i) All classification models effectively classify stress levels in higher education students; ii) The best results (without feature selection) were achieved by random forest, with F1-score values of 0.91; iii) Applying Shap as a feature selection method either improves classification performance or yields comparable results to those without feature selection across all classifiers. iv) Classification performance on data reduced using Shap is comparable to that achieved with other feature selection methods.

Future work will involve engaging an expert to analyze the factors identified by each algorithm. Additionally, we plan to compare various agnostic post-hoc explainable algorithms.

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# Enhancing Higher Education with AI: Balancing Personalized Learning and Ethical Responsibility

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## 1 Introduction

AI (Artificial Intelligence) in higher education enhances teaching and learning through personalized experiences, real-time feedback, and automated assessments. However, it also raises ethical concerns regarding fairness, accountability, and transparency, necessitating careful management for responsible use.

## 2 Artificial Intelligent tools in higher education

AI is rapidly increasing within educational processes, finding applications in various forms. Online intelligent tutoring systems (ITS) utilize AI algorithms to provide personalized support to students. Systems like ALEKS provide adaptive learning by identifying knowledge gaps and offering targeted exercises tailored to individual students' needs [1]. The careful meta-analysis conducted by Fang et al. [2] validated the effectiveness of the tool, which "by adapting to individual students' knowledge states and personalizing interactive practice and feedback" becomes particularly effective when used to supplement traditional instruction. DreamBox is fully classified within the taxonomy of personalized learning tools; it is a mathematics learning system that continuously adapts the learning path based on students' responses. Its interactive lessons use virtual manipulatives, verbal descriptions, tables, equations, and graphs to ensure that students have the opportunity to engage in reasoning about math structures, strategies, concepts, and skills [3]. Smart Sparrow is an adaptive eLearning platform that allows educators to create personalized interactive lessons, using AI to adapt the content to students' needs [4]. Educational chatbots, such as those developed by AdmitHub and Replika, respond to frequently asked questions and offer personalized advice. Studies on chatbots began in the early 1980s [5] but have proliferated significantly with recent developments in natural language processing, AI, and deep learning, which have increased their usability. Numerous applications of educational chatbots exist, including AdmitHub, an intelligent virtual assistant that provides students with personalized test preparation and training services. Automated assessment tools enable teachers to quickly evaluate students' work. Besides saving time for educators, these systems create a virtuous cycle where students can receive immediate feedback to correct their work even during exams. In this context, Jacquard is noteworthy; it is an open-source autograder specifically designed to integrate with the Gradescope platform. Gradescope uses AI to

automate grading and assessment of assignments, improving the efficiency and consistency of evaluation [6]. Finally, Turnitin AI combines plagiarism detection with automated writing assessment to provide detailed feedback to students [7]. The application of AI in scaffolding, though less explored, is highly intriguing. Scaffolding is an educational method that provides temporary support to students, gradually reducing it as they become more competent. Ardimento et al. [8] are experimenting with an innovative approach to teaching UML in software engineering courses, focusing on understanding and improving student behavior and skills during modeling activities. The experiment is based on a cloud-based tool (UML-miner) that captures and analyzes the UML diagrams created by students. The tool integrates a large language model with retrieval-augmented generation (LLM-based RAG), generating useful feedback for students by leveraging the knowledge acquired during the modeling process.

## 3 Risks

The usage of AI requires appropriate regulation, continuous training for teachers and students, and a constant commitment to monitor and mitigate biases and inequalities. In this context, Hagendorff's study [9] is particularly interesting as it examines to what extent ethical principles and values are implemented in experimental research and the development of AI systems, and how the effectiveness of AI ethics demands can be improved. Hagendorff's study shows that the most pressing ethical issues include responsibility, privacy, and fairness: these seem to constitute the minimum requirements for building and using an "ethically correct" AI system. It is noteworthy [10] that technical solutions have already been developed for these aspects, such as IBM's "AI Fairness 360" [11], Google's What-If Tool (WIT) [12], [13], Google's Facets, fairlearn.py [14], and "Fairness Flow" [15]. In recent years, enormous technical efforts have been undertaken to achieve goals in the context of AI ethics [16]. Many of these efforts are managed by the research and practice groups of the FAT ML (Fairness, Accountability, and Transparency in Machine Learning) and XAI (Explainable AI) communities, which play a crucial role in developing ethical and reliable AI systems. These groups focus particularly on fairness to ensure that machine learning models do not discriminate and treat all demographic groups fairly, accountability to ensure that there is a clear attribution of responsibility for decisions made by ML models, and transparency to promote understanding of ML models, making it clear how and why models make certain decisions.

## 4 Conclusions

AI tools can greatly enhance personalized learning and assessment in higher education by offering targeted support and real-time feedback. Effective AI integration improves teaching efficiency and fosters deeper learning. However, managing ethical challenges like fairness, accountability, and transparency is crucial. Ongoing regulation, training, and monitoring are essential to ensure responsible and equitable AI adoption, benefiting the educational landscape.

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# Generative AI in Higher Education: two case studies

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## 1. Introduction and motivation

The impact of recent developments in artificial intelligence (AI) on higher education (HE), like other fields, is causing profound transformations that affect the entire organization of academia. In their systematic review covering scientific papers published between 2016 and 2022, hence only partially covering the ChatGPT phenomenon, Crompton and Burke have highlighted how the use of AI in higher education has grown significantly over the period 2018-2022, with publications increasing two to three times in 2021-2022 compared to previous years [1]. They have also observed how the number of articles from educational departments has exceeded the number of articles from other university departments. This finding, which seems particularly relevant considering that until a few years ago most of the papers in this area were written by authors belonging to technology departments, confirms how AI has become a determining factor in educational processes. These data confirm a trend that had already emerged in previous years: for example, a bibliometric analysis of research on the application of AI in higher education between 2000 and 2020 authors observed how research on AI was interdisciplinary, but dominated by the fields of computer science and engineering [2]. Moreover, they also observed how AI research in higher education was growing from contributing 22% in the first 15 years to 78% in the last five years. Recent studies on AI in education have explored how these technologies effectively affect the higher educational context, proving a beneficial impact both in teachers' and students' everyday practice. For instance in [3] the use of AI tools allow students to achieve better performance in terms of time and increased retention, while in [4] authors shed light on teachers' support offered by AI tools for the assessment, intelligent tutoring and managing learning processes. However, if from one hand the use of AI tools seems to provide an essential support in several activities from the other hand challenges related to data quality, and proper training for instructors emerged [5].

While most studies focus on the benefits of using AI in teaching practices, this paper aims to explore how the rapid emergence of generative AI tools, such as ChatGPT, has necessitated an almost immediate revision of university course curricula across disciplines. This impact extends beyond the STEM fields, including also the courses in humanities, and this is not surprising since it is well-known that generative AI proves to be more effective in tasks involving text processing (such as summarizing, rephrasing, and improving text), while it tends to be more fallible in tasks requiring logical reasoning or calculation. This shift highlights the need for a comprehensive reevaluation of how we approach education in the age of AI, considering both its strengths and limitations across various academic fields.

In this paper, we present two case studies reporting how the introduction of generative AI in higher education contexts has affected university teaching through the experience in two academic courses in two completely different fields.

## 2. Case studies

The two case studies presented in this paper concern the first-year course of 'Educational Technologies' in the program of the Master's Degree in Primary Teacher Education at LUMSA University, Palermo campus, and the course of 'Open Data Management', a third-year course in the Computer Science Bachelor Degree at the University of Palermo. These two courses address two different areas being the first more on the humanities and the second on the technological field.

The course 'Educational Technologies' aims at providing knowledge and skills related to the use of digital technologies in learning contexts. Technological tools are presented according to the historical-pedagogical-social approach that characterizes the field of Educational Technologies. This ensures that students acquire methodological knowledge and technical skills that will enable them to identify the affordances of technologies that can support learning processes; at the same time, students will be able to apply the same method to technological solutions that will become available during their career path as teachers.

In the 'Open Data Management' course, bachelors students of Computer Science apply Python programming language to develop a data transformation pipeline that follows the steps from data finding, data cleaning to data visualization and data modeling for Linked Open Data leveraging Semantic Web technologies.

The two courses cover different topics, teachers follow different teaching approaches but both of them have been affected by the introduction of ChatGPT.

Students were guided by teachers towards a conscious use of generative AI applied to their specific learning path. Initially, students tried to use generative AI as a substitute for common search engines. They just write down a general question or an exercise in the ChatGPT interface to get an answer to their commitments, usually without elaborating further the result and more often with a very limited interaction with the AI tool. The effective use of generative AI needs elaborated prompts and better results are achieved when users interact with the tools by providing more details, or asking to refine the answers better. For this reason, in both courses, students were invited to modify the way they use the GenAI tools, with particular emphasis on analyzing critically the answers provided by the tool, and on the benefit of having chats with the tool to adapt the results to the specific context.

To this aim, the course curricula in both cases were changed by introducing specific content related to prompting and which strategies can be put in place to chat with these tools to get optimal results. At the same time, it has been highlighted how ChatGPT is a valid support for students but only if students have expertise in their domain of interest. As a consequence, both groups of students were more engaged in delving into the topics faced in the two courses. However, there is a growing need for specific intervention in higher education to support teachers and students in a better understanding of AI-enhanced teaching and learning potential. It is difficult to answer

the question of whether we are truly ready for the change that GenAI is introducing, there is no unified vision but AI literacy can help.

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# Approaches for Integrating AI activities in Computer Science courses

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## 1 Introduction

Artificial intelligence (AI) is becoming increasingly pervasive in various work fields and in our daily life routines. The potential of AI to revolutionize industries and enhance our lives is enormous, underscoring the importance of responsible development and use. In an era marked by swift technological advancements, AI is gaining momentum with disruptive implications for the education of current and future generations [1–3]. Some researchers predict a forthcoming transformation in higher education computing curricula, focusing more prominently on AI and Machine Learning (ML) principles [4] and recent literature reviews identify an increasing number of initiatives aimed at integrating AI into K-12 education [5, 6]. However, the debate among educators is still open about introducing AI at K-12 level through Computer Science (CS) education [7–9]: computing, computational thinking, or programming, are subjects restricted to a rather limited number of classroom hours in national curricula and teachers are already struggling with the recent wave of integrating computational thinking [10].

In our opinion, introducing AI in schools is of paramount importance for several reasons, ranging from the social and working impact to the paradigm shift in learning experience [11]. However, the need for AI, from our perspective of CS educators, does not diminish the need for teaching traditional programming, because applications are nowadays a combination of data-driven and structured rule-driven computing. Thus, AI and ML must be an addition and not a replacement w.r.t. traditional programming. In this paper we are interested in discussing what kind of activities should be proposed to students for conveying AI fundamentals into CS courses for undergraduate students. For higher education, this work is important both for reasoning on curriculum alignment, avoiding gaps in learning and ensuring a seamless transition from secondary to post-secondary education, and for professional development of educators, promoting collaboration between K-12 educators and higher education faculty.

## 2 Approaches

In our opinion, each general discussion about AI must consider three different aspects, that should be emphasized depending on the contest.

– Principles and fundamentals: history of AI, models, learning algorithms, etc.
– Applications: generative AI, image recognition, recommendation systems, medical diagnosis, etc.
– Ethical and social aspects: bias, fake proliferation, privacy, impacts, etc.

ML and data-driven systems, that constitute one of the fundamental bricks of AI, are already part of our society and there is a clear need for understanding their way of functioning [12]. However, at the same time, computational thinking and traditional programming must not be neglected, since AI is deeply connected and embedded in common apps, built with traditional programming languages. Thus, the need for thinking and building learning activities that can integrate AI in established CS courses, for instance by using methodologies like project-based learning or laboratories. To discuss how to combine traditional programming and AI, we first consider two opposite approaches.

– Black-box approach: we concentrate on using the AI system, without caring about the internal details; in this case the AI system can be leveraged by using an API.
– Clear-box approach: we build the AI model from scratch, concentrating on very few features that can be programmed; in this case we need a specific knowledge of data features, that can varying very much depending on the application field.

Both approaches require programming knowledge but focusing on different aspects, with pros and cons: the black-box approach allows for building medium-complexity applications but it hides machine learning and/or neural networks principles by using APIs; whilst the clear-box approach can emphasizes ML principles such as feature extraction and recognition but it does not allows for building medium-complexity applications in a short amount of time, since the whole ML pipeline must be programmed from scratch [13]. Obviously, if we consider the different steps of a machine learning workflow, we can consider each step as a box and we can decide which step should be black-boxed or not, leading to hybrid approaches.

In general, we propose to evaluate the teaching effectiveness of the different approaches with few criteria:

– Students' Attitude: i) interest and commitment; ii) participation and involvement.
– Learning goals: i) coding ability in a certain programming language; ii) understanding of AI principles and mechanisms.

## 3 Conclusion and Future work

AI poses many challenges for teachers and individuating what to teach and how it should be done imposes reflections and debates, moreover from a CS educator's perspective. In the future we plan to evaluate the effectiveness of black-box and clear-box approaches for conveying both traditional programming and AI principles to students.

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# Generative AI in Higher Education - Perspectives from Students and Teaching Staff

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## 1 Introduction

As a result of a massive increase in user numbers of Generative Artificial Intelligence (GAI) like ChatGPT [3], members of higher education institutions have started to integrate such tools into their work and studies [9], for example as part of their lecture follow-ups [2, 14]. Students can use GAI to summarize lectures [10], while lecturers can use various tools to support the didactic design of their lectures and offer students more options to repeat learning materials [7].

However, GAI does not come without risks, such as the spread of false information or a reduction of mental engagement with the courses [10]. Especially for written assignments, like bachelor or master theses, GAI tools pose a challenge: AI detector tools work unreliably at best when attempting to identify AI-generated texts [12], so lecturers have no reliable tool to differentiate between human and AI submissions, which negatively affects fair evaluations [11]. Beyond that, there are concerns regarding algorithmic bias and a subsequent increase of discrimination amongst students [1].

Despite these risks, few institutions have established clear guidelines on how GAI tools should be used by staff and students [6], leading to various challenges for education [5]. There have been calls for more research on how GAI tools can safely be integrated into universities [4], and little research has considered the experiences and opinions of students and lecturers. We address this gap with semi-structured interviews among students and teaching staff.

## 2 Research Procedure

We conducted a total of $N = 30$ interviews with $n = 16$ students and $n = 14$ staff from different German universities. The interviews were conducted and recorded via a video conferencing tool (except for one interview, which was conducted face-to-face) and lasted an average of 30.33 minutes ($SD = 7.81$). After transcription, a content analysis [8] was carried out using open coding [13].

For these interviews, we created a guide for the student and university staff interviewees respectively. These guides were largely similar, differing with regard to the interviewees' roles at their university. After gathering demographic data

(such as age, study field, and academic experience) we asked participants what GAI tools they are using (as part of their studies or course preparation respectively). If participants did use such tools, we further asked what benefits they expect for themselves and how they deal with the responses (e.g., whether they check the results for correctness). In the second block of questions, we asked interviewees what chances and challenges they see in using GAI tools for educational purposes, and whether they were worried regarding their careers in the future. The third question block dealt with how such tools affect the fairness of evaluations (e.g., when some students use these tools and others do not) and discrimination. Besides open questions, we also presented examplatory scenarios of cheating using GAI tools (and resulting unfair evaluations) to gather interviewees' opinions and whether they had already experienced similar situations. In the fourth thematic section of the interview guide, we asked interviewees whether they felt that GAI tools needed regulation in the university context, what rules they would like to see implemented, and who should be responsible for these rules. The fifth question block allowed students to state whether they had specific questions for their lecturers, with common questions being integrated into the university staff interview guide. At the end of the interview, interviewees had the option to voice any additional comments not yet covered by the questions.

Students were acquired through lectures, university-wide communication channels, and personal contacts. For the university's perspective, both administrative and teaching staff were contacted and asked for their participation. We attempted a balanced distribution of gender, study fields, and academic experience for participants. Regarding university employees, we focused on full-time teaching staff (i.e., lecturers and professors) as well as administrative employees who are responsible for planning and evaluating teaching (e.g., staff of the university didactics department).

## 3 Preliminary Results and Future Steps

Preliminary results reveal individual differences both, within and between the groups, while the general tone implies many similarities: Interviewees agree that GAI tools force universities to rethink written assignments and possibly shift to more oral exams. GAI offers many chances for more interactive teaching, with many interviewees stressing that GAI tools can especially help weaker students. Some lecturers reject GAI tools (both their own and students' use), while many others actively assess the impact of such tools on their courses, and some even create interactive studying companions trained on their course materials. Many students actively use or have used such tools, with few rejecting their use. Most interviewees agree that their respective universities should clearly state which uses of GAI are and are not permitted, while also agreeing that implementing a ban is neither sensible nor possible. We aim to use these findings to aid universities in understanding their members' preferences and suggest possible guidelines for safe GAI use.

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# Does Time Matter in Learning Analytics?

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## 1 Introduction

Learning analytics (LA) is a branch of artificial intelligence that focuses on analyzing educational data, such as students' interactions with virtual learning platforms (VLE). Proper analysis of this data can provide valuable insights for all stakeholders involved in the educational process [4]. Students can use this information to identify and improve their weaknesses and strengthen their study habits. Teachers can use the insights to enhance their courses, and faculty members can organize special support measures based on the analysis. However, while the students' learning process is inherently evolving, most of the literature analyzes educational data as a static block [6]. Very few studies incorporate the temporal factor into their analyses [3, 2, 1]. The biggest problem hindering the use of learning analytics for evolving data is the lack of data with time information.

In this work, we utilized the information present in the well-known Open University Learning Analytics Dataset (OULAD) [5] to create a student-oriented dataset where the temporal evolution of user interactions is preserved alongside other demographic and evaluation information. Our data comprises 1,718,984 rows, each sample is described by 34 features, which detail the number of student interactions with each facility available on the VLE (e.g., forum, glossary, homepage, HTML activity, etc.), other than demografic information, and the students' grade, for a given student, course, and time T. The target classes are as follows: Distinction - 0 (308,642 samples); Fail - 1 (227,550); Pass - 2 (1,022,760); Withdraw - 3 (160,031).

The research question we aim to answer is: " Does time influence the effectiveness of classification models to predict the students' outcomes?" To address this question, we identified various temporal units, starting with one year, followed by six months, three months, and one month. We then applied a classifier, specifically XGBoost, to verify two key points: i) Whether the information within these temporal units is sufficient to make effective predictions; ii) Whether using smaller temporal units improves the classifier's performance compared to models trained on data divided into larger temporal units or on the data as a whole.

**Table 1.** From left to right, from top to bottom: Average classification performance over the temporal units: the entire dataset, semesters, trimesters, months.

| | Accuracy | Precision | Recall | F1 |
|---|---|---|---|---|
| 0 | | 0.86 ± 0.00 | 0.32 ± 0.00 | 0.46 ± 0.00 |
| 1 | | 0.8 ± 0.00 | 0.2 ± 0.00 | 0.32 ± 0.00 |
| 2 | | 0.67 ± 0.00 | 0.98 ± 0.00 | 0.8 ± 0.00 |
| 3 | | 0.7 ± 0.00 | 0.25 ± 0.00 | 0.37 ± 0.00 |
| Avg | 0.69 ± 0.00 | 0.77 ± 0.00 | 0.44 ± 0.00 | 0.49 ± 0.00 |

| | Accuracy | Precision | Recall | F1 |
|---|---|---|---|---|
| 0 | | 0.94 ± 0.04 | 0.65 ± 0.18 | 0.76 ± 0.12 |
| 1 | | 0.91 ± 0.03 | 0.49 ± 0.19 | 0.62 ± 0.15 |
| 2 | | 0.78 ± 0.07 | 0.99 ± 0.01 | 0.87 ± 0.05 |
| 3 | | 0.89 ± 0.07 | 0.57 ± 0.13 | 0.69 ± 0.11 |
| Avg | 0.81 ± 0.06 | 0.88 ± 0.05 | 0.68 ± 0.12 | 0.74 ± 0.11 |

| | Accuracy | Precision | Recall | F1 |
|---|---|---|---|---|
| 0 | | 0.94 ± 0.03 | 0.70 ± 0.13 | 0.80 ± 0.09 |
| 1 | | 0.93 ± 0.03 | 0.50 ± 0.16 | 0.64 ± 0.13 |
| 2 | | 0.81 ± 0.06 | 0.99 ± 0.01 | 0.88 ± 0.04 |
| 3 | | 0.92 ± 0.08 | 0.54 ± 0.13 | 0.67 ± 0.11 |
| Avg | 0.84 ± .06 | 0.90 ± 0.05 | 0.68 ± 0.11 | 0.75 ± 0.09 |

| | Accuracy | Precision | Recall | F1 |
|---|---|---|---|---|
| 0 | | 0.93 ± 0.03 | 0.69 ± 0.14 | 0.79 ± 0.10 |
| 1 | | 0.92 ± 0.04 | 0.50 ± 0.14 | 0.64 ± 0.12 |
| 2 | | 0.81 ± 0.07 | 0.98 ± 0.01 | 0.88 ± 0.04 |
| 3 | | 0.94 ± 0.07 | 0.54 ± 0.13 | 0.67 ± 0.11 |
| Avg | 0.83 ± 0.06 | 0.90 ± 0.07 | 0.68 ± 0.13 | 0.75 ± 0.12 |

## 2 Experiments and Discussion

Experiments were conducted to study the effectiveness of the given classifier when varying the temporal unit. We considered the whole dataset (referring to 2013 and 2014), data divided into semesters, trimesters, and months. This resulted in one dataset for the whole data, four datasets for each semester, eight for trimesters, and twenty-four for months. We then applied XGBoost, which is well-known for its effectiveness in processing tabular data, to each dataset.

Table 1 shows the average classification performance for each temporal unit in terms of accuracy, precision, recall, and F1 score for the four classes and the average value over the classes. Since the four classes are unbalanced, we will focus on F1 score values for a fair comparison and precision and recall values to evaluate the model's ability to avoid false positives and negatives.

Overall, we observe that dividing the data into smaller temporal units increases the average F1 values over the four classes. This suggests that models trained on these smaller temporal units are more capable of classifying new samples than models trained on the entire dataset. As the F1 score increases, the precision and recall values also improve. Notably, with the whole data and semester-based divisions, the models struggle to classify samples belonging to the second class correctly. However, when the temporal unit's size is reduced, precision and recall for this class increase drastically, approaching nearly perfect values. A split by semester is sufficient for the other three classes to improve the classification models' performance.

## 3 Conclusions and future work

In this work, we propose a new dataset based on the Open University Learning Analytics Dataset, which includes information about the time students interacted with the platform. This enhancement allowed us to study the influence of the temporal size unit of data on the effectiveness of batch classification models. Our results show that using smaller temporal intervals leads to better results than processing the data as a whole. This suggests that time is crucial when analyzing educational data and must be considered.

Future work will focus on studying the effectiveness of incremental and adaptive algorithms in analyzing this new dataset as a stream to address classification and concept drift detection tasks.

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# Beyond Problem-Solving: Using ChatGPT to Foster Deep Learning and Engagement Among Pre-University Students*

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## 1 Introduction

In recent years, the integration of artificial intelligence (AI) in educational settings has significantly transformed teaching and learning methods [1]. ChatGPT [2], a large language model developed by OpenAI, has become a central resource for students who use such technology extensively in their learning process [3]. However, there is a growing concern that students primarily use this tool for completing tasks or solving practical problems, often bypassing a deep engagement with the underlying academic concepts [4]. This approach can hamper student development and limit AI's potential to facilitate more exploratory and enriching educational experiences [5].

This paper presents the preliminary findings of a novel application for ChatGPT, highlighting its usage as a dynamic knowledge repository instead of a problem-solving tool. Our research study aims to enhance student engagement by incorporating ChatGPT into the learning process and solidifying comprehension of concepts through active learning methodologies [6].

We conducted a study among pre-university students in Palermo, Italy. The students used ChatGPT to explore knowledge and focused on the topics of the ozone hole and recycling. We encouraged them to use ChatGPT to enhance their understanding of the subjects. After this phase, we assessed their comprehension and retention with a questionnaire.

Our study shows that using ChatGPT improves learning outcomes, with students achieving commendable scores. This suggests a promising future for AI in education, focusing on exploration and knowledge discovery.

## 2 Methodology

The methodology employed in this study was crafted to assess the educational benefits associated with the integration of ChatGPT as a tool for enhancing learning among pre-university students. The structured experimental program

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aimed to facilitate interaction with the AI, evaluate its impact on learning outcomes, and gather comprehensive student feedback on the overall experience.

The experimental session began with an introductory presentation on ChatGPT. Students were provided with an overview of its capabilities and potential applications within an educational context. This introductory session was imperative to ensure students felt at ease and well-informed about the technology before integrating it into their learning experience.

After the initial introduction, due to time limitations, the primary session involved a 40-minute segment. Students engaged with ChatGPT to delve into and elaborate on two predetermined academic concepts: ozone hole and recycling. These concepts were selected according to the teacher since they aligned with the student's current curriculum. The interactions were organized around concept maps designed to steer the students' inquiries and foster a comprehensive exploration of the main concepts.

Following their interaction with ChatGPT, the students were tasked with completing a 10-minute thematic questionnaire without any technological support administered via LimeSurvey. This assessment tool was designed to measure their comprehension of the discussed concepts and capacity to integrate the information acquired through their interaction with ChatGPT.

After the session, there was a dedicated discussion where students openly shared their experiences, reflected on their knowledge, discussed challenges, and provided feedback on using ChatGPT as an educational tool. This discussion allowed facilitators to assess student engagement and evaluate the methodology.

## 3 Results

The evaluation of students performances relied on quantitative methodologies, with a focus on the accuracy of their responses to a themed questionnaire. This assessment involved a comparative analysis of the results obtained from the study group of 17 students, which utilized ChatGPT, and a control group of 32 peers from other classes who did not integrate ChatGPT in their learning process. The detailed comparison of these findings is presented in Table 1. The table contains the average number of questions answered correctly by the students, clarifying the disparities in students' performances and offering a visual representation of ChatGPT impact on improving student understanding and retention of the covered concepts.

**Table 1.** Comparison between experimental and Control Group performance.

| Topic | Experimental Group | Control Group | p-value |
|---|---|---|---|
| Ozone hole | 0.853 | 0.792 | 0.011* |
| Recycling | 0.941 | 0.903 | 0.067 |
| Total | 0.871 | 0.811 | 0.003** |

$^{**}P$-value $\leq .01$; $^{*}P$-value $\leq .05$

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# Combining Large Language Models and Linked Open Data for Authoring of Learning Task

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## 1 Introduction

Authoring learning tasks is a difficult and time-consuming process. Teachers must search for information, adapt it to the educational level of their students, prepare it for use in different environments (e.g., in a written test or in a learning environment such as Moodle), etc. The creation of learning tasks can be supported with Linked Open Data [1] (LOD) to get reliable information about the topics the teachers want to work on (e.g., [2]). There are cross-domain LOD sources (e.g., [3]) that provide reliable and accurate data that can be employed in multiple domains. Moreover, LOD sources are frequently interlinked, facilitating the discovery of additional information and fostering data reuse. Unfortunately, access to LOD is challenging to teachers as they require knowledge on Semantic Web technologies. With the emergence of Large Language Models [4] (LLM) they could be employed to lower the accessibility hurdle of LOD. The combination of LOD with LLMs for creating learning tasks may mitigate the problem of hallucinations, which is a common problem in LLMs [5]. By using LOD as input, LLMs can be guided to generate more accurate and reliable content.

In this work, we aim to explore **whether combining LOD with LLMs can effectively help teachers generate learning tasks**. For this propose, a study was conducted involving 11 teachers using ChatGPT and LOD from the Cultural Heritage domain. This would be the first step to research how to train teachers in Artificial Intelligence education domain to use these technologies in a combined way, to know if using LOD in LLM removes their hallucinations, and to see if the barrier to access LOD is reduced thanks to LLM.

## 2 Experimental Design

The study involved 11 teachers from an Italian High School and consisted of a three-hour session divided into five stages. First (Stage 0), teachers were asked

to imagine that they are going on a school trip to a European city and that they would like to carry out learning activities with their students in the points of interest (POI) of these cities. Teachers indicated which cities they would like to work in. During an introduction to open data, LOD, and LLM (Stage 1), LOD that could be useful for teachers regarding POIs (e.g., links to Wikidata, DBpedia, Wikidata sites, POI name, description, location, etc.) were retrieved from some LOD repositories and shared with them. Teachers were then asked to use LOD and a LLM (specifically ChatGPT-4o) to generate learning tasks that they could carry out with their students (Stage 2). They were not given any examples or details of what they could do. After a few minutes, they were shown an example of how LOD and ChatGPT could be used to create a learning task for CHEST [6], an application that supports ubiquitous learning using LOD from Cultural Heritage domain. With this example in mind, the teachers went back to working with LOD and LLM (Stage 3). At the end (Stage 4), they were asked to complete a survey and share the conversation they had with ChatGPT.

## 3 Results

The teachers had 97 interactions with ChatGPT (we define interaction as a teacher's input together with the corresponding ChatGPT response). In 61 of them, teachers used LOD. Following the classification of Generative Artificial Intelligence's potential support in learning design proposed in [7], 26 interaction were of the type "Inspiration hub", 41 "Co-design facilitor", and 32 "Prototyping consultant" (teachers could request more than one task in each interaction). Furthermore, following the classification of task types of [2], ChatGPT proposed learning tasks in which students were required to take photos, answer textual questions (short and long), multiple choice, and true or false. In this experiment, ChatGTP proposed learning tasks of knowledge, comprehension, analysis, synthesis, and evaluation levels of Bloom's taxonomy [8].

10 teachers completed the optional survey, with questions about the quality of the learning tasks generated by ChatGPT (free text question in the questionnaire). Most of the responses (9 out of 10) indicated that the tasks were of good quality. 2 of the positive answers, however, also indicated that the proposed learning tasks would need to be reviewed. One of the teachers indicated that the learning tasks were only sometimes of quality. The UMUX scale [9] was included in the survey to measure the usability of the combination of LOD and LLM. A score of 67.08 (STD 15.02) was obtained, which suggests a good usability. Moreover, teachers were asked to indicate their comfort level with automation in a system designed to support the creation of learning tasks. The scale ranged from 1 (tasks created by human without any system support) to 5 (tasks created by the system without human intervention). The average score for this question was 3.60 (5 teachers selected option 3, 4 chose option 4, and 1 selected option 5). This suggests that while the teachers generally favor benefiting from LLM support to create learning tasks, they still want to retain some degree of control.

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# Formative Assessment Supported by Artificial Agents

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## 1 Introduction

Recent scholarly investigations have highlighted the critical importance of feedback in enhancing educational outcomes [1; 2; 3; 4]. Feedback empowers students' autonomy in the learning process, enables informed institutional decision-making, ensures continuous improvement, fosters engagement and motivation, and enables personalized learning experiences [5; 6; 7]. Nevertheless, despite its acknowledged importance, the practical implementation of feedback processes in everyday teaching is often hampered by large class sizes and time constraints. Recent technological advancements have led to the development of diverse computer tutoring systems designed to support the feedback process across various educational domains and tasks [8; 9]. These systems, characterized by their distinctive designs, have emerged as valuable tools in addressing feedback implementation challenges. Notably, plenty of tools investigate multiple-choice questions and relatively few on open-ended questions [8], thus leaving room for improvement. In order to meet this challenge, the didactic research group from the Department of Education, Cultural Heritage and Tourism at University of Macerata, initiated an investigation exploring the use of Artificial Agents in the evaluation of open texts [9; 10; 11; 12]. This research is carried out under the PRIN AI&F "*Artificial Intelligence and Feedback for Effective Learning*" project, in collaboration with teams from the Universities of Bari and Padua. This paper presents an experimental work, conducted in the academic year 2023/24, which involved 264 students attending the first year of the Master's Degree course in Primary Education.

## 2 Methods

The research aims to construct a recursive pathway between human and artificial agent that allows the analysis of short open-ended responses, making the process more sustainable and favoring a formative evaluation using generative feedback.

The process consists of several steps:

1. The teacher prepares the tasks (open ended questions) and, at the same time, the rubric and one or more target texts in order to train the system with possible answers.

2. The tasks, together with the rubric, are assigned to the students who will answer the questions.

3. The LLM-based system operates on both target texts and student responses. In both cases, the texts are segmented (*tokenization*) and each segment is transformed into a vector (*embedding*). The system then compares each text vector with the target text vectors and, based on their similarity, ranks the answers.

4. The teacher examines the classification made by the artificial agent, focusing on the border areas between the classes and identifies new target texts from the students' answers in order to refine the classification.

5. The artificial agent re-classifies the answers after being trained with the new target texts. It also indicates the scores where the margin of uncertainty is greatest.

6. The teacher examines the new classifications and can either accept them or propose new target texts with which the system repeats the previous cycle (steps 5-6).

7. The teacher analyzes the answers given by the system and, if the new classification appears acceptable, ends the recursive process between human agent and artificial agent. If not, a new cycle begins.

8. Once the recursive process ended, answers are sent to the students, together with an indication of the parts of each answer which deserves further attention.

9. The students, having received timely feedback on the different parts of their work, with an indication of the answer's strengths and weaknesses, can start the feedback cycle with the teacher if they have any doubts.

The process is therefore characterized by three phases: 1) the preparation of the task by the teacher and the execution of the task; 2) the recursive cycle between human and artificial agent to arrive at a classification of the papers; 3) the interaction between teacher and students in which the classifications are discussed.

## 3 Conclusions

The research is still ongoing, but, at the moment, three points seem to require special attention: 1) The selection of the LLM to be used by artificial agent for the incorporation and classification of the answers. For instance, using an LLM specifically trained on the Italian language, ensures that the model can handle the unique aspects of the language, leading to more accurate results. 2) The preparation of the target texts to train the artificial agent on meaningful examples of texts. These should avoid generic and ambiguous sentences. The training of the system using a large number of texts from the reference literature have been tried and tested for some time. In our case, in correcting short open-ended responses, we obtained better results by using target texts specially prepared by the teacher. 3) The definition of procedures to obtain a final agreement between the human agent and the artificial agent on the evaluation of the text. First results from two tasks completed by 264 students seems to indicate that the artificial agent can support the feedback process by suggesting a useful classification of students' answers in more than the 80% of the sample; within this percentage, the convergence with the human agent's correction is total in 90% of the cases. Further development of the research will include the testing of other LLMs and trials in different subject areas.

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# Stress in the university population: the positive role of physical activity in improving the wellbeing of students

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## 1 Introduction

Physical activity is recognized as a crucial element for promoting both physical and mental health. The World Health Organization (WHO) recommends engaging in at least 150 minutes of moderate activity or 75 minutes of vigorous activity per week (Bull et al., 2020). This level of activity is associated with a reduced risk of numerous chronic diseases and significant improvements in psychological well-being. Despite these well-documented benefits, sedentary lifestyles remain prevalent, particularly among university students (Guerriero et al., 2024; Moscatelli et al., 2023). This population represents the adults of the future, who in the university phase are sedimenting life habits that will stabilize in adulty (Peng et al., 2022) and meet the need for care considering also the burdens that weigh on health systems.

University students often lead sedentary lifestyles due to long study periods and frequent use of electronic devices. This sedentary behavior correlates with high levels of stress and anxiety. University students frequently suffer from physiological and psychological health problems due to stress, which can negatively impact academic performance (Wunsch et al., 2021).

The university period, especially during exam phases, is characterized by increased levels of stress and anxiety among students. This condition is often exacerbated by a sedentary lifestyle and the lack of regular physical activity (Moscatelli et al, 2023). Studies show that during these high-demand cognitive periods, perceived stress can significantly reduce cognitive functions and academic performance (Rettinger, 2011; Ruthig et al., 2011).

Numerous studies support the idea that physical activity can act as a stress-buffering mechanism, helping to mitigate the negative effects of stress on health. Regular physical activity is associated with a reduction in symptoms of anxiety and depression and can improve sleep quality and overall well-being (Wunsch et al., 2021; Kayani et al., 2018). Furthermore, physical activity was significantly associated with improved academic performance and reduced stress among students with relatively low levels of physical activity (Kayani et al., 2018; Guerriero et al, 2024).
A way to promote physical activity is the use of digital tools and artificial intelligence-based training that has shown promising results (Guerriero et al., 2024). Indeed, the use of virtual chatbots, wearable devices that provide sound feedback, message and reminder support not only allows recording and monitoring of daily physical activity and lifestyle in general but often modulates by designing feedback and activities based on the parameters recorded on the subject (Guerriero et al., 2024). Support of AI, both with the personalization of the intervention and verbal or visual feedback to the exercises' performances in addition to the use of chatbots and messages to keep up daily motivation, can become a valuable tool for intervening in the well-being of students by accommodating their needs.
The aim of this contribution is to analyse the literature for studies correlating physical activity and stress in university students, in consideration of the evidence in the literature of the benefits of exercise and its effects on stress. The study is intended as a first pilot approach to create an overview in research on this topic and set the basis for experimental studies.

## 2 Materials and methods

A literature review was conducted on Scopus and PubMed including studies between 2021 and 2024. The search query included the terms: university student AND physical activity AND stress. The inclusion and exclusion criteria were review only, English language only, open access only. Each term had to be present in the title and/or abstract. Studies that did not analyze stress in correlation with physical activity and vice versa, studies that did not have university students as a target population and studies that considered other mental health issues were excluded. PubMed provided 11 results. Scopus provided 2,855 results and PubMed 11 results, which were significantly reduced by applying the inclusion and exclusion criteria.

## 3 Discussion and conclusions

In summary, the literature suggests that regular physical activity can provide significant benefits for both mental and physical health of university students. However, greater attention is needed to the quality and quantity of physical activity, especially during periods of high academic demand. Future research should focus on validated measurement methods and consider the timing of data collection to better identify periods of maximum stress. Physical activity-based interventions, potentially enhanced by AI,

could be crucial in improving the overall well-being and academic performance of university students, also considering factors related to gender, lifestyle and motivation.

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# Enhancing STEM Education with an AI-powered System that Promotes Interactive Learning and Engagement

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## 1 Introduction

In recent years, AI-enhanced digital learning environments have shown promising opportunities to provide personalized and adaptive learning support, which can help students to solve complex problems and train higher-order thinking skills; however, gaps remain in theory-based systems that provide AI support for collaboration [1]. This paper introduces an AI-powered collaborative learning system designed to enhance Science, Technology, Engineering, and Mathematics (STEM) education by implementing an extension of the Learning-by-Explaining (LbE) [2] pedagogical approach based on the Interactive, Constructive, Active, and Passive (ICAP) learning framework [3]. The system addresses various challenges such as teacher shortages [4], low performance in STEM subjects [5], and low engagement in digital learning environments [6]. It can be used by learners of all ages, both in and out of school settings.

A great potential of AI in education lies in its ability to interact with students, encouraging learners to increase engagement. According to the ICAP framework, learning success results from cognitive engagement with instructors, learning materials, and peers in the learning process [3]. Higher levels of engagement such as interactively collaborating with a peer are most beneficial for promoting learning. Constructive engagement is characterized by generative behaviors such as writing an explanation of the learned material (i.e., LbE) and is less effective than interactive learning but more effective than active (e.g., taking notes) or passive (e.g.,reading text) respectively. However, recent research indicates that combining different learning modes with higher and lower levels of cognitive engagement tend to provide the best learning opportunities [7, 8].

The system also aligns with the Three Basic Dimensions (TBD) of effective teaching [9] by offering classroom management, high cognitive activation through active and interactive activities, and constructive feedback from both teachers and a generative AI.

## 2 The System

Our system supports students in learning in all four engagement modes of the ICAP framework and especially facilitates collaborative and constructive learning. In the learning phase, students can passively read or watch the learning materials, actively take private or shared notes, and interactively clarify their understanding in the chat with peers, teachers, and the embedded generative AI. The AI can link the learning materials to the previous chat history and use this information to answer questions. In the co-constructive explaining phase, students write explanations of the previously learned material in groups (LbE), making use of the notes and key points they created in the learning phase as scaffolding guides. Learner groups can request feedback or guidance from the teacher or the AI. The system also includes a teacher module for class creation, lesson planning, upload of multimedia learning material, and classroom management, allowing teachers to monitor and guide students' collaborative learning activities synchronously. The integration of a generative AI enhances learning by providing interactive, adaptive feedback and support, helping students to engage more deeply with the learning material and reducing the workload of teachers.

We developed the system as a web application optimized for various devices. Based on the theoretical background of the ICAP framework, its features include a real time chat with text-to-speech functionality to interact with peers, teachers, and a generative AI, a collaborative editor for co-constructive writing of explanations, the possibility to take private or shared notes, and multimedia learning material including videos of AI-generated pedagogical agents. For the AI services, we decided to use commercial tools to be able to focus on the design of our system and the effect of such technology instead of its development. The components form a comprehensive educational platform supporting both teachers and students.

## 3 Conclusion and outlook

We developed an AI-powered system designed to enhance STEM education, with potential applications extending to a wide range of subjects and applications in education. It provides a comprehensive environment for both teachers and students, facilitating especially collaborative learning. Although our system is primarily designed for synchronous classroom teaching, it is also suitable for asynchronous self-paced learning. In a first project, it will be used for online professional development courses for teachers and in this context, we will evaluate our system using the Comprehensive Evaluation of Use of Technology in Education (CEUTIE) instrument [10]. We further plan to assess learning gains of combinations of different engagement modes, explore different collaborative task formats, grouping methods, and AI support. We promote the development of AI-powered systems for education that not only integrate the latest AI technologies, but also align with educational theories and research findings. We argue that this approach not only improves system effectiveness but also increases system usability, ultimately contributing to the advancement of educational technology.

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# Enhancing language assessment with AI and intelligent technologies: an Intelligent Language Assessment Platform

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## 1 Introduction

Assessment of language proficiency can be realized in various formats, such as essay writing or multiple choice and is important in several contexts, for instance for university admission or work-related purposes [8]. For a general understanding on the topic of language assessment, a distinction between two key constructs in assessment, summative and formative assessment, seems necessary. The former refers to assessment that evaluates student learning and compares it to a benchmark. An example for summative assessment would be a final exam or a standardized test. The latter, on the other hand, refers to collecting information about the student's learning process can give insights into student knowledge development, which is useful for informing teachers about student progress and guide their instructions and learning materials. Examples for formative assessment include quizzes or writing assignments that give information about the students' progress. Furthermore, formative assessment has been shown to be a predictor of student performance in summative assessment [5].

Traditionally, some language tests have been conducted in the form of pen-and-paper tests [8], which have to be manually created and scored. However, the rise of modern technologies and natural language processing (NLP) has brought advancements to the field of language education such as automatic speech recognition (ASR), generative AI or text-to-speech (TTS). Automating language tests could potentially contribute to making assessment more cost-efficient and feasible for large-scale assessment. Recent advancements in technology have accelerated the progress of automation in language assessment [2, 10]. Among the tests profiting from recent technologies in the area of language assessment is the Elicited Imitation Test.

### 1.1 Elicited Imitation Test

The Elicited Imitation Test (EIT) is a sentence repetition task, measuring general language proficiency [12] and implicit knowledge of a language [3] and can

be used as a placement test in an educational setting [11] or as a teacher tool to assess second language (L2) learners' oral production skills in language classes [1]. The advantage of an EIT is that it is quick to administer and shows high validity [12]. During an EIT, the test-taker listens to sentences, which they are instructed to repeat verbatim. The test is reconstructive, meaning that the test-taker forms a representation of what they have heard and repeat the sentence using their own grammatical knowledge [4]. EITs can be developed with different design features, for example ungrammatical sentences to test the acquisition of grammatical constructs [4].

Recent advances have been made in different parts of the automation of the test [6, 7], but no automatic pipeline exists for Elicited Imitation tests yet.

## 2 System description

We introduce an Intelligent Language Assessment Platform that streamlines language test creation, administration and scoring and incorporates technologies and generative AI. Currently, the platform offers a pipeline for Elicited Imitation tests, with plans to implement more test types in the future. The platform is web-based and can be integrated as a module into Intelligent Computer-Assisted Language Learning (ICALL) systems for data collection in Second Language Acquisition (SLA) research or can be used as a formative assessment tool, for example in the classroom.

The platform offers two interfaces, one for test creators and one for test takers. It supports test creators in their test creation for EIT by providing an annotated corpus for flexible item creation, generation of spoken test items with text-to-speech technology, generation of ungrammatical items with GPT-4o [9] and automatic scoring with Automatic Speech Recognition (ASR) and string edit distance measures, converted to a percentage. Tests that have been created by the test creator can be shared via an access code and can be taken by students or participants on the test taker interface of the platform. Finished tests can be automatically scored, reducing the workload for teachers and educators.

This project enhances language assessment and research by alleviating the workload of educators and test creators. It furthermore contributes to the standardization of language testing in research and can be integrated as a reusable module in existing ICALL systems as well as being used for formative assessment purposes in the classroom.

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# Flipped Learning and AI in Initial Teachers Training

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## 1 Introduction

The initial training of teachers requires a systemic approach and educational models that promote awareness of the value of study among students, in line with the Dublin Descriptors, and support responsible learning [1]. It is essential to develop educational pathways that combine IT skills and digital tool awareness, encouraging critical and constructive thinking about technological innovations [6]. Understanding the limits and risks of digital technologies allows for more effective management, thereby enabling a focus on available opportunities. The flipped model, supported by Artificial Intelligence (AI), overcomes the limitations of traditional methods by moving towards more experiential and interactive methods, providing students with dynamic tools to generate personalized learning opportunities [3, 8, 9]. The integration of chatbots into the flipped learning model enhances learning by providing immediate and personalized feedback, increasing student interaction and confidence [4, 5]. In this integrated AIflipped approach, the centrality of "doing" emerges as a fundamental principle that challenges the academic tradition, and prepares students to be competent professionals and agents of change [2, 11].
The contribution verifies the effectiveness of an innovative educational intervention based on the AI-flipped model. This approach enhances interest and stimulates enthusiasm for learning, while developing critical thinking and problem-solving skills [7]. By promoting advanced learning processes through the use of Artificial Intelligence, it aims to enhance students' ability to tackle real and complex challenges, contributing to the development of key competencies such as adaptability, creative problem solving, and critical thinking.

## 2 Description of the study

The study explores the implementation of AI-supported flipped classroom activities to create interactive learning environments that enhance student engagement and learning.

It focuses on promoting personalized teaching and self-assessment, shifting from passive to active learning, and improving university students' competencies. The intervention involves testing new tools, methods, and strategies for peer group management and instructor-student interaction, evaluating their effectiveness. The study involved 316 first-year students from the Bachelor's Degree in Primary Education Sciences at the University of Palermo (2023-2024). The flipped classroom activity was structured with clear objectives, encouraging students to use ChatGPT for refining their writing through instant feedback. Activities included grammar checking, proofreading, summarizing, and creative writing. The process enhanced students' awareness of the importance of improving writing skills and fostered collaboration, allowing for in-depth analysis of the AI system's limitations and potentials.

To further investigate the outcomes of the educational intervention, a mixed-method approach was employed, combining both qualitative and quantitative data collection techniques. For the qualitative component, the Delphi technique was used in focus groups, each consisting of 10-12 students. This structured process, based on the method proposed by Okoli and Pawlowski (2004) [10], was carried out in three phases: the brainstorming phase, where initial opinions and ideas were collected and discussed; the clarification phase, involving in-depth discussion, conflict resolution, and categorization of key themes; and the completeness assessment phase, where the synthesized results were integrated to provide a comprehensive overview of the topics discussed. The research has highlighted a significant impact on the development of students' skills. In fact, 87% reported having acquired the skills necessary for independent and informed project design. Additionally, 92% emphasized that the flipped model facilitated personalized learning, greater access to educational materials, and a more responsible approach to learning. Furthermore, 93% of students showed a greater willingness to participate in collaborative decision-making processes. It has also been observed that the adoption of AI-flipped methods had a positive impact on outcomes. Thus, it emerges that adopting a hybrid teaching model, which effectively integrates traditional methods with mobile digital technologies, makes both the organization of educational activities and learning environments more efficient and effective.

## 3 Conclusion

Reflections on the implementation of the model show that, in addition to improving academic skills, the AI-flipped approach has significantly enhanced interpersonal relationships among students, and between students and teachers, promoting a climate of collaboration and idea exchange. The results of the educational intervention demonstrate that students not only gained a greater awareness of the value of study but also experienced the joy of "a job well done," with positive reflections on their personal and professional growth. In conclusion, the integration of AI in the flipped learning model represents a significant methodological advancement in teacher training, offering promising insights for future research on the effectiveness of this approach in the modern educational environment. This study lays the groundwork for further investigations into the long-term impact of these innovative methodologies on the training and professional development of educators.

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# Can Thinking Strategies Improve Understanding of Machine Learning?

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## 1 Introduction and Motivations

Recently, Artificial Intelligence (AI), and particularly Machine Learning (ML), has become a common part of daily life. The availability of software tools that make it possible to use ML mechanisms without technical skills [4], opened their use also to untrained people, including children and young adults. However, while these tools engage users, they do not always foster a deep understanding of ML principles, leading to reliance on speculative interpretations and superficial engagement with the technology. For this reason, ML can be an opportunity, but also a threat if not properly understood and managed [7, 4]. Promoting awareness of the mechanisms, opportunities, and weaknesses of ML is a children's right [6], and it is crucial to equip them with the proper abilities to take advantage of ML, and not being unconsciously controlled by it.

This study, a collaboration between psychologists and computer scientists, seeks to address this issue by enhancing children's comprehension of ML through training in *thinking strategies*, rather than teaching directly ML concepts. Moreover, the training we propose is unplugged, meaning it does not involve the use of digital tools, and therefore has the broader goal of training not only functional thinking for understanding ML concepts, but also decision-making skills in everyday situations. Indeed, as emerged in recent studies [2, 5], mastering tools does not equate to understanding complex mechanisms. This is particularly relevant to ML. For instance, while tools for image recognition can demonstrate ML's capabilities, they do not clarify their internal processes. As a result, children often lack an understanding of these internal processes, making it difficult for them taking an active role in controlling the tool behavior (such as providing training samples that include rare or counter-examples).

The objective of our work, summarized in this abstract, is to set up a training that supports the development of a correct understanding of how ML works, generalizing from any specific tool or specific algorithm. The training is specifically aimed at fifth-grade children, corresponding to 9-10 years old children.

## 2 Training of Thinking Strategies

Theories of thinking, distinguishing between *intuitive thinking*, which is rapid and prone to biases, often leading to errors, and *deliberative thinking*, slower and more demanding, supporting accurate reasoning and hypothesis formulation by considering alternatives, including counter-examples [3].

We aim at enhancing ML understanding through activities that train deliberative thinking, contrasting with intuitive approaches. The conjecture is that this training will improve comprehension of ML principles, potentially integrating seamlessly into early education without prerequisites or specific tools. We have identified three key thinking strategies:

1. Taking the necessary time to think without relying on quick judgments and the first idea that comes to mind.
2. Considering rare and possible cases.
3. Applying unconventional thinking, reasoning about the correct answer without being influenced by stereotypes, or the most prominent features that might lead to incorrect conclusions.

To train these strategies, we have developed three unplugged activities that we implemented in the classroom.

## 3 Evaluate the Success of the Training

The steps that we designed to assess the effectiveness of the thinking strategies training is similar to [1] and consists in:

1. performing a test to determine children's baseline level;
2. administering the training to the children;
3. performing again the test to assess the improvement.

Most of the approaches in the literature aim to develop tools or activities to explain concepts to children, the effectiveness of which is assessed by testing how much the concept has been understood by children. As a difference, in our approach the subjects of the training are the thinking strategies, while the objective is to increase ML understanding. To evaluate the effect of the training, we have developed a series of exercises that assess understanding of ML which requires exploiting the identified thinking strategies.

So far, we have conducted the experiment in 8 classes, and we will replicate it in other 8. Initial results on the effectiveness of the training are encouraging.

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# Virtual Worlds and Intelligent Tutoring Systems for learning motivation: a narrative review

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The education and training system has the delicate task of finding ever new strategies to promote meaningful learning and the educational success for each student. It is essential that each student occupies a central position in the teaching-learning process, and exploits teaching models. All this will promote development not only individual disciplinary skills but also transversal skills, such as critical thinking, problem-solving ability and autonomy in learning [1-2].

Since learning is a dynamic and interactive process, students need active involvement and flexible, dynamic and interactive tools that personalize the learning process by adapting to the different styles typical of each individual.

In a learning environment characterized by *well-being* atmosphere, students develop awareness of their own abilities, and they are oriented towards conscious choices and significantly rediscover their talents [3-4]. In learning environments structured on *well-being* and based on the learning personalization, the motivation to learn and the variables to be correlated are strongly enhanced [5-6].

Adaptive Learning (AL) stands out for its ability to personalize the learning process through detailed analysis of student performance and responses. This generates feedback and tailored learning content during interaction with the learner [7] and promotes student motivation [8-9] and engagement [10-11] by proposing challenges appropriate to their level of competence and providing positive and encouraging feedback [12].

Although scientific literature highlights the effectiveness of individualized teaching in promoting student learning [13], the large-scale implementation of adaptive teaching requires the intervention of advanced and accessible technologies that have not been fully available up to now.

In response to this need, on the one hand Intelligent Tutoring Systems (ITS) appear as a promising solution [14], embodying the intersection between computer science and educational neuroscience, on the other hand Virtual Worlds (VW) appear as a type of adaptive learning environment as they are able to satisfy the four fundamental principles that underlie it [12-15].

Furthermore, the advent of Digital Transformation in the field of education has significantly revolutionized teaching and learning methods and tools [16]. This is why teaching based on cooperative learning in Virtual Worlds integrated with the new Intelligent Tutoring Systems is configured as a supporter of a learning environment that generates *well-being* because it responds to the current needs of students [3-17].

This study, basically, aims to investigate the accessibility of Virtual Worlds, also in the Metaverse, in the context of education and special education, analyze the different typologies of Virtual Worlds in the context of Adaptive Learning, study the joint applications of Virtual Worlds and Large Language Models (LLM) and Artificial Intelligence (AI) systems in the educational context.

It considers the concrete possibility for students to explore Virtual Worlds within which they can find and use structured material for personalized learning and tutors created with artificial intelligence that simultaneously accompany the student in the learning process.

This paper, therefore, comprehensively explores and analyzes the impact of Virtual Worlds associated with Intelligent Tutoring Systems, investigating about the educational and motivational processes and outcomes related to learning.

In particular, the main objective is to evaluate how Virtual Worlds, set up according to an adaptive scheme, have a positive impact on learning outcomes and related motivational processes [18]. Subsequently, the study tends to highlight how Virtual Worlds integrated with Intelligent Tutoring Systems (ITS) are associated with better outcomes both in terms of profit and in terms of effects on learning motivation.

The narrative review methodology was adopted for the comprehensive analysis and synthesis of the literature to assees the impact and integration of Virtual Worlds in education, used in combination with Intelligent Tutoring Systems, focusing on identifying trends, challenges, and opportunities in this area.

The main outcome of this study is to demonstrate how the comprehensive exploration of the VW/ITS binomial has a significant potential on improving learning experiences, enhancing the outcomes through an immersive learning within an interactive environment capable of stimulating critical and creative thinking, communication, collaboration skills and all the other life skills and the new digital soft skills.

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# Public Speaking Skills and Anxiety Awareness in Future Teachers. Using AI and IoT in Higher Education for research and training

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## 1 Introduction

Public Speaking (PS) is the ability to speak effectively in front of an audience [1]. PS falls under the broader umbrella of oracy [2], which is the essential set of all skills related to oral communication, including coherent speech, active listening, and effective participation in discussions. It is a fundamental skill for university students in general and, even more specifically, for future teachers who are required to master the PS skill in order not to compromise the effectiveness of the teaching-learning process [3]. One of the main challenges people face when approaching PS is the issue of anxiety. Public Speaking Anxiety (PSA) is defined as ‘‘a situation-specific social anxiety that arises from the real or anticipated enactment of an oral presentation’’ [4, p. 72] and represents a common experience for the majority of the population with percentages of those affected exceeding half of the total [5; 6]. Future teachers, indeed, frequently mention anxiety as a concern about the teaching experience [7]. Given the importance of developing oracy in future teachers and the incidence of PSA in the general population, it was grasped as relevant to investigate how PSA affects future teachers and the extent to which they are aware of it.

From this hypothesis, two research questions were formulated:

1. Are future teachers aware of their anxiety concerning PS?
2. Can an AI emotion recognition model and an IoT stress detection device identify highly emotional students and support teachers in developing personalized and inclusive university teaching?

The proliferation of AI solutions has led several researchers to develop new models in education aimed at helping students improve their knowledge and skills and helping teachers develop strategies to improve the quality of teaching. AI solutions have not only been adopted to assist learners during the learning journey but can also be used to detect the emotions felt by students during learning activities [8], facilitating the instructor's identification of potential gaps in students that can negatively impact performance. Another aspect that can influence student performance is the level of stress perceived by students, which can affect memory and prevent them from

achieving their learning outcomes [9]. Several researchers have identified the increase in heart rate (HR) during classroom activities as a sign of stress [10]. The collection of this data through IoT devices could be particularly beneficial to teachers during the feedback process [11]. This paper analyzes how aware students are of the emotional states they feel during PS to support university teachers in designing specific PS training to make their teaching more inclusive.

## 2 Methods

The research was conducted with students attending the "Foundations of Teaching and Learning" first-year course of the Master's Degree in Primary Education at the University of Macerata. Students were required to answer questions from the PSA Survey [12] before giving a group oral presentation during the final workshop of the course. The presentation of 25 students, selected on a voluntary basis, was monitored by a video recording lasting up to 5 minutes. During the presentation, students were required to wear a portable stress tracker device in order to extract the HR data needed to predict students' stress perception. A Polar OH1+, an optical heart rate monitor connected to the online application 'Polar Flow' was used as it allows the accurate collection of 60 HR records per minute and the download of a csv file [13].

The subsequent study analyzed the students' public speech video presentation to extract the main emotions felt during the activity. An AI emotion detection model based on Convolutional Neural Networks (CNNs), previously developed and tested during a group presentation activity, was adopted for this scope [14]. This model consists of a combination of deep learning and convolutional neural network, which is able to extract emotions from facial expressions thanks to the use of the OpenCV Python library. The model thus returns 5 main emotions and a list of body movements made by the students during the presentation.

Thanks to these data, it was possible to check potential changes in the emotional states of the students by monitoring the increase in HR during the video or the HR variability, which can be influenced by the stress condition [15]. After the collection, the data from the survey, videos, and Polar sensors were cross-referenced for analysis.

## 3 Conclusion

The analysis of the 257 answers gathered from the PSA survey shows that most students report high levels of PSA. To address the first research question, we cross-referenced the survey data from the 25 selected students with data from emotion detection conducted through AI tools. The level that emerged from the survey was not consistently reflected in the emotional state detected by AI, showing how students were not always able to correctly self-assess their anxiety under or overestimating it.

This preliminary analysis shows that AI-based emotion recognition tools can help teachers identify students with high levels of PSA and support students to become more aware of their emotional state. Moreover, this kind of data can help university teachers design specific training on PS and improve personalized and inclusive learning paths.

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# Bridging the AI Literacy Gap: Future Educators' Perspectives on AI Integration in Education

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## 1 Introduction

The increasing presence of Artificial Intelligence (AI) across various sectors requires that educators better understand AI opportunities and challenges for education as a condition for a more aware adoption of these technologies into teaching practices [1,2,3,4,5]. However, the level of AI literacy among future teachers remains largely unexplored [2,7]. This study aims to bridge this gap by examining the understanding and perceptions of AI with a focus on its integration in education among student teachers in Primary Education at the University of Florence. Therefore, the two research questions that led this study were: "What are the self-perceived levels of AI literacy and awareness among future teachers?" (RQ1); "How do future teachers perceive AI benefits and drawbacks for education?" (RQ2). To answer these questions, a validated questionnaire was administered, designed to measure student teachers' self-perception of AI both in general and with a focus on the educational contexts. The questionnaire was developed based on a comprehensive theoretical framework that addresses the various components and interrelations at the core of AI understanding.

### 1.1 The theoretical framework

To tackle the complexity and multifaceted nature of AI literacy, a general framework for AIL [8] was adopted, consisting of four essential aspects that together cover the entire scope of AI literacy. These factors work together to create a comprehensive prism through which AI literacy can be investigated, evaluated, and developed. They emphasize the importance of moving beyond passive consumption of AI towards a more active and responsible knowledge, providing a comprehensive, integrative method to addressing AI literacy. For the purposes of the present study, together with this general framework framing AIL components for citizenship, the literature on opportunities and challenges of AI for education (AIED) [3,9] was taken into consideration in order to integrate the framework in the context of education.

## 2 Methodology

Based on this framework and literature on AIED, a questionnaire was developed [10] and adapted to be administered to the participants for this study, i.e. 314 student

teachers in Primary Education at the University of Florence. The questionnaire aimed at capturing the self-perceptions of AI literacy among them, with a focus on AIL for education. The survey incorporated items that assessed their knowledge, operational skills, critical thinking abilities, and ethical considerations regarding AI and the responses provided a comprehensive overview of their familiarity with AI concepts and their attitudes towards the integration of AI in educational contexts.

## 3 Results

Referring to RQ1, "What are the self-perceived levels of AI literacy and awareness among future teachers?", the survey results indicate a general lack of AI knowledge among the participants. Most students reported little to no understanding of AI definitions, theoretical foundations, basic mathematical functions, and the application of AI knowledge. There was also limited awareness of how to evaluate AI applications or AI systems. Ethical issues related to AI were self-reported as poorly understood among the majority. Additionally, many students expressed uncertainty about the critical skills necessary to engage effectively with AI, indicating a need for more comprehensive AI education that goes beyond basic familiarity. This general lack of AI literacy is also reported when future teachers underline that many of them feel not currently equipped with the knowledge and skills required to integrate AI effectively into their teaching practices. In relation to RQ2, (How do future teachers perceive AI benefits and drawbacks for education?), participants identified several areas in teaching where AI could potentially offer support. Administrative tasks were seen as the most suitable for AI assistance. Many students believed that AI could effectively help in managing schedules, and other routinary tasks, thereby freeing up more time for teachers to focus on instruction and student interaction. However, there was notable scepticism about AI's role in more direct educational activities such as assigning lessons, monitoring students, and planning lesson content. These tasks were perceived as requiring a level of personalized attention and judgment that AI might not be able to provide. Concerns about AI taking jobs and its potential for errors were also prominent, reflecting broader apprehensions about AI's reliability and ethical implications in educational roles. These concerns emphasize the need for a framework to guide AI integration in education, ensuring that AI serves as a tool to augment rather than replace human roles.

## 4 Conclusion

In conclusion, this study highlights the importance of enhancing AI literacy among future educators. By addressing the ethical concerns and ensuring that AI is used as a supportive tool, educators can harness the benefits of AI while preserving the essential human elements of teaching. The findings suggest a balanced approach to AI integration in education, advocating for its use in well-defined, controlled scenarios. Future research should focus on developing comprehensive AI literacy programs that equip educators with the knowledge and ethical frameworks necessary to navigate AI's integration effectively.

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# AI Act: a text analysis

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## 1 The Ai Act in the global Scenario

When a new disruptive technology is introduced in the global scenario the reactions are usually as intense as the capacity of the technology to change the socio-economic rules and the social balance of powers. In 2022, when OpenAi globally launched Gpt, the first AI chatbot, forefather of a large number of generative AI tools, the entire world expressed enthusiasm for the new capabilities but at the same time the society started to express its concerns about it [1]. The potential fearful consequences of this new special medium, accused of putting human life at risk, generated new concerns. In Italy the choc for this technology has been so strong that the Data Protection Authority decided to temporarily block it.

Even from a legal perspective, a new technology often forces the legislator to change the legislation under social pressure. It is actually also a semiotic question because the previous laws often suddenly appear unable to interpret the reality. That's because ancient law loses the referent to the current social context where the technology has modified the modus operandi.

In Europe the current arrival point of this social process, animated by fears but also by hopes of a bright future is the AI European act, approved on March 13, 2024. [2, 3]. It is a large text many pages long, where the general social new AI needs converge to be regulated [4]. The AI Act is a wide net aimed to circumscribe an enormous social context to give the paths to use a continuously updated technology [5]. So it is a law that tries to set limits and offers rules of conduct for the future use and tries to reassure all the implicated stakeholders [6, 7].

From a pedagogical perspective nowadays it is very important to analyze this text to understand if and how the European commission proves to be able to focus on the most important education-related issues.

## 2 The quanti-qualitative analysis

The analysis proposed in this paper is a multiperspective textual analysis that has the objective to offer a first interpretation of the law based on a quantitative and qualitative analysis from a pedagogical point of view. The final aim is to identify pros and cons of this law in the specific field of education.

The first part of the analysis is a quantitative analysis. It aims to individuate the pedagogical lexicon in the global text of the law. The aim is to verify which are the specific pedagogical words the legislator has chosen, if they are sufficient to describe and offer guidance to the huge number of European citizens and to the different European states. The AI law is not specifically related to the educational legislation, but it is important to understand how much and how the legislator has taken into account the educational issues. A first quantitative analysis shows that the education-related words are a minority in the context of a law that seems to be addressed more to big tech companies rather than to the school or university world.

But it is important to analyze the relation between these words and the text context where they are used and also the general context of the law, where other semantic categories appear more in depth.

The qualitative analysis helps to focus on how these words are used. In a crucial turning point of the history of educational technologies, it is important that a European law could offer innovative perspectives on the methodologically correct use of AI in the learning environment. If on one hand the law has the merit to underline some critical points (as first of all the risks in the generative AI use), on the other hand it should mark the way of an educational-profitable practice.

The cultural heritage of a not very fresh perspective is unable to offer an innovative guidance to enhance learning in the big context of the global European educational field. In a global way it appears little able to go beyond a general warning about the AI related issue and an appeal to an "anthropocentric" use of AI toward a more complex theoretical framework.

The qualitative analysis allows a comparison between the European AI act and the other worldwide legislations, as the USA law. While the *laissez faire* USA approach is more focused on the technological and economic development [8], the Ai Act is more human-centered and aimed to the protection of citizens' human rights. This comparison is useful in a historical moment where Europe wants to play a role in the general technology context projecting its highest profile values (as democracy, inclusiveness, etc...).

## 3 Preliminary conclusions

As a general conclusion, this qualitative and quantitative textual analysis of the European AI act is useful to trace some general tendencies about the European approach to AI in relation to the pedagogical point of view. The general appeal to European values and to an anthropocentric use of the AI is an interesting key to propose new points of view about a disruptive technology.

But the shortage of education-related words in the text underlines a general poor consideration of the potential use of AI to enhance learning [9]. The frequent risk related semantic occurrences proves a not very innovative perspective to the use of Artificial intelligence and in general of the new technological tools [10].

It looks like an old risk-benefits paradigm about technologies prevails on the opportunity of offering general guidance in the educational context.

A general major pedagogical focus could be a key point in further legal AI European updates.

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# Gen-AI Systems in Context: Ethical Understandings and Model Cards

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## 1 Introduction

As generative artificial intelligence (Gen-AI) systems [1] are adopted in higher education, there is a gap in agreed-upon frameworks for ethical implementations of these systems [2] to address faculty concerns such as academic misconduct, academic integrity, options for banning such systems and preparing students for the future [3, 4]. Some of the challenges that have been identified in the literature are preparing educators for AI Readiness [5] and AI Literacy [6 - 9], and ensuring that the use of Gen-AI systems is linked to the context in which they are introduced [10]. Gen-AI systems are built and trained upon data sets. Such an interdependence on their design affects the data being stored, shared or used to train future iterations of these systems. Furthermore, there are ethical and moral implications of engaging with Gen-AI systems that span beyond the physical tools themselves or their impact post-use [11]. Some developers have used model cards as a way to disclose the details of their systems, including training data, the intended users, implications for use, caveats, recommendations and ethical considerations [13]. Model cards provide an avenue for fair, accountable, transparent, and ethical review [14], which is necessary for those wishing to implement such AI systems in the context of higher education [4, 14]. A mixed-methods study was undertaken to examine higher education instructors' and instructional designers' thoughts on the effectiveness of modified model cards intended to inform users of the potential ethical implementations.

Model cards, a strategy intended to provide relevant information on suitable use cases in machine learning, and for which we see as having strong potential for education contexts [12], are proposed to support the responsible use of AI in education by increasing transparency for students and educators considering integrating these technologies into their teaching and learning. In particular, a modified version of model cards influenced by UNESCO's Principles for Ethical AI [13] and Adam et al.'s [15] Ethical Principles for Artificial Intelligence in K-12 Education, allows educators to make informed decisions on the integration of Gen-AI systems through critical analysis and identification of ethical issues. Furthermore, model cards can support educators in cultivating AI literacy and AI readiness, enabling them to contextualize the introduction of Gen-AI systems in the classroom.

Considerations are necessary when working with higher education students whose interactions with Gen-AI systems may have the potential to have lasting effects on their future academic and professional endeavours. UNESCO [13] further advocates for awareness and literacy of AI systems, noting the need for fair and non-discriminatory systems. AI literacy and critical examinations of bias have been challenges for educators and their students. This can be seen through the work of Adam et al [16], where they propose a framework for the ethical consideration of AI use with children, specifically looking at AI literacy, children's rights, pedagogical appropriateness and teacher well-being. Using modified model cards influenced by UNESCO's Principles for Ethical AI and Adam et al.'s Ethical Principles for AI in K-12 Education, we propose a framework for the ethical implementation of Gen-AI systems within higher education.

## 2 Methods

A mixed method approach [16, 17] was undertaken to examine higher education instructors' and designers' thoughts about the integration of Gen-AI systems, model cards and ethical consideration into various contexts. Qualitative and quantitative data [18] were collected from an AI Ethics in Education course of 21 graduate education students and one instructor. In this course, students were presented with the concept of model cards. They were then introduced to UNESCO's Principles for Ethical AI and Adam et al.'s Ethical Principles for AI in K-12 Education. Students were encouraged to examine the intersection of these three frameworks and modify the model cards to suit the context of their work (i.e., graduate education studies, college instructor, instructional designer, computer science professor). The data consisted of 81,743 words from weekly learning journals and 19,297 words from conversation notes, which learners wrote as part of the course, as well as qualitative digital artifacts from the instructor. Topic modelling of this corpus was explored through a process called Latent Dirichlet Allocation (LDA) [19]. Using NVivo 14, we additionally performed word frequency, sentiment analysis and thematic analysis of the weekly learning journals and conversation notes.

## 3 Findings

Early results indicate that many Gen-AI systems used in education may not yet have model cards or even model-card-type information that concretely define sections suggested by Mitchell et al. [14] (e.g., model details, intended use, metrics, evaluation data, ethical considerations, etc.). Of greatest concern across all contexts was the absence of ethical considerations, as indicated by word frequency and thematic occurrence in both the weekly learning journals and conversation notes. A modified model card specific to the context of the educational setting provides the necessary transparency for education practitioners who may be integrating such Gen-AI systems into teaching and learning. Tan and Subramonyam [20] examined teachers' needs regarding the integration of ChatGPT. They suggest providing model card information to highlight gaps in the mapping of AI literacy goals in education. As a result, a modified version of model cards that specifically caters to stakeholders working in education provides a steppingstone for building AI literacy and AI readiness.

## 4 Conclusion

This study indicates that a modified model card framework influenced by UNESCO's Principles for Ethical AI and Adam et al.'s Ethical Principles for AI in K-12 Education was helpful to better understand the ethical implications of the incorporation of Gen-AI Systems into various educational contexts. Our preliminary results note that context significantly impacts modified model cards with context directly affecting the focus areas under UNESCO's Principles and Adam et al.'s Principles. Ongoing analysis is needed to further examine what factors within context most greatly influence a modified model card approach. A modified model cards approach not only helps to increase awareness and consideration of ethical implications of Gen-AI, it can also provide a starting point for introducing Gen-AI systems to education practitioners, ensuring a holistic view of Gen-AI systems, their impacts and the implications for both in the classroom.

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# Enhancing Teacher Literacy in AI through the PROSPETTIVA Project

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## 1 Introduction

Artificial Intelligence is a research topic that has always found applications in the educational field [1]. Whereas artificial intelligence in education was once primarily a subject of academic research, the introduction of large language models (LLMs), especially with the launch of ChatGPT [2], has extended the use of artificial intelligence to ordinary users. ChatGPT, a readily accessible web application, offers a convenient interface through which users can issue commands via natural language prompts, enabling the program to accomplish specific tasks. The emergence of ChatGPT has notably advanced the integration of artificial intelligence in educational settings. Students and teachers have started to integrate the aid of artificial intelligence into their daily routines [3]. Regrettably, ChatGPT and other large language models arrived before users fully understood how to employ them conscientiously. This premature deployment raises significant concerns about ethical usage as individuals and organizations grapple with integrating these advanced tools into everyday practices without a comprehensive grasp of their potential impacts [4]. Therefore, a primary objective is to ensure that educators possess the necessary AI literacy to leverage these technologies effectively. A proper knowledge of LLM can help teachers in making their job better and at the same time to transfer this knowledge to students in order to make them aware of the potentialities and risks of using such technology.
In this paper, we introduce the "PROSPETTIVA" project, which was launched in Sicily in 2024, which aims to bridge this gap by fostering a deep understanding of AI among teachers. This initiative enhances educators' teaching abilities and equips them to navigate their students through the complexities of modern learning landscapes, thus making education more relevant and captivating in this digital age.

## 2 Project Description

The "PROSPETTIVA" project is centered on the creation of an advanced web platform featuring AI integration to deliver tailored learning experiences with the strategic goal of mitigating high school dropout rates. In addition to the

incorporation of AI tools, the project places a significant emphasis on the professional development of educators. This dual approach ensures that the utilization of AI in education is not only technologically advanced but also pedagogically robust. Educators are provided with comprehensive training to effectively utilize AI tools such as ChatGPT and refine their teaching methodologies to accommodate diverse learning styles and capabilities. This comprehensive approach aims to create a more adaptive and inclusive learning environment, addressing the individual needs of each student.
The project results from the collaboration between the Institute for Educational Technology of the National Research Council of Italy and the ICTG Carlo Alberto dalla Chiesa of Partinico (Sicily, Italy). In the initial phase, the project will involve hundreds of Sicilian students, particularly those in pre-university education, and around 20 teachers, but the platform will also be accessible to high school students and teachers.

## 3 Methodology

The training initiative of the "PROSPETTIVA" project is based on a dual approach, incorporating an extensive theoretical framework and robust practical applications. Initially, educators participate in a series of lessons, providing an in-depth exploration of Machine Learning principles, specifically focusing on Deep Learning technologies and large language models such as ChatGPT. These workshops are tailored to illuminate the sphere of AI and exemplify its potential applications within educational contexts.
Subsequent to the theoretical training, educators engage in a structured *learning by doing* phase [5], actively utilizing ChatGPT across various educational tasks. These include content generation, simplifying complex texts to enhance student comprehension, and developing engaging and interactive learning activities. This hands-on approach cultivates an understanding of AI's practical nuances, enabling seamless integration of these tools into their daily teaching practices. Moreover, educators are equipped with the skills to construct effective prompts to elicit optimal responses from AI, thereby enriching the educational experience. This methodology not only increases the confidence in the use of AI but also empowers educators to elevate their teaching methodologies.

## 4 Conclusion

The "PROSPETTIVA" project presents a comprehensive approach to education reform, centering on AI literacy as a means to empower educators and enhance student learning experiences. Through the provision of essential tools and knowledge for the effective integration of AI into teaching practices, the project is designed to foster a dynamic, inclusive educational environment that is well-suited to the demands of the 21st century.

## 5 Acknowledgment

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# Effective AI in Education: Transitioning from Sensor-Based to Interaction-Based Models in JOINclusion case study

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## 1. Introduction

Artificial intelligence (AI) is recognized as a transformative tool in educational practices. However, integrating AI into educational settings presents significant ethical and practical challenges, concerning the collection and use of sensor-based data from minors (Holmes et al., 2019). In contrast, previous studies highlighted the advantages of interaction-based models (Celic, 2022; Zhai, 2010; Chen, 2023). This paper proposes a novel approach by advocating for an interaction-based model that leverages students' interactions and demographic information rather than relying on sensor-based methodologies. The study outlines a trajectory for shifting from sensor-based to interaction-based models, to enhance trust and transparency in AI-powered educational tools while prioritizing pedagogical considerations.

## 2. Materials and Methods

To explore the shift from sensor-based to interaction-based AI models in a real educational context, the JOINclusion AI algorithms were developed to utilise the interaction and demographic data to adapting to individual student needs and pedagogical priorities. The evaluation framework involved piloting the app in multiple educational settings, measuring student engagement, learning outcomes, and trust, through qualitative and quantitative data collection methods, including surveys, interviews, and behavioral analytics, to comprehensively assess the effectiveness and ethical considerations of the interaction-based AI models in fostering inclusive and personalized learning experiences. A key innovation of the JOINclusion app is its focus on privacy and security in compliance with the EU AI Act. Unlike sensor-based systems, which involve continuous monitoring and significant privacy concerns, the interaction-based model is less intrusive and more controlled. JOINclusion addresses privacy and security

issues by 1) anonymizing and aggregating data to prevent user identification; 2) obtaining explicit consent before data collection; 3) employing encryption and secure storage practices; 4) providing clear information about data use and collection purposes.

## 3. Main Results

The study yielded key results highlighting benefits and feasibility of interaction-based AI models in education. The most significant is the enhancement of privacy and data security, as the interaction-based approach significantly reduced risks, addressing major ethical concerns associated with the use of AI in educational settings (Floridi et al., 2018). The interaction-based model fostered greater trust and transparency among students, parents, and educators; crucial for widespread adoption of AI technologies in education (Hassija, 2024). In accordance with the EU regulation on the use of AI1, JOINclusion interaction-based model avoids collection of biometric or physical sensor data, subject to higher regulatory scrutiny due to their sensitive nature. The model relies on anonymized, non-intrusive interaction data—such as click patterns, time spent on tasks, and engagement metrics—that do not identify individuals or track physical states.

The AI algorithms developed demonstrated the combination of interaction-based information and demographics had potential in personalizing learning experiences. The study found strong correlations between student behavioral patterns with self-reported engagement and enjoyment levels. For instance, the algorithms identified specific behavioral patterns, such as increased participation in and time spent on assignments, which correlated with an improvement in students' engagement and enjoyment. The interaction-based model aligned with pedagogical principles, emphasizing inclusivity, accessibility, and learner-centeredness. For example, the JOINclusion app effectively supported students with diverse learning needs, resulting in an improvement in learning outcomes for students who previously struggled with traditional sensor-based approaches. This alignment ensures that AI development was driven by educational goals rather than technological capabilities alone, supporting a more learner-centered approach to AI in education.

## 4. Conclusions

The transition from sensor-based to interaction-based AI models represents an evolution in the integration of AI technologies in education. This study demonstrates that interaction-based models not only overcome the ethical and practical challenges associated with sensorial data collection, but also promote a more transparent, personalized, and pedagogically sound approach to AI in education. This contribute to the discourse on the future of AI in education advocating for the responsible and effective integration of AI technologies, by identifying an interaction-based model that leverages students' interactions and learners-centered pedagogies. This can be particularly effective in

[1] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)698792

online learning and higher education settings, where student engagement and personalization are critical. Interaction-based AI can adapt to diverse learning styles, track progress through digital interactions, and provide tailored feedback that enhances the online educational experience, create a more inclusive and engaging learning environment, making it well-suited to the flexible and dynamic nature of higher education.

Despite the promising results, the pilot testing was conducted in a limited number of educational settings, which may affect the findings generalizability to other contexts or larger populations. Further research is needed to validate them across diverse educational environments and with additional measures of student learning outcomes.

## Acknowledgments

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# Beyond Coding with AI: an Educational Intervention and a Research Methodology for CS Education

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## 1 Introduction

In the past couple of years, the educational landscape has been caught off guard by the rapid advent of artificial intelligence technologies. Educators, unprepared for these swift advancements, face significant challenges in effectively integrating these tools into their teaching practices. Educational research now has the crucial task of providing them with swift and practical solutions to navigate this crisis, offering tailored strategies for each discipline involved.

Computer science is particularly affected by this issue, due to the quality of code generated by both general AI models (ChatGPT) and LLMs specifically trained for programming (Codex). Additionally, the direct integration of these AI tools into IDEs further complicates the landscape. While these technologies can potentially enhance coding efficiency and provide real-time feedback, they also require a rapid adaptation in teaching methods and curricula. We must ensure that students not only understand how to use these tools but also maintain critical coding skills and the ability to evaluate AI-generated code effectively.

In this paper, we propose an educational intervention to help students understand the pros and cons of using AI in programming tasks, along with a comprehensive, multimodal data collection methodology to study how students interact with generative AI for coding, aimed at refining future interventions.

The proliferation of AI-generated code in CS education has met mixed reactions. While some acknowledge the benefits of shifting focus from code writing to the solution process, others view it as a shortcut and a form of cheating [2, 3]. Meanwhile, research methodologies in CS education are still in their infancy compared to fields like mathematics education, hindering the development of effective pedagogies to understand and integrate AI's effects [4].

## 2 Methods

To address these concerns, we performed a two-day intervention designed as a learning experience linked to a data collection procedure. Building on the work of

Ojeda et al. [6], the activity required 39 students, divided into 13 groups of three, to solve programming and algorithmich exercises under specific rules: only AI-generated code was allowed, the number of interactions with AI was limited, and different programming languages had to be used for each exercise. This approach promotes learning by having students explicitly outline the steps behind their solutions [1] and apply critical thinking to evaluate the AI-generated code [6].

Regarding the data collection, we aimed to gain a holistic understanding of the underlying processes of this learning experience by employing a multimodal approach, including:

- *Log Analysis:* Students interacted with various AI engines through a specific platform designed to collect logs of all interactions with AI during the challenge. This data helps us analyze the evolution of their prompting strategies.
- *Audio and Video Recording of Students' Activity:* We recorded all work in two groups; in one case, the setup included screen and vocal interactions with the webcam off, and in the other, the screen and vocal interactions with the webcam on. This data integration helps us connect the log of students' interactions with AI to all intermediate processes. For the video analysis, we refer to the methodology in Powell et al. [8].
- *Pre- and Post-Activity Survey:* The survey assesses students', before and after the activity, problem-solving approaches, self-awareness, metacognition‹[7], as well as their reflections on perceived learning outcomes.

## 3 Results and Conclusions

The initial pilot study using the proposed approach, apart from addressing technical limitations and testing equipment, demonstrated a positive impact on student understanding of the role of AI in programming and collected comprehensive data to analyze their learning experience. This intervention encouraged students to engage deeply in the practice of explaining and discussing their reasoning before moving to the final solution. It also provided researchers with clearer insights into students' problem-solving approaches. The combination of exercise results, logs, and audio-video recordings offered a multimodal view of the learning process, which was further contextualized by pre- and post-activity surveys, enabling an in-depth study of students' reasoning development. Detailed results will be presented in the full paper.

This proposal, merging AI-powered programming sessions with a comprehensive data collection procedure, provides a promising approach to support research on the learning processes within this discipline. Framed within the concept of AI as "Intelligence Augmentation" [5], this approach encourages a shift in focus from mere code writing to the essence of problem-solving, thereby enhancing students' awareness and critical thinking. Following the initial pilot and refinement of technical limitations, we plan to implement this procedure in laboratory classes for first-year undergraduate CS students during the 2024-25 academic year. This will allow for further validation of the methodology and

provide deeper insights into programming learning within this approach. Additionally, the versatility of this data collection methodology suggests potential applications in other fields, such as language teaching, where it could similarly enhance our understanding of student learning dynamics.

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# Special Track 7

# Laboratory teaching and experiential learning in digital environments

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# Promoting undergraduate mathematics students' TPACK knowledge through digital resource productions

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## 1 Introduction and Research Context

Recent advances in educational technology have led to an increasing interest in research exploring how the process of designing educational resources impacts the learning of the designers, especially when the latter are students, the primary beneficiaries to whom the learning design is addressed [1], [2], [3], [4]. The designing, creation, and use of digital educational content, such as e-books, by integrating classic resources with augmented experiences is increasingly significant for enhancing both mathematics teaching and learning [5], [6]. According to Mayer [7], "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." At the university level, project-based learning, and digital resources' design for meaningful learning [8], [9], are mainly used for teacher professional development and less in university teaching and learning. We just investigate in a university pure mathematics context the knowledge outcomes coming from learners' generated resources in topology for their own class or for a preceding class through the lens of the TPACK framework [10], which integrates technological, pedagogical, and content knowledge. Also, being engaged in a resource design activity makes students appear to have early teaching knowledge, and Klein discontinuity begins to shape [11].
We focus on the following research question: *How does the students' designing and use of digital resources in a learning activity to be addressed to peers or quasi-peers impact the construction of their content, pedagogical, and technological knowledge?*

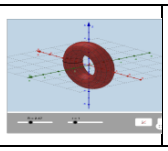
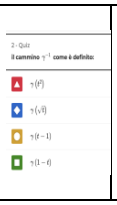
## 2 Methodology

The experiment, held in the second semester of the academic year 2023-2024, involved thirty-four third-year undergraduate students attending a topology course within a bachelor's degree in mathematics. They were asked to work on a project, divided into small groups. The task required them to create digital resources, such as multimedia presentations or digital books, in the GeoGebra environment on topics related to course content opportunely chosen for their own class or for a preceding second-year class, containing both theory and activities for real-time or asynchronous discussions within and between different classes as well as reflections, due to the also

online permanent accessibility of the shared resources. Furthermore, a questionnaire exploring students' individual perceptions of the digital experience they had lived was required at the end of the activities. Our data, specifically student-generated resources and feedback questionnaires were qualitatively analysed through systematic and objective identification of some factors (processes, actions) from which strong signs of TPACK characteristics would emerge, to highlight to what extent they were harbinger of TPACK knowledge in tune with research [12], [13], [14] (see Table 1).

## 3 Some findings and conclusion

**Table 1.** TPACK findings emerging through some factors within products and feedbacks.

| **TPACK Factors** | **Outcomes from products** | **Outcomes from perceptions** |
|---|---|---|
| **Knowledge to be taught construction** | A careful selection of illustrations and animations explaining the concepts, such as the Klein bottle construction **(CK)**, was made to forge a more understandable and attentive formalism **(PK).** | *St7: [...]only think of the animation from a cup to a ham that my group used to best illustrate the concept and meaning of homotopy **(TPK).*** |
| **Communication of the theoretical content** |  Communication was mainly based on visualisation instruments (**TPK**). | *St3: There are a lot of great animations in topology that really make you understand the basic concepts, so you must make use of these applications (**TCK**, **TPK**).* |
| **Designing** | A special attention was given to the structure design, always including a theoretical section enriched with examples **(PK)** to understand definitions and the meaning of propositions **(CK)**. | *St7: Designing the resource involves a thorough knowledge of the topics dealt with, improving language skills, and learning to present students, qualities that I very much appreciated **(PCK).*** |
| **Problem Posing** |  The idea to propose an interactive quiz through Kahoot at the end of the students' implementations was a more fun way to enhance learning and stimulate collective discussion **(TPACK).** | *St17: In problem posing we created challenges that would require the classroom to apply concepts learned during the theoretical lesson: interactive models and exercises for the active exploration of concepts in an original way (as Kahoot) **(TPACK).*** |
| **Digital Technology Knowledge** | Within GGbooks, an approach allowing one to visualise and analyse a space structure in an intuitive way has been done through interactive three-dimensional graphic applets, allowing the dynamic manipulation of rays and the rotation of the view **(PCK)**. | *St7: I believe that the use of digital technology to teach mathematics improves my skills, my way of presenting a topic, my way of communicating, my focus on language, my attention to how to pose a problem, and my technological attitude **(TPCK).*** |

Our initial findings show that implementing a GeoGebra Book, enriched with videos, theory, images, topology content, and interactive assessments via Kahoot, exhibits a well-balanced integration of TPACK with university mathematics education. Further investigations are needed, also considering the tiered research approaches [15], [16].

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# Augmented and Virtual Realities: prospective teachers knowledge, intentions and believes about their use in geometry teaching design

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## 1 Introduction

The origins of VR can be traced back to pioneering efforts such as those by Lanier in the 1980s, who coined the term "virtual reality" and significantly advanced the technology. More recently, Luckey's development of the Oculus Rift in 2012 marked a pivotal moment, bringing VR into mainstream consciousness (Luckey, 2020).

AR saw significant early development in the 1990s with the work of Caudell and Mizell who introduced AR to assist in manufacturing processes. Recent innovations include Apple's Vision Pro, launched in 2023, which combines AR and VR capabilities in a single device, further pushing the boundaries of these technologies.

AR integrates digital elements into the real world by using the device's camera to overlay digital objects onto the physical environment In contrast, VR creates an entirely digital environment, isolating the user from the real world and relying on screens and internal sensors rather than the camera.

In education, AR and VR have become significant tools over the past 25 years, enhancing learning experiences by providing interactive and motivating environments. These technologies revolutionize traditional teaching methods, offering interactive tools and 3D visualizations that boost student engagement and understanding of complex concepts (Lee, 2012; Chang et al., 2022).

In mathematics education research, several studies have highlighted the benefits of integrating AR and VR in educational contexts in mathematics.

Cevikbas et al. (2023) emphasized the role of AR and VR in enhancing the discovery of 2D and 3D Geometry concepts, while Albaladejo et al. (2020) emphasized the potential of AR and VR in complementing each other and to traditional learning methods by offering interactive and visually stimulating experiences.

Interesting studies highlighted also possible differences between traditional and augmented reality teaching and to what the methodological approach for teaching with innovative technologies has to be based on (Albaladejo, et al., 2020; Milici et al., 2024). In particular some Authors specified that a teaching methodology mediated by AR and VR has been defined with the aim of supporting teachers in identifying the

most relevant activities that can be implemented with the use of specific devices, robotics and 3D technologies, to stimulate students' creativity and guiding teachers in supporting learners during all learning phases. (Farella, et al., 2020).

The successful introduction of such advanced technologies in the classroom depends on the teachers who implement the technology in practice. Although the research community has studied various aspects of AR and VR (e.g. design and development, effect on learning), not many researches has been conducted toward understanding student teachers' beliefs about using AR and VR in their future teaching.

The aim of our study is, in this context, to explore prospective teachers' Mathematics Pedagogical Content Knowledge (MPCK, Borko & Putnam, 1996), perceptions, believes and possible decision to use AR and VR in their teaching design.

The study addresses the following research questions:

1. What are prospective teachers' intentions regarding the use of AR and VR technologies in their future teaching?

2. What is prospective teachers' perceived ease of use regarding using AR and VR in their future teaching?

4. What relative advantage do prospective teachers believe AR and VR can offer to their future teaching compared to traditional teaching in Mathematics?

5. How could the use of AR and VR in teaching mathematics improve student's 3D Geometry competences in classroom?

## 2 From teaching perceptions to meaningful training

According to our research questions our study is focusing on two different aspects, interconnected each other. On one hand we are collecting data aimed to investigate prospective teachers' teaches intention and/or beliefs about AR and VR use in their teaching (in particular mathematics teaching). On the other hand, we are implementing an AR and VR educational paths within a training course for prospective school teachers at the University of Palermo (starting from September 2024) aimed to address the social and educational needs related to teaching/learning Geometry through AR and VR technologies and to promote a more innovative and active approach to teaching mathematics among future educators.

A three-part questionnaire collects quantitative and qualitative data as follow:

1. Demographic information items (i.e. gender, age, teaching practices/training)
2. Items on intentions (i.e. using AR/VR in training/teaching, future teaching intentions, predicted difficulties) and perceived ease of use, measured on a Likert scale.
3. Open-ended questions on beliefs regarding AR and VR in future classrooms, particularly mathematics.

The designed educational intervention encourages future teachers to reflect on MPCK factors (Borko & Putnam, 1996) exploring innovative teaching practices to promote more engaging learning experiences and teaching design activities by integrating AR and VR technologies in geometric modelling, and 3D printing. In particular, the use of Meta Quest 2 headsets and CAD modelling software - such as Tinker-

cad, allows prospective teachers to interact with geometric objects in a virtual space, improving their ability to recognize, model, and manipulate three-dimensional shapes.

## Acknowledgment

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# Foggia Occupator: a case study on the creation of an Open Educational Resource through the digitization of a historical newspaper

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## 1 Introduction

This contribution explores the intersection between Digital Humanities, Open Educational Resources, and didactics of history through a case study of the "Foggia Occupator", a World War II-era newspaper published in occupied southern Italy [1]. This project aims to digitize and analyze a unique historical source, and subsequently create an innovative Open Educational Resource that bridges the gap between traditional archival research and modern digital pedagogy. By doing so, we seek to demonstrate how digital tools can transform historical artifacts into interactive, accessible resources for both researchers and students. Furthermore, by proposing the creation of a digital edition of the newspaper and subsequent quantitative literary analysis of this unique primary source, we strive to demonstrate the potential for leveraging digital tools to enhance accessibility, research, and education in the field of humanities.

## 2 Between Digital Humanities and Open Educational Resources

Our proposal integrates several key techniques from the Digital Humanities toolkit, including optical character recognition for text digitization [2], XML-TEI encoding for standardized markup [3], and computational methods for literary analysis such as topic modelling, sentiment analysis and network analysis [4]. These tools could enable a multifaceted examination of the newspaper's content, revealing hidden patterns in power dynamics, social relationships, and discourse evolution over time [5]. Concurrently, the process of transforming this digitized historical artifact into an Open Educational Resource is evaluated, adhering to principles of accessibility, reusability and pedagogical effectiveness [6]. This interdisciplinary approach aims to create a dynamic, interactive learning environment that encourages students to engage critically with primary sources.

## 3 Foggia Occupator: an insight into the daily life in American-occupied Southern Italy at the end of World War II

The "Foggia Occupator" newspaper, published weekly from December 1945 to August 1946 in Foggia, opens a window onto the complexities of post-war occupation in southern Italy. Its pages reflect the intricate dynamics between American forces and local populations, documenting both mundane town events and pivotal moments in Italian political history [1]. This rich body of content provides fertile ground for both historical inquiry and innovative educational approaches. For example, a few articles contain references to tensions between American soldiers and Italian citizens, while others report examples of cooperation and conviviality, such as on Christmas Eve 1945, when American soldiers dressed up as Santa Claus and brought gifts to the Italian children. Furthermore, almost an entire volume is dedicated to the 1946 referendum which changed Italy's political system from monarchy to republic. The comments, photographs and overall impressions of such a crucial historical event, collected in the newspaper, can be a prime candidate as a precious source for research and teaching. By digitizing and analyzing these diverse narratives, we aim to provide a nuanced, multifaceted view of this historical period, challenging students to consider multiple perspectives and interpretations.

## 4 An intervention proposal

Our proposed intervention encompasses four key objectives: improving accessibility through digitization and markup, conducting in-depth quantitative analysis, developing contextual materials for enhanced understanding, and designing a laboratory-based teaching activity. More specifically, the intent of the activity is highlighting the processes of newspaper writing and digitization themselves, borrowing concepts theorized by Freire [7], while also focusing on the possibilities to open education through the co-creation of Open Educational Resources [8]. Additional attention is given to the historical contents of the materials. This holistic approach aims not only to preserve and highlight a valuable historical resource but also to demonstrate the potential for digital methodologies to transform archival materials into dynamic, interactive educational tools. The goal is to build a bridge between historical artifacts and contemporary pedagogical practices, fostering critical thinking skills and digital literacy among students. Moreover, this project seeks to demonstrate how digital humanities techniques can be applied to create engaging, multifaceted educational resources from primary historical sources.

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# Educational relationship educator-children-robots: a study within the practicum for future educators

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## 1 Theoretical framework

**Child-robot interaction and educator mediation**

Since the first studies on the use of robots in kindergarten, ICT have been seen as useful to promote the use of basic skills for the child's global development (1). In research on child-robot interaction (cHRI), regarding the Ethical Considerations of Applying Robots in Kindergarten Settings, a macro perspective has been proposed for studies that always consider a. the nursery as an institution (with normative rules and pedagogical rhythms not to be distorted despite the presence of the robot), b. young children as a vulnerable group, c. the role of the caregiver, d. the pedagogical purpose (2). Regarding points b and c, two important elements are underlined: a. the educator must always mediate the young child's relationship with the robot without completely exposing him to the exclusive relation- ship; b. the use of the robot must be able to be verified in terms of an affective increase in learning, which would otherwise be avoided. The main reviews on the use of social robots in kindergartens have focused attention on the results on the skills of the participants: in addition to technical skills, the impact on transversal and cognitive skills, on involvement in learning and on emotions (3). Other reviews have especially emphasized that the introduction of robots - and related Intelligent Tutoring Systems - into educational practice implies the resolution of technical challenges and the change of educational practice: a. the robot needs a sufficiently correct interpretation of the social environment for it to respond appropriately – as the robot must understand the student's abilities and progress to allow him to choose appropriate actions; b. given that the effectiveness is not generalizable in the operational settings of kindergartens, the focus must remain on the child-educator relationship (4, 5) and that the robot remains a non-agent support of the relationship.

**Immersive practicum for student educator**

The practicum is a pivotal phase for pre-service educators in which they develop professionally (6). The practicum is necessary for the training of future educators and mandatory in the university studies in Italy. Although the practicum as a professionalization environment is much studied, most studies on teacher education focus on practice in primary and secondary schools, while practicum in nursery schools has received less attention in the international literature (7). The available studies underline the importance of focusing attention on the point of view of the perceptions and representations of educators in initial training, given that the practicum experience could greatly influence subsequent representations and professional choices (8).

The intervention session of group A included a first phase of mediation by the psychomotricity (I*a*) and a second phase of mediation by the robot Nao (II*a*) in the presence of the educators. The intervention session of group b included a first phase of mediation by the psychomotor therapist (I*b*) and a second phase of mediation by the educators (II*b*).

The data were collected via a questionnaire on representations (for educators and trainees) and behavioral observation grids (for children and relational settings). The data were analyzed statistically-descriptively.

## 2 Design and methodology of the study

**Relation children-educator-robot within an immersive practicum**

The proposal presents the first results of an empirical study carried out during the practicum into the 'Scienze dell'educazione e formazione' bachelor degree (SEF), within the training agreement between the Department For.Psi.Com. (University of Bari) and Children's Service and kindergarden 'Matite colorate'. The investigation focused on the educational relationship offered by social robotics in child-educator mediation and described the mutual influence expressed through behavioral changes and representations of the actors involved. The quasi-experimental design had two non- equivalent groups, formed on the basis of family parents' adherence/non-adherence to the experiment. Each group was made up respectively of 10 children aged between 24 and 36 months (one of whom was diagnosed with autism), 4 educators (two with experience, two as SEF trainees), a psychomotor therapist, two Ph.D. doctors as external observers. The intervention session of group A included a first phase of mediation by the psychomotricity (I*a*) and a second phase of mediation by the robot Nao (II*a*) in the presence of the educators. The intervention session of group b included a first phase of mediation by the psychomotor therapist (I*b*) and a second phase of mediation by the educators (II*b*).

The data were collected via a questionnaire on representations (for educators and trainees) and behavioral observation grids (for children and relational settings). The data were analyzed statistically-descriptively.

## 3. Results and reflections

The results of the study concern the changes in behavior and representations of the actors involved, as follows:

- no substantial behavioral changes were detected between groups of children a and b - in group a, after an initial phase of curiosity towards the Nao robot, attitudes of seeking contact and communicative exchange with the educators prevailed. The frequency of such attitudes is similar between phase IIa and IIb;
- no substantial changes were detected in the representations of experienced educators:
- substantial changes were detected in the representations of the SFE trainees - in the trainees of group A there was a strong increase in interest towards robotics, in general, and towards the integration of the Nao robot in educational settings; in the trainees of group b there was a moderate increase in interest towards robotics, in general.

The study communicates that the mediation of the robot within the educator-child relationship in educational settings influences more novice educators (who question the design of adequate settings), less so veteran educators (who use the robot to attract children's interest) and children (who prefer a direct relationship with the educator) (9, 10).

The study offers hint for thought as well as avenues for further investigation regarding the design of immersive internships in kindergartens which involve the mediation of robots which should be traveled especially by the organizers and managers of courses at university level (11).

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# Principles, teaching strategies and communication styles of educating young people for the world of work: audio-visual as a support tool for university teaching

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## 1 Introduction

This contribution is based on the experience of VideoLink, a social educational project launched in January 2022 and still ongoing, promoted by CAFRE University of Pisa, Link University-Business Laboratory, and Fondazione Area. The project involves the creation of a micro-learning pathway in short segments with the collaboration of numerous companies, research centers, and educational organizations active across Italy. VideoLink has seen the collaboration of experts, companies, young people aimed at the production of more than 240 videos, shared on the YouTube channel over approximately two and a half years of activity. We can define VideoLink as an "experience digital library," a form of distance education that aims to be immersive and engaging through an appropriate communication strategy and careful educational considerations. This abstract offers a deeper analysis compared to the previous contribution presented at Helmeto 2023 titled “VideoLink: An Educational Project for Innovation in Teaching and Interconnection between Students and Professionals.” Specifically, this abstract will analyze different audience engagement strategies, the main communication forms used by experts, and methodological aspects that may be useful for designing future interventions in the field of education.

## 2 The “VideoLink” social educational project

### 2.1 Strategic Objectives and Underlying Principles

The objectives of the VideoLink social educational project include bridging the gap between academia and the job market, especially for university students, by bringing them closer to the business world. It offers a thematic audiovisual tool on YouTube [1] and aims to enhance communication skills among students, teachers, and managers by developing an innovative communication strategy that is both engaging and methodologically rigorous [2]. The project also seeks to create an interactive social community for sharing educational content, directly involving young people in content production, expert interviews, video editing, and social promotion [3]. Additionally, it promotes active collaboration among students, managers, entrepreneurs, and experts to foster

employability [4] and encourages synergistic partnerships between educational institutions and private companies across various sectors [7]. The project serves as a social bridge involving professionals and managers interested in collaborating with a university institution open to business and innovation in training. The VideoLink program, initially designed to modernize academic education through audiovisuals and social media for Human Resource Management students at the University of Pisa, has since expanded to all YouTube users to explore new educational methods to engage future generations [9]. The project is rooted in the idea that videos enhance engagement [10], offering flexibility, the ability to revisit content, and ease of note-taking and sharing [5]. Despite the lack of physical presence and instant feedback, the project leverages young people's familiarity with social learning and educational videos, a trend accelerated by the COVID-19 pandemic. VideoLink emphasizes that audiovisual tools convey more than just theoretical knowledge, adding personal and contextual layers that enhance learning. The decision to create short 3-4 minute videos was to maintain attention and stimulate curiosity, with the videos serving as complementary tools to simplify key concepts and support teachers in making theory more tangible [1].

### 2.2 Structure of the videos

The contributions proposed by VideoLink are based on a simple narrative structure that includes the presentation of the specific topic shared in the segment, along with a brief introduction of the expert. A starting statement on a certain topic or a hypothesis that needs to be proven, or a (rhetorical) question that the expert poses to intrigue the viewer, keeping them engaged for the 3-4 minutes. A reference to the central content that the expert wants to share. The sharing of significant personal experience. The narration of practical examples. Each video concludes with a "moral of the story," or a summary that offers concise conclusions and opens up to other possible future investigations.

### 2.3 Communication strategies

The professionals involved in video production, aware of the impact of communication style on a video's appeal, have employed various strategies to better engage young audiences. Some experts analyzed other educational channels to identify the most suitable strategy for their communication style and desired image [12]. Others focused on writing scripts, selecting information, narrating personal experiences, or sharing historical content and refined reflections. Some prioritized diction and oral presentation, enhancing content through careful word choice, rhythm, and pauses. Others paid attention to the recording environment, ensuring an appropriate background and setting. Female experts often focused on their external appearance, including clothing and hairstyle, while contributors experimented with both formal and informal communication styles. Some used animated and technological elements to capture attention, while others emphasized the importance of intriguing video titles, consistent release schedules, brief summaries, and sharing content on social media.

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