# I•HE2023

## *Proceedings*

_ accelerating towards a digital and inclusive campus

Innovating Higher Education Conference 2023        EADTU        Anadolu University

# _accelerating towards a digital and inclusive campus

Overview of papers as presented during the
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# The Message of Istanbul

## Accelerating towards a digital and inclusive campus
## Empowering Learners: Micro-credentials, Generative AI, and Equity

The IHE-2023 Conference has explored some of the most prominent topics of the year: the use of Large Language Models (LLM) such as ChatGPT in higher education, the conceptualization and implementation of micro-credentials, equity and widening participation, and personalisation..

EADTU and the affiliated universities have worked intensively in these areas in recent years, resulting in reports and input in EU consultation meetings.

### Generative AI and LLM in Digital Education

Generative AI and in particular Large Language Models (LLMs) have significantly disrupted higher education, leading to debates about their use and implications. The introduction of LLMs affects all key stakeholders, including students, teachers, support services, institutional leadership, and authorities.

Universities should establish the educational and ethical conditions for using LLMs to enhance education by integrating them into teaching and learning design models. The process of incorporating generative AI and LLMs in higher education requires building trust in what are new and effective ways to teach and learn with AI.

With the support of the European Commission, EADTU keeps up with these developments by:

- Continuously monitoring the latest developments in research, innovation, and institutional policies related to LLMs in education;
- Developing frameworks for the deliberate use of LLMs in teaching and learning design based on these developments;
- Implementing and evaluating the use of LLMs in teaching and learning activities in the membership;
- Developing recommendations for the ethical use of LLMs and Generative AI for teachers and students, including institutional policies;
- Providing ongoing professional development for staff and leadership on the use of LLMs and generative AI in higher education.

### Micro-Credentials and the Bologna Process

The European Council Recommendation characterizes micro-credentials as short, flexible learning programmes that aid individuals in reskilling, upskilling, or changing careers. The EU encourages Member States to use micro-credentials to facilitate lifelong learning, with a goal of 60% of adults participating annually.

Open and distance universities in EADTU have been delivering continuing education online through short courses for many years. The digital delivery of micro-credentials has the benefit to offer flexible and scalable solutions for continuing education and career development for large numbers of students across Europe. However, there is a significant variation in the institutional qualifications for continuing education among universities.

To ensure transparency of micro-credential qualifications for academia and employers, it is crucial for universities and governments to agree on a unified award structure for micro-credentials that

aligns with the European Qualification Framework. EADTU and the European MOOC Consortium have already pioneered the Common Microcredential Framework (CMF), which offers consistent microcredential programmes with a total volume of 4-6 ECTS, making it suitable for continuing education for learners who are combining work and study.

The CMF Framework represents an initial common qualification. It's suggested that additional layers or exit points should be defined in a qualification framework for micro-credentials, based on the learning volume and the EQF qualification levels. This would form a comprehensive framework that should be incorporated into the Bologna Process.

**Equity and widening participation**
In higher education institutions, diversity arises from a variety of factors such as differences in prior knowledge, cultural background, language skills, self-learning abilities, availability of time, and self-esteem. This leads to a variety of needs that must be addressed. As society's need for complex competencies grows, the challenge of promoting key competences for all through high-quality education, training, and lifelong learning becomes even greater.

Higher education institutions have an increasing responsibility to promote inclusion in degree programs as well as in continuing education. This requires implementing measures to widen participation, improve retention, and provide adaptive education that meets the individual needs of learners.

As part of their mission, EADTU member universities have a unique position in national higher education systems to ensure equal opportunities for all to access higher education and the labour market. They have established a task force to optimize participation and retention in higher education and better prepare all individuals for the labour market.

In line with their core mission, EADTU universities are in the fore-front of promoting equity is one of the strategic objectives for cooperation in education and training at the EU-level (European Pilar of Social Rights).

**Personalisation**
Open and distance teaching universities are committed to providing high-quality, scalable, cost-effective, personalized, and tailored course offerings to meet individual and entrepreneurial needs. This commitment to openness and personalization has been a distinguishing feature of European open and distance universities.

The advent of digital teaching and learning, supported by learning analytics and AI, has created new opportunities for combining openness and scalability with personalization. EADTU members are developing new technology-based strategies and methodologies for teaching and learning to achieve this. However, these are still in the early stages, and the continuous emergence of new technologies provides ongoing opportunities for further exploration and development.

Key strategies include adapting the mode, content, or pace of instruction based on students' learning needs as indicated by learning analytics and AI, and providing real-time pathways and resources that go beyond one-size-fits-all learning experiences.

Also, study counselling plays a crucial role in personalization, especially for part-time students balancing work and family. It assists students in making study career decisions, including advice on study planning, course selections, choosing a major or taking the opportunity of workplace learning. At open and distance teaching universities, study counselling starts when students begin their studies and assess what knowledge and skills they already have and need for potential career and

corresponding study options. Technology can play a significant role in assisting with this personal mapping of knowledge and skills and progress made.

Ensuring the well-being of students is another important aspect of study counselling. It helps students feel confident in their studies.

EADTU and the members establish a Task Force Personalization to share expertise and experience and for developing a framework for modelling personalization.

**European and global outreach**
EADTU is committed to ensuring European and global outreach by initiating European projects that result in generic models and guidelines for digital higher education, collaboration, and mobility. It provides online continuous professional development for higher education staff and leadership through its EMPOWER services. Quality assurance for online and blended education is ensured through the e-excellent scheme.

EADTU maintains an ongoing dialogue with its members, the European Commission, and other authorities. In collaboration with other European organizations, it has a service contract with the European Commission for the European Digital Education Hub.

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# Blended Education

# Blended Learning as a Method for Educating in Cinema Direction and Cinematography: Design, Structure and Evaluation

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## Abstract

This paper concerns the development of two distance learning courses, one undergraduate and one master's degree course that deal with subjects related to cinema and cinematography. Traditionally studies in cinema are not offered as distance learning courses, since they deal with issues that have direct effect on visual perception, human interaction and are mostly of a subjective nature. The School of Applied Arts and Sustainable Design of the Hellenic Open University has developed a four year undergraduate course on Studies in Cinema that incorporates fully online distance learning modules, as well as blended learning workshops for modules that need physical interaction between students, teachers and equipment, such as cinema direction and cinematography. Moreover, advanced studies in cinematography is also offered as a major in the master's degree "Lighting Design", in which the same approach is used.

The present work will present the structure of these courses and focus on the organization and implementation of the physical workshops in relation to their online counterparts emphasizing on evaluation results by the students that have been collected after the first run of the programs. The evaluation is composed of questionnaires that grade faculty, facilities and learning material, as well as provide insights on possible upgrades for the courses. Preliminary results have a profound positive evaluation of the two programs in most questions. Statistical results and tendencies will be shown and discussed, as well as lessons learned from the evaluation and a discussion for future actions based on the proposed requirements of the enrolled students.

**Keywords:** blended learning, film studies, film making,

## 1. Introduction

The 21st century is characterized as a period of rapid development of science and technology, which affects modern society and creates new needs in the labor market, which also bring about developments in the field of education.In this context, specific curriculum development criteria have been set by authoritative bodies, such as UNESCO (2001) and EUA (European University Association). These bodies focus on program content and results (process criteria), adopting a student-centred approach to curriculum development, as discussed below (EUA, 2020; UNESCO, 2001).

In this direction, HEIs tend to adapt to the new context, providing study programs that prepare students to adequately face the challenges of new demands in the labour market.

It is clear from the research in the field of the Higher Educational Institutes (HEIs), that the open and distance educational process in contrast to conventional education, especially after the period of the Covid-19 pandemic, is gaining ground and a preference in open and distance study programs is observed worldwide (UNESCO, 2001). According to the European Union research report (EUA 2021, https://eua.eu/resources/publications/954:digitally-enhanced-learning-and-teaching-in-european-highereducation-institutions.html, retrieved 7/5/2023) in the field of open and distance learning and teaching in HEIs, for the next five years, 95% of HEIs worldwide are expected to include in their priority strategies e-learning and blended learning. The benefits of respective study programs derive from qualitative evidence, which focuses on both the content and the process of delivering an undergraduate study program, as already mentioned above (EUA, 2021).

On this basis, the method of the blended learning (physical interaction among students, professors and equipment in workshops and on-line distance learning) has been developed and implemented in the 4-year undergraduate course on Studies in Cinema as well in a postgraduate program about "Lighting Design". The blended learning is developed and implemented in specific modules such as cinematography and cinema direction, from which the first evaluation results from the students have been collected.

## 2. Necessity of film studies in Greece
Film studies is a field that many students choose to attend in the Greek University exams every year. Moreover, the production of motion pictures has an upward tendency, as can be deduced by the participation in the respective festivals, that is increasing. Similarly, fictional television series are showing an upward trend. In addition, with the contribution of Governmental Institutes, such as EKOME and the Film Office, many foreign film productions are run in Greece. In this context, the necessity of HEI film education arises, which can contribute to the formation of well-qualified creators, both at a theoretical and practical level, who will be able to adequately meet the above needs and be part of a national film infrastructure.

## 3. Criteria of organizing and implementing the blended learning
According to the research report from the Union of European Universities (EUA, 2020), there is a tendency to adopt a student-centered model for the design and creation of higher education programs.

This study mentions the quality elements/standards that lead to the creation of a higher education curriculum, which are:

- Defining characteristics that distinguish the course, being a point of reference and a comparative advantage over the corresponding study programs in other university institutions.

- Balancing the provision of specialized and interdisciplinary knowledge and skills for the labour market.

- Ensuring program consistency by linking objectives to expected learning outcomes.

- Inclusion of the learning process in a specific learning environment based on students' experiences (intangible environment of the curriculum).

- Targeting teaching variety and outcome based on the student-centered learning model.

- Including the prospect of creating curricula with the involvement of external partners/stakeholders.

- Encouraging active participation of students.

- Adoption of the policy of continuous exchange, communication and collaboration with broad participation in the creation of curricula, integrating research and the continuous professional development of teachingconsultants.

- Encourage feedback at regular intervals and create opportunities to improve the curriculum.

As mentioned by Siakas & Mouri (2011), the development of the analytical program is necessary to be based on the special needs of the students. Students' needs are captured through their feedback and personal choices in curriculum material. A learning environment rich in stimuli and participation opportunities, as a characteristic of constructivism (Piaget, 1977; Vygotsky, 1978), ensures corresponding choices of student participation in it. In the case of extracurricular activities at Hellenic Open University (HOU), the students' choices are highlighted by the corresponding Course Modules with which an individualized study program is structured. Additionally, in Lionarakis et al. (2017), the importance of learning communities in the direction of the active participation of students in the learning process is emphasized. In the same study, specific parameters are given to ensure the active participation of students in learning, making use of the available digital technology. More specifically, the possibilities of moodle as a "room" simulation platform for studentcentered learning are highlighted.


## 4. Structure of the undergraduate program of film studies: Screenplay, filmmaking and research (SKI)

The Undergraduate Program of Film Studies (UPFS) titled "Film studies: Screenplay, filmmaking and research (acronym: SKI)" is the only program in Greece in the field of cinema that is open, accessible to everyone and is focused on distance learning, with all the advantages and limitations that this imposes.

The program provides three types of training modules:

The basis is the Course module (CM), which is the basic constituent unit of all study programs at the Hellenic Open University (HOU), based on Law 2552/1997. The Course Module cognitively concerns three or more subjects that fit together, creating a learning set more complex than that of a conventional course. The learning objects or materials of a CM constitute the teaching material, which consists of basic bibliography, auxiliary bibliography, written assignments and a study guide, that is, an accompanying text that explains the bibliography, the exercises, while also including self-assessment exercises/activities, so that it is integral part of the curriculum in the absence of a live meeting with the teachers. The evaluation of the TEs is done through the grading and feedback of the written assignments and exams at the end of each academic semester.

The second educational module is the Laboratory Course Module (LCM), which is more flexible and includes laboratory exercises and activities, either distant or in person, depending on the cognitive objects it deals with. LCMs are not assessed by exams, but by the evaluation of students' creative artistic works during the semester.

The third educational module consists of the thesis, which in this program can be either theoretical or creative with the production of a short film.

On the contrary to the corresponding undergraduate degree programs related to cinema, this program (SKI) includes a number of innovative elements, which are spread over distinct categories, based on the studentcentered approach of learning that is the basis of the philosophy of Distance Education. More specifically, according to the theoretical approaches and the pedagogical definition of distance education, its physiognomy is summed up in the phrase of A. Lionarakis (2011) that the student learns how to learn. In

addition, in a more modern view of this position, the student must also learn how to use the cognitive content to achieve the learning goals.

This in turn, according to Schunk (2005), requires the development of self-regulatory skills to control learning within an active approach to the learning process. The catalytic factor in the operation of all of the above in SKI is the educational material. As Lionarakis (2001) notes, the role of the educational material in distance and open education, in addition to providing information, also includes communication parameters with which the educational material has the role of the teacher. In other words, the teacher is replaced by the educational material. In this context, the categories in which the innovations of this program are included are placed, on the one hand, in the academic subjects and, on the other hand, in the design and development of the educational material that includes them.

More specifically, regarding the cognitive contents in SKI, the following innovative elements are identified:

- Animation, one of the most dynamic forms of cinematic storytelling worldwide, has been included as a distinct course unit with its own "chain" of development in 4 semesters of study. By completing all the "links in the chain" of this course unit, the student has a comprehensive knowledge of the subject of animation in its most modern forms and methods of creation. It also becomes capable of producing animation content either as a stand-alone film or in collaboration with live-action films.
- New interesting audiovisual creation items have been added to this program, expanding research perspectives in contemporary approaches to cinematic storytelling. Indicatively, the course sections "small form filmic cultures", "anthropology and cinema", "new narrative perspectives in audio-visual narration", "research in cinematic narration" are mentioned.
- Specific learning activities have been integrated organically into the supporting learning material for each week of study. These activities have been structured around the element of self-regulation (Schunk, 2005). More specifically, they are accompanied by feedback parameters, such as self-assessment activities, with corresponding indicative answers. In this way, the element of self-regulated learning is strengthened without the teacher's presence being necessary.
- Flow chart of the educational process, which includes all learning activities, as well as the corresponding resources with links and bibliography. In this way, the basic operating principle of the Distance Learning is satisfied where the student, during the self-regulation of his studies, should be fully aware of both the individual and the overall fields related to the learning process. As Lionarakis (2007) very characteristically notes, the student abroad should know exactly what he is doing, when he is doing it, how he is doing it and why he is doing it.

In addition, regarding the structure of the program SKI, the issue of openness should be emphasized. The structure of the program includes the provision of a core of thematic modules necessary for the basic knowledge one should acquire in cinema. From the fourth semester of studies, the selection of specialized film studies courses gradually begins, with complete openness in the last semesters.

Regarding the development of the educational material, the following are included:

A. Provision of the content innovations of this program, as developed above, on a specialized distance learning platform, which includes the following communication and collaboration capabilities:
- Forum for exchange of opinions both between the professor-advisor and the students, and between the students. Counselors have at their disposal online and physical space to communicate with students and have a community of their own to communicate, share good practices and exchange experiences.

- Automatic feedback functions of learning activities, included in each week of study.
- Possibilities of direct communication between the students and the professor-advisor.
- Tools for setting up personalized learning, such as a calendar, timetable with study weeks, with specific goals per week.

In addition, it is important to add that creating the material per week gives pace to the learning. Also, the evaluation of the learning activities and the corresponding feedback is given weekly. Successful completion of the weekly learning activities is a prerequisite for participation in the final exams. This weekly distribution of the educational material and the corresponding feedback differentiates this undergraduate program, especially in the theoretical courses, from the typical higher education, in which the student is able to complete a semester course by participating only in the final exams.

In all the above, the support team for the creation of the educational material should be highlighted, which is well qualified and has a lot of experience in the HOU. The writing of the educational material, in addition to external collaborators, authors, management staff and consultants on external issues, also includes specialized legal advisors on copyright issues. This is very important as it ensures the validity and legitimacy of the educational material.

The blended learning occurs on the LCMs that deal with Directing (7 modules) and the LCMs that deal with Cinematography. These modules offer intensive 8 hour day courses with cinema equipment. Each LCM that deals with Cinema Direction offers 5 such days per semester, while LCMs that teach cinematography offer 2 days per semester live one-on-one training with state-of-the-art cinema equipment, cameras and lighting. In both cases blended learning incorporates semester long exercises that culminate in two or three days workshops depending on the case and LCM. The final educational product of the students are short films incorporating the techniques described in the online educational platform.

B. Polymorphic rendering of educational material. More specifically, all learning contents are given through various media such as videos, text, links, scientific articles, case study activities, etc. However, there remains a need to further improve this field by enriching it with audiovisual film libraries. This necessity is considered quite important, due to the cognitive object of this program.

In addition, the students' work, both in theoretical and practical learning activities, enriches the existing educational material both in terms of content and form. In this way, students participate in the shaping and dynamic nature of the educational material.

Besides, the dynamic nature of the educational material is enhanced by the masterclasses and presentations by experts, which are videotaped and posted on the educational platform.

C. Extroversion Orientation. The program SKI was designed based on its adaptation to the real conditions of filmmaking and its inclusion in the wider film community. The cooperation with the international short film festival of Drama is a key element in this direction of extroversion. More specifically, the program has included in its programming contract the cooperation with the international short film festival of Drama, which includes specific institutional parameters, such as:
- The holding of the Directing Festivals in Drama, making use of the equipment and screening rooms provided by the international short film festival of Drama.
- There is a provision to utilize the international short film festival of Drama for the final screening of the students' work on a cinema screen. Thus, students, through this experience, learn and acquire knowledge, which they can use in real situations. In addition, students participate in a broad creative

"conversation" in the field of cinema, i.e. they come into contact with new trends in a dynamic field of cinema, such as short films. In this field, they have the opportunity to see their own films on the big screen, pitted against other creations from around the world, and to get immediate feedback from the real field shaping trends, textures and themes at an international level.

In this context, the specific undergraduate study program provides a range of academic subjects related to a holistic approach to the cinematographic art both at a theoretical and applied level.

D.  Details of the program compared to the conventional cinema undergraduate programs by HEIs in Greece:
- Each Course Module corresponds to 7.5 ECTS, in contrast to the courses of the corresponding study program of the conventional universities of Greece, where the correspondence in ECTS ranges from 4 to 7.
- In addition, SKI is the only film studies program offered through the distance education process in Greece. As stated in the UNESCO report/report (2015), the HOU provides purely distance undergraduate and postgraduate programs equivalent to those provided by "traditional" universities, which makes Greece among the five European countries that have HEIs for purely distance higher education (UK, Germany, Italy, Spain, Greece). In this context, the creation of the SKI undergraduate curriculum meets the standards set for the composition of an "ideal" curriculum, where the educational material is an important functional factor of the educational mission of each HEI (EUA, 2020).
- It is noteworthy that students can gain experience of real conditions of creation, but also to meet the film market, as the LCUs are held in Drama, where the international short film festival takes place annually and offers the experience of the film world at the level of creation, production and distribution and to the students of SKI. This is a comparative and competitive advantage, as well as a unique reference point of the superiority of the specific undergraduate study program over corresponding programs of conventional universities, enhancing extroversion and adaptation to market data.

## 5. Structure of the Master's Degree program in Lighting Design (SFP).

The Master's Degree Program "Lighting Design" (acronym: SFP) aims at the in-depth study of issues related to the combination of the art and science of light that are often encountered at both the theoretical and the applied level. In particular, the Program focuses on the psychology of perception, the physiology of visual perception, the influence of light and lighting on humans and the achievement of visual comfort, the physics of light, the design of natural and artificial lighting from a scientific, artistic, and technological point of view, lighting as a means of sustainable development, and relevant computer simulations.

The specialization in Film Photography Direction with emphasis on Cinematography Lighting, discusses visual literacy in the use of lenses and their focal strength versions, which shape frame composition, possible camera movements, aesthetics, and the creative choice of various shooting angles, and ultimately the creation of a particular lighting choice through the combination of the aforementioned preferences, experiences, and specialized knowledge.

As noted in the case of the undergraduate program SKI, the postgraduate program's SFP main educational unit is the Course Module and the Laboratory Course Module. The two Cinematography Lighting LCMs follow the same principle as the ones used in the undergraduate program. There are year long exercises done through the online educational platform and tutorial meetings that culminate into a three-day intensive workshop with professional cinema and lighting equipment in a specially prepared studio space. Again the final product of the

students are short films that incorporate all the techniques learned through the online tutorial meetings and the study material on the educational platform.

## 6. Conclusions

In this paper a framework for developing a distance undergraduate study program based on the standards as set by the European University Association (EUA) and published by UNESCO is presented. (EUA, 2020, https://eua.eu/resources/publications/919:curriculum-design.html 07/05/2023).

In this context, similarities, common orientations but also distinct differences concerning both the nature of Distance learning and the content of this sort of studies were emphasized, making this program of film studies sustainable in the Greek territory among the other HEIs.

However, as a new undergraduate program, it has prospects for further development such as the introduction of specific CUs and LCUs in the program and the collection of films in a repository to facilitate professorsconsultants and students in their cooperation for better learning results.

In any case, the necessity of coordination with the corresponding undergraduate programs in Greece is highlighted, as the problems, necessities and goals in the field of cinematographic studies are common. Furthermore, necessities, such as the film repository, inherent in this course of study can only be met with the cooperation and coordination of the respective university institutions.

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# Online and Distance Education

# Leveraging Jupyter Notebooks in Assessment Development, Completion and Marking to Reduce Cognitive Load and Minimise Errors

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**Abstract**

When redeveloping a level two Algorithms and Data Structures module the decision was made to centralise the learning material and assessments around Jupyter Notebooks. We shall explore the lessons learnt and advantages gained through an assessment process which now has development, assessment and marking all completed within the Jupyter Notebook infrastructure.

The cognitive load associated with assessment development often stems from the complexity of the task and the risk of introducing errors during various stages of the process. By leveraging Jupyter Notebooks, authors can benefit from a range of features that enhance productivity, promote collaboration, and reduce the likelihood of errors.

This presentation will delve into several key areas where Jupyter Notebooks can significantly contribute to the assessment development process. We will discuss the seamless integration of code, documentation, and visualisation capabilities, which allows developers to write and test their assessment in a single environment. This not only enhances readability and maintainability but also facilitates the identification and rectification of errors through an interactive and iterative development process.

We will explore the collaborative nature of Jupyter Notebooks within the GitHub infrastructure, enabling developers and reviewers to work together. Furthermore we will explore the in-house development of a plug-in to reduce the chances of amendments becoming desynchronised between student-facing and assessor-facing versions.

Jupyter Notebooks can also help reduce cognitive load for students who are taking assessments. Traditional assessments can often be challenging to follow, with a series of complex instructions, questions, and response formats. Even digitally completed programming assessments may have question documents, answer documents and multiple program code files to be read, changed and submitted. This can lead to cognitive overload, especially for students who may already be feeling stressed or anxious about the assessment.

Jupyter Notebooks can help mitigate this by providing an interactive and visually appealing assessment experience. By presenting questions, code and responses in a single digital format, Jupyter Notebooks allow for more flexible and intuitive navigation, reducing the cognitive load required to understand and respond to questions.

Additionally, Jupyter Notebooks can provide immediate feedback to students, providing a sense of clarity and direction. By offering automated testing and visual cues, such as colour-coded responses, Jupyter Notebooks can help students quickly identify areas to be developed and adjust their approach accordingly.

The final area of utilisation of Jupiter Notebooks is in the assessment process; markers are provided a single document per student to mark, without having to view additional code files. As well as again reducing cognitive load, assessors are saved the potential hassle of having to chase students for additional files which should have been submitted but may be missed. We will look at a second in-house plugin which has been developed to aid and streamline the assessment process.

**Keywords:** Assessment, Distance Education, Programming, Cognitive Load, Programming

## 1. Introduction

M269 (The Open University, 2023) is a second-level (year two) degree module focussing on algorithms, data structures and computability. While it utilises Python programming heavily, it is not a programming module; rather programming is used to illustrate and exemplify the Computer Science learning points within the module. Traditionally M269 has been delivered in what, for the Open University, is a traditional manner; presented over nine months with multiple auto-marked formative assessments, two tutor-marked assessments (TMAs) at intervals roughly 1/3 and 2/3 through the course, and a final examiner-marked assessment (EMA). The TMAs involved answering short and medium length answers and writing significant portions of Python code into existing Python files. Questions were on a question paper, with answers either being inserted into the question paper, a separate answer document, or within the Python files. Students had to submit the correct answer document and all of the relevant Python files. The EMA was paper based, consisting of short, medium and long written answers and were either hand-written (in an examination hall) or, during COVID, typewritten into a separate word-processed document.

A number of problems occurred during the writing, administration, completion and marking of these assessments. These are discussed here, along with the iterative attempts made to solve or reduce the impact of the problems by introducing Jupyter Notebook based assessments.

### 1.1 Versioning Differences

During development, authors shared versions of the assessments with one another for critical reading and review. As each assessment consisted of numerous files, this often led to oversights where files were missed, and differing versions were reviewed. With no formally agreed template, questions often looked quite different as well, in both format and style.

TMAs are made available some time before the submission date, and invariably colleagues or students would spot errors in the documents that would need clarification or amending. It quite frequently occurred that the corrections would be made in one version of the files but not others, meaning that the files that students and their tutors were looking at did not always marry up.

### 1.2 Completion Issues

The real problems came in the completion of the assessments by the students – particularly in the TMAs which had multiple Python files, data files, and often differing question and answer papers. Having to move between so many documents ran the chance of increasing cognitive load on the students unfairly as students must mentally switch between different resources, locate relevant information, and maintain a clear understanding of the overall assessment structure. The context switching and transitioning between different task concepts can disrupt the flow of thinking significantly. Supporting library code files, test harnesses, students' own code files and the like represent extraneous cognitive load while the question content itself represents intrinsic cognitive load (Cerdan, Candel, & Leppink, 2018). It has been suggested that when only minimal extraneous

cognitive load is required by the student, they can cope with a higher intrinsic cognitive load which can in turn result in more learning or, in our case, better performance under assessment (Lafleur, Côté, & Leppink, 2015).

**1.3 Marking Issues**

Further problems occurred when colleagues attempted to mark the submitted assessments. First of all, there were a number of files to be submitted; as well as the answer document there were often numerous python files each of which represented an individual question, part or sub-part. Where a file was missing there could be significant marks lost. And as the files were potentially dependent a single mistake in one could cause a knock-on impact which could, unfairly, cost students further marks. Furthermore, due to student submitting sometimes relatively large numbers of extraneous files such as duplications of data and library files, temporary files and so on, the submission could be quite time consuming for the tutor to navigate.

The cognitive load could impact the tutors as much or more than the students. They also had to jump between multiple files just like the students. However, many tutors like marking question by question rather than student by student. While this is simple with printed assessments, with many files in many folders and sub-folders it really wasn't possible in the existing situation.

Tutors also had to complete feedback in differing ways depending upon the question type, with a mix of comments on the word or pdf answer document and embedded comments within the Python code. As providing feedback can already be one of the most time-consuming aspects of marking (Cavanaugh & Song, 2014)so any additional hurdles can cause significant frustration.

Finally, some programming questions were able to be automatically tested by running tutor code. This meant the code files had to be copied to the student folder(s), the student filenames, function names and so on checked so that the tutor code could find them, and then the test code loaded into the development environment and run to check the results.

## 2. Module Rewrite

When the original module came around for a rewrite, the production module chair decided to craft the whole module in Jupyter Notebooks – the original module had many web pages on the VLE (Virtual Learning Environment), a printed textbook, and downloadable Python files. Jupyter Notebooks allowed students to explore, write and execute code in an interactive manner. This means they can run code snippets and see their outputs immediately. With the more traditional method, students would typically have to type out and execute code in a separate environment and switch back and forth to view results. Jupyter Notebooks have been shown to help develop interdisciplinary problem solving and resilience (Willis, Charlton, & Hirst, 2020).

Jupyter Notebooks provide a rich environment where we could combine code, text, visualizations, and multimedia elements like images and videos. This makes it easy for the author to explain their thought process and create interactive narratives. It's a powerful tool for educational purposes. In the more traditional approach, it is harder to maintain a coherent narrative while moving between book, VLE and code files (Perez & Granger, 2021).

Jupyter Notebooks provide seamless integration with data visualisation libraries like Matplotlib and NetworkX which have been used within the material, amongst other things, for demonstrating graphs. We could generate visualisations and immediately display them within the Notebook; students could adapt and change the module code and re-display the visualisations, allowing for a more interactive and exploratory code analysis process. While it's possible to display visualizations on the VLE webpages, they would have been static, relying

on students to install additional software (of the correct versions) in their development environment if they wanted to explore that code themselves.

The production chair wrote supporting scripts to convert the markdown the content was written in into Jupyter Notebooks and thence to HTML and PDF versions automatically (as well as producing separate Python files) to support accessibility issues. Jupyter Notebook is not currently considered web-accessible (Al-Gahmi, Zhang, & Valle, 2022), while the HTML and PDF versions have all of the accessibility tools available with those formats.

Moving to Jupyter Notebooks had another advantage; they enabled the development team to have complete control over the content, without having to "make do" with the textbook author's work or jump through administrative, and time-consuming, hoops to have the content put on the VLE. Changes and improvements to the material can be released to students very quickly.

## 3. Assessment development

With the learning material being developed in Jupyter Notebooks, it felt counter-intelligent to continue producing assessment material using multiple Word/PDF files and Python code files; with the assessment model changing to three tutor marked assessments (TMAs) and an "examiner marked TMA (emTMA)" replacing the more traditional exam, the decision was taken to produce the assessments in Jupyter Notebooks as well, with all of the affordances offered above being available to the assessments.

### 3.1 General approach

There were several general decisions made by the module team; firstly, the intent was to have the Jupyter Notebook "front end" the assessments, so these were the only documents students needed to use and edit. Initially, as each TMA is completed in two halves (for example part 1 in week 5, part 2 in week 10) the TMAs were split into two Jupyter Notebooks. As content was reduced slightly for the second presentation of the module each TMA has now been combined into a single Jupyter Notebook file for the second presentation. Each TMA is out of 100 marks. There is the intention to use automatic marking as much as possible. This enables students to automatically trial their code with sample test data for an indication of wrongness. The sample test data is insufficient for them to guarantee rightness unless they expand it to include all scenarios. Additionally, the tutors will be able to automatically test their code with unique unseen test data which should cover all scenarios and therefore indicate correctness. There is a test harness built into the production material which is reutilised for this purpose. Auto grading has been shown to improve the student experience by reducing feedback time and removing bias in scoring (Hahn, Navarro, Burgos, & De Lan Fuente Valentin, 2021). Furthermore, as the test harness and test data is made available to students it has the added advantage of supporting students in testing their own code, which reduces mistakes, identifies areas for improvement and has a substantial impact on learning (Nutbrown, Higgins, & Beesley, 2016).

Each "main question", denoted by number, consists of a single topic area or scenario. This is then split into question parts (denoted by letters) and sub-parts (denoted by roman numerals). Each question, part or sub-part has a *single* area for students to write their answer; if they are required to write both code and a written solution these are split into sub-parts.

Other decisions had to be made and reinforced with the new assessment system. Unlike the previous module which had an unseen examination, students had full access to the Internet and a significant period of time to tackle the tasks. We therefore had to drop relatively simple recall questions in favour of testing understanding, to avoid students simply searching online for definitions (Davies, et al., 2022).

Furthermore, we have made a concerted effort to avoid "double jeopardy", wherein a problem with one answer leads to an inability to score well in further answers. As a rule, if a student is required to design an algorithm in Q1(a), then they will be asked to write a *different* program to *our* design in Q1(b) and analyse the complexity of a *third* algorithm or program, which we will give them, in Q1(c).

As the finished assessments became relatively long documents (with no page delineation as would be found in Word or PDF versions), we developed a JavaScript snippet which students and tutors run that automatically colour codes certain aspects of the document, based on the colours utilised by the *empinken* plugin (Hirst, 2022) used by colleagues in a later module. Areas where students need to write an answer are given a pale-yellow background. Marking guidance are given a pink background, and feedback is given a blue background.

**3.2 First Iteration**

The first presentation of the redeveloped M269 was run from October 2021 to July 2022 and given the designation 21J. An initial authoring and marking solution was developed shortly prior to, and within the early months of, this presentation.

**3.2.1   Authoring System**

As a module chair, one of the most frustrating aspects of the original assessment system was differing versions of the assessment and marking guidance floating around between students, tutors and the module team. And early decision was to create a single master document which would then be split pragmatically into student-facing and tutor-facing versions. The first iteration had code written in markdown and then sent through a Python script to generate three versions. This enabled Python to add in the specific things which were not easily accessible within Jupyter (or could be easily mis-entered), such as metadata. The three generated files were:

- A Master version containing everything; questions, answer areas, the marking guidance and areas for the tutor to provide feedback.
- A Student version with the feedback and marking guidance removed leaving just the questions and the yellow answer sections.
- A Tutor version having the answer spaces and feedback spaces removed, leaving just the questions and the pink marking guidance.

All questions, instructions and code that students need to edit are included within the Jupyter Notebook itself which is distributed within a zip file. While supporting Python files, data files, and embedded images and videos may be distributed within the zip file, these are never edited or examined by the students and therefore if students forget to return them, then they are easily replaceable by tutors. In fact, some tutors replace them as a matter of course to ensure students haven't been tempted to alter the test harness to give falsely correct results when tutors run their test code.

**3.2.2   Marking System**

Similarly to the production script, a Python script was shared with tutors which would go through a student's submitted work and identify answer areas. Below this it then inserted a feedback cell and a cell which prompted the tutor to enter the marks for that question part. When the Jupyter Notebook was then opened by the tutor the JavaScript snippet would colour code these sections blue. Initially the marking guidance was also copied in; however University guidelines is that marking guidance is not shared directly with students, so the script was modified to remove this. As this was a batch process, tutors could process all students in one go ready to be marked.

Tutors were then able to open Jupyter Notebook, and open each students' answer in a new tab. With the marking guidance document open either in another tab or, frequently, on a separate screen, tutors were able to very swiftly mark on a question-by-question basis (Suoto & Nadas, 2007).

### 3.2.3    Teething troubles

Writing in markdown is not quite as simple as writing in Jupyter. While there are systems for automatically switching between Jupyter and markdown files, some colleagues struggled with these. Writing in markdown required authors to stick to quite rigid rules, with differing heading levels indicating differing things and increasingly complex codified instructions to tell the generation script whether to create a text or a code cell. This became even more complex when a question switched between text, code, and back again. This invariably meant the author had to go through and make innumerable manual edits to the markdown to get the script to run and produce a usable Jupyter Notebook file. The interface was also somewhat unwieldy, with template files, question part files and so on in a number of folders.

The marking preparation script also had a number of teething troubles. Part of this was the software, being in active and rapid development, did not have the best user interface being entirely command line based and a little nuanced. There was also the problem that any additional cells entered by the user would not have the correct markdown flags, meaning that there was a chance that answer cells were put in the wrong place or not inserted at all. A larger problem lay in a very minor development error which "locked" student answers – ostensibly to stop them being mistakenly edited by the tutor. The outcome of this was that tutors were also unable to run the code cells or make direct comments, leading to a somewhat onerous manual process to unlock them.

That being said, marking went relatively smoothly. While there was some concern by the marking team initially, a lot of the worries never actually came to pass; some of the more technically minded tutors tweaked the marking script and fed this back to the module team and their colleagues which led to further incremental improvements.

### 3.3 Second Iteration

In 2022-23 the second presentation of the new module material, and hence the new module assessments, was run. The Python scripts were replaced with plugins to smooth the workflow for the assessment authors and the tutors that had to mark the assessments. Jupyter Notebooks are extensible, with the nbextension (Jupyter Notebook Extensions, 2023) toolkit frequently being used to create plugins for underlying infrastructure. This was used as a starting point for the second iteration, although a lot of the functionality interacted directly with the Jupyter Notebook itself.

### 3.3.1    Writing Plugin

The authoring plugin allows the assessment authors to work directly within Jupyter Notebooks, creating the master file. As this is a Jupyter Notebook already, it needs no conversion (and hence has fewer chances of going wrong). The plugin is driven from a single button on the toolbar which brings up a dialogue box giving the author a range of options, see *figure 1*.
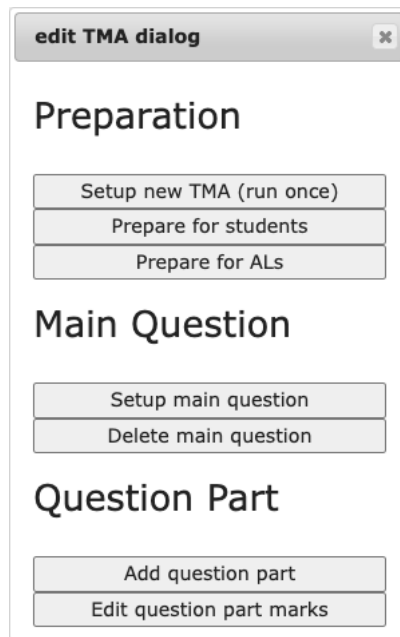
Figure 1: Author's TMA editing dialogue box.

This enables the author to setup a TMA template which includes introductory information, warnings to students, the JavaScript snippet, and submission information at the end. Authors are prompted for total marks, numbers of questions, and numbers of parts, all of which are set up for them in the template in the format agreed upon by the module team. (Main) questions and question parts are dealt with slightly differently, but for both authors are asked whether they want to setup the question/part as a stem or to actually ask for a student response. A stem is introductory information, such as a scenario, which the following question parts or sub-parts will actually ask about.

When setting up a question part, the author is prompted for all required information which enables the plugin to put in the correct headings with question part details, marks and so on. All of the required areas are produced, with a question area and instructions for extending to include additional code or text boxes if needed, an answer area with pre-written prompt in both text and code formats (the un-needed one can be deleted), a solution box, bullet-pointed marking breakdown and all agreed prompts.

It may seem as if there are options missing from the dialogue; the buttons provided are all that the authoring team has needed to date although should additional functionality be needed it is available and just needs a button creating for it.

### 3.3.2 Marking Plugin

An additional plugin was developed for the tutors to support their marking. This added a number of buttons to the toolbar, as shown in *figure 2*.
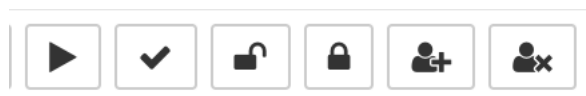


Figure 2: Marking buttons

The first tool prepares the TMA for marking. This is analogous to the preparation script from the previous incarnation. This is done none-destructively, with the Jupyter Notebook being duplicated and the new copy having -MARKED appended to the filename. A feedback box is added to each student answer, along with a separate box which prompts the tutor to enter the marks for that question part (with the amount available also shown). Colour coding is automatically applied.

One of the problems with the earlier iteration was the student's answer cells being un-editable. The lock/unlock buttons fix this by removing and reapplying the editable metadata on all of the student's cells in one go, meaning a tutor can comment on or run student answers and then relock them so as to not inadvertently edit them. This also enables additional feedback and mark boxes to be copied in if a student did happen to do something odd and cause them not to be generated correctly.

The person buttons were in response to a tutor who complained that, when marking question by question in this way, they struggled to remember whose assessment they were marking and hence struggled to make the marking personal. Personalised feedback has an increasingly effective impact on improving learning (Perez-Segura, Ruiz, Gonzalez-Calero, & Cozar-Gutierrez, 2022). The person with a plus button adds some code to temporarily make the student's name cell (the first cell in the Jupyter Notebook) float at the top of the screen regardless of scrolling. The person with an x button returns the box to its rightful place at the top of the script.

The tick button iterates through all of the mark boxes and creates a table of marks at the bottom of the assessment. Any marks that are missing are highlighted and the tutor warned. Very occasionally, students inadvertently duplicate answer fields, which can cause duplicate feedback and marking boxes. This is also highlighted to the tutor. The table of marks correlates with the assessment recording system the University runs so the marks can be transferred over easily and the totals compared, reducing the chance of human errors.

### 3.4 Additional Tools

Further tools have been developed to support tutors and students which fall outside of the realm of Jupyter Notebooks but which nevertheless support assessment writing, marking and completion. Perhaps the most useful of these is *allowed* (Wermelinger, 2023), which is designed to enable assessment authors, tutors, and most importantly students to ensure their code does not deviate from the agreed and taught subset of Python used within the module. The module has strict guidance that any students using constructs not taught within the module receive zero marks for the question. This was originally designed to restrict users from using, for example, list comprehension which made assessing algorithm complexity (a central tenet of the module) more difficult. However, there are always get some students who, deliberately or inadvertently, submit work which breaches this rule. The *allowed* tool reduces the chances of these mistakes occurring by allowing students to check their own code in advance. This in turn, reduces the unnecessary stress on students while making the assessment process more accurate and simpler for the tutor since they can also run the tool to detect problems.

### 4. Conclusions

Thousands of TMAs have now been completed in Jupyter Notebook, submitted and marked within M269. While not all students enjoy having all module material within a single location, with some wishing to have a print book, there have been no complaints regarding the assessment material being self-contained within the Jupyter Notebook.

There have been no occurrences of tutors and students ending up with differing version of the assessments, and in-presentation changes have been much simpler in the second presentation using the plugin than in the first presentation using the Python scripts.

In the second presentation the module team have been more active in monitoring tutors' marking. There have been minimal complaints from tutors with regards to the uptake of the marking plugin in comparison to the scripts used in the first presentation and although one tutor has experimented with an alternative marking methodology, all other tutors have marked using the plugin, with no issues reported to or identified by the module team monitors.

There is no comparative data available as to the level of cognitive load experienced by students either before or since the change to Jupyter Notebooks. However, casual conversations with both tutors and students have suggested that the methodology works and cognitive load in terms of document switching and multi-file management is minimised.

Further exploration is needed to quantify improvements as well as to identify and develop further functionality within the authoring and assessing plugins, as well as additional tools to support tutors, module team and students through their learning journey. A group of like-minded tutors and students both past and present has been set up to explore these opportunities.

## 5. Acknowledgements

While the assessment process, tools and plugins were written by the author, their development and testing was a team effort; I thank Michel Wermelinger (production chair), Brendan Quinn, Adam Linson, Phil Hackett and Jane Evans for forming a well-knit and forward thinking module team and all of the M269 tutor team for being willing to trial and feedback upon new technologies.

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# Developing Effective Open and Distance Learning Educational Material in the Context Of Resilient Geo-Heritage Conservation: A Case Study at The Hellenic Open University

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## Abstract

This paper reports on the trepidations and opportunities encountered during the development and dissemination of educational material developed as part of a new open and distance learning Masters' course in resilient geo-heritage conservation. The educational material was developed as part of the new open distance learning master's course Protection of Cultural Heritage and Monuments of Nature from the Effects of Climate Change at the Hellenic Open University of Greece and included educational material presented during monthly student meetings, written assignments and final exam papers. Dissemination of geo-heritage conservation related material in an open distance learning course poses a number of challenges as this research topic typically requires on site measurements, experimental investigations, which are typically not available as part of an open distance learning course. This structural limitation of open e-learning course was counteracted by the dissemination of study material containing recorded videos of on-site measurements and reported case studies as well as online platforms, which can be used to create historical maps of the geomorphological landscape evolution. The results presented in this paper highlight the elements that are necessary for a successful culmination of distance learning geo-studies as measured by key indexes such as academic performance and drop-out rate and emphasize the suitability of historical maps as a viable alternative to on-site measurements when studying geomorphological landscape evolution.

**Keywords:** distance learning, resilient geo-heritage conservation

## 1. Introduction

Distant learning education is increasingly gaining worldwide interest especially after the post-Covid era and the inadvertent introduction and familiarization with asynchronous learning material (Hebebci et al., 2020; Lily et al., 2020; Sari and Nayır, 2020; Yilmaz et al., 2020; Koçoglu and Tekdal, 2020; Pregowska et al., 2021). The development and dissemination of open and distant learning educational material poses a number of challenges due to the inherent complexity in the nature of the synchronous and asynchronous learning process (Sophason and Prescott, 1988; Deshler and Hagen, 1989; Jegede, 1991; Holmberg, 2005; Keegan, 1996; Gibson, 1993; Garrison, 2000; Van de Vord, 2010; Gunawardena and McIsaac, 2013; Klímová 2015; Fojtík, 2018; Traxler, 2018). The comprehensiveness of the disseminated synchronous and asynchronous educational material is

considered a key barrier in distance learning education (Muilenburg and Berge, 2001). This challenge becomes more pronounced in specific disciplines, which typically involve significant laboratory and/or field data collection. The aim of this paper was to present the trepidations and opportunities encountered during the development of educational material associated with the new open distance learning master's course Protection of Cultural Heritage and Monuments of Nature from the Effects of Climate Change at the Hellenic Open University of Greece (https://www.eap.gr/en/protection-of-cultural-heritage-andmonuments-of-nature-from-the-effects-of-climate-change/). The module explores the key geomorphological indexes such as tidal notches, beachrocks, sand dunes stability, weathering degree which can be used to monitor the ongoing erosional processes that influence geo-heritage conservation under climate change conditions (Calvet et al., 2003; Riebe et al., 2004; Tsoar, 2005; Vieira et al., 2006; Livingstone et al., 2007; Pye and Tsoar, 2008; Desruelles et al., 2009; Evelpidou et al., 2012; Pirazzoli and Evelpidou, 2013; Antonioli et al., 2015; Karkani et al., 2017). The objective of the paper was to assess the suitability of the developed material using key indexes such as academic performance, student satisfaction and course dropout rate (Garrison, 1987; Parker, 1999; Chou et al., 2008; Shachar and Neumann, 2010, Lee and Choi, 2011; Yokoyama, 2019). The result presented in this paper may be of interest to other researchers developing synchronous and asynchronous educational material in the context of resilient geo-heritage conservation.

## 2. Research Methodology

Monitoring the geomorphological landscape evolution may typically involve on site measurements, sample extraction and laboratory investigations, which are typically not available as part of an open distance learning course. This structural limitation of open e-learning course was counteracted by the dissemination of study material containing recorded videos of on-site measurements and reported case studies as well as online platforms, which can be used to create historical maps of the geomorphological landscape evolution. Field trips were replaced with virtual geo-trips using the GIS platform https://geovirtualfieldtrips.com/ and recorded videos from on-site measurements available at https://www.youtube.com/@nikievelpidou7908/about (Figs. 1-2).
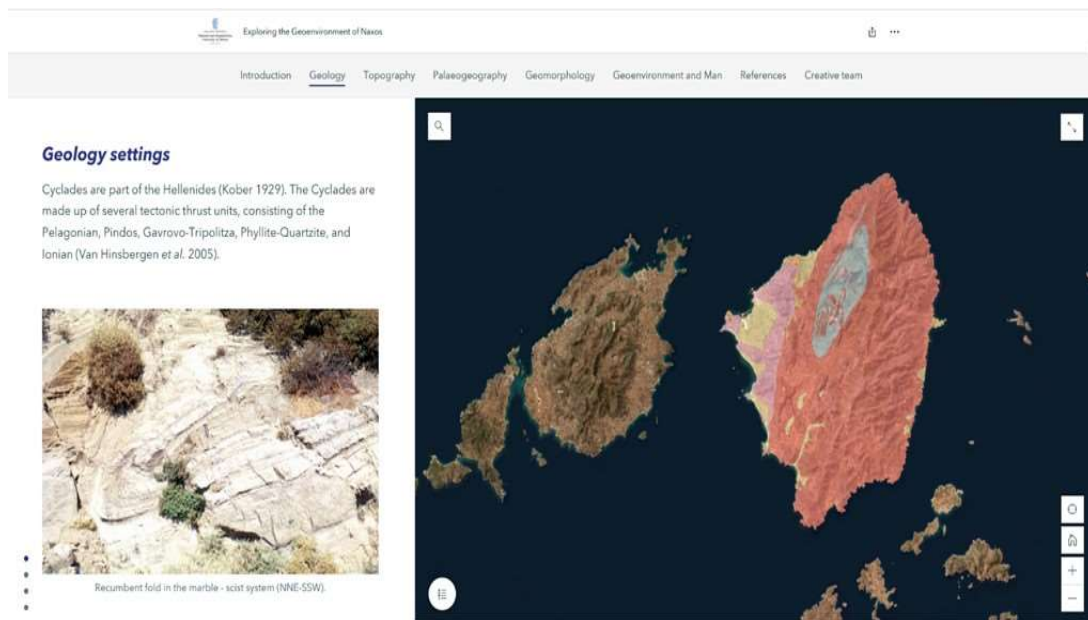


Figure 1: Replacing field trips with virtual geo-tours using the platform https://geovirtualfieldtrips.com/

Figure 2: Monitoring erosional rates and sea level fluctuations using tidal notches available using https://youtu.be/aH0A56EZUOY

Other platforms which were used to monitor geomorphological landscape evolution included Google Earth (https://earth.google.com/web/) and Ktimanet (https://gis.ktimanet.gr/gis/apr/). Ktimanet is a Greek web-GIS developed system which can be used to track landscape based on aerial photos dating back to 1945. Figure 3 shows a map based on aerial photos providing information for the landscape evolution using of Glifada coastal zone, Naxos island. Beachrocks indicate the former beach fossilized and submerged nowadays.
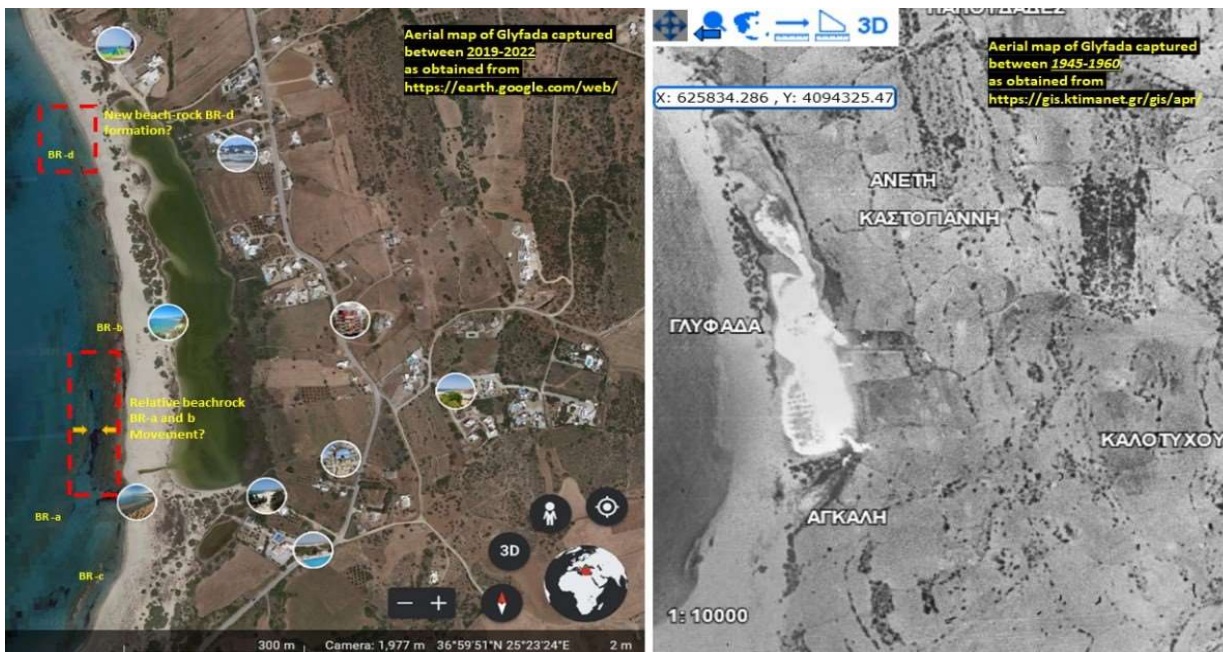


Figure 3: Aerial photos providing information about the landscape evolution using Google Earth (https://earth.google.com/web/) and Ktimanet (https://gis.ktimanet.gr/gis/apr/) platforms.

## 3. Results and Discussion

The suitability of the developed educational material, which included study material, presentations during monthly student meetings, written assignments and final exam papers was assessed using key indexes such as academic performance, student satisfaction and course dropout rate (Garrison, 1987; Parker, 1999; Chou et al., 2008; Shachar and Neumann, 2010, Lee and Choi, 2011; Yokoyama, 2019). The academic performance of the students was monitored on a regular basis using the assignment performance and was observed to be stable with improving tendencies. Student satisfaction was measured by an in depth anonymous module assessment questionnaire. The results of the anonymous students' assessment questionnaire together with the zero module drop-out rate indicate that the use of virtual geo-trips recorded videos form on site sampling and GIS platforms, which can be used to create historical maps of the evolving landscape geomorphology sufficiently replaced the learning experience acquired from on site measurements and experimental investigations, which are typically not available as part of an open distance learning course. The results of the anonymous assessment questionnaire show that the educational material successfully disseminated geomorphology related context confirming the observations by Muilenburg and Berge (2001) that the comprehensiveness of the disseminated synchronous and asynchronous educational material is critical in distance learning education.

## 4. Conclusions

This paper assesses the suitability of the synchronous and asynchronous educational material developed as part of the resilient geo-heritage conservation module of the new open distance learning master's course Protection of Cultural Heritage and Monuments of Nature from the Effects of Climate Change at the Hellenic Open University of Greece. The suitability of the developed educational material to monitor ongoing erosional processes that influence geo-heritage conservation under climate change conditions was assessed using key indices including academic performance, student dropout rates and students' satisfaction as measured by students' module evaluation questionaries. The results show that the overall academic performance and zero drop-out rate of the new module course indicate that historical maps and virtual geo-tours can be used as a viable alternative to field measurements when studying geomorphological landscape evolution. The developed asynchronous material included recorded videos of on-site measurements and reported case studies as well as online platforms, which can be used to develop historical maps that help understanding the landscape evolution.

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# Leveraging Chatbots As An Agile Student Support System in Open and Distance Education: A Case of Anadolu University Open Education System

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## Abstract

Open and distance education has witnessed significant advancements in recent years by providing learners with flexible learning opportunities regardless of time and location. However, the lack of adequate and immediate interaction and support can be a challenge for learners. To address this challenge, leveraging chatbots as an intelligent and agile student support system holds promise. The use of chatbots in education milieus has been a topic of growing interest in recent years as they have the potential to enhance learners' engagement by providing personalized support, feedback, and guidance to learners. Taking this into account, this case study aims to examine the usage, effectiveness, and potential use of chatbots as a student support model in the open and distance education system of Anadolu University. With this aim, the study focuses on the following research questions: How integration of chatbots as an agile student support model maximize student support? What are the usage statistics of the chatbot system in the open education system of Anadolu University?? The obtained findings highlight that even though chatbots are helpful, the learners seek human interaction. In addition, the compatibility of the system with artificial intelligence technologies can provide a great convenience for institutions as a workforce. The study findings will provide information for further understanding of chatbot usage as an agile student support model in open and distance education. The recommendations and implications based on the paper's findings may appeal to other open and distance education providers who desire to adapt the lessons learned and results and build the chatbot system in their own educational contexts.

**Keywords:** student support, chatbot, open and distance education, online learning

## 1. Introduction

With the development of information and communication technologies and the digitalisation of the world, online distance education is becoming increasingly popular and widespread. Especially in the Covid-19 process, online distance education has been competing to be an important part of mainstream education. So, it is necessary to develop methods for fostering interactions between teachers and learners as well as strategies for enhancing learners' self-directed learning. This has increased interest in deploying chatbots in the educational sector (Han et al., 2022). However, in this form of teaching and learning, student support services have a very important place as students are far from each other, teachers and learning resources. In addition, there may be a lack of interaction between learners and teachers and the institution in online distance education. This can lead to a sense of isolation and disengagement. In this case, the provision of an efficient quick, and agile support service for learners can be of paramount importance (Adamopoulou & Moussiades, 2020). One important way to address this issue is through the use of chatbots in online distance education

processes. Within this context, chatbots can be broadly defined as computer programs that can interact with people or other users by using natural language models (Adamopoulou & Moussiades, 2020; Han et al., 2022; Luo, et al., 2022; Tamayo et al., 2020). Chatbots can be used efficiently in all areas where interaction and support are required. They can also be used in online distance learning to provide personalised support to students, answering their questions and giving them feedback on their studies. In this paper, we explore the use of chatbots as student support services in online distance education and examine their effectiveness in supporting students. We also discuss the design and development of chatbot usage in Anadolu University's Open Education System, the current status of this technology implementation, and the challenges faced in this process.

## 2.  Chatbots Usage in Open and Distance Education

The use of chatbots as student support tools in online distance education has gained attention in recent years. In online distance education, chatbots have become flexible tools for student support that offer individualized assistance and improve learning and engagement of students (Hanet al., 2022; Neo et al., 2022).  Within this context, several studies have investigated the impact and potential of chatbot-based learning on learner motivation, performance and engagement. According to a study conducted by Winkler and Söllner (2018), chatbots are still in the early stages of entering the field of education, indicating the need for further research and development in this area. However, Malik et al. (2021) worked on chatbot adoption for learning among higher education students. The researchers applied and extended the Technology Acceptance Model (TAM) to understand the factors that influence the adoption of chatbots for educational purposes. The study highlights the importance of perceived convenience and improved performance in the adoption of chatbots for learning. Another study conducted by Pérez et al. (2020) identified different chatbot applications used in non-formal learning and non-formal education, such as SmarterChild and Duolingo. Their review provides an overview of the different contexts in which chatbots have been used in education.

According to the literature, chatbots could improve the learning process by giving learners individualized support, feedback, and guidance. By doing so, guidance and counselling services can be automated using through chatbots, making them more readily available to learners. The chatbot technology also presents unique opportunities as digital learning instruments for communication and information. As a result, chatbots can effectively improve student learning and have a favourable impact on learning outcomes. A study conducted by Baskara (2023) explored the potential of chatbot technology in a flipped classroom teaching model. The study highlighted the ethical and privacy issues when implementing chatbots in education. It also suggested future research directions to further enhance learner engagement and learning outcomes through personalised support and collaboration. On the other hand, Kuhail et al. (2022) conducted a systematic review of 36 articles to understand the use of chatbots in education, analysing various dimensions related to education setting and chatbot usage indicators. Their review provides a comprehensive overview of recent attempts to use chatbots in education. In addition, Huang et al. (2021) conducted a systematic review of on chatbot usage in language education settings. Their review identified 25 empirical studies that investigated the use of chatbots in language learning. The review aimed to discover the technological, pedagogical and social affordances that chatbots enable in language learning. Overall, the literature suggests that chatbots have the potential to increase learners' motivation, performance, engagement in online learning environments.

## 3.  Student Support in Anadolu University's Open Education System

Anadolu University Open Education System is one of the largest open education service providers in the world with 1 million active students each term and more than 4 million graduates. In such a large institution, the place and importance of student support services is also of great importance. At the university, different

channels are used to provide effective and robust support to students. The support services used at the university include phone call, Frequently Asked Questions (FAQ) module, question tracking system and chatbot technology (Figure 1). One of the most important services among these is phone call support service. In previous years, it was not possible to manage and monitor the intensity due to direct calls to the phone numbers in the offices, but with a special call center infrastructure, support is provided by the office staff and open to everyone during working hours on weekdays. The Interactive Voice Response (IVR) system is used to reduce the intensity of the call system and to direct students more quickly. IVR is updated in calendar-specific processes such as enrolment - enrolment renewal, examination, and diploma delivery, delivering announcements to students. The phone call service, which can be provided through the internet infrastructure established in the offices around the country, has been structured so that the office staff can carry out this service from home during the pandemic period. The phone support service within the open education system is one of the busiest calls center in Türkiye. Especially during the pandemic period, the call intensity was at a high level. In addition to this system, learners are also informed through FAQ.
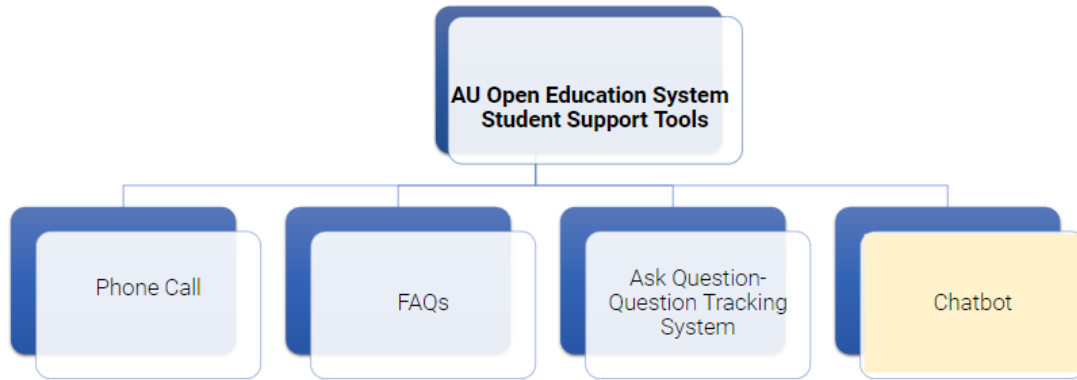
Figure 1: Student support tools used in Anadolu University's Open Education System

Anadolu University Open Education System also provides support services to students, graduates, and anyone who wants to get information through the question tracking system (https://aosdestek.anadolu.edu.tr). The system has been in service since 2018. While announcements, searches, frequently used links, and question categories are offered on the website, questions received through the "Ask a Question" link are directed to the relevant office staff. The questions of those who choose from the question categories created in the "Ask a Question" section are automatically directed to the subject matter expert officer. Questions from students who do not select a category are directed to the relevant unit with a special moderator team. The relevant office staff answers questions received via the "Ask a Question" link within an average of 4 hours. Besides these tools, the chatbot system, which began to serve in 2022, answers student questions automatically 24/7 through special questions and answers created by the support services desk (Figure 2). Using natural language processing and keyword-sensitive artificial intelligence systems, pre-designed answers to students' questions are used through the system. In the first phase, there are 2573 questions within the scope of 209 questions and 21 scenarios, each created in 5 different ways. Besides website, the mobile application of the chatbot support tool can also be used by students (Figure 3).
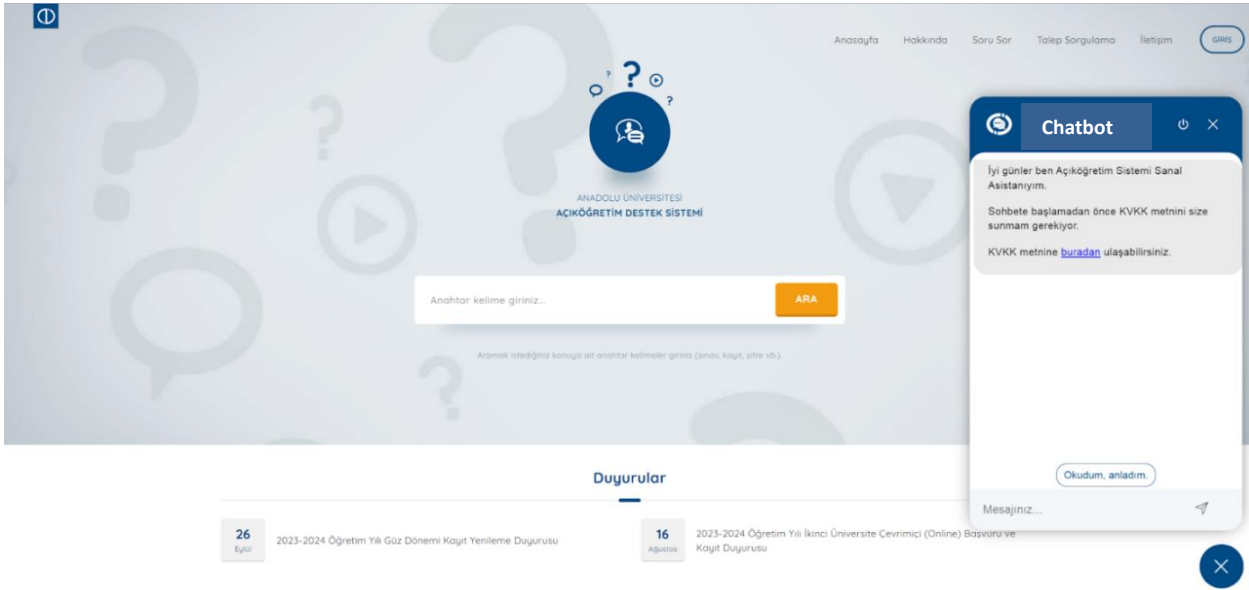
Figure 2: Question tracking system and chatbot tool in Anadolu University's open education system
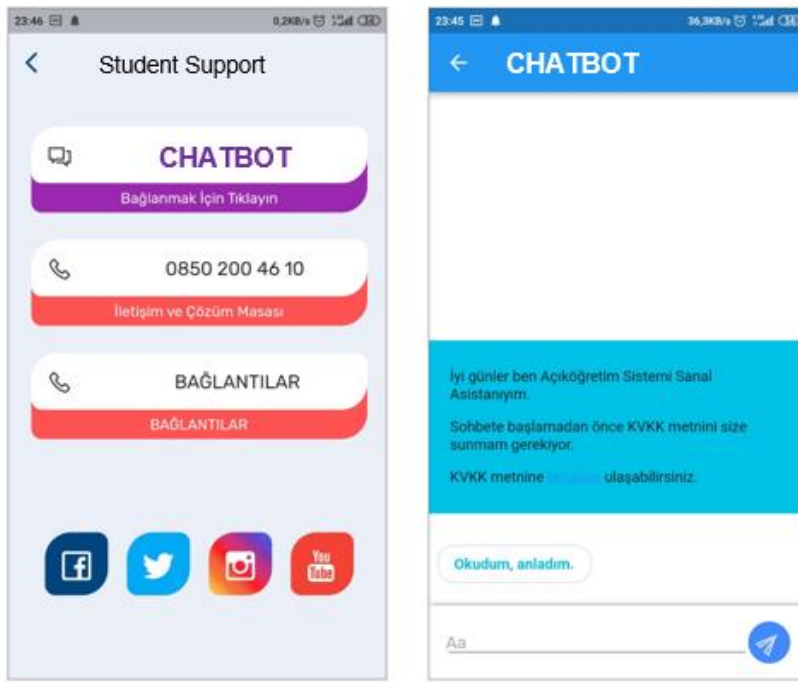


Figure 3: Chatbot usage in mobile app of Anadolu University

Lastly, apart from these services, SMS messages are also used to support online distance students. Approximately 40 million SMS messages are sent annually for purposes such as announcements, promotions, reminders and information about the open education system. In addition to general information about enrolment and examination procedures, SMS messages are also sent to specific student groups on the requested topic.

### 4.   Chatbot as an Agile Student Support Tool in Anadolu University's Open Education System

The use of chatbot technology in Anadolu University Open Education system started in 2022. Usage statistics so far show that this technology is a robust support system. After the chatbot started to be used in the system,

there was a significant decrease in the number of telephone calls and the use of the question tracking system support tool (Figure 4). This can be considered as a positive indicator of the use of chatbot in support services.
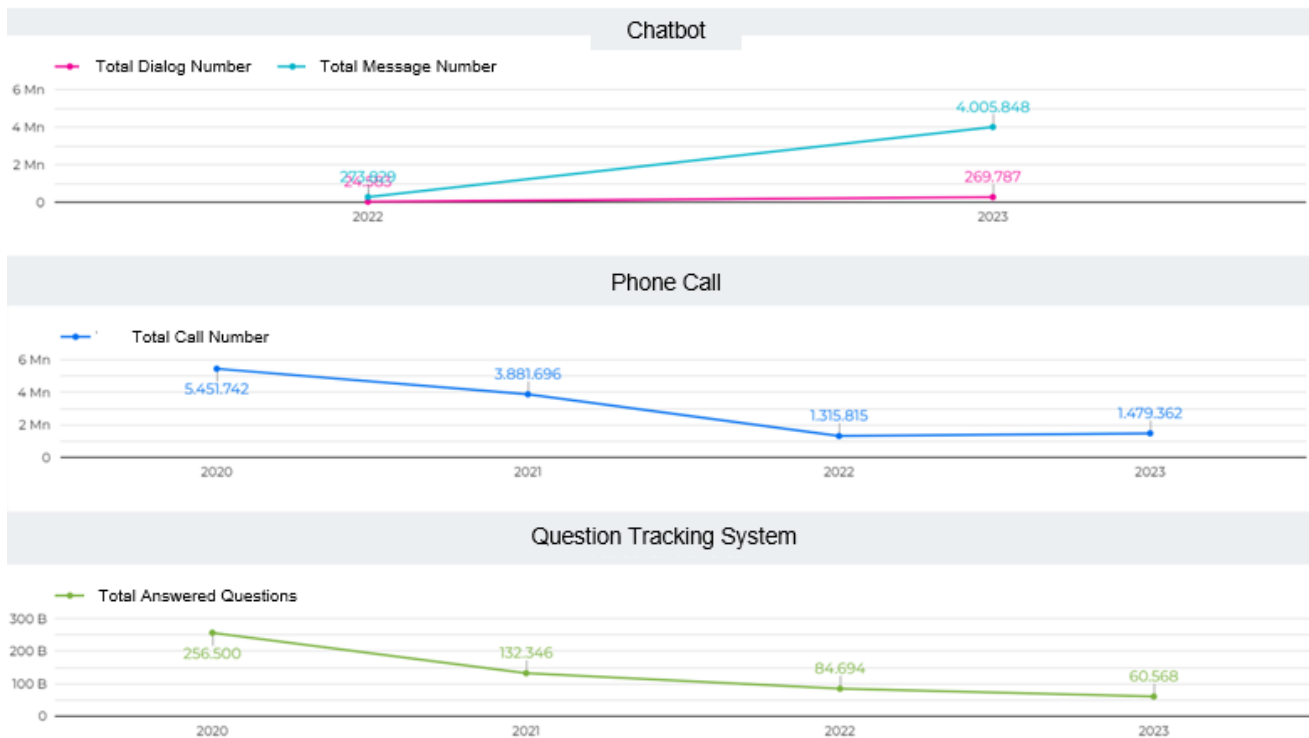


Figure 3: Comparing the chatbot usage numbers with other support tools.

Besides statistics, there are some user and system challenges with this system. For example, students who use phone support servises often report that they would prefer to speak to a live person rather than use a chatbot. The uptake of this technology is not yet at the desired level in terms of some of the habits that students accept and the ease of use of this technology. In addition, it takes time to integrate some data provider systems into this technology due to some personal data regulations and institutional policies. In general, however, it can be said that the system is being used slowly but surely.

## 5. Conclusions

Chatbots have become agile student support tools in online distance education by providing tailored support and boosting students' learning experiences. By supporting interaction between student and teacher or institution, and enhancing learning, they have the potential to make a big impact on the online distance education milieus. The full potential of chatbots in online distance education can be unlocked as technology develops further thanks to research and development in this field. The implications of Anadolu University Open Education System suggest that chatbot technology has a promising future and can be used as a robust student support service in online distance education environments.

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# Exploring Creative Narration: Innovating Ideation Techniques for Open Universities and Distance Learning

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**Abstract**

In the evolving field of distance learning, maintaining student engagement and fostering creativity are paramount. This article introduces the "Creative Narration" technique, a method intertwining storytelling with traditional pedagogical approaches. Through workshops, the research assesses the technique's effectiveness in remote learning contexts. Building on initial findings, further workshops integrate Creative Narration with other methods, emphasizing its application in the context of "Data Ethics in a Post-Covid Era". This proposal highlights the potential of the Creative Narration Technique in reshaping distance education and advocates for extended research into the approach.

**Keywords:** creative narration, distance leaning, online learning, collaboration, creativity

## 1. Introduction

In the contemporary educational landscape, distance learning has emerged as a pivotal domain, particularly accentuated by global circumstances such as the Covid-19 pandemic. This research is anchored in the field of distance learning, specifically targeting the challenges of creative ideation and collaboration. A recurring observation, both in this study and corroborated by prior research (Martin et al., 2018; Dixson, 2010), is the diminished student engagement and collaboration in remote learning environments.

To address this, we introduced the "Creative Narration" technique, a novel method that integrates storytelling into the learning process, aiming to foster engagement, bolster collaboration, and stimulate creativity. The scope of our research spanned the development and assessment of this technique, primarily focusing on its applicability and efficacy in distance learning scenarios. Our methodological approach involved conducting two comprehensive workshops. In these workshops, participants were exposed to the fundamentals of Creative Narration and engaged in various tasks designed to gauge the technique's effectiveness.

In essence, this research executed two distinct experiments: the first workshop, which introduced the Creative Narration technique, and the subsequent workshop, which refined the approach based on initial feedback and further probed its potential by integrating it with other techniques such as Impact Mapping.

Campbell's foundational concept posits that myths and stories from various cultures share universal structures and themes, pointing to a shared human experience and psyche. He suggests that these narratives aren't merely imaginative fiction but resonate with profound psychological and spiritual truths (Campbell, 1949). The hero's journey starts in the ordinary world, where the hero receives a call to adventure. Guided by a mentor, the hero faces challenges, meets allies and adversaries, and undergoes transformative experiences. This journey culminates in an "apotheosis" where the hero attains a divine realization. Upon return, the hero shares their newfound wisdom, effecting positive change in their community.

The preliminary results have been encouraging, indicating the technique's potential as an ideation tool in creative workshops for engineers. Further experiments are planned to enrich the technique, aiming to enhance its efficiency, participant enjoyment, and functionality. Writing, inherently challenging for those unversed in it, remains an area of focus. Ongoing research seeks to refine the technique for even better outcomes (Manias and Mavromati, 2022).

Historically, digital learning platforms have predominantly focused on solo tasks, encountering difficulties in fostering creativity due to limited opportunities for collaborative brainstorming (Stacey, 1999). This research explores the implementation and efficacy of Creative Narration, which aims to infuse creativity and collaboration into distance learning.

This article unfolds in two sections. The first delves into "Creative Narration," exploring its methodology and application. The latter section focuses on the technique's role in enhancing "Distance Learning," addressing challenges and showcasing its benefits.

## 2. Creative Narration

Introduced in this research, Creative Narration is a structured technique that incorporates elements from creative writing to enhance scenario-based ideation. Developed to address the absence of a clear methodology for defining settings and characters in such ideations, the research observed its application among a group of six engineers, predominantly computer and electronic specialists, aligning with the demands of the 4th industrial revolution.

The proposed technique, rooted in the hero's journey, has demonstrated effectiveness in providing a structured creative process for engineers and promoting idea exchange. Notably, engineers, who typically don't receive training in ideation techniques as designers or architects do, found the stepwise approach beneficial.

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## 2.3 Impact Mapping

Conversely, Impact Mapping, while sharing traits with Creative Narration, offers a distinct approach to ideation (Adzic, 2012). While both Impact Mapping and Creative Narration employ a narrative structure, their objectives diverge. Impact Mapping, rooted in project management, strategically visualizes the path from project actions to desired business outcomes, ensuring alignment and clear communication among stakeholders. In contrast, Creative Narration, pivotal in educational contexts, harnesses the art of storytelling to bolster engagement and understanding in learning experiences, understand the project area, and create innovative product and service ideas.

Despite their differences, the comparison between the Creative Narration and Impact Mapping centers on their roles in assisting stakeholders to create products in specific areas with defined objectives.

The steps in constructing an Impact Map include:

• Defining the Goal: Start with the primary business objective or problem the project addresses.

• Identifying Actors: Recognize the individuals or groups affected by the project, whose behavior change is essential for the goal.

• Establishing Impacts: Detail the measurable outcomes indicating progress toward the set goal.

• Mapping Deliverables: This step involves linking software deliverables or features to the impacts they aim to achieve, ensuring that each feature correlates with a specific impact.

The Impact Mapping technique steers teams toward prioritizing efforts by zeroing in on the most influential deliverables that align with the project's objectives. Furthermore, it fosters enhanced communication and collaboration among stakeholders, establishing a unified perception of the project's mission and benchmarks for success (Adzic, 2012).

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In the workshops detailed in the forthcoming section, we heavily relied on those foundational techniques: Creative Narration (CN) and Impact Mapping (IM). Through the use of specific online tools, these methods were pivotal in structuring the design and execution of our educational sessions. Moreover, these tools rendered the workshops aptly suited for distance learning, ensuring each session was not only engaging but also closely aligned with our intended outcomes.

**2.4 The Workshops**

The research presented here (Manias and Mavromati, 2022) conducted two distinct workshops. The inaugural workshop was segmented into three phases: free writing, the hero's journey, and poetry composition, all themed around "Data Ethics in a Post-Covid Era." This session spanned three hours and engaged six MSc students from the University of Patras' Human-Computer Interaction course, accompanied by their tutor and a facilitator. Trend Radar from ITONICS aided in topic selection.

An objective of this study is to probe the potency of the Creative Narration technique in enhancing the learning experience, particularly in distance learning environments. By intertwining storytelling with conventional pedagogical methods, this research seeks to address the inherent challenges of student engagement, collaboration, and creativity in remote settings. More precisely, through a series of workshops, the experiment delves into the potential of merging Creative Narration with other methodologies. The second workshop, building on the foundation of the first, endeavors to refine the approach, explore the synergy of combined techniques, and assess their effectiveness in nurturing creative ideation and problem-solving, especially in the nuanced context of data ethics in a post-Covid era.

Initially, free writing enabled participants to channel subconscious reflections without the constraints of grammar or spelling. The subsequent phase, encompassing the hero's journey, traced the narrative arc of a protagonist's adventures and challenges, culminating in a transformation. On concluding this journey, participants shared their tales, which then served as a foundation for novel product ideas.

Google Classrooms was the chosen platform for disseminating resources, tasks, and assessments. Post-workshop evaluations encompassed open-ended queries and a structured survey. Notable strengths included the workshop's structured format, collaborative spirit, and the enriching experience of navigating the hero's journey. Feedback also indicated a desire for elongated sessions to ensure a more relaxed and concentrated engagement.

Survey data revealed a predominant sentiment of ease in technique adoption and satisfaction with outcomes. Unanimously, participants expressed a willingness to revisit the technique and advocate its benefits to peers.

In essence, the first workshop garnered positive reception, yielding insightful creative ideation.

The sequel workshop aspired to refine and authenticate the techniques from its predecessor. A thorough analysis of the prior workshop's outcomes and feedback pinpointed areas of enhancement. Key modifications spanned task structuring, participant filtering, and time estimation.

To address the time-intensive nature highlighted in the first workshop, tasks underwent a redesign to allocate more time to pivotal creative endeavors, such as story crafting and product brainstorming. An upfront collection of demographic data aimed to optimize workshop time. Moreover, a more rigorous selection criterion was implemented, centering on computer engineering students to evaluate their creative aptitude within a mathematical paradigm.

This subsequent workshop was split into two parts and three groups based on participants' demographic data. The initial part entailed demographic data submission and the formation of groups unified by creativity and English proficiency levels. The core segment saw three distinct techniques in action across the classrooms: creative narration, impact mapping, and an amalgamation of the two.

In the second workshop's classrooms, the methodologies varied. The initial classroom employed the creative narration technique, akin to the first workshop. The subsequent classroom melded impact mapping with the hero's journey, whereas the final classroom centered exclusively on impact mapping.

The impact mapping technique encompassed the establishment of SMART goals, actor identification, actor-centric impact definition, scope determination, and pinpointing the most direct route to goal attainment. This approach sought to synchronize projects with institutional objectives, curtail redundant tasks, and emphasize outcomes directly driving goal achievement.

Upon workshop conclusion, each classroom's participants appraised the strengths and limitations of the techniques in play.

In essence, the second workshop was envisioned as an evolution of the first—integrating enhancements, probing the efficacy of merging distinct techniques, and accentuating creative ideation and problem-solving, particularly in the "post-Covid era" data ethics context.

An analytical comparison of the techniques, based on product and service conceptual designs, utilized novelty, variety, and quality metrics. Notably, the products from the creative narration-exclusive group surpassed their counterparts. They conceived seven products, a stark contrast to the single product each from the combined technique and impact mapping-only groups. This underscored the superior ideation efficiency of the first classroom.

**2.5 Evaluation**

The second workshop's assessment hinged on the "User Experience Questionnaire," gauging participant user experience. This inquiry offered insights into pragmatic and hedonic attributes, spotlighting efficiency, usability, and pleasure facets.

Results underscored that participants immersed in the creative narration technique registered the highest overall contentment, cherishing the method's engaging nature. Yet, they expressed a need for extended time to fulfill tasks comprehensively.

Conversely, the impact mapping group, interacting via Zoom, encountered communication glitches and ambiguity. Despite these challenges, they found the workshop's framework intriguing and voiced an eagerness to revisit the technique.

The contingent employing both impact mapping and creative narration valued collaborative endeavors, working in concert towards shared objectives. For some, this novel approach was a revelation, unlocking latent creativity and yielding commendable outcomes. However, a few participants faced difficulties in group dynamics, especially in accommodating diverse perspectives

The assessment underscored a prevalent theme: most engineering participants were unacquainted with creativity-centric techniques. Nonetheless, they expressed gratitude for the introduction to such methods, emphasizing the nurturing of their creative faculties. A unanimous feedback across all groups pinpointed time constraints or its management during the workshop as a primary challenge.

## 3. Creative Narration and Distance Learning

In education, distance learning stands out as an accessible and flexible mode of learning, breaking geographical and temporal barriers. However, it presents intrinsic challenges, chief among them being the task of maintaining student engagement and fostering a rich, collaborative learning experience. This section delves into the alignment of Creative Narration with distance learning, elucidating its potential to mitigate prevalent issues in remote education.

Creative Narration hinges on the art of storytelling. Historically, stories have been powerful tools to captivate audiences, convey intricate ideas, and spur emotional connections. When applied to distance learning, CN breathes life into the otherwise static digital content. Instead of passively absorbing information, students, through CN, become active participants, crafting and sharing their narratives. This not only deepens their understanding of the subject matter but also builds a virtual community, a shared space of learning and interaction.

CN allows for a more personalized learning journey. In traditional classrooms, students often follow a set curriculum, progressing at a uniform pace. In contrast, CN in a distance learning setup enables students to craft their narratives, allowing for diverse perspectives and learning pathways. This personal touch, inherently embedded in storytelling, can significantly enhance the sense of connection and engagement, often lacking in conventional distance learning modules.

In essence, while distance learning offers the platform and flexibility, Creative Narration infuses it with engagement, emotion, and personalization, resulting in a holistic and enriched learning experience in the ideation design phase.

**3.1 Potential contribution of Creative Narration in Distance Learning**

In the area of distance learning, several hurdles have been identified, where Creative Narration could have a positive impact:

**Lack of Engagement:** Distance learning educators consistently confront the task of kindling active student engagement. Findings from Martin et al. (2018) and Dixson (2010) intimate that remote learning environments often register diminished student engagement vis-à-vis conventional in-person setups. Creative Narration, rooted in storytelling, offers an immersion into the learning process, thereby amplifying engagement (Bruner, 1991). Narratives, historically, have captivated audiences, spurring interest and participation in educational pursuits (Mar, 2004; Haven, 2007). This positions Creative Narration as an apt tool for bolstering engagement in distance learning.

**Limited Collaboration:** Effective collaboration remains a central challenge in the distance learning sphere. Research from Borup et al. (2014) and Haythornthwaite (2000) highlights the asynchronous character of many online learning environments as an impediment to real-time collaboration. By leveraging Google Classroom for Creative Narration, learners can engage in either synchronous or asynchronous storytelling, cultivating a collaborative ethos (Zhu, 2006). This methodology furnishes a milieu wherein students are galvanized to collaborate actively, enriching the interactive quotient of the learning experience (Kear, 2011). The lucidity of instructions and collaborative activity assessments resonates with students' perceptions of peer interactions and perceived learnings. In essence, a transparent instructional framework engenders enhanced connectivity among students and amplifies the educational yield from collaborative endeavors. By crafting a collaborative nexus, this technique addresses a salient obstacle in online pedagogy (Faja, 2013).

**Creativity Deficit:** Traditional online learning environments have often faced challenges in fostering creativity, primarily due to their emphasis on individual tasks which limit brainstorming opportunities (Stacey, 1999). Khlaif et al. (2020) noted a pronounced creative deficit in these settings. Incorporating the Hero's Journey through Creative Narration can invigorate the learning process, promoting novel idea generation and creative problem-solving. This technique holds potential to redefine student engagement in online creative ideation classes (Cropley, 2001).

**Lack of Social Presence:** Social presence pertains to the extent individuals feel connected and aware of others in computer-mediated interactions, like online communication or virtual reality. Its quality directly influences communication and overall user experience in tech-mediated environments (Biocca, Harms & Burgoon, 2003). Research underscores that distance learners often grapple with feelings of isolation, diminishing social presence and affecting learning outcomes (Richardson et al., 2017; Garrison et al., 1999). By creating a shared storytelling space, Creative Narration can enhance community and collective identity, mitigating feelings of isolation (Rovai, 2002; Swan and Shih, 2005).

**3.2 Contradictory Opinions**

Online teaching faces challenges across three primary domains: learners, instructors, and content (Kebritchi et al., 2017). For learners, challenges span expectations, readiness, identity, and participation. Content-related challenges touch upon multimedia integration, instructional strategies, and content creation nuances. For instructors, the transition from traditional to online teaching, evolving roles, time management, and teaching styles emerge as key hurdles.

**Learner Readiness and Engagement:** The efficacy of techniques like Creative Narration largely hinges on learner readiness and engagement (Chen, 2014; Bawa, 2016). While some students might resonate with structured, conventional pedagogies, others may find explorative and creative methods daunting. Storytelling, despite its potential, requires considerable time and cognitive investment, which might not align with every student's preference (Jonassen & Hernandez-Serrano, 2002; Wang et al., 2010).

**Pedagogical Alignment:** Questions about storytelling's universal applicability persist (Wu et al., 2010). While disciplines demanding higher creativity might find Creative Narration invaluable, its relevance in structured domains, especially within STEM, remains debated (Aldridge et al., 2009). This calls for a critical assessment of the technique's broad-based application.

### 3.3 Technological Limitations

While the Creative Narration technique holds promise, its technological underpinnings also present challenges (Kebritchi et al., 2017). The disparate levels of digital literacy among students can create barriers in harnessing the technique's full potential. As digital platforms form the backbone of this method, not all students may be adept or comfortable navigating them, emphasizing the significance of bridging digital literacy gaps (Hargittai, 2002; Helsper & Eynon, 2013).

## 4. Conclusion

The Creative Narration technique emerges as a potent remedy to the inherent challenges of collaboration and creativity in distance learning. It is argued that by integrating this technique into pedagogical strategies, educators can elevate engagement, bolster collaboration, ignite creativity, and instill a robust sense of social presence in online educational environments. As distance learning continues to evolve, the technique's adaptability and efficacy warrant further exploration across diverse educational landscapes and varied learner demographics (Garrison and Cleveland-Innes, 2005).

Embracing the power of Creative Narration in the context of distance learning signifies a pivotal shift in pedagogical methodologies. While traditional approaches have their merits, the innovative fusion of this technique with modern online teaching strategies heralds a new era of education. Beyond mere engagement and collaboration, it promises a holistic learning environment where students not only consume knowledge but also craft their own narratives. As we look to the future, the onus is on educators and institutions alike to harness the transformative potential of such techniques, ensuring that learning remains a dynamic, interactive, and deeply personal experience.

The theoretical virtues of Creative Narration in the sphere of distance learning find tangible expression in the online workshops highlighted in this document. As we chart the future course of distance learning, such real-world examples offer invaluable insights, emphasizing the need for continual innovation and adaptation.

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# A Comparison of Distance Education Students' Attitudes towards e-Learning Resources

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## Abstract

In the digital world, permeating all levels of society, the flexibility of distance education in terms of time and space is increasingly gaining importance. One of the most significant aspects of utilizing internet technologies in open and distance learning is the availability and effectiveness of e-learning resources. Examining distance education practices worldwide, it is possible to see that e-learning resources play a central role in many systems. Students' attitudes towards these innovative resources are crucial, as they can directly affect the success of both learners and the system. As a result, the attitudes of students towards e-learning resources are also in a constant state of change. This makes studying students' attitudes towards e-learning resources under changing conditions an important research topic. This study aims to compare the attitudes of university students enrolled in distance education programs towards e-learning resources based on age and gender. For this purpose, a survey was developed, adapted from Guillasper, Soriano and Oducado (2020) and Compeau and Higgins (1995). This survey was transferred to an online environment and presented to Anadolu University Open Education students. A total of 411 distance education students participated in the survey, of which 114 were female and 297 were male. Students' age distribution was as follows: 194 were under 30 years old, 151 were between 30-40 years old, and 66 were over 40 years old. Findings indicate that distance education students have quite positive attitudes towards e-learning resources (X=16.5, Max=20). We determined that age was not a statistically significant determinant on distance education students' attitudes towards e-learning resources. Although male students' attitudes were higher than female students', the difference was not statistically significant. Interestingly, we observed an increase in positive attitudes towards e-learning resources among female students as they aged. This trend was not observed among male students, and we could not find any age-related attitude changes. The reasons for this increase in positive attitudes towards e-learning resources among female students as they age need to be examined more thoroughly in future studies. Understanding these factors can contribute to the development of more inclusive and effective distance education programs and better cater to the diverse needs of students.

**Keywords:** distance education, e-learning resources, students' attitudes

## 1. Introduction

The flexibility of distance education in terms of time and space is becoming increasingly important in terms of its place in the digital world that permeates society at all levels. The use of Internet technologies in open and distance learning has brought significant developments in the availability and effectiveness of e-learning resources. With the impact of the pandemic and rapid developments in educational technologies, e-learning resources have evolved, diversified and attracted more attention (Çevik & Bakioğlu, 2022).

E-learning refers to learning and teaching activities that take place in any electronic environment. E-learning resources refer to the electronic resources, materials, tools, and applications used in these environments. They cover a wide range of content, including online courses, multimedia presentations, interactive modules, e-books, instructional videos, and virtual simulations. E-learning resources are designed to provide a flexible and

interactive learning experience that allows students to access educational content anytime, anywhere. They can be used in a variety of educational settings, including academic institutions, corporate training, professional development, and informal learning.

It is clear that e-learning resources play a central role in distance education practices worldwide. Students' attitudes towards these innovative resources are vital as they directly affect the success of both students and the overall education system. Consequently, students' attitudes towards e-learning resources are subject to constant change. Therefore, examining their attitudes under changing conditions is of significant research value. This study aims to compare the attitudes of university students enrolled in distance education programs towards e-learning resources considering age and gender factors. E-learning, which involves the delivery of learning and education through digital resources, is widely accepted and used in various educational fields (Helena et al., 2019).

## 1.1 Literature

This study, which aims to investigate university students' attitudes towards e-learning resources according to age and gender, is important in the current educational context where there is an increasing interest in e-learning. In the literature, there are a number of studies investigating the importance of e-learning resources in distance education. For example, Doe and Smith (2017) conducted a survey with undergraduate students to examine their attitudes towards e-learning resources. The findings revealed that the majority of students had a positive perception of e-learning resources, emphasizing their convenience, flexibility and ability to enhance learning experiences. Similarly, Lin et al. (2020) investigated the role of e-learning resources in the distance education context and their impact on student learning. Their study showed that e-learning resources such as online video lectures were perceived as useful by students. They found that video lectures enabled students to better understand the course content, gave them more flexibility in studying and improved their academic performance. Brown and Davis (2020) used qualitative methods to explore students' perspectives on e-learning resources. The study found that students value video lectures, interactive modules, and discussion forums and consider them essential for engagement and effective learning. Hodgkinson-Williams and Trotter (2018) conducted a study investigating how Open Educational Resources (OER) can facilitate access and flexibility in distance education. They found that the use of OER enables educators to create innovative teaching methods, promote inclusive education, and improve students' learning outcomes.

When it comes to university students' attitudes toward e-learning resources, studies have identified various factors that influence their perceptions. A study by Hsu et al. (2019) found that students' previous experience with online courses, motivation to participate in distance learning programs, and perceived ease of use of e-learning resources are important predictors of their attitudes. Lee and Johnson's (2018) study focused on identifying factors that influence students' attitudes toward e-learning resources. The findings highlighted the importance of factors such as usability, interactivity, content quality, and instructor support in shaping students' perceptions of e-learning resources.

Studies in the literature have shown that gender and age can also influence students' attitudes toward e-learning resources. For example, a study conducted by Çoklar et. all (2020) in Turkey showed that female students had positive attitudes towards e-learning resources compared to their male counterparts. They also found that older students were less likely to use e-learning resources than younger students. Chen and Wang (2019) investigated the effect of personal characteristics such as age, gender, and prior e-learning experience on students' attitudes toward e-learning resources. The study found that previous experience and technological competence significantly affect students' attitudes, while age and gender have a limited effect.

The current study comparing students' attitudes towards e-learning resources by age and gender builds on previous research and is expected to make a valuable contribution to the field of distance education. It is important to understand how students' attitudes change over time and how certain factors may influence their perceptions of e-learning resources.

## 2. Method

We prepared a questionnaire form to determine the attitudes of distance education students toward e-learning resources. The questionnaire form has two parts. The first part includes two questions that collect information about the students' age and gender. The second part consists of 4 5-point Likert-type items aimed at measuring students' attitudes toward e-learning resources. In creating these items, we used the items of the "Computer Self-Efficacy Measure" developed by Compeau and Higgins (1995) and the "Attitude towards e-Learning Scale" developed by Guillasper, Soriano and Oducado, (2020). The items are listed below.

- e-learning resources make education more interesting.
- Working with e-learning resources is fun.
- I like using e-learning resources.
- I look forward to those aspects of the course that require me to use e-learning resources.

The questionnaire form was reviewed by 4 field experts for face and content validity. In accordance with the feedback received from the field experts, an annotation was added to the second part of the questionnaire form. In this annotation, the following definition of "e-learning resources" was added: "In this study, the term "e-learning resources" refers to all electronic instructional resources delivered to students via the Internet, intranet, extranet, satellite broadcasts, audio/video, interactive television, and CD-ROMS". The questionnaire form, finalized according to the suggestions of the field experts, was transferred to the online environment and made ready for application.

Approval was obtained from Anadolu University Scientific Research and Publication Ethics Committee to confirm that the research was conducted in accordance with scientific ethical principles. Then, with the permission of the Dean's Office of Anadolu University Open Education Faculty, the survey was opened for students to participate online. The online survey was published in the student web portal. Students who voluntarily wanted to participate in the study could complete the survey by clicking on the survey link. Students could exit the survey and delete their information at any stage of the survey. The online survey yielded complete data from 411 students. The age and gender of the participants are shown in Table 1.

Table 1: Age and Gender of Participants

| Demographic | Groups | N | % |
|---|---|---|---|
| Gender | Female | 114 | 27.7 |
| | Male | 297 | 72.3 |
| Age | <30 | 194 | 47.2 |
| | 30-40 | 151 | 36.7 |
| | >40 | 66 | 16.1 |

It is seen that 72.3% of the participants were male and 47.2% were under the age of 30. Beyond descriptive statistics, we used Independent Samples T-Test One-Way ANOVA and Tukey Post-Hoc Test to analyze the data obtained.

## 3. Findings

The mean score of students' attitude towards e-learning was 16.5. This score is very close to the maximum score of the scale which is 20 points. This result shows that distance learning students have a high level of positive attitude towards e-learning resources. The mean and standard deviation scores of students' attitudes according to their age and gender are shown in Table 2.

Table 2: Group Descriptive Statistics

|  | Group | N | Mean | SD |
|---|---|---|---|---|
| Gender | Female | 114 | 16.3 | 4.29 |
|  | Male | 297 | 16.6 | 4.12 |
| Age | <30 | 194 | 16.9 | 3.71 |
|  | 30-40 | 151 | 15.9 | 4.48 |
|  | >40 | 66 | 16.9 | 4.55 |

According to Table 2, male students have a higher mean attitude than female students (X=16.6>X=16.3). When analyzing according to age groups, it was found that the mean attitudes of students under 30 and over 30 were the same. However, the mean scores of students between the ages of 30 and 40 were lower than the other age groups (X=15.9). The Independent Samples T-test was used to determine whether the comparison by gender was statistically significant. The results of the t-test are shown in Table 3.

Table 3: Independent Samples T-Test

|  | Statistic | df | Mean difference | p |
|---|---|---|---|---|
| e-Learning Attitude | -0.791 | 0.429 | -0.363 | 0.429 |

As seen in Table 3, although the mean scores of males were higher than the mean scores of females, this difference was not statistically significant. This result shows that the attitude of distance learning students towards e-learning resources does not change according to their gender. We used One Way ANOVA and Tukey's post hoc test to compare the mean attitudes of students according to age. The results of One Way ANOVA and Tukey post-hoc test are presented in Table 4.

Table 4. Results of One Way ANOVA and Tukey Post-Hoc Test

|  |  | <30 | 30-40 | >40 |
|---|---|---|---|---|
| <30 | Mean difference | — | 0.984 | 0.0281 |
|  | t-value | — | 2.19 | 0.0476 |
|  | df | — | 408 | 408 |
|  | p-value | — | 0.075 | 0.999 |
| 30-40 | Mean difference |  | — | -0.9564 |
|  | t-value |  | — | -1.5628 |
|  | df |  | — | 408 |
|  | p-value |  | — | 0.263 |
| >40 | Mean difference |  |  | — |
|  | t-value |  |  | — |
|  | df |  |  | — |
|  | p-value |  |  | — |

In the table, the difference in mean scores between age groups was statistically analyzed. As a result of one-way ANOVA and Tukey's post hoc test, we found that these differences were not statistically significant. However, we did find an increase in women's positive attitudes toward e-learning resources as they got older. Figure 1 shows the change in attitude scores by gender and age.
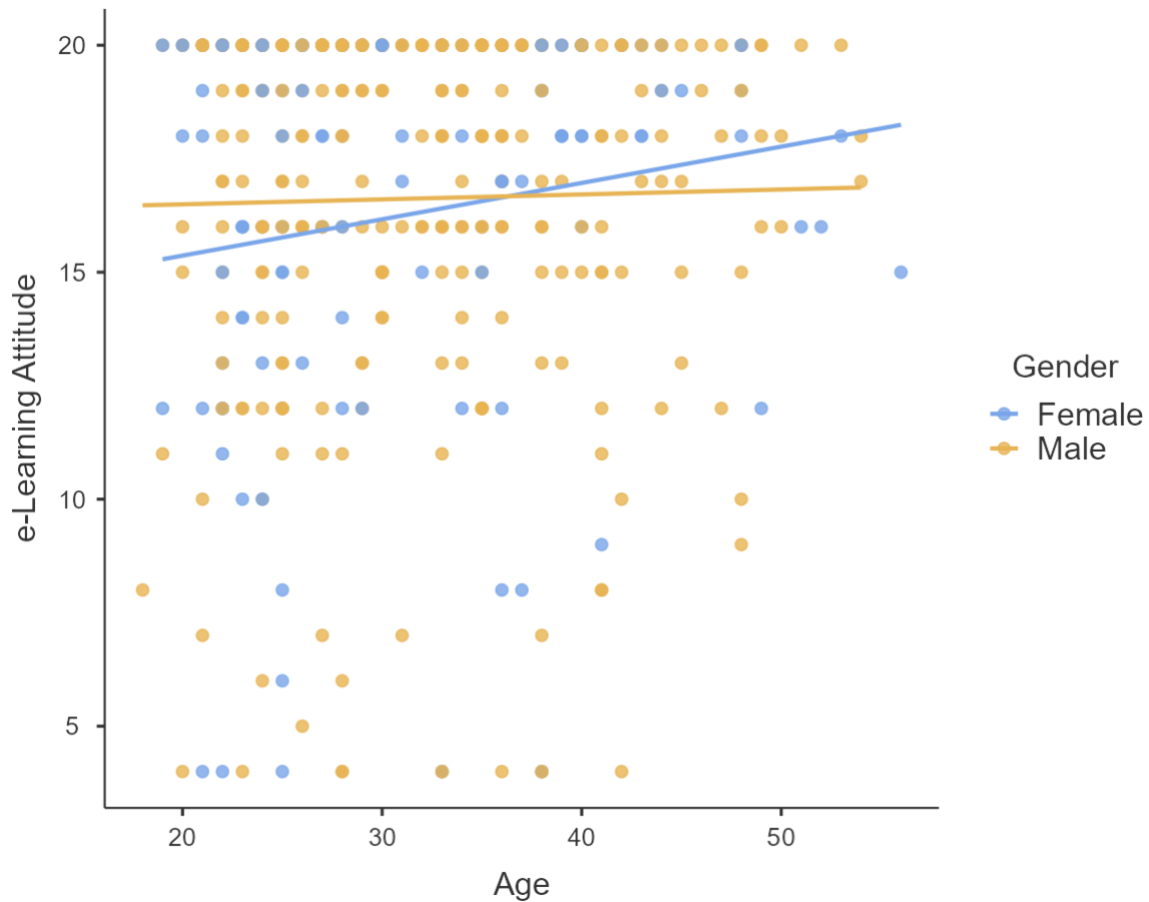


Figure 1: Change in mean attitudes toward e-learning resources by gender and age

As can be seen in the graph, positive attitudes towards e-learning resources increase with age for both males and females. However, it can be observed that attitudes towards e-learning resources increase more for females with increasing age. This finding suggests that women's interest in e-learning resources increases with age. More research can be done on this finding.

### 3.1. Limitations
In this study, attitudes toward e-learning resources are limited to the measurement of four 5-point Likert-type questionnaire items. The descriptive and parametric test results obtained in the study are limited to the survey data of 411 distance education students. Finally, this research is limited to quantitative data. Qualitative data can provide a more detailed perspective in determining attitudes toward e-learning resources.

### 4.  Conclusions
This study investigated the attitudes of distance education students toward e-learning resources. As a result of the analysis of the quantitative data obtained from a total of 411 students, it was found that the students had a high level of positive attitudes towards e-learning resources. This finding is consistent with the findings

of the studies (Doe and Smith, 2017; Brown and Davis, 2020; Hodgkinson-Williams and Trotter, 2018; Lin et al. 2020) that determined students' positive attitudes towards e-learning resources.

We found that the age of distance education students is not a statistically significant determinant of their attitudes towards e-learning resources. This finding is consistent with Chen and Wang's (2019) finding that gender and age have a limited effect on attitudes towards e-learning resources. Although male students had higher attitudes than female students, the difference was not statistically significant. Interestingly, we found that female students' positive attitudes towards e-learning resources increased with increasing age. This finding supports the results of the study conducted by Çoklar et. all (2020). A similar trend was not observed among male students. No age-related change in attitude was observed among male students. These reasons for the increase in positive attitudes towards e-learning resources among female students with age need to be investigated in more detail in future studies. Understanding these factors may contribute to the development of more inclusive and effective distance education programs and better serve the diverse needs of students.

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# Redefining Distance Learning: An In-depth Analysis of Study Guide Development at Hellenic Open University

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## Abstract

Hellenic Open University stands as the exclusive state university institution in Greece, providing open and distance education programs at both the undergraduate and postgraduate levels. The significance of educational material, particularly in ensuring the satisfaction of its quality characteristics, is of utmost importance in distance education. In particular, the teaching and learning experience quality in open and distance education is closely linked to the quality of the study materials. In line with this, Hellenic Open University has developed printed textbooks and books that adhere to specified guidelines and pedagogical specifications for creating educational materials tailored to the unique requirements of distance learning. However, there is often a need to supplement these materials with additional resources that were not originally designed for distance education. To address this, study guides are developed to complement the core textbooks and provide essential elements to facilitate their effective utilization within the educational process for distance learning students. Academic personnel at the Hellenic Open University, adhering to precise standards, specifications, and pertinent instructions, develop these study guides. The Educational Content, Methodology, and Technology Laboratory of Hellenic Open University actively monitors and supports this development process. Additionally, the resulting study guide is certified in accordance with the International Standard for Quality Management, ISO 9001:2008, ensuring their adherence to rigorous quality standards. This paper focuses on examining the perspectives of study guide authors regarding the processes they employ. A comprehensive questionnaire comprising both open-ended and closed-ended questions was carefully constructed to achieve this. The survey sample consists of the authors responsible for developing the study guides during the academic year 2022-23. Employing a mixed data analysis approach, we identified both strengths and weaknesses in the current study guide development process. The outcomes of this research will contribute to enhancing the study guide development process and improving the quality of produced

educational materials. Ultimately, these advancements will benefit both distance education students and creators alike, fostering an enriched learning experience.

**Keywords:** Hellenic Open University, study materials, distance learning, quality assurance

## 1. Introduction

Hellenic Open University (HOU) is the only state institution in Greece providing both undergraduate and postgraduate programs with the method of open and distance education. In the educational process of distance education, learning material is considered "*the primary lever of instruction, a flexible teaching tool aimed at engaging a significant; perhaps the largest part of the teacher's role.*" (Lionarakis, 2001). In addition, it serves to deliver instructional content to learners (Keegan, 1996), offering guidance and fostering active engagement in the learning process, leading them "*towards a self-directed learning path*" (Lionarakis, 2001). Furthermore, supports self-paced learning enabling students to follow their own pace to study educational material and accomplish educational activities (Garrison & Anderson, 2003) so learning becomes an autonomous and personal process, the progression of which relies significantly on the learners themselves. Multimodal educational material facilitates interaction between learners, enhances active participation (Moore & Kearsley, 2011), and accommodates various learning styles and preferences (Pashler, McDaniel, Rohrer & Bjork, 2008). Moreover, educational material in distance education offers opportunities for learners to receive feedback on their progress (Nicol & Macfarlane-Dick, 2006), an important element for personalized learning.

From the aforementioned, it is evident that ensuring the quality characteristics of educational materials is paramount in distance education, with a significant impact on overall satisfaction (Laurillard, 2002). More specifically, the quality of the teaching and learning experience in open and distance education is closely connected to the quality of study materials (Naidu, 1994). Finally yet importantly, distance learning material is a central factor that as a dynamic tool defines the quality of the learning experience and its results (Hartofylaka, 2007).

## 2. Background

Taking into consideration the importance of learning material quality in distance education, HOU has developed a methodology for its development. For this purpose, the Education Content, Methodology, and Technology Laboratory of HOU (e-CoMeT-Lab) has created pedagogical specifications aligned with the principles of distance education, contemporary scientific and technical specifications appropriate to each kind of digital and printed educational material (Kameas, Spanaka & Pierrakeas, 2016). In addition, e-CoMeT-Lab coordinates and manages the process of development through comprehensive technical assistance, guidelines, and developer training, utilizing state-of-the-art equipment and software resources. To ensure the quality of the learning material, this procedure is certified in accordance with the International Standard for Quality Management, ISO 9001:2008.

However, since new scientific data is emerging, there is often a need to supplement printed books and textbooks with additional resources that were not originally designed for distance education. To address this, study guides are developed to complement the core textbooks and provide essential elements to facilitate their effective utilization within the educational process for distance-learning students. These study guides are developed by HOU's academic personnel, adhering to precise standards, specifications, and pertinent instructions. e-CoMeT-Lab has developed these specifications according to distance learning principles. Also, monitors and supports this development process providing training to the developers. It is worth mentioning

that the development procedure is certified in accordance with the International Standard for Quality Management, ISO 9001:2008. ISO 9001:2008 is an international standard for quality management systems. It provides a framework for organizations to establish and maintain a systematic approach to quality management.

The development process starts with the decisions of the governing committee about the study guide development. In addition, authors are given a template for writing the study guides and specified guidelines. Then authors send study guides to e-CoMeT-Lab for check. If needed, they receive comments formed in a checklist form. This procedure may continue until every study guide follows all necessary specifications according to principles for the development of learning materials in distance education. It is worth mentioning that there is no economic reward for the authors.

In this paper, we examine the perspectives of study guide authors regarding the processes they employ. The outcomes of this research will contribute to enhancing the study guide development process and improving the quality of produced educational materials.

## 3. Method

To achieve the aim of the research, a short comprehensive questionnaire with mainly closed-ended questions was carefully constructed. We designed the questionnaire using Google Forms and distributed it to participants to complete it anonymously via email. The survey sample consists of the 46 authors responsible for developing the study guides during the academic year 2022-23. For analyzing closed-ended questions we used the software SPSS.  Authors had the choice to write any comments or suggestions for improving the study guide development process. For analyzing this question our methodology was based on grounded theory, a data analysis approach (Martin & Turner, 1986).

Additionally, we employed thematic analysis to qualitatively analyze the data, adhering to the following steps: 1) becoming familiar with the data, 2) generating initial codes, 3) identifying themes, 4) reviewing these themes, 5) defining and naming them, and 6) compiling the research report (Braun & Clarke, 2006). To assist this process, we utilized NVivo software (version 10). To ensure the validity of our research findings, we implemented a crosscheck procedure conducted by the authors.

## 4. Results

The academic personnel who completed the questionnaire were about 67% of the sample. The majority were Tutors (67, 7%), 16,1% were the Thematic Unit Coordinators, 9,7% were Teaching and Research Staff, and 6,5% were Directors of the Study Programme (Table 1).

Table 1: Participants

| | |
|---|---|
| Tutors | 67,7% |
| Thematic Unit Coordinator | 16,1% |
| Teaching and Research Staff | 9,7% |
| Director of Study Programme | 6,5% |

Most of the participants (90,3%) had a certification in the field of distance education. The majority of them (35,5%) found the study guide development procedure quite difficult (Table 2). The second most popular answer is "Slightly" difficult (29%).

Table 2: Difficulty of study guide development procedure

| | |
|---|---|
| Extremely | 3.2% |
| Very | 9.7% |
| Quite | 35.5% |
| Slightly | 29% |
| Not at all | 22.6% |

38,7% of the authors regarded the development procedure as very clear and 32,3% as extremely clear and understandable from its beginning (Table 3).

Table 3: Difficulty of study guide development procedure

| | |
|---|---|
| Extremely | 32,3% |
| Very | 38,7% |
| Quite | 16,1% |
| Slightly | 6,5% |
| Not at all | 6,5% |

About the template for writing the study guides, 58,1% of the subjects commented that was very easy to complete (Table 4).

Table 4: Difficulty of study guide template

| | |
|---|---|
| Extremely | 16,6% |
| Very | 58,1% |
| Quite | 22,6% |
| Slightly | 3,2% |
| Not at all | - |

For most of the participants (80,6%) there were no specifications that were difficult to follow. Also, the majority (54,8%) found e-CoMeT-Lab guidelines very useful for the development procedure (Table 5).

Table 5: Difficulty of study guide template

| | |
|---|---|
| Extremely | 19,4% |
| Very | 54,8% |
| Quite | 22,6% |
| Slightly | 3,2% |
| Not at all | - |

Authors' opinion (54,8%) about the checklist form was that was very easy to understand (Table 6).

Table 6: Difficulty of study guide template

| | |
|---|---|
| Extremely | 19,4% |
| Very | 58,1% |
| Quite | 19,4% |
| Slightly | - |
| Not at all | 3,2% |

Most of the respondents mentioned that the development procedure was very organized (45,1%), it adequately took into consideration the needs and characteristics of the target audience (35,5%) and adequately achieved its goals in terms of the quality of the produced study guides (42%) (Table 7).

Table 7: Developing procedure

| | Extremely | Very | Quite | Slightly | Not at all |
|---|---|---|---|---|---|
| Organized | 22,5% | 45,1% | 32,4% | - | - |
| Considering the audience's needs and characteristic | 16,1% | 32,2% | 35,5% | 16,1% | - |
| Achieved its goals | 22,6% | 42% | 29% | 3,2% | 3,2% |

Last but not least, 54,8% of the participants believed that there is no need for further training to develop study guides. The remaining participants suggested that additional training would be beneficial, especially for authors without prior experience in distance education. The proposed subjects for such training were case studies and best practices.

The authors mentioned that it would be beneficial for the study guide template to be more flexible in terms of its structure. They also emphasized the importance of providing authors with incentives, such as financial rewards or study guides' copyright.

## 5. Conclusions

The study underscores several pivotal findings regarding the development of study guides at HOU:

- Quality Assurance Mechanisms: Lionarakis (2001) underscore the importance of quality assurance in distance education. HOU's adherence to the ISO 9001:2008 standard signifies its unwavering commitment to upholding exemplary standards in educational materials, as noted by Hartofylaka (2007).
- Study Guide Development Dynamics: The development procedure was perceived as clear by a majority of authors. However, certain challenges were identified, suggesting avenues for enhancement, as discussed by Keegan (1996) and Garrison & Anderson (2003).
- Guidance Infrastructure: The instrumental role of e-CoMeT-Lab in steering the development process is evident. Most authors reacted positively to the provided guidelines.
- Feedback Protocols: The feedback mechanism was deemed effective and transparent, especially via the checklist form. This accentuates the significance of lucid communication in the development process, as emphasized by Nicol & Macfarlane-Dick (2006).

- Pedagogical Training: While a significant portion of authors felt adequately trained, there was a subset, particularly those unfamiliar with distance education, who advocated for supplementary training. Braun & Clarke (2006) and Martin & Turner (1986) echo this sentiment.
- Incentivization Strategies: The feedback underscored the potential advantages of motivating authors, perhaps through monetary incentives or intellectual property rights, as proposed by Laurillard (2002).
- Template Adaptability: A recurring matter was the desire for increased flexibility in the study guide template, indicating potential areas for refinement, as pointed out by Moore & Kearsley (2011) and Pashler et al. (2008).

In synthesizing the findings, it is evident that while HOU exhibits a robust methodology in study guide development, there exists potential for further enhancement. By addressing the identified challenges and perpetually refining the process, HOU stands poised to augment its educational offerings. This continuous improvement will indubitably benefit educators and learners within distance education, as articulated by Naidu (1994).

## 6. Future Directions, Implications, and Limitations

This research provides valuable insights into the study guide development process at HOU, setting the stage for subsequent investigations and enhancements. The feedback from the authors suggests the potential for refining the development process through regular reviews and feedback loops. Additionally, there is a discernible need for tailored training modules that cater to varying levels of author expertise. The topic of author incentivization also emerges as a significant area for further exploration to understand and implement effective reward systems. Moreover, the balance between template structure and flexibility warrants deeper investigation to optimize the development process.

However, it is crucial to acknowledge the limitations of this study. The research primarily focused on the perspectives of study guide authors, potentially missing insights from other stakeholders like students or administrators. Furthermore, the sample size, limited to authors from the 2022-23 academic year, might not capture the full spectrum of experiences and challenges faced over the years.

In sum, while this study lays a foundational understanding of the current situation at HOU, continuous research-driven efforts are essential to ensure the institution's sustained excellence in distance education.

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# Chat GPT, Generative AI and Large Language Models (LLM)

# Enhancing a Special Education Course through ChatGPT: A Case Study from the Hellenic Open University

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**Abstract:**

Navigating through the rapidly evolving digital landscape, higher education, in less than a year, is increasingly embracing innovative technologies like Generative Artificial Intelligence (AI) and Large Language Models such as ChatGPT. This presentation provides a case study from the Hellenic Open University on the utilization of ChatGPT as an assistive learning tool in an introductory Special Education course. The study engaged 24 graduate students (23 females, 1 male) from diverse educational backgrounds, who had no previous exposure to ChatGPT. Utilizing a mixed-method approach, the study comprised student assignments, peer reviews, and a follow-up questionnaire to gauge attitudes toward AI-assisted learning. Notably, a majority of the participants favorably rated content generated by ChatGPT, emphasizing its potential utility in facilitating personalized learning and providing instant, adaptive feedback. Beyond the mechanical advantages, the study also uncovers nuanced student perceptions, featuring a blend of optimism and cautious skepticism regarding AI's role in educational settings. These attitudes open avenues for further inquiry into the ethical and psychological dimensions of AI integration. Importantly, while the findings are promising, they are derived from a relatively small sample size and specific demographic, emphasizing the need for broader, longitudinal research. Given the exploratory nature of this case study, it serves as a foundational step for more in-depth research aimed at understanding the implications of AI for specialized educational needs, especially in the context of Special Education. Our ongoing research aims to further illuminate this potential and identify best practices for the ethical and effective integration of AI tools in the educational landscape.

**Keywords:** artificial intelligence, chatgpt, higher education, special education, ethical considerations, personalized learning, mixed-method approach, student perceptions.

## 1. Introduction

The 21st century has ushered in a wave of technological innovations, significantly impacting the field of education, which traditionally relied on in-person interactions and tangible resources (Selwyn, 2016; Luckin et al., 2016).). This impact is especially evident in Special Education, a discipline aimed at catering to the unique needs of students with disabilities. Special Education increasingly depends on technology to offer flexible and adaptable solutions tailored to individual learning needs (Edyburn, 2013). Although a review by Salas-Pilco, Xiao, and Oshima (2022) illuminated the promise of Artificial Intelligence (AI) in enhancing student engagement and performance, it also underscored the technological and sociocultural challenges that remain.

The growing influence of Artificial Intelligence (AI) extends to higher education, serving as a powerful tool in academic research, administrative tasks and especially in the training of future teachers. Universities are now leveraging AI to simulate different educational environments and challenges, thus providing future Special Education teachers with a richer, more diverse educational experience (UNESCO, 2023). This integration of AI into higher education teacher education programmes enriches the pedagogical strategies used, opening doors for more specialised and effective educational approaches.

There is substantial promise for the transformation of education through AI, particularly language models like OpenAI's ChatGPT (Radford et al., 2019). ChatGPT can generate texts based on input, offering personalized learning solutions in the field of Special Education. In a recent paper, Mollick and Mollick (2023) describe how AI can be effectively applied for data-driven teaching strategies, including distributed practice and low-risk testing. Additionally, OpenAI (2023) presented case studies that showcase ChatGPT's adaptability to quizzes, role-playing and language learning. These publications, part of a rapidly growing field of research, showcase the transformative potential of artificial intelligence tools like ChatGPT in educational contexts. However, despite its potential, there is limited research focusing on the use of ChatGPT in Special Education.

This paper addresses this gap by presenting a case study from the Hellenic Open University, focusing on the application of ChatGPT as an assistive tool in an introductory Special Education course. It seeks to answer the research question: How can AI tools like ChatGPT enhance the learning experience in Special Education, and what are students' perspectives on its utility?

In the next section, we'll examine some of the latest literature about artificial intelligence technologies, such as ChatGPT.

## 2. Literature Review

The emergence of Artificial Intelligence (AI) has brought about a transformative shift across various domains, with education being a prime beneficiary, and has created paradigm-shifting opportunities, impacting diverse aspects of learning. As delineated by Zhu et al. (2020), AI promises to revolutionize personalized learning, enhance student engagement, streamline administrative responsibilities, and offer actionable predictions about educational outcomes.

In the broader scope of educational dynamics, Gillani et al. (2023) undertook a comprehensive examination of the intricate "Black Box" of AI, shining light on its multifaceted nature. They demystified AI, arguing that it is more than just a single entity; it's an array of computational techniques designed to serve different purposes. By introducing guiding questions, they hoped to determine the actual benefits, potential pitfalls, and equitable distribution of AI in educational settings. Gillani and colleagues emphasized the dire need for a synergy between AI specialists and educators, envisaging a future where AI aids in genuine, human-centered learning.

Building on this AI-led transformation in education, Das, Malaviya, & Singh (2023) delved deep into AI-driven personalization's profound effects on learner performance. Their research illustrated the power of AI in tailoring instructional content, which in turn has showcased positive correlations with enhanced academic achievements, student engagement, and satisfaction levels. Through AI's lens, the trio visualized a world where traditional pedagogical methods could be enhanced, if not replaced, to provide a more enriched and inclusive educational experience for all.

In UNESCO's 2023 Quick Start Guide, ChatGPT is highlighted as a transformative AI tool with diverse applications in higher education, ranging from teaching and learning to research and administrative tasks. The guide emphasizes both the utility and ethical considerations of ChatGPT's role, including the potential for nonhuman authorship in academic publishing. As ChatGPT continues to be integrated into higher education settings, the guide suggests a need for institutions to judiciously and creatively adapt the technology, while also building the capacity to understand and manage it (Sabzalieva & Valentini, 2023).

From an administrative standpoint, the realm of AI-enhanced educational data mining came under the purview of Rabelo et al. (2023). Their findings accentuated the invaluable role of data, particularly from e-learning platforms, in shaping pedagogical decisions related to curriculum, assessment criteria, and catering to diverse

learning styles. Supporting this narrative, Lampropoulos (2023) provided a comprehensive overview of the importance of data analytics in modern education, emphasizing the creation of smart learning environments tailored to individual needs.

Shifting the spotlight to Special Education, UNESCO's Recommendation on the Ethics of Artificial Intelligence (2022) has been instrumental. This foundational document underscores AI's potential in ensuring differentiation, promoting inclusivity, and providing personalized support tailored to the unique requirements of students with special needs.

Garg & Sharma (2020) promote a perspective that reflects the transformative influence of artificial intelligence, especially with regard to students with disabilities such as visual, auditory, motor and intellectual disabilities. As a result of their qualitative research, which included interviews with students with disabilities and comprehensive literature reviews, they highlighted how AI has played a pivotal role in creating inclusive pedagogies for students with disabilities, fostering environments that promote equal opportunity for everyone.

Further exploration by Ojha (2022) emphasized AI's indispensable role for children with disabilities. Ojha highlighted the advantages AI platforms offer, particularly in providing real-time insights into challenges faced by students. This immediacy can guide educators in formulating timely interventions, thus reshaping the learning trajectory tailored to student-specific needs. Yet, Ojha also accentuated the importance of adequate training in AI-assisted tools, advocating for the preparedness of educators, parents, and therapists.

Despite the promising avenues AI provides, challenges persist. Marino et al. (2023) presented a balanced examination of the potentials and pitfalls of large AI models like ChatGPT in Special Education settings. The authors championed the potential benefits of AI, especially as a "cognitive prosthesis," but simultaneously emphasized the importance of ethical considerations. They advocated for comprehensive discussions on AI's integration, ensuring a well-rounded understanding of its immediate benefits and potential long-term implications.

While the existing literature provides a detailed description of the transformative influence of AI on education in general, in Special Education there is still a great need to further explore the influence and effective use of AI. A new perspective is offered through this case study by emphasizing students' ideas and experiences through AI-based language models, such as ChatGPT, in Special Education.

Building upon the insights garnered from the existing literature, we will now outline the methodology employed in this case study to explore the impact and perceptions of ChatGPT within an educational setting.

## 3. Methodology

This study was conducted at the Hellenic Open University, focusing on an introductory Special Education course. The participant pool included 24 graduate students—23 females and 1 male—from diverse academic backgrounds. All were first-time users of ChatGPT technology.

### 3.1. Integration of ChatGPT into the Course

ChatGPT was uniquely incorporated into the course. Students were required to evaluate a ChatGPT-generated assignment alongside their regular 300-word assignments in a peer review format. The assignment prompts for ChatGPT and the students were identical, aiming to foster deep engagement with the material and explore the potential of AI-generated content.

### 3.2. Assignment Ranking Exercise

After evaluation by the students of the class, the students ranked the first three assignments, including the one created by AI. As a result of this exercise, both human creation and artificial intelligence were critically analyzed.

### 3.3. Debriefing and Student Feedback

A debriefing session clarified the capabilities of ChatGPT and addressed student queries. A follow-up questionnaire captured student attitudes toward ChatGPT, including comfort level, perceived benefits, and drawbacks, providing guidance for future pedagogical applications of AI.

### 3.4. Examination and AI-Generated Feedback

The study also examined ChatGPT's impact on final exams and its capacity to offer insightful feedback. The exam consisted of 20 multiple-choice questions on course material. ChatGPT not only took the exam but was also required to justify its answers. These justifications were later used as feedback for the students.

Collectively, these methods aimed to assess students' reactions to the integration of AI in an educational environment, especially in av introductory course to special education. The study explored the potential pedagogical benefits and challenges of using ChatGPT, examining its role in different assessment methods. In addition, the research sought to provide insights into how implementing artificial intelligence tools like ChatGPT could affect the future practice of special education professionals. Understanding the effectiveness and limitations of ChatGPT could provide valuable guidance for integrating AI into special education curricula, ultimately shaping how future educators approach participatory, inclusive, and adaptive learning. With a comprehensive presentation of our research methodology, let us now turn our attention to the data collected and the key findings that emerged from the study.

## 4.  Results Evaluation of Assignments

In the initial experiment, students were asked to rank the three best assignments from a group of 24 written papers that included both student-created tasks (23) and one task created by ChatGPT. Their ratings were both critical and insightful. Impressively, 19 of the 21 participating students chose the paper written by ChatGPT as one of their top three choices. This important preference for choosing the written paper created with AI highlights the potential of AI in educational settings. In addition, of the 23 students, 20 expressed admiration for the capabilities of ChatGPT, which lends further credibility to the effectiveness of the technology. However, it is worth noting that three students expressed reservations about possible misuse of the technology, underlining the need for adequate guidelines when integrating such advanced technologies into education.

### Student Perspectives on ChatGPT

Following the class discussion on the utilization of ChatGPT, an anonymous questionnaire was administered to gather further student insights. The central question posed was, "What do you think of ChatGPT?" The subsequent quantitative analysis revealed diverse student perspectives on ChatGPT's utility in their educational journey.

Through an in-depth analysis of these responses, four prominent themes emerged:

1. **Pragmatic Optimism**: A majority of the students acknowledge the promising advantages of ChatGPT as an educational asset. The technology is viewed as a valuable resource across multiple learning contexts, from mainstream classrooms to specialized educational support systems. It is considered to be particularly beneficial for students facing specific challenges, such as dyslexia, and offers transformative possibilities for special education. Nevertheless, the optimism displayed was measured,

emphasizing that the effectiveness of ChatGPT is highly contingent upon its application and context (13 responses 1, 2, 3, 6, 8, 11, 12, 14, 15, 17, 18, 19, 20).

2. **Cautious Skepticism**: This theme encapsulates concerns related to the reliability and ethical dimensions of ChatGPT. The students voiced misgivings about the veracity of the information generated and highlighted apprehensions about its irresponsible or malicious use. These observations accentuate the imperative for meticulous oversight and critical engagement when deploying AI in educational frameworks (10 responses 1, 2, 4, 7, 9, 10, 13, 16, 18, 19).

3. **Apprehension about the 'Uncanny Valley'**: A subset of students exhibited discomfort attributable to ChatGPT's human-like capabilities. They articulated that the AI's ability to closely mimic human output gives rise to unsettling feelings, commonly referred to as the 'uncanny valley' in robotics. This sentiment speaks to broader societal concerns regarding the rapid advancements in AI technology and their potential ramifications (3 responses 5, 16, 17).

4. **Importance of Training and Judgement**: Several students emphasized that the effective development of ChatGPT requires both training and critical judgment. They pointed out that while ChatGPT can be an invaluable tool, its responsible and appropriate use requires a comprehensive understanding of its capabilities and limitations, especially when used with vulnerable populations such as children (5 responses 11, 14, 16, 18, 19).

These collective insights offer an invaluable gauge of user attitudes towards AI's role in education. They underline the need for a balanced approach that marries the strengths of AI with human judgement, critical thinking, and ethical considerations.

## Longitudinal Impact on Exams

Additional results emanate from a follow-up experiment exploring ChatGPT's influence on students' final examinations. Using the most recent iteration of ChatGPT-4 Plus, which necessitates a paid account, the AI successfully answered all 20 multiple-choice questions on the final exam, complete with justifications for each choice. After minimal corrections, this feedback was relayed to students. Spontaneous reactions revealed their enthusiasm for the unexpected exam feedback. Comments included statements such as, "The latest unexpected feedback turns today's exam into a learning process.", "This is the first time I have received final exam feedback!" "In two questions I guessed the answer right; with the feedback, now I know the right answer".

Having presented the empirical data and initial observations, we now turn our focus to the Discussion section, where we will delve deeper into the implications, limitations, and future applications of these findings in the realm of educational technology.

## 4. Discussion

### Interpreting the Results in Context:

The primary objective of this study was to explore students' perceptions and the potential effectiveness of AI-generated content, particularly through ChatGPT, in educational settings. The findings demonstrate an overwhelmingly positive inclination toward AI-generated content. The fact that a majority of the students ranked ChatGPT's work highly and viewed its capabilities positively supports the notion that AI, when introduced thoughtfully, can be accepted and valued within educational circles.

### Reflection on the role and learning outcomes of ChatGPT:

Our data shows that ChatGPT is not just a technological innovation, but rather an essential contributor to educational outcomes. The theme of "Pragmatic Optimism" in student responses suggests that ChatGPT is seen as a legitimate complement to the educational process. Students perceive it as a flexible tool for various learning contexts, from general classroom operation to targeted educational interventions. Importantly, our data also shows that students support the responsible use of AI, emphasizing its role in enhancing, not replacing, human teaching.

**Value of AI-Generated Content in Education:**

With constant advancements in educational technology, new tools and methodologies continuously redefine pedagogy. AI technologies like ChatGPT signify a new era of customized, instantaneous feedback and diverse content delivery in classrooms. Our findings confirm that students are optimistic about the technology's potential. Moreover, ChatGPT's ability to provide precise, timely feedback, especially during assessments, could be instrumental in meeting individual learning needs, increasing engagement, and fostering a deeper understanding of the material.

**Special Educational Potential of ChatGPT:**

Addressing special education needs requires highly individualized and tailored instruction. Our findings reveal that AI, particularly ChatGPT, can efficiently provide this personalized experience. Its capabilities extend to constant tutoring, which is particularly beneficial given the usual limitations in human resources. It offers interactivity and engagement—crucial elements for students with disabilities. Moreover, the accessibility of ChatGPT opens up opportunities for students without immediate access to specialized resources.

**Reflection on wider implications:**

Our study reveals a broader, overwhelmingly positive attitude towards the role of AI in education, including special education. However, this enthusiasm needs to be handled carefully. As artificial intelligence technologies like ChatGPT become an integral part of education, ongoing assessments are crucial, not only for effectiveness but also for equitable access to educational opportunities for all.

**Benefits and challenges of AI in education:**

Our study highlighted several advantages of ChatGPT, such as adapting assessment materials, direct feedback, and creating a variety of content. However, we must also consider the challenges. The issue of " Cautious skepticism" raised concerns about the reliability of AI-generated content, especially with bibliographic citations, and the potential for misinformation. Additional concerns included the risk of over-reliance on AI, which can negatively affect the development of critical thinking skills, as well as ethical issues related to potential misuse of the technology.

In short, while integrating AI tools like ChatGPT into education is promising, responsible use based on ethical considerations is imperative. It is becoming vital to balance the potential of AI with human critical judgment to fully exploit the educational potential of these tools.

As we look ahead, it is important to consider not only the potential transformation, but also the challenges and limitations of integrating AI into educational settings, paving the way for future research to further explore and improve these aspects.

## 5. Implications for Future Research

**Interpreting Current Findings:**

The insights gained from this case study offer a preliminary understanding of the potential role and reception of AI-generated content, such as ChatGPT, in educational settings. While the sample size and scope are limited, the findings suggest areas worthy of further research. The mixed feelings of optimism and caution among participants could be an interesting launching point for future studies that aim to explore the psychological and emotional impact of incorporating AI tools in education.

**Future Research Recommendations:**

A recurring concern among participants was the ethical implications of using artificial intelligence in education. This highlights the need for future research to develop ethical frameworks that address issues such as data privacy and content accuracy. The question of how AI interacts with traditional teaching methods is another area that needs further investigation. Assessing how teachers can combine AI tools with human guidance could provide valuable insights. In addition, the short-term nature of our study highlights the need for long-term research, exploring the sustainable use and potential impact of AI on educational outcomes. Finally, as more AI tools are developed, comparative research could help identify the features that are most beneficial and the potential pitfalls that should be avoided.

As we approach the conclusion of this study, it is important to recognize that integrating artificial intelligence tools like ChatGPT into educational environments raises complex issues that warrant ongoing, thorough research.

## 6. Conclusions

The introduction of AI-based tools, such as ChatGPT, into educational contexts offers interesting possibilities, as shown by our case study. Rather than just an additional resource, these tools have the potential to redefine how teachers and students interact by offering more dynamic, adapted, and responsive educational content.

The promise of artificial intelligence is particularly impressive in the field of Special Education. Our study highlights the ability of artificial intelligence, and ChatGPT in particular, to meet diverse learning needs with a level of adaptability and personalization that traditional methods may struggle to offer. This adaptability enhances the educational experience for a wider range of learners, heralding the potential for more inclusive and equitable educational environments for all.

However, this growing reliance on AI in education requires a balanced approach. Our study also highlighted concerns about ethical use and the possibility of over-dependence. The integration of AI should be addressed through continuous evaluation and ethical review. Emphasizing critical thinking skills and maintaining the irreplaceable elements of human interaction in education is imperative as we navigate this evolving landscape.

In sum, our modest case study offers preliminary insights into a potentially transformative role for AI tools like ChatGPT, especially in Special Education. We are at an interesting juncture, where these digital tools could greatly influence the future of education. While the promise is indeed substantial, it's accompanied by a set of responsibilities and challenges that require equally substantial attention. As we stand at the threshold of a new educational era, the potential benefits of AI must be carefully weighed against its limitations and ethical considerations.

**Note on Language Assistance:** Given that English is not my first language, the editorial process of this manuscript benefitted from the utilization of OpenAI's ChatGPT. While ChatGPT was not involved in the generation of original content, ideas, or arguments, it did provide assistance with language editing to enhance the clarity and coherence of the text. Its use was instrumental in fine-tuning the manuscript's language while maintaining the academic rigor and originality of the research.

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# Widening Participation, Study Progress, Retention and Student Support

# Supporting student retention in distance learning by designing motivating course completion methods

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**Abstract**

An important challenges for higher education distance learning is to support course completion. In a previous study, we mapped the significance of known course completion risk factors in different (non)completion stages: 1. not initiated, 2. abandoned, 3. submitted but failed, and 4. successfully completed. Our findings indicated that not initiating was explained by available time, low motivation, and inappropriate completion methods. Task abandonment was predicted by life situation as well as inappropriate completion methods. Failed submissions were associated with task difficulty level and poor availability of the learning material.

As studying gets abandoned at each completion stage for different reasons, countermeasures need to be well targeted. The data from our previous study suggests that, at the initial stages, supporting study motivation by designing suitable course completion methods seems like the most effective measure to counteract noncompletion risk. At the later stages, academic skills increased their significance for course completion.

We discuss how course completion design and study motivation can be improved in combination using the psychological self-determination theory of motivation. According to the theory, intrinsic study motivation and engagement require experiencing competence, autonomy, and communality. We present our tested completion method designs supporting students' experience of these basic human needs. In conclusion, we suggest that course completion may be best supported by flexible distance learning and completion methods that provide constructive feedback and encourage a sense of communality among students.

**Keywords:** please add your keywords without capitals here, separated by commas.

## 1. Introduction

The contemporary policies of lifelong learning in education together with digitalization and the COVID-19-pandemic lockdown restrictions have required increasing flexibility from higher education. The selection of available courses to potential students has widened considerably. Open universities have been at the leading edge of this development due to their demographically and residentially diverse student populations. Instead of classroom exams, students complete their courses in distance learning environments with electronic study materials and completion methods.

Designing distance learning, however, requires more investment and staff competence from the organization due to technological requirements (Tu & Corry, 2002). Students enjoy greater freedom but need to bear greater responsibility of themselves during studies. The increased requirements, however, have resulted in declines in quality of technological (Aydın et al., 2019; Gaytan, 2015) and pedagogical implementation (Lee &

Choi 2011; Lee et al., 2013), study performance (Alqurashi, 2019), study skills (Bağrıacık Yılmaz & Karataş, 2022; Yukselturk et al., 2014), social contacts, support and communality (Lee & Choi, 2011), as well as study motivation (Maunula et al. 2021), due to which distance learning suffers from lower student retention levels compared to face-to-face learning. Moreover, adult distance learners have reported trouble reconciling studies with work life (Yukselturk & Inan, 2006; Maunula et al. 2021).

Efficient student retention measures require detailed understanding about course completion risk factors. In our previous study (under review), we mapped the significance of these student retention risk factors in different stages of course completion. Our aim was to help targeting the most effective countermeasures at each stage. We expected that course completion risk factors may differ at different stages of study. We will focus on the risk factors that can be affected by pedagogical solutions.

Our approach to this issue is above all practical: to support as efficiently as possible course completion in distance learning. Targeting appropriate countermeasures requires detailed data about the risk factors' effects at each study completion stage. Instead of formulating specific hypotheses, we explored course completion risk factors in further temporal detail than done in previous studies: We investigated study engagement risk factors in four different course completion stages. Finally, we will discuss practical but science-based suggestions for supporting course completion at different stages. We will specifically discuss how to apply an influential theory of study motivation in improving completion rates by pedagogical course design (Ryan & Deci, 2017, 2020). According to the theory, genuine interest in studies depends on the amount of student's experienced competence, autonomy, and social support. We argue based on our results that genuine interest can be the most effectively fostered by designing appropriate completion methods.

We measured basic studies psychology students' self-reported levels of study engagement risk factors during their study progress and their reported course completion performance at four stages (Kember, 1995):

1. Not initiated,
2. Abandoned (initiated but not submitted),
3. (submitted but) Failed
4. Completed.

Eleven risk factors were included:

1. Life situation
2. Available time for studies
3. Study motivation.
4. Course completion method
5. Instructions
6. Formative feedback
7. Difficulty level or academic skills
8. Learning material
9. Material availability
10. Learning environment
11. Study schedule

The risk factors changed stage-by-stage, as presented in Figure 1.
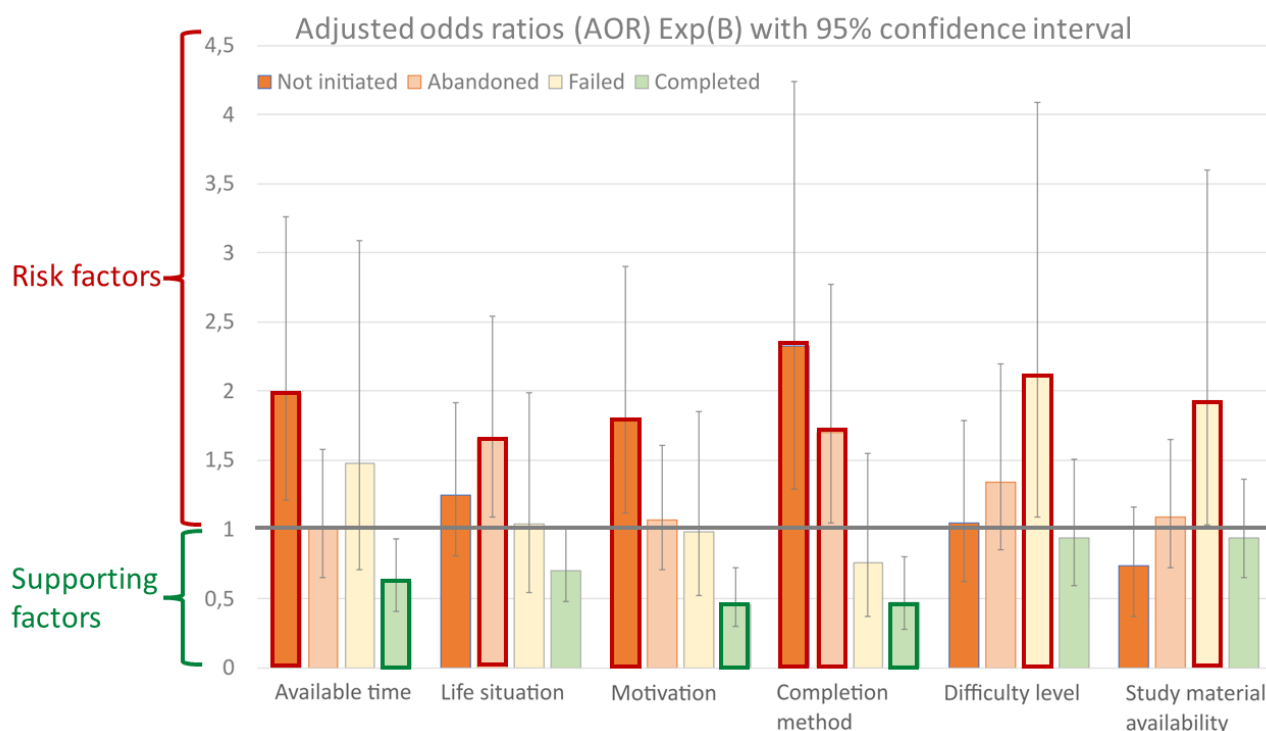
Figure 1: Adjusted odds ratios (AOR) Exp(B) for each risk factor at each completion stage with 95% confidence interval. AOR = 1 no effect, AORs > 1 indicate elevated noncompletion risk, and AORs < 1 increased completion level. Statistically significant odds ratios highlighted.

The most critical risk factor of not initiating course completion – and the supporting factors for completion – are time available for studying, study motivation and the course completion method. In this article, we focus especially on motivation and how it can be pedagogically supported in course completion design.

## 2. Motivation and course completion method design

### 2.1 Motivation

In addition to students' general wellbeing and functioning, their study engagement and course completion levels depend highly on their study motivation level (Johansen et al, 2023; Vansteenkiste et al., 2006; Walker et al., 2006). For interpreting this phenomenon, we need a helpful conceptualization of motivation. A widely used theory of motivation – also in the academic study context – is the self-determination theory of motivation (Froiland & Worrell, 2017; Howard et al., 2021; Ryan & Deci, 2017, 2020; Vansteenkiste et al., 2006; Walker et al., 2006). According to this theory, there are two relevant motivation types (Deci & Ryan, 2000):

1. Intrinsic (autonomous) motivation: This type motivates practicing an activity for its own sake and pleasure.

2. External (controlled) motivation. This type motivates practicing an activity based on external rewards. It can contribute to autonomous motivation by means of introjection.

Both types of motivation may help study performance in different ways, but it is especially the autonomous motivation that supports students' wellbeing, functioning, study performance and engagement (Johansen et al., 2023). The main crux of the theory is that motivation type 1, intrinsic (autonomous) motivation, depends on satisfaction levels of the basic psychological needs of autonomy, competence, and (positive) communality

(Ryan & Deci, 2017, 2020). The basic need satisfaction works as receiving natural primary rewards from an activity. The greater the need satisfaction level, the greater the intrinsic motivation level to an activity (Hope et al., 2019). As a result, motivation is strongly associated with self-efficacy (Duchatelet & Donche, 2019) and engagement to an activity (Murillo et al., 2018). Therefore, this is the relevant motivation type for understanding study engagement.

## 2.2    Supporting motivation in course completion method design

The major observation based on our results was that the risk factors differ greatly across different completion stages. From a pedagogical perspective, the most critical observation was that the risk factor of not initiating course completion and the supporting factors for completion are the same: available time, study motivation and the course completion method design. At other stages, the risk factors are more specific, like poor availability of study material, or immune to possible countermeasures, such as a suddenly changed life situation.

Since the amount of available time for studies is counteracted in a relatively straightforward fashion, we shift our focus on supporting study motivation and course completion method design. Moreover, it turns out that study motivation can be effectively supported by measures relevant to course completion method design. In effect, course completion method design greatly benefits from pedagogical formats fostering study motivation. As an interim conclusion, the most effective way of supporting course completion and student retention seems to be focusing on how to support study motivation by completion method design. This is how we have developed the pedagogy at our institute, and in the following, we will describe these development measures.

We will divide the measures of study motivation support into three broad categories based on the basic needs described in the self-determination theory. We describe how, first, the sense of competence, second, the sense of autonomy, and third, the sense of communality can be supported by appropriate completion method design.

### Competence

Competence means being good enough at performing a given activity. An individual's sense of competence is closely related to self-efficacy, meaning being able to act in an appropriate manner to achieve a goal and believing so. Sense of competence for an open higher education student could mean that he or she feels she is able to learn the course topics, and eventually to complete the course. In addition to perceiving the study topic inherently valuable and interesting, the student feels motivated to study when performing well, and when perceiving improvement in studies; learning is a powerful natural reward for human individuals.

Self-efficacy is also related to learning related emotions such as curiosity and enthusiasm (Camacho-Morles et al., 2021; Chen et al., 2022; Løvoll et al., 2017). These positive emotions facilitate memory trace formation (Kang et al., 2009; Duan et al., 2020), and adoption of optimal learning strategies (Muis et al., 2015).

To increase the students' sense of competence, the completion method should include individual feedback facilitating improvement and progression monitoring. Teachers' verbal feedback should target improvement points and detail the measures the student should take. Students value honest, fair, and constructive feedback (Rae & Cochrane, 2008). We have applied multiple minor assignments with formative assessment in between, and pretesting-testing quizzes, for this purpose.

**Autonomy**

Autonomy means having a feeling of control over, influence on, or the ability to make decisions about things related to oneself. The sense of autonomy in the context of distance learning in higher education could mean that the student can influence the study schedule, and possibly choose the assignment topic and format. Students value if they can align and apply the study topic to their own interests (Johansen et al., 2023). Moreover, this enhances the adult students' feeling of being trusted.

At our institute, we have opted for flexibility at multiple levels of the pedagogical formats. Students can begin and finish their courses at their own individual schedules. Multiple completion methods are offered. Some advanced students prefer exams to progress in a fast schedule. We have offered for example online supervision, multiple written assignments or study diaries, group presentation workshops and pretesting quizzes as completion methods for students in need of more guidance with academic skills and the course topic.

**Communality**

Communality in higher education distance learning can mean the sense of belonging to a given organisation (Merriman, 2010; Won et al., 2017). Interaction between students, and with the teacher, is critical especially in the beginning of studies (Johansen et al., 2023). Students motivate each other and develop motivation regulation skills in interaction with each other (Smit et al., 2017).

In the learning environment, we use inclusive discourse throughout, and we have recorded welcoming introductory interactive videos by teachers to orient and engage the student in the topic and the organization. Discussion forums and social media groups serve as communication platforms for students to support group study. The students may complete the course by group works or participating in presentation workshops with the element of peer assessment.

## 3. Conclusions

Course completion levels are critical for Finnish open higher education distance learning, as measures of pedagogical quality, and as a source of funding. More broadly in society, digitalization, the need for lifelong learning, and the pressure of higher education to serve work life compel teachers to design shorter study and degree formats (Lauder & Mayhew, 2020), offered in the form of scalable distance learning courses. For these type of studies, low study motivation and engagement levels, external regulation and lack of communality are major challenges. Pedagogical formats aiming at increased study engagement and performance levels in adult distance learners should include a communal learning environment with constructive instructor and peer feedback, and flexibility in schedule and learning methods.

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# Academic writing: challenges in on-line and face to face learning process

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**Abstract**

According to self-assessment grids, writing skills in C2 level (CEFR) are describing the overall performance of learners who can write clear, smoothly-flowing text in an appropriate style, who can write complex letters, reports or articles which present a case with an effective logical structure which helps the recipient to notice and remember significant points, as well as reviews and summaries. Concerning academic writing and oral presentations, in blended and on-line learning, as well as in face to face learning, there are indications that written and oral skills have to be reinforced. We will present a brief outline of the main challenges university students face as well as suggestions for improving the overall quality through strengthening of oral and written production skills in higher education.

**Keywords:** blended education, on line education, skills, error analysis, higher education

**Academic writing: challenges in on-line and face to face learning process**

## 1. Introduction

The Council of Europe approaches language training issues in a broader social context. Modern approaches concern modules which combine linguistic issues with broader educational issues. The modules address language awareness in education, guidelines for assessing program content. Expected outcomes take due account of key competences and teachers' awareness of language education, program improvement as well as the methods and principles that can be applied when revising the linguistic content of teaching, education programs aimed at future teachers of all subjects.

We will study the issues of language education based on the analysis of errors that appear during the production of oral and written discourse as well as possible approaches to dealing with them. According to one taxonomy ("Linguistic Category Toxonomy": LTC) classification is based either on the linguistic level (phonetics/phonology, syntax, morphology, lexicon/semantics) or on the linguistic constituent, affected by the error or on both at the same time.The second model ("Surface Strategy Taxonomy": SST) sheds particularly clear light on the ways in which surface structures are altered. In these models learners  may omit necessary elements or add unnecessary ones. They can produce defective shapes or erroneous arrangements.

One of the most important elements concerns the dimensions of written expression, regardless of the thematic area and the most frequent failures in written expression. *The Handbook for Curriculum Development and Teacher Training: The Language Dimension in All Subjects* (Beacco, 2016) summarizes the key elements of what need to be improved in writing and speaking skills.

Especially when it comes to writing, "in many classrooms, written expression requirements are limited in order to help students achieve minimum required performance, e.g., filling in gaps in text and copying marks. This practice, of good will, helps students achieve the minimum required. However, if applied to a large extent, it can limit students' ability to express themselves in a form and style required for complex thinking and subtle meanings.''(Beacco)

The European Center for Modern Languages (ECML) approach presents the concept of language awareness and its importance in all aspects of the educational and teaching process. It is evident that this is a question of particular concern to undergraduate and postgraduate programs at all levels, but also the most effective approach, at a time when precise expression and communication are required in all branches of science and technology.

By studying the expression of language in written and oral speech, even in higher education, we note a weakness in terms of expression in terms of analysis of concepts, linking theoretical approach and practical analysis. Lack of accuracy limits the development of analytical and synthetic thinking. These findings persist in written and oral production of students in blended and face to face learning.

A frequent phenomenon concerns the use of connectors as well as the presentation of the arguments. We often observe weaknesses regarding the nuances of vocabulary and fixed expressions as well as the appropriate use of punctuation.

This is essentially a complex question which concerns also a parameter that is rarely investigated in: teacher-learner interaction during lessons, through verbal communication. The learning framework and teaching approach differ, as do the subjects covered. It would be particularly interesting, in countries with the same language but different educational and cultural contexts, to study how instructions are presented during lessons, how instructions and statements are presented in textbooks and during exams.

In terms of assessment, performance is often assessed based on the final text delivered by students and no emphasis is placed on the process. In formative assessment, we basically look for the elements that need to be improved while usually no emphasis is placed on the production process, written and oral discourse, during the setup to avoid weaknesses.

There is often a certain ease regarding oral and written production, but there is often a difficulty in adequately distinguishing between genres, when students are called to produce discourse instead of answering multiple choice questions. Orality elements intervene in production of a formal nature: Often in practice, oral linguistic skills can only concern the response to questions and rarely the production of continuous speech.

Efforts are made to improve each learner's language skills, although language use in the school environment may have different outcomes. There is need to reflect on the expression and linguistic elements used in the teaching of all subjects, on the linguistic expression in school textbooks as well as on the use of ad hoc teaching materials created by each teacher, in all educational frameworks.

## 2. Written production

It is worth studying the written production of students, since they are vastly using everyday expressions instead of formal register. The structures are usually syntactically and grammatically acceptable but sometimes awkward. We investigated the written production in blended learning and in face-to-face learning without significant differences in the traits of the discourse produced by the students of the two groups.

Examples of written production and comments:

*Αντλώντας πληροφορίες <u>από την ατζέντα που έχει δοθεί</u>, θα προσανατολίσουμε*

Here there is use of the everyday language term "ατζέντα'' instead of "ημερήσια διάταξη '' that is the formal term.

*και θα πραγματοποιηθεί <u>εξ' απ οστάσεως</u> μέσω μιας ειδικής πλατφόρμας*
The term εξ' αποστάσεως is presented in an obsolete way, that is no longer used. The widely used term is without apostrophe.

*Το συνέδριο και οι παρουσιάσεις που θα πραγματοποιηθούν θα περιλαμβάνουν ειδική ορολογία*
The syntax used is presented in an awkward way that is not the most appropriated and effective one

*<u>Όταν ο διερμηνέας βρίσκεται στον ίδιο χώρο με τα άτομα που διερμηνεύει έχει την δυνατότητα να παρατηρεί</u>*
The phrase "τα άτομα που διερμηνεύει'' (the persons that he is interpreting for) is actually presenting as subject the persons and not the discourse. The actual subject in the sentence is the discourse to be interpreted

- η προσοχή του να είναι απερίσπαστη <u>από αυτό</u> που θα κάνει

- The usage of the pronoun (αυτό που θα κάνει) is actually replacing the nouns task

- *Παρόλα αυτά ο <u>διερμηνέας</u> <u>δεν θα πρέπει να βασιστεί στην εικασία της πιθανής απλότητας χρήσης της γλώσσας,</u> καθώς δεν σημαίνει πως σε κάθε περίπτωση <u>θα συνυφανθεί</u> και με σωστή χρήση της.*
In this case there is vague, ambiguous and pompous structure

- *να παρατηρήσουμε <u>τι χρήση</u> της γλώσσας προτιμάει να κάνει,*

Erroneous spelling and incorrect use of the pronoun

- *εποχή της πανδημίας θα γίνει αναφορά σε προσαρμοσμένες προσφορές ή οικονομικά πλάνα, όπως <u>all-inclusive πακέτα,</u> λόγω της έκτακτης κατάστασης*
Integration of foreign language terms while there is the Greek term

- μπορεί να αξιοποιηθεί <u>και μια διαπολιτισμική γνώση</u> του διερμηνέα

  There is often unjustified usage of indefinite pronouns

- Η M.S. είναι <u>Ανώτατη Λέκτορας (Senior Lecturer)</u>

The term «senior lecturer» does not correspond to ανώτατη λέκτορας since this academic position does not exist in Greece

- Το εύρος του θέματος μπορεί να καλύπτει από δημοσιεύσεις σε διάφορα blog <u>ή pressrooms</u>, μέχρι συνεντεύξεις, ρεπορτάζ, και άλλους τρόπους προώθησης των εταιρειών, είτε μέσω περιοδικών

  The use of «pressrooms» does not respond to the actual event, it is a misnomer

- <u>Πρέπει να κρατήσουμε το γεγονός</u> πως η παρουσίαση θα γίνει από τον πρόεδρο της εταιρείας
«Πρέπει να κρατήσουμε το γεγονός» is not the appropriate collocation

- Δηλώνει επίσης πως τα εμβόλια ίσως <u>δεν επιφέρουν την παλιά «κανονικότητα»</u> στις <u>διεθνής ταξιδιωτικές συμπεριφορές,</u>
«Επιφέρω κανονικότητα» approximatively means " to bring normality" while the actual meaning is return to normality

- ή <u>κατά πόσο δούλεψαν διάσημοι τουριστικοί</u> προορισμοί
«δούλεψαν οι προορισμοί» is a collocation of jargon that is not appropriate for a formal report

- έχει συνεργάτες της <u>σε διάφορες χώρες,</u>
There is abusive usage of «διάφορες χώρες» (several countries) that is void of meaning

- ο διερμηνέας <u>θα μπορούσαμε να πούμε</u> πως θα είναι επαρκώς προετοιμασμένος

- «Θα μπορούσαμε να πούμε» is part of colloquial expressions, while the exact expression would be "it might be argued tat

οι πελάτες θα έχουν και <u>ιδιωτικά meeting</u>
The English term meeting might be replaced by the Greek term συνάντησηη

## 1.2    **Oral production**

We also investigate the oral production of students having the same educational background and similar experiences in face to face and blended learning. The structures are usually syntactically and grammatically acceptable but sometimes awkward. We investigated the oral production in blended learning and in face-to-face learning without significant differences in the traits of the discourse produced by the students of the two groups.

Examples of oral production and comments:

- <u>Ορισμένα μέλη των</u> κοινοβουλίων
  The  expression "some members of parliament" is not adding information to the overall meaning the sentence. The "ορισμένα'' (some) could be omitted

- Συζητήσεις οι οποίες <u>έχουνε δημιουργήσει</u>

"Εχουνε δημιουργήσει', the form «εχουνε» is a morphological variant of informal discourse

- Συνάντηση όπως χαιρέτησε ο προλαλήσαντας
  The adverb "όπως" is not appropriate

- Καταστροφική <u>είσοδο </u>της Ρωσίας στην Ουκρανία
  The term "είσοδος'' refers to invasion. Instead of using the Greek equivalent of "invasion", the equivalent of  "entrance" is used

- Υπερτερεί <u>στην επιφάνεια της γης</u>
  The expression used here is the equivalent of  "It has an extensive surface " . The student simply wanted to note that the country is one of the largest ones in terms of surface

- Τα ταμπού <u>τα οποία έχουν αμαυρωθεί</u>
  The expression used in Greek is  "The taboos are  tarnished" . The exact verb to be used should be " abolished "

- Έχει αποτελέσει <u>μια σημαντική δουλειά</u> ( έχει επιτελέσει σημαντικό έργο)
  "Δουλεια" is the equivalent of  «job» while the appropriate expression would be «has performed considerable amount of work

- Η επίθεση <u>απέναντι</u> στην Ουκρανία

The preposition "απέναντι'' is not needed. The correct expression should be "Η επίθεση στην Ουκρανία''. The "invasion of Ukraine" is sufficient. The Greek equivalent of "against" is not needed

## 3. Conclusions

The study of the oral and written and oral production, in university students production, indicates that there no significant differences in the production in distance and face to face learning in students of similar learning and linguistic background. The main interference concerns the introduction of oral expressions in written discourses and awkward expressions in terms of collocations.

One main suggestion seems to be reinforcing oral and written production in frequent tasks and avoiding simple answers and multiple-choice questions, that undermine the correct production of oral and written discourse. Working in small groups and errors analysis in groups indicates improvement in written and oral production in terms of register and collocations. Suggestions and error analysis, in the end of semester or academic year, as applied usually,do not improve the overall outcome. There are not significant differences when students are taught on line or face to face.

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# Diversity & Inclusion in open and online education

# Developing and Embedding a Diversity and Inclusion Staff Development Programme to Improve Academic Outcomes for Open and Online Students from Traditionally Disadvantaged Backgrounds

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## Abstract

Research and practice show inequitable outcomes for students from traditionally disadvantaged backgrounds compared to students from backgrounds of privilege (Awan, 2020, Rai & Simpson, 2023, Richardson, 2015, Richardson et al., 2020). Closing student awarding gaps is a problem across the sector (Universities UK, 2022). Student success for all students regardless of background is inextricably linked with staff understanding of diversity and inclusion. Most organisations have required their staff to undergo diversity and inclusion professional development for many years. But is this professional development still appropriate for 2023 and beyond? How does staff training translate into a more diverse and inclusive student learning experience that improves retention and student outcomes?

In the Faculty of Wellbeing, Education and Language Studies at the Open University UK, we developed and implemented an equity, diversity and inclusion strategy that included a forward-facing and aspirational professional development programme to tackle racism and discriminatory behaviour and to promote diversity and inclusion for our students. The programme is called 'Unlearn and Learn', acknowledging that staff might need to 'unlearn' what was previously appropriate and 'learn' how to be allies and how to agitate to affect change. In under two years, we have run 90 sessions across various topics including gender, disability, race, and ethnicity which 689+ unique staff have attended. As a result, we have developed knowledge and understanding amongst staff, contributing to positive changes in practice.

The success of the programme can partially be attributed to creating a learning community that is a safe space for staff to expose their lack of understanding or knowledge of difficult issues, where they are able to ask awkward questions and not be judged, and where they can learn to improve their own practice and the student experience. In the first year, most sessions were delivered by external experts. In the second year, this was flipped, and most sessions were run by internal staff, presenting their own research or staff from diverse backgrounds who are experts by experience. This approach reduced costs, increased local relevance and the combination of internal and external speakers enhanced credibility and attracted more delegates.

**Keywords:** Student outcomes, higher education, professional development, awarding gap, EDI, Theory of Change, online distance education

# 1. Introduction

### 1.1 Inequitable student outcomes in the United Kingdom

'Equality and students' is a priority area in Higher Education in the United Kingdom (UK) (Office for Students, 2023, UUK, 2023b). In the UK, there are four Nations: England, Northern Ireland, Scotland, and Wales. Across all Nations, research and practice show inequitable outcomes for students from traditionally disadvantaged backgrounds compared to students from backgrounds of privilege (Awan, 2020, Rai & Simpson, 2023, Richardson, 2015, Richardson et al., 2020). This is when students from backgrounds of privilege have higher academic outcomes compared to students from traditionally disadvantaged backgrounds. These are called awarding gaps and occur across the entire student journey, for example module retention and achievement, progression from one module to the next, completing or achieving a qualification, and progressing into highly skilled employment or additional higher education. The data at all levels (UK sector, institutional, faculty, programme or module) show us that there are inequitable academic outcomes. Closing student awarding gaps is a challenge across the UK sector (Universities UK, 2022).

In the UK, particular attention has been drawn to the following protected and special characteristics where student outcomes are inequitable, and we find statistically significant and meaningfully significant awarding gaps:

- Ethnicity
- Disability (including Mental Health in the UK)
- Socio-economic background
- Gender identification

Each Nation has its own funding council that analyses and monitors awarding gaps, working with the sector to improve outcomes for all students and to close awarding gaps. Gaps are often analysed as a percentage point difference between one group of students and another. For example, Black students compared to white students, students who declare mental health distress compared to students with no mental health distress, students who reside in lower socio-economic areas compared to students who reside in the wealthiest areas, or students who are transgender compared to students who are not. For example:

- Group A has 200 students (Ethnicity A)
- Group B has 1000 students (Ethnicity B)
- 61% of group A complete and pass a qualification (122 students out of 200)
- 80% of group B complete and pass the same qualification (800 students out of 1000)
- To calculate the percentage point gap between group A and group B take 80% subtract 61% = 19 percentage points
- The awarding gap in this example is 19 percentage points

It is also important to report awarding gaps by cohort size to know how many students are impacted by the inequity. From the example above:

- If the outcomes were equitable, both groups would have a completion and pass rate of 80%
- The awarding gap is 19 percentage points
- If the gap did not exist, in Group A 160 students out of 200 (80%) would have completed and passed the qualification.

- In reality, 122 students completed and passed (61%). Therefore, if you subtract 122 (Group A who completed and passed) from 160 (the number of students who would have passed if 80% completed and passed as per group B), you have 38 students who would have completed and passed if the gap did not exist.

For groups where the cohort numbers are small, qualitative research should be used alongside quantitative analysis (Office for Students, 2023a). The student voice is essential for understanding both their life experiences and their study experience and is particularly important and helpful in understanding how an institution can better support students to achieve equitable outcomes.

Historically, awarding gaps were often not considered when analysing and discussing student success, and if they were, the responsibility for achieving or not achieving was placed on the student. In some cases, it was believed that because a student was from a particular background they did not achieve, and the role of the institution was irrelevant. This is deficit model thinking. More recently thinking and the framing of awarding gap challenges has shifted and researchers and institutions are asking 'what can we do better to improve outcomes for students from traditionally disadvantaged backgrounds?', taking responsibility within the institution. In 2018, in England, the Office for Students introduced Access and Participation Plans (APP) for all registered English Higher Education institutions that wanted to increase student fees (Bolton & Lewis, 2023). Each provider agreed with the Office for Students what targets it would set and what actions it would take to address inequitable outcomes.

### 1.2 Addressing inequitable students outcomes at the Open University UK

The Open University UK (OU UK) prides itself on its open access policies, being open to students with any level of prior educational qualifications and from any and all backgrounds. For years, the OU UK has worked hard to support students to achieve to the best of their abilities, regardless of their prior learning and living experiences. Like other UK HEIs, the OU UK reports inequitable outcomes and has structures in place to address the challenges presented by awarding gaps. The University's Pro Vice Chancellor Students' unit (PVC Students) houses an Access, Participation and Success (APS) subunit which is responsible for producing the University's Access and Participation Plan (APP). A central Data and Student Analytics team produces data that is used not only for reporting to external stakeholders, but also to the central PVC Students and to faculties. Each faculty works with the PVC Students APS team to agree annually the actions it is going to take to address the specific needs within the faculty.

In 2021, the Faculty of Wellbeing, Education and Language Studies (WELS) co-created an Equality, Diversity & Inclusion (EDI), Access, Participation & Success (APS) and Accessibility plan for 2021 – 2024. The plan included a staff aspect (EDI), a student aspect (APS), and 'accessibility' to better support students with additional needs. The plan's vision for the faculty was: 'authentic, sustainable structures of equity are rooted in who we are and what we do, enabling students and staff to thrive and achieve to the best of their abilities'. The plan was developed in collaboration with faculty colleagues and was a call to action for all WELS staff. External sector, OU-wide and faculty drivers and data informed the creation of a heat map that identified urgent areas, emerging areas, satisfactory areas and good practice for the faculty over the next three years. There was a focus on staff as it was acknowledged that if staff are not able to work to the best of their abilities in a

supportive, equitable, diverse and inclusive environment, then they may find it challenging to support students to achieve to the best of their abilities.

The faculty plan acknowledged that each staff member has a unique lived experience that must be reflected and respected. As a faculty, there were different levels and kinds of experience and knowledge across different

aspects of APS, EDI and accessibility. The plan articulated the best way to approach the change that was needed was with an open mind, knowing it is okay to be uncomfortable and to ask questions, co-creating with students and working collaboratively across the faculty and University. Each member of the faculty was responsible and accountable for achieving the plan's vision. To achieve this, staff development was agreed as a priority and funding was secured through PVC Students APS centrally and through the Faculty Executive.

## 2. Methodology

### 2.1 Setting up the 'Unlearn and Learn' programme

Since its inception in 1969, The Open University UK has promoted educational opportunity and social justice under the mission to be open to all people, places, methods and ideas. Equality, diversity and inclusion principles are not new to the University. For the past 50 years, staff have been undertaking professional development courses in EDI. But is what has been taught over the last 50 years still appropriate for today? What do EDI and APS mean for students now? We needed to understand what it means for our students and their study experience and for our staff and their working experiences. The new WELS programme was designed and implemented under the name 'Unlearn and Learn' to promote the idea that we have to unlearn some of what we have been taught about equality, equity and anti-racist and anti-discriminatory behaviour, and learn what is appropriate for today.

### 2.2 Year one

The WELS plan set out a 'three schools one faculty' approach to EDI with a desire to address change in a comprehensive manner. The programme needed to not only consider the challenges and the opportunities, but also needed to facilitate action required to impact systemic inequalities. To attract and engage as wide a range of staff as possible, a four-pronged approach was taken (see figure 1). First, training options were considered for different staff roles such as the Faculty Executive, academic staff writing curriculum and assessment, lecturers delivering tutorials, faculty administrators and other academic-related roles. Second, using the heat map, topic areas were prioritised and a plan was set out across the three years. In the first year, key areas included ethnicity, student mental health and socio-economic background. In addition, a series of workshops about care-experienced students and a webinar on students in prison were delivered. Third, the skills required to affect change were considered: allyship, advocacy, liberating the curriculum, inclusive assessment and feedback, and being a change agent. Workshops on Theory of Change were also delivered to upskill staff on how to evaluate EDI interventions. Fourth, a variety of session types and length were offered ranging from one hour drop in sessions to multi-day workshops, from webinars, to expert seminars, music workshops, a mini-conference and introductory sessions providing much time for questions and discussion.

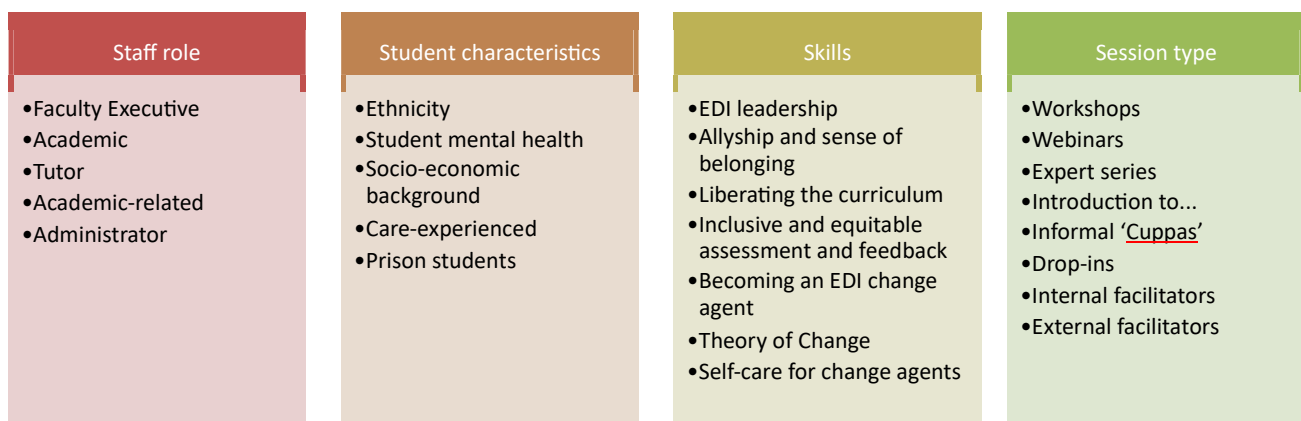| Staff role | Student characteristics | Skills | Session type |
|---|---|---|---|
| •Faculty Executive<br>•Academic<br>•Tutor<br>•Academic-related<br>•Administrator | •Ethnicity<br>•Student mental health<br>•Socio-economic background<br>•Care-experienced<br>•Prison students | •EDI leadership<br>•Allyship and sense of belonging<br>•Liberating the curriculum<br>•Inclusive and equitable assessment and feedback<br>•Becoming an EDI change agent<br>•Theory of Change<br>•Self-care for change agents | •Workshops<br>•Webinars<br>•Expert series<br>•Introduction to...<br>•Informal 'Cuppas'<br>•Drop-ins<br>•Internal facilitators<br>•External facilitators |

Figure 1: Four pronged approach to 'Unlearn and Learn'

The design and implementation of the staff development programme was the responsibility of the Academic Lead for Access, Participation and Success supported by a senior manager and an administrator. The overarching aim was to provide events to help staff gain the skills and confidence to promote EDI in their work. It was imperative that the programme encouraged staff to think of each student as a whole human with a unique lived experience. All sessions were designed to be safe spaces where staff could ask questions and explore their own knowledge.

For some of the topics, we engaged with external experts to bring credibility into the faculty and to the 'Unlearn and Learn' programme. For example, Advance HE, a leading British professional membership organisation promoting excellence in higher education, provided a programme of events on EDI leadership and EDI in Learning, Teaching and Assessment. Professor Jason Arday delivered a series of workshops on Allyship that were tailored to the faculty. A former prison student delivered a session sharing her experiences. Within the faculty, we drew upon staff to deliver expert seminars in areas such as student mental health, inclusive curriculum, and intersectionality, providing a specific faculty-focus. This four-pronged approach (staff role, student characteristic, skills, session type) and mixing external and internal facilitators provided a breadth and depth so most staff could attend sessions that genuinely interested them.

The programme was designed to build a solid foundation in the faculty that could establish authentic, sustainable structures of equity. In the first year, 39 events ran with more than 340 staff attending. Of those, more than 235 were unique delegates.

**2.3 Year two**

Following year one, there remained a need for focused staff development, there continued to be a strong commitment (as well as a requirement) to improving student outcomes, and a robust infrastructure to support a programme of events was already in place. Year two of the 'Unlearn and Learn' programme was initially based on participant feedback, as well as gaps in knowledge outstanding from the initial year of the programme. Staff feedback indicated that there was a benefit in revisiting some topics in more depth, as well as sharing the information with a wider audience across some areas. Responding to staff feedback in such a nuanced way would inevitably require monetary investment and in some cases, specific expertise external to the institution. At a time where budgetary commitments were being curtailed across several areas of work, it became apparent that commiting to such an investment was a challenge.

The solution to this therefore, was to harness internal expertise. This took the form of sharing and disseminating scholarship and research activity, expert lived experience from both students and staff, as well as raising awareness of APS work across the faculty and making the data on inequitable student outcomes more visible. This enabled staff at all levels to understand the experiences of traditionally disadvantaged students and consider what individual contributions could be made across all roles within the organisation to contribute to the agenda of inclusion, diversity, equality, and equity. In taking this approach it was discovered that there is in fact a wealth of scholarly activity taking place across the faculty with a very clear focus on improving teaching and learning. 'Unlearn and Learn' provided an opportunity to share that work within a supportive and collegiate environment, and amongst staff who have a shared vision for change and improvement of students outcomes.

In year two, 51 events were held with more than 810 delegates. Of those delegates, more than 450 were unique. In addition, in year two, following on the success of year one, the faculty ran a week-long WELS EDI Festival that included 15 events attended by more than 647 people, of which 283 were unique.

## 3. Discussion

### 3.1 Evaluating the programme

For work funded through the Access and Participation Plan (Office for Students, 2023a)  there is a requirement that the 'Unlearn and Learn' series is evaluated. The framework used is the Theory of Change (TASO, 2023) which facilitates better understanding of the delivery of 'Unlearn and Learn' in the context of The Open University. As part of this process, the aim of the series and what changes are looking to be made as a result of delivery of the sessions are considered. Also considered is investment in the series in terms of time and resources, and what is desired to be achieved in the short term and long term. Therefore, the measurable effects (things we will in fact achieve and what we hope to achieve) were considered and a realistic ambition of the anticipated impact was articulated, including what improvement in positive impact hoped to be seen on inequitable student outcomes.

One of the mechanisms used to capture direct feedback from participants is a survey. Participants are asked to complete the online survey at the end of each session attended. This process captures information about participant experience of the session, what participants intend to change in their work life as a result of attending the session, and what other areas of equality, diversity and inclusion development the participant would benefit from. Other areas of evaluation are the number of sessions delivered, number of attendees (including unique attendees), as well as one's role within the organisation. The collated quantitative data provides information relating to the level of staff engagement and gives an indication of what sessions attract a larger audience. The qualitative data often provides a rich narrative which enables a more nuanced response to training and development needs. Year on year the full evaluation is shared across the faculty and is available to all colleagues.

### 3.2 What are the benefits of 'Unlearn and Learn'?

**What worked well?**

Participant engagement increased by over one hundred percent from the first year of delivery, more than doubling the number of attendees. Not only did the series grow in momentum over time, but the team worked closely with the marketing and communications department regarding advertising in the faculty newsletter and setting up a repository of information in a dedicated APS webpage. Messaging about the series was also amplified by the Equality, Diversity, Inclusion and Accessibility (EDIA) Champions, targeting particular staff groups where sessions were of direct relevance.

Collaboration with the Black, Minority Ethnic staff network and the PRIDE staff network enabled crossinstitutional reach. It also facilitated better engagement and understanding of the expert lived experience that otherwise would not have been achievable within the institution.

There was benefit in recording some sessions and being able to later signpost colleagues to the content. Where a session is recorded, however, it is necessary to remind participants at the beginning of each session. The recording is then stopped so learning can be consolidated freely in the plenary discussion. It is important to note that some sessions are not recorded due to the sensitive nature of some topics. In some cases this can be at the request of the speaker, but some sessions are reserved for non-recorded discussion.

Sessions delivered by students were extremely well received. One session was attended by a senior accessibility colleague who valued the candid and first-hand feedback of the student's lived experience. This discussion reflected on the student's needs around reasonable adjustments (Equality Act, 2010) and reflected on the practicalities of navigating university process. The outcome of this session was far reaching in that it led to consultation with the EDIA Champions (including students) on a university wide initiative aimed at improving accessibility.

Feedback from participants tells us that sessions are most effective and impactful where there are actionable insights and learning to be had. A framework for contributors was developed to enable clear mesaging about the purpose of each session:

- Cuppa - an introduction to an EDI and/or APS related topic. An informal session with an opportunity for participants to have discussion around the topic.

- Expert Seminar - Expert by experience or evidence based. Delivery of an EDI and/or APS related topic. We encourage participants to pose questions in advance of, and within the session.

- Workshop - Facilitation of a workshop on an EDI or APS related topic. Participants should be given an opportunity to discuss the topic in smaller groups as well as with the wider group of participants.

Taking this approach ensures that participants take actionable insights away from the session and are able to better understand how to apply this learning in practice. The approach also encourages development of empathy towards student issues whilst supporting professionals in their own work practices. 'Unlearn and Learn' helps to navigate EDI related issues and gain knowledge of *good practice* as it relates to one's own institutional structures and beyond.

**What didn't work?**

Although it was great to deliver 51 sessions in the academic year, this is a significant commitment where one person is designated as having session hosting responsibility. Going forward, an adjusted delivery style has been designed to free up more time around other commitments, leaving alternate weeks free where there are no sessions. Another way to address this might be to distribute this element of the work amongst a team of colleagues.

The series trialled evening sessions, intended to give more opportunities for colleagues to access the sessions given the varied working patterns across the institution. Although colleagues did attend the sessions, the change did not bring about a significant increase in attendees, particularly not in the teaching community as envisaged. Feedback will continue to be sought regarding providing sessions outside of core working hours.

Lower return rates for surveys in 22/23 were seen compared to the previous academic year (the expectation being to complete a survey after each session). This could be attributed to survey fatigue or even time within busy work schedules, particularly where participants attend more than one session. However, the qualitative data received is very valuable and has provided excellent insight.

Due to budgetary constraints, the series drew heavily on internal staff expertise. This provided an opportunity to really interrogate areas of EDI in the context of OU learning and teaching. Whilst there was great benefit in this approach, and there will be significant benefit in continuing this practice, there is also acknowledgement that external expertise and alternative perspective is equally valuable. This coming year will see a combination of both approaches.

## 4. Recommendations for the development of an 'Unlearn and Learn' EDI programme  4.1 Strategic Approach

To make best use of resources, it is important to start by analysing your institutional data to determine where you have the greatest challenges and can make the most impact. This includes looking at any quantitative data regarding student outcomes to determine whether you have any inequitable gaps in your outcomes. For example, are white students achieving at higher rates than Black students? Are students with mental health difficulties being retained at lower rates to students who have no known disabilities? Are students with lower prior educational qualifications achieving at lower rates than students with higher levels of prior educational qualifications? It is equally important to analyse qualitative data. For example, is your institution receiving high levels of complaints from particular groups of students who are experiencing discrimination or feel invisible? Do student satisfaction survey results point to challenges for particular groups of students from traditionally disadvantaged backgrounds compared to those from privileged backgrounds? Do findings from student focus groups identify key challenges for your institution? Not only is it important to consider inequitable outcomes and student experience, but also to consider the cohort size of groups to determine how many students might be adversely affected. It is important to note that volume (number) of students experiencing adverse impact does not determine whether intervention/attention is required or not, as every single student issue is important.

Once the key areas of challenge have been determined, it is then important to prioritise which areas could benefit most from staff development. Once the priority areas have been agreed, a programme can be built.

Additional strategic questions to consider when building the programme include:

1. In what ways can the leadership team demonstrate commitment to EDI training and development?
2. Which staff groups would benefit from what types of training?
3. What skills do staff need to cultivate an inclusive, anti-discriminatory culture? It may be useful to do a skills audit. This can help identify skills gaps and who can deliver some of the events.
4. Is it possible to set EDI objectives for all staff?

Operational questions include:

1. Location
   a. Are sessions to be online or in-person or hybrid?
   b. What physical spaces and resources are available at what cost?
   c. What online platforms are available?
2. Timings
   a. What times of day or days of the week would attract most staff?
   b. Is it better to block out whole and half days or to run sessions that are an hour long?
   c. How frequently should sessions be run?

**4.2 Operational recommendations**

**Communication between the programme lead and the administrator**

Clear communication between the 'Unlearn and Learn' programme lead and the administrator is critical. Regular check-ins to discuss programme development, schedule, costings, feedback etc., help ensure the programme targets the priority areas and is manageable. It is recommended to create a calendar using spreadsheet software. The calendar can set out unavailable times such as holidays, weekends, and peak periods. It will allow the programme to be balanced across the year and repeat sessions set out in a timely manner.

**Communication between the trainers and the programme lead or administrator**

Working with trainers and vendors requires clear communication and strong organisational skills. Ensure the vendor knows exactly what is being asked to be delivered. In turn, ensure what the vendor needs to deliver their session is known well in advance. It is also worth undertaking technical run throughs, particularly with external trainers/presenters who may not be familiar with institutional software or hardware. In some cases, it would be beneficial to provide media training or links to effective presentation resources.

 Being clear from the outset will streamline communication. Some areas for consideration include:

- Date
- Title and an abstract/short description of maximum 100 words
- Being recorded or not being recorded?
- Available only to delegates, or to be shared with a particular group, across the institution, or externally?
- Is there a cap on the number of delegates?
- Length of time of presentation
- Length of time of questions and answers
- Pre-reading or preparation required by delegates
- Use of breakout rooms
- Payment requirement and details

Creating a form for vendors to provide this information upfront helps to ensure a good session is delivered, expectations are met and payment is correct.

**Promoting the events**

Promoting the events well leads to a more engaged and open-minded audience. There is a careful balance to strike between good outreach and not bombarding staff with emails and other forms of promotion. In WELS we used a faculty newsletter, emails to all staff, an internal faculty calendar, our faculty EDI intranet pages and colleague dissemination. Word of mouth was an effective method to promote events.

**Gaining and ensuring ongoing staff commitment**

First and foremost it is important to set realistic expectations, especially in year one. Consider your resources: expertise, time and finances. What is actually possible to deliver? Starting out, attendance is likely to be small

and grow by word of mouth as it evolves into a cultural norm. This can take time. In order to achieve staff commitment, make the sessions meaningful by delivering sessions they want to attend. In addition to sharing theory, share actions. Ensure staff can leave knowing what they can do differently as a result of being in the session. Begin with a few high-quality sessions. Offer events that include interactivity and space and time for discussion. It may be that less than 10 or 20% of staff are initially interested. Instead of spending time trying to persuade the additional 80 or 90% of staff to engage, develop the 10 to 20% of hyper-engaged staff, who are likely to be influencers, into allies. For staff who are influencers in an organisation, take time to explain the programme, gain their support, and develop them into allies as well. As your programme grows, really listen to students, staff, and delegates so that you can improve the offerings. With an open mind and agile systems, it is possible to adapt and provide options tailored to delegates. A generic offering is unlikely to attract high numbers. And finally, likely to be *the* key in getting staff commitment to a programme, is providing safe spaces for them to ask questions and show vulnerabilities, a way to learn without intrepidation.

In summary:

- Set realistic expectations within your expertise, time and finances
- Make it meaningful: offer sessions staff want to attend
- Start small with high-quality
- Engage staff influencers as allies
- Listen to your students, staff and delegates
- Be agile: adapt and provide options
- Create safe spaces

In the words of two delegates: "THANK YOU: You're really inspiring and make me feel comfortable to reflect and engage" and "Thank you so much! I really appreciated the focus on action - not just principles, but ideas for what to actually do."

### 4.4    Evaluating and enhancing the 'Unlearn and Learn' programme

One of the best ways to improve an 'Unlearn and Learn' programme is feedback from the delegates. Using an online feedback form at the end of the session before staff leave is one of the most effective ways to gather feedback. A short form with a few key questions is recommended such as:

1. How would you evaluate today's session? [Great, really glad I attended; Good, there was something in it for me; Ok use of my time; Could have been better; Wasn't for me]
2. What will you do differently in your work as a result of today's session?
3. What feedback, if any, would you give the presenters?
4. Are there any other topics you would like to see covered at future 'Unlearn and Learn' events?

The qualitative feedback can be rich and incredibly useful. For example:

"I greatly enjoyed the session and it is a shame that we had to rush through the final slides and limit questions. Perhaps a longer session next time?"

"Give plenty of time to get into and stay in breakout rooms, some time was wasted."

"I enjoyed the presentation, but it was hard to listen for so long with no slides or visual focus.  Key points on a PowerPoint would have been appreciated to reinforce messages."

Moving forward with this feedback, the next year of the 'Unlearn and Learn' programme will aim to be more supportive to the vendors in their event preparation, such as by providing a guidance document, covering presentation, PowerPoint, and accessiblity advice. Timings of events and activities will be considered more, such as adding extra time for breakout room activities. This in turn will aim to make the sessions more accessible and supportive to attendees as well, allowing more time to engage, discuss, and reflect.

## 5. Conclusions

The best way to summarise the impact of the 'Unlearn and Learn' programme is through staff quotes:

> "Thoroughly enjoyed the presentation style - it was formal where it was needed, but informal in places too, which fostered a really welcoming and pleasant environment to learn about important topics."

> "These two sessions have been the best workshops I've attended. An excellent balance of evidence-informed, practical things to take forward, and acknowledgement of the challenges around discussing and trying to implement EDI change / being open to being uncomfortable and making mistakes. The idea of the control/influence model combined with the practical tips has encouraged me to think about what I can do proactively, instead of waiting for management/leadership to tell me what to do. I've been thoroughly inspired and would like to say a massive thank you to the presenters."

> "I want to now always think about my own positionality in the materials that I'm producing in an endeavour to appreciate better the positions and complex intersections of those coming from very different backgrounds."

> "As a new Associate Lecturer I didn't really know whether I should be mentioning to my students who have declared a disability, that I am aware of this. I have just emailed each student individually offering support. Today I learned that I can mention this specifically to those who have declared something to the university."

This work is ongoing and the learning for ourselves is infinite. It will take time to measure the impact quantitatively in student outcomes and to measure direct causality is impossible, but the qualitative feedback from staff, such as the quotes above, indicate that the culture is changing, and staff are pro-actively unlearning and learning in order to create a more inclusive learning experience for students from traditionally disadvantaged backgrounds.

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# Micro-credentials for continuing education (Short Learning Programmes & MOOCs)

# Micro-credentials and MOOC Training for Upskilling Lighting Professionals

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**Abstract**

The objectives of the ECOSLIGHT project are the identification of skills and competences required for the professionals operating in the lighting sector, the detection of training programs currently offered and the gaining of deep insights and an analysis of gaps. Due to these goals, 342 valid questionnaires were gathered, 40 stakeholder interviews from France, Germany, Greece, and Italy were done, and 125 training programs were found. Results indicated that today it is difficult to find the appropriately trained personnel fulfilling the needs of the lighting sector; professionals specialized in the smart lighting area appear to be the top priority for the market, followed by lighting designers.

Based on the project's research findings, seven roles have been identified as emerging job profiles in the lighting sector: Lighting Designer, Lighting Systems Engineer, Smart Lighting Systems Technician, Lighting Consultant, Lighting Systems Assistant Engineer, Landscape and Street Lighting Technician, and Street Lighting Business Manager. The project developed modular vocational training curricula as well as open educational resources for the four of the aforementioned profiles, which were chosen after a rigorous evaluation. Through the adoption of the e-Competence Framework 3.0, the DigComp 2.1, the EntreComp, the LifEComp, various Green Skills and Lighting competencs identified through the survey, the project has developed a comprehensive skillset for lighting professionals.

The implementation of the course was made through an 8-week free online training MOOC, which had 879 enrollments, intended to assist members of the lighting and broader construction industries, in developing their lighting, digital, green, entrepreneurial, and life competencies. All learners who successfully finished the MOOC could apply for the second phase of the training: the specialization courses for the job profiles, including motivational e-learning and face-to-face lectures (blended course) and a work-based learning phase, available for people living in Greece, France, Italy, and Germany. The learners also obtain microcredentials for accomplishing each specialization course, in addition to a European certification for successfully completing the entire program.

Overall, the project identified a series of challenges for the human capital of the lighting sector; first and foremost, more training programs are required to support the market demand and the open job vacancies. Secondly, these programs should be accompanied with some type of work-based learning in order to enable learners to develop hands-on experiences. Thirdly, the respective training programs should not focus only to the development of lighting skills, but should include also green, digital, entrepreneurial skills, and human qualities, in order to support the development of competent professionals able to adapt to market challenges.

**Keywords:** lighting, lighting professional, lighting sector, e-Competence, MOOC, microcredentials.

## 1. Introduction

In order to comply with the European Commission's vision for a low-carbon economy by 2050, the construction sector faces novel challenges in providing smart, energy-efficient, and sustainable lighting environments for infrastructure, cities, buildings, and industry. There is an urgent and growing need for lighting design skills that integrate lighting design and smart technologies, as well as skills that consider ecological and human-centric issues in lighting systems. The ECOSLIGHT: Environmental Conscious Smart Lighting project (N° 612658-EPP-1-2019-1-EL-EPPKA2-SSA), supported by the European Framework of Erasmus+/Sector Skills Alliances Programme, seeks to improve the employability and career prospects of individuals working in the lighting industry while also assisting companies in identifying the necessary competencies to improve their competitiveness.

The ECOSLIGHT project, a large-scale attempt, aimed to upgrade the lighting industry and provide professionals with the skills and knowledge required to successfully negotiate the changing environment. It symbolizes the commitment of the European Union to encourage collaboration between companies and educational institutions to solve skill gaps in vital industries. The project intends to embrace this opportunity by giving lighting industry experts cutting-edge skills and capabilities that are in line with the most recent developments in smart lighting technology and ecological concerns. Furthermore, it contributes to the global effort of creating a sustainable future and a common training language among lighting professionals. The ECOSLIGHT project's dedication to a comprehensive learning strategy is at its core. Traditional lighting education sometimes emphasizes design or technical issues while ignoring the significance of sustainability and the human experience. By encouraging a thorough curriculum that includes ecological awareness, cutting-edge technology, and a human-centric design philosophy, the project overcomes these limitations. By doing this, the initiative hopes to transform the way lighting experts think about their work and give them with knowledge that is typically not covered in traditional lessons for vocational education.

## 2. Skills and Competences

Due to technological improvements, shifting customer preferences, and ecological issues, the lighting industry has seen substantial changes recently. The research investigates the changing market circumstances, the related skill requirements in the lighting sector and evaluates the knowledge and abilities needed to thrive in this dynamic field. Current market developments consist of energy efficiency and sustainability, smart lighting and IoT (Internet of Things) integration, human-centered lighting, and the incorporation of artificial intelligence are influencing the future trajectory of the sector.

Energy efficiency has risen in significance as people's awareness of environmental issues and the demand for energy conservation has grown. As an illustration, incandescent light bulbs are being phased out in favor of LED (Light-Emitting Diode) illumination, which is more energy-efficient. IoT technology enables smart lighting systems, which offer intelligent automation and control of lighting fixtures. Numerous advantages are provided by these systems, such as increased energy efficiency, personalized lighting experiences, and increased security. The goal of human-centric lighting is to create lighting conditions that mimic natural light and adapt to meet people's needs as their day proceeds. Lighting conditions have been found to have an impact on mood, circadian rhythm, and overall performance. Finally, in order to reduce energy usage and provide cutting-edge lighting control, AI (Artificial Intelligence) technologies are also rapidly being incorporated into lighting systems. Data analytics, machine learning, and software development expertise are necessary for the integration of AI in lighting, creating new job possibilities.

Thus, a variety of skills—including new digital, social, environmental, managerial, and economic skills— should be considered for professionals with expertise in this field of change. Professionals with digital skills may stay on the cutting edge of innovation and successfully use technology to create better and integrated lighting solutions. Social abilities such as good communication, empathy, and knowledge of human behavior enable experts to create lighting that improves well-being, productivity, and comfort, as well as to operate effectively and efficiently in teams. Environmental knowledge enables professionals to make improvements to a greener and more sustainable lighting business. People with managerial abilities may successfully traverse the difficulties of the lighting industry and guarantee that lighting projects are carried out. Professionals can show the worth of their lighting initiatives to customers and stakeholders thanks to their economic expertise.

## 3. Emerging job profiles in the lighting sector

The project's goals are to identify the knowledge, abilities, and competencies needed by professionals working in the lighting industry, to find training programs that are already being given, to get in-depth understanding, and to analyze any gaps. With the help of these objectives, 342 valid questionnaires were gathered, 40 stakeholder interviews from France, Germany, Greece, and Italy were conducted, and 125 training programs were discovered. The findings showed that there is a need for professionals in the lightingrelated construction sector, but the training programs that are currently being offered do not meet those needs, according to ECOSLIGHT surveys (quantitative and qualitative) on the identification of Emerging Roles and Needs in the Lighting-related Construction Sector. These issues call for (a) the development of additional experts to work in the lighting sector and (b) the implementation of human capital development activities (mainly training programs). In terms of the professionals hired, many of them have degrees (such as architects, engineers, etc.) and have worked within the sector for a number of years in order to be effective and competitive. As a result, the industry requires the training and hiring of additional individuals with specialized and practical understanding of the subject.

Based on a preliminary market needs research, the ECOSLIGHT's project activities discovered a set of seven emerging job roles profiles in the lighting sector, while it focused its further development efforts in four of them. These are:

- **Smart Lighting Systems Technician.** Is a developing, horizontal profile that can be used indoors as well as outdoors. The emergence of ICT technologies, sensors, and the IoT as a whole has increased the demand for a job profile that can improve lighting tasks with smart lighting. Since the skills and R&D are provided by IT experts, this position may and should be at the technician level rather than above. A Smart Lighting Systems Technician is a hybrid technical expert on IT smart solutions and lighting that should be able to:

  - Analyze the lighting project data.  ○ Determine information system requirements and define project objectives.
  - Apply software development process, development environments, tools and techniques.  ○ Make recommendations for necessary IT system components e.g. hardware, software and networking systems.
  - Design, implement and deploy new smart lighting services.  ○ Operate IT systems and services in relation to lighting.
  - Provide support and training to various types of users.

- **Lighting consultant.** With a successful fusion of creativity and efficiency, he or she develops concepts, designs, and then turns them into practical solutions. It is crucial for these specialists to work closely together with creative teams, architects, and designers. Some of the main missions of a lighting consultant are to:

  - Provide expert advice and solutions for beautiful and functional lighting indoor or outdoor.  o Recommend sustainable lighting options that will create pleasant effects in every space.
  - Convert lighting needs into a clear design with everything required for purchasing and installation.
  - Design light that is functional, dynamic and enhances living spaces.  o Work in close collaboration with customers.

- **Lighting Systems Assistant Engineer.** In order to support the work of a Lighting Systems Engineer, he or she develops, enhances, and implements integrated systems of people, money, knowledge, information, and equipment that are applied to lighting systems and its components. Moreover, is concerned with the optimization of complex processes, systems, or organizations. The main tasks that a Lighting Systems Assistant Engineer is dealing are:

  - Developing and testing lighting components and modules for any kind of lighting.  o Supporting the Development of functional requirements and specifications.  o Supporting the preparation of prototypes of the new product concepts.
  - Preparing reports with test summary analyses.
  - Supporting the implementation of projects to release to production new/changed products, components and processes.
  - Keeping abreast of technical developments in own field through literature, technical contacts, and industry competition analyses.
  - Working closely with support functions and the Lighting Systems Engineer.
  - Working within a matrix organization whilst delivering towards project-based goals set by the program management team.

- **Landscape and Street Lighting Technician.** It is their responsibility to set up, install, rig, wire, operate, and maintain the lighting systems used in theatres, venues, music halls, broadcasting studios, indoor and outdoor live events, streets, etc. He or she puts the lighting design into practice in accordance with the plan and directions of the lighting designer and creates the proper visual effects for a show, event, or other form of televised production. His or her job is physically demanding since installing lighting equipment frequently necessitates heavy lifting and working at heights, which call for physical mobility, balance, strength, and agility. Key tasks and responsibilities of the Landscape and Street Lighting Technician includes the following:

  - Interpreting a lighting designer's plan.  o Installing, wiring, rigging, focusing and operating necessary lighting equipment.  o Programming lighting control consoles and auxiliary equipment before the show/event.  o Choose and combine colours to achieve the desired effect.
  - Provide and distribute power around the set and support areas.
  - Operating manual and computer-controlled lighting systems and controls during a show/event.

- Performing routine maintenance functions such as replacing damaged light fixtures, luminaire drivers, color filters, so as to ensure the safe operation of lighting equipment and prevent technical problems.
- Maintenance and proper utilization of electrical tools and equipment.
- Operating within current health and safety regulations especially when working at heights and installing equipment.
- Uninstalling all equipment at the end of the broadcast or production and ensure its safe transport and/or storage.
- Attending production meetings to establish lighting requirements for a production.
- Conferring with the lighting designer or the director of photography and other staff so as to integrate their creative vision into the lighting design as well as with other departments, such as sound and camera, the floor manager and producer etc.
- Coordinating the equipment and the technical crew and train other crew members as required.
- Conducting risk assessments and ensure health and safety with regards to lighting.
- Providing advice on the lighting budget and on the purchase of equipment.
- Keeping abreast of the advances in technologies and techniques in the industry.

## 4. The MOOC

Based on these outcomes, specific VET curricula were designed for each one of the four new job profiles identified. The design of the curricula was based on the e-CF 3.0 advanced digital skills (European Framework for e-Competence), DigComp 2.1 skills (Digital Competence Framework for Citizens), entrepreneurship skills (EntreComp compliant), life skills (LifeComp compliant), Green and Lighting-related. Through the development of the customized Job Role Profiles and the creation of the corresponding VET curricula, the ECOSLIGHT fills the demands outlined previously. The distribution of academic knowledge - via a MOOC and a specialization course that combines online and in-person training - and work-based learning both included in these modular curricula.

Four (4) new VET (Vocational education and training) curricula (EQF level 5) for lighting professionals were created under the ECOSLIGHT project, incorporating blended learning (online, face-to-face, and work-based learning), and were made available to the lighting professionals throughout the project's lifespan. The project developed modular vocational training curricula as well as open educational resources for each of the new job role profiles. Through the adoption of the e-Competence Framework, DigComp, EntreComp, LifEComp, Green Skills, and Lighting skills, the project has developed a comprehensive skillset for lighting professionals.

A MOOC-based common training approach that fulfills the demands of all job roles while employing the same learning resources and activities conducts the initial training session for all four job positions simultaneously online before learners are assigned to or choose them. The selection was made because (a) the specific competencies are shared by all four job role profiles and (b) it is thought of as the first stage of the two phases. An understanding of the biological, optical, energy, emotional, and psychological aspects of lighting should be shared by all of the participants. Although each of these difficulties has been brought to various professionals in the lighting sector, a combination of all of them is required for an integrated result.

A "horizontal" MOOC with an 80-hour learning equivalent has been planned for the first phase of the VET methodology. All participants in this training received instruction in 22 skills over the course of 8 weeks. The following 22 competencies were included:

Table 1: MOOC competences.

| Week | Competence | Type/Framework | Hours |
|------|-----------|----------------|-------|
| 1 | Indoor Lighting for Buildings and Artificial Lighting | Lighting | 4 |
| 1 | Understand and promote the value of sustainable lighting | Green | 5 |
| 2 | Evaluating data, information and digital content | DigComp | 3 |
| 2 | Understand the sustainable assessment of lighting systems and solutions: purposes, methodologies, standards | Green | 4 |
| 2 | Spotting opportunities | EntreComp | 3 |
| 3 | Light for Outdoor installations | Lighting | 4 |
| 3 | Collaborating through digital technologies | DigComp | 3 |
| 3 | Growth mindset | LifeComp | 3 |
| 4 | Lighting system and components technologies including smart Lighting (indoor and outdoor) | Lighting | 5 |
| 4 | Understand the new sustainable lighting techniques applied to sustainable lighting | Green | 4 |
| 5 | Protecting personal data and privacy | DigComp | 3 |
| 5 | Understand the selection criteria of lighting services / systems and products in terms of sustainability | Green | 4 |
| 5 | Creativity | EntreComp | 3 |
| 6 | Light influence on human health, well-being and working performance (Lighting Ergonomics) | Lighting | 4 |
| 6 | Vision | EntreComp | 3 |
| 6 | Valuing ideas | EntreComp | 3 |
| 7 | Understand the circular economy approach to lighting sector | Green | 5 |
| 7 | Critical thinking | LifeComp | 3 |
| 7 | Taking the initiative | EntreComp | 3 |
| 8 | Energy Efficiency and Lighting performance | Lighting | 5 |
| 8 | Planning and management | EntreComp | 3 |
| 8 | Coping with uncertainty, ambiguity and risk | EntreComp | 3 |

| | Total hours: | 80 |
|---|---|---|

Each lighting competence had a learning equivalent of 4-5 hours during the MOOC, each basic digital competence (DigComp) had a learning equivalent of 3 hours, each green competence had a learning equivalent of 4-5 hours, and each entrepreneurial (EntreComp) and life competence (LifeComp) had a learning equivalent of about 3 hours.

## 5. Specialization courses

In the second phase, learners got engaged in both online and conventional face-to-face learning sessions as part of a blended learning strategy. They also participated in an engaging and productive work-based learning project.

Each unique job role profile received its own section in the specialization course's second phase of online learning.

Table 2: Specialization course competences.

| Competence | Type / Framework | Smart Lighting Systems Technician | Lighting Consultant | Assistant Lighting Systems Engineer | Landscape and Street Lighting Technician |
|---|---|---|---|---|---|
| Lighting Design and solving technical problems | Lighting | 7 | 6 | 7 | 7 |
| Lighting policy, regulation, energy labelling | Lighting | 6 | 6 | 6 | 6 |
| Economic models related to lighting | Lighting | 7 | 6 | 6 | 6 |
| Environmental impact of lighting | Lighting | 7 | 7 | 7 | 7 |
| Integrating and re-elaborating digital content | DigComp | 5 | 4 | 4 | 4 |
| Solving technical problems | DigComp | 5 | 5 | 5 | 5 |
| Identifying needs and technological responses | DigComp | 5 | 4 | 4 | 5 |
| Product/service planning | e-CF | 7 | 6 | 6 | 6 |
| Application design | e-CF | 7 | 6 | 6 | 6 |
| Innovating | e-CF | 7 | 6 | 6 | 6 |
| Application development | e-CF | 7 | 7 | 7 | 7 |
| Solution deployment | e-CF | 7 | 6 | 6 | 6 |
| User support | e-CF | 7 | 6 | 6 | 6 |
| Education and training provision | e-CF | 7 | 6 | 6 | 6 |
| Risk management | e-CF | 7 | 6 | 6 | 6 |

| Understand the types and principles of the basic Environmental and Energy Labelling schemes and national / international | Green | 7 | 6 | 6 | 6 |
|---|---|---|---|---|---|
| **Competence** | **Type / Framework** | **Smart Lighting Systems Technician** | **Lighting Consultant** | **Assistant Lighting Systems Engineer** | **Landscape and Street Lighting Technician** |
| policies | | | | | |
| Understand sustainable building certification systems in the lighting sector | Green | 7 | 6 | 6 | 6 |
| Understand the use of Environmental and Energy Labelling | Green | 7 | 6 | 6 | 6 |
| Understand the Life Cycle Costing (LCC) process, apply the LCC to build environment decision-making to lighting cases | Green | 7 | 6 | 6 | 6 |
| Understand the new sustainable / green trends in lighting and how to integrate the environmental / sustainability criteria in the lighting design process | Green | 7 | 6 | 7 | 7 |
| Ethical and sustainable thinking | EntreComp | 5 | 5 | 5 | 5 |
| Financial and economic literacy | EntreComp | 5 | 4 | 4 | 4 |
| Working with others | EntreComp | 5 | 5 | 5 | 5 |
| Learning through experience | EntreComp | 5 | 5 | 5 | 5 |
| Flexibility | LifeComp | 5 | 4 | 4 | 4 |
| Empathy | LifeComp | 5 | 4 | 5 | 5 |
| Communication | LifeComp | 5 | 4 | 5 | 5 |
| Collaboration | LifeComp | 5 | 4 | 5 | 5 |
| Managing learning | LifeComp | 5 | 5 | 5 | 5 |
| **Total hours:** | | **178** | **157** | **162** | **163** |

Each lighting competence had a learning equivalent of 6-7 hours during the Specialization course, each basic digital competence (DigComp) had a learning equivalent of 4-5 hours, each green competence had a learning equivalent of 6-7 hours, and each entrepreneurial (EntreComp) and life competence (LifeComp) had a learning equivalent of about 4-5 hours. All competences oriented to the EQF level 5. A practical project tailored to the responsibilities of each different job role profile was included as part of the learning equivalent of each skill during the Specialization course. Based on the needs identified by the ECOSLIGHT quantitative survey and ECOSLIGHT interviews, the learning equivalent per competence varied.

One of the major accomplishments of ECOSLIGHT was the simultaneous application of competencies resulting from DigComp, e-CF, EntreComp, and LifeComp, in conjunction with competencies related to lighting and others emerging from several "green-related" frameworks. According to all these European guidelines and goals, there hasn't been another implementation in the sector to date.

## 6. Micro-credentials

The learning outcomes of short educational programs, such a short course or training, were certified by micro-credentials. They provide a flexible, focused method of assisting individuals in acquiring the competencies, information, and skills essential to their personal and professional growth. The use of Microcredentials is recommended by the EU since 2022 in order to support individuals to acquire, update and improve their knowledge, skills and competences so as to "thrive in an evolving labor market and society, to benefit fully from a socially fair recovery and just transitions to the green and digital economy and to be better equipped to deal with current and future challenges".

The micro-credentials issued under ECOSLIGHT had the form of an online badge (so as to be owned by the learner, being shareable and portable) and included the following information: (a) Title, (b) Description (including learning outcomes), (c) Issuer and date, (d) Transparent and clearly defined criteria used to assess the accomplishment of learning outcomes. The micro-credentials approach implemented supports the development and implementation of flexible learning pathways, followed in practice through the four different ECOSLIGHT VET curricula.

## 7. Conclusions

The project has a lasting impact on continuing education in addition to the immediate benefits. The ECOSLIGHT findings and experiences guide to the development of lighting-related courses at educational institutions and VETs. The project makes sure that next generations of lighting experts are well-equipped to handle the needs of a fast changing world by merging sustainable practices, smart technology, entrepreneurial skills, and human-centered design. Evaluation results indicated that the learners were quite satisfied by the training content (although demanding at some cases), the support they got from the tutors and the compliance of the work-based learning against the preliminary agreements. Apart from that, testimonials indicated that the learners were willing to pay in order to participate in those courses in the future, as they were strongly related with the market needs and their professional requirements.

The initiative assures that sustainable lighting practices will continue for many years to come by developing a solid foundation of knowledge, skills, and values. The message of sustainability is carried by these empowered professionals as they begin their careers. This ripple effect impacts industries outside of the lighting industry, serving as a testament to the spirit of innovation and cooperation in Europe.

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# Quality Assurance in Blended & Online Education

# Online Assessment

# Security in Online Exams: Academic Dishonesty

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## Abstract

In the last 20 years, with the impact of developments in the field of information technology, there has been a trend towards online education all over the world. After the COVID-19 pandemic, the speed and intensity of this trend have increased even more. In this context, determining academic success in open and distance learning environments is critical for learners, instructors, and educational institutions. While online exams offer many advantages such as ease of assessment, reduced cost, time, and instant feedback, they also bring with them the problem of academic dishonesty. This academic dishonesty in online exams leads to significant problems such as distrust of online course certificates, reduced institutional credibility, employers' distrust of graduates' abilities, and wasted time and resources. Especially in online exams, it is of great importance to conduct the exam in a secure environment and to create environments that do not allow cheating. In order to prevent academic dishonesty, create a reliable online exam environment, and obtain reliable and fair exam results, academic dishonesty should be addressed in all aspects and technological methods and practices should be reviewed in creating a secure environment. In this study, academic dishonesty in online exams is discussed based on the literature, and the methods used to create a reliable online exam environment are emphasized.

**Keywords:** Academic dishonesty, fraud, cheat, online exam, security.

## 1. Introduction

The education system has evolved greatly towards online environments in the last 20 years. Recent developments in the field of information technology have led to the proliferation of online education all over the world (Crawford et al., 2020; Martin et al., 2020, Balderas &Caballero-Hernández, 2020; Nguyen et al., 2020, Aljaraideh, 2019). In this context, online exams, which started with the COVID-19 epidemic and gained increasing importance, have many advantages for higher education institutions. Some of these are ease of assessment, instant feedback, test security, secure data storage, rapid results, cost-effectiveness, paper savings, and automatic record keeping for item analysis and learning analytics (Butler-Henderson & Crawford, 2020; Ilgaz, & Afacan-Adanır, 2020). On the other hand, it also brings with it problems such as academic dishonesty or the cheating used instead in the literature (Costley, 2019; Alexandros et al. 2019; Gamage et al., 2020; Ngqondi et al., 2021; Blau & Eshet-Alkalai, 2017). Academic dishonesty in universities offering online courses is a situation that could potentially threaten accreditation. Therefore, all educational institutions should be sensitive to this issue (Roberts and Hai-Jew, 2009)

## 2. Academic dishonesty

Academic dishonesty is one of the biggest challenges to maintaining the security and integrity of online assessments (Garg, & Goel, 2022). In one study, about one third of the faculty members believed that undergraduate students could easily cheat in an online exam (McNabb & Olmstead, 2009). On the other hand, there are study results showing that both faculty members and learners think that it is easier to cheat in online exams (Valizadeh, 2022; Watson & Sottile, 2010; Mastin, Peszka & Lilly, 2009; McNabb & Olmstead, 2009). In another study, 60 per cent of learners admitted to cheating on online exams (Costley, 2019). Gamage et

al.(2020) stated that in online environments, it is very difficult to assess whether learners' work is original or not, and learners cannot be assessed fairly. Consequences of Academic Dishonesty in Online Exams;

- Mistrust regarding online course certificates
- Decreased institutional credibility
- Employers' lack of confidence in graduates' abilities
- Developing "the habit of not learning" by learners
- Wasting time and resources allocated for quality learning process

It produces negative results, such as affecting other research studies by giving incorrect results (Ngqondi et al., 2021; Alexandron et al., 2019; Alexandron et al., 2017; Amigud et al., 2018; Xiong and Suen, 2018). Roberts and Hai-Jew (2009) noted that the perception of academic dishonesty in universities will threaten accreditation by reducing trust in the institution. Today, the continuing possibility of a pandemic increases the need for safe online assessments. Therefore, the solution to the problem is; It includes determining the causes of academic dishonesty and taking preventive measures, and practices and standards that protect online exam data. To prevent academic dishonesty, answers to certain questions must first be sought (Garg and Goel, 2022):

- Why do online learners behave this way?
- How do online learners cheat?
- What are the practices that can be used to protect academic integrity?

### 2.1. Reasons for academic dishonesty behaviour

Academic dishonesty occurs when prevailing circumstances force a person to undertake an option that violates a position of trust (Ngqondi et al., 2021). McGee (2013) explained that committing academic dishonesty may result from internal or external pressures. It is stated that internal pressure arises from the desire to achieve better results and pass a course, fear of failure, procrastination or laziness (Ballentine et al., 2019; McGee, 2013; Paullet et al., 2014). Ballentine et al., (2019) state that students who find a course interesting or useful to them are less likely to cheat. External pressures include pressure from parents, guardians, or teachers (Ballentine et al., 2019; McGee, 2013). On the other hand, the fear of losing money, for example, the fear of losing educational scholarships and the desire to win awards may lead students to academic dishonesty. In addition, the absence of punitive measures or the low sanction power may be reasons that push students to behave academically dishonestly (Ballentine et al., 2019; McGee, 2013).

Peled et al. (2019) investigated the impact of personality traits, motivation, attitudes toward academic dishonesty, and cultural differences on academic dishonesty. For example, one of the factors that researchers investigate the impact of is personal characteristics. The personal characteristics that researchers investigate the impact of are as follows: conscientiousness, emotional stability, agreeableness, extraversion and openness to experience. Researchers have stated that individuals with conscientious personality traits are people who comply with rules and norms. They stated that emotionally stable individuals have a good sense of security and cannot be forced into actions with which they do not always agree. Peled et al. (2019) emphasized that these characteristics can positively or negatively affect the intention to commit academic dishonesty. As a result of the research, it was seen that extroverted learners were more likely to cheat in online exams. On the other hand, it has been stated that learners with the characteristics of conscientiousness, emotional stability,

agreeableness and openness to experience, who study in an environment where academic fraud is not allowed, are less likely to cheat in online exams (Peled et al., 2019). Diego (2017) stated that the reason why students cheat is based on the culture of social acceptance/admiration and 'debt of gratitude'. Valızadeh(2022) stated that online learners cheat due to lack of knowledge, getting high grades, some technical problems, lack of proctoring and exam stress.

## 2.2.    Ways online learners commit academic dishonesty in online exams

Online learners exhibit academic dishonesty in exams in different ways. Valizadeh(2022) stated that in online exams, learners cheat by using online resources such as Google to copy and paste answers, consulting others, or using personal lecture notes or the textbook. On the otherhand; online learners can take advantage of weak identity checks to substitute themselves for exams. They can share information via e-mail, mobile phone or Skype (Amigud et al., 2018; Okada). Feinman (2018) stated that learners use glasses equipped with wireless cameras to transmit questions and answers. On the otherhand, Nader, DeMara, Tatulian, & Chen, (2019) asserted that in some cases, the student is looking at the webcam while someone else is typing on the keyboard.

## 2.3.    Preventing academic dishonesty in online exams

Since online exams involve great risks, effective and multi-factor authentication mechanisms must be used. These include biometrics-based authentications, live remote proctoring, Q&A interrogation, and keystroke dynamics. On the other hand, in addition to technological security configurations, supporting frameworks such as policies and a clear outline of how online exams should be set up are also needed (Ngqondi, at al, 2021, Vegendla,&Sindre, 2019; Beust et al., 2018; Amigud et al. 2018; Okada et al., 2019).

### 2.3.1.    Identity Verification

This is the process of verifying the identity of the test taker, usually by requiring them to provide some personal information such as name, email, ID number, or photo. Some online proctoring services also use biometric verification methods such as facial recognition or fingerprint scanning. Biometrics-focused security is based on multiple biometrics, or multi-factor authentication, in which biometrics play a central role. Online exam security should be based on biometric-based authentication mechanisms (Urosevic, 2019). For example, there is a security model consisting of three modules: authentication, monitoring and classification module (Apampa, Wills and Argles, 2010).  The authentication module is first activated using students' face and fingerprint. After authentication, students are moved to the monitoring module. The monitoring module captures video and location details of the student taking the exam for continuous authentication. Video recording focuses on facial recognition and tracks head movement during the exam. It is essential to have face and voice recognition features that constantly monitor students during the exam (Urosevic, 2019). On the other hand, Traore et al. (2017) argued that most online exam systems verify the identity of students at the time of entry, but not whether they are legitimate students at the time of the exam. Their authentication systems include facial recognition, mouse and keystroke dynamics. Another authentication suggestion is SABBAH. Sabbah (2017) states that an online exam security system should address security elements such as confidentiality, integrity, usability and authenticity. SABBAH uses a multi-modal authentication mechanism consisting of biometrics (facial recognition, fingerprints) and keystroke dynamics. Another project on this subject is TesLA, supported by the European Union (Ngqondi et al.2021). TeSLA has enabled the use of facial recognition, anti-plagiarism software, keystroke dynamics and question-answer challenge in user authentication (Okada et al, 2019).

Another method that confirms student identity is the question-answer challenge technique. In this technique, students are asked a series of questions to prove their identity. These questions can be predetermined or adjusted dynamically using background data (Ngqondi et al.2021). Ullah.Hannan and Barker (2019) used a question-answer technique to reduce impersonation. This technique requires students to record their answers before a question-answer authentication session (Ullah.Hannan and Barker, 2019). However, there are some problems with this technique. Students can always share their questions and answers with their impersonators.

### 2.3.2. Continuous monitoring

Continuous monitoring is the process of monitoring and supervising the examinee's actions and surroundings during the exam. This monitoring can be done in online exams using live remote proctoring, keystroke dynamics, question and answer, biometrics, or a combination of these (Urosevic, 2019; Turani, Alkhateeb, & Alsewari, 2020; Cramp et al., 2019, Traore, et al,2017).

Ngqondi et al. (2021) recommends the use of real-time automatic background audio controls, face recognition, time delay and head posture for continuous monitoring. On the other hand, the exam platform needs to use a browser lockdown that controls which applications students can open during the exam (McGee, 2013; Paulet et al., 2014). The aim here is to reduce the dependency on full-time remote proctors and to reduce costs. Because if a large number of students take the exam at the same time, it may be costly to have a full-time remote proctor during the exam. However, visual recordings by a webcam during the whole exam can be used for facial recognition (Ngqondi et al., 2021). Ngqondi et al., (2021) emphasised that these recordings can also be used to monitor delays and head movements while answering questions, and that the data obtained from background sound checks and webcams should be transferred to an algorithm that can predict cheating in real time. Vegendla & Sindre, (2019) reported that such measures minimise the possibility of exam cheating through the use of prohibited materials, imitation, assistance/collaboration, remote communication and whispering.

### 2.3.3. Academic dishonesty mitigation plan (ADMP)

There are many studies in the literature on academic dishonesty and its prevention. However, each study has only considered a subset of the existing forms of dishonesty and made recommendations. Garg and Goel (2022), recognised this gap and developed an Academic Dishonesty Mitigation Plan. This plan has been created to assist in the decision-making process regarding the reduction of dishonesty in online assessments and to support academics in selecting alternative assessment solutions based on dishonesty parameters and examination requirements.

According to Garg, and Goel (2022), an effective approach to dishonesty should include dishonesty prevention and dishonesty detection. Therefore, the ADMP includes both prevention and detection approach strategies for effective mitigation. Preventive strategies start before the assessment is initiated. Potential threats to assessment integrity are identified and parameters such as probability and impact are assessed by the academic team to create a proactive plan for dishonesty prevention. The researchers created a concept map to identify different types of dishonesty and their related prevention strategies (Figure 1).
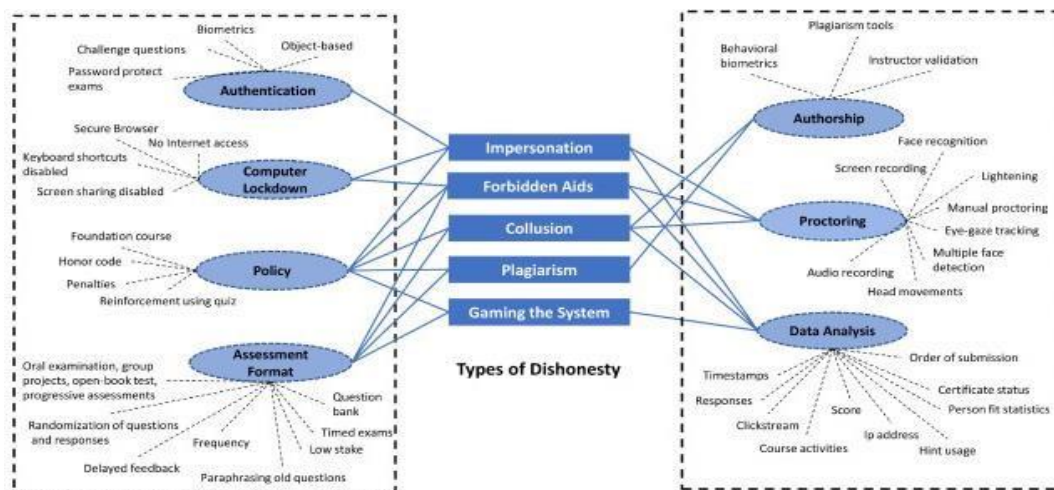
Figure 1: A concept map for academic dishonesty mitigation plan (Garg, &Goel, 2022).

## 3. Conclusions

In this study; academic dishonesty behaviours of learners in online exams, the reasons for this behaviour, the ways of exhibiting this behaviour, and finally what can be done to prevent these behaviours and create an online exam with reliable results in a safe environment are discussed based on the literature.

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# Artificial Intelligence in Teaching and Learning

# Conditions for AI support of Open Educational Resources at HEIs

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**Abstract**

Open Educational Resources (OER) and Artificial Intelligence (AI) have been the subject of research for more than two decades and are being tested by early adopters in the context of technology-enhanced teaching and learning. With ChatGPT's free availability since November 2022, interest in AI has increased, making it necessary to address the support possibilities of AI for the use and creation of OER, further enhancing a learner-centered didactic approach (Ouyang et al., 2022).

Tlili et al. (2021) describe several approaches for using AI to support OER creation, including monitoring learning processes, automatically generating metadata, classifying the quality of OER, analyzing learning traces, and personalizing learning processes. However, these approaches to establishing a smart, AI-supported OER environment also face several challenges (Holmes et al., 2019; Kopp et al., 2022), such as didactic issues, legal frameworks and ethical concerns, lack of competencies of the involved stakeholders, and funding.

Creating AI-enabled smart OER environments will require significant research and teaching efforts. At the institutional level, HEIs must fulfill necessary conditions, such as preparing stakeholders for smart OER environments, valuing instructional designers, expanding interdisciplinary work, establishing legal certainty, and providing financial and human resources.

As a shift from static OER provision to dynamic OER production (Downes, 2019), smart OER environments will support interactivity and community-based creation of OER. However, most teachers need to adapt to this change. Qualification offers are necessary for OER creators to acquire sufficient didactic and technological competencies for the implementation of learner-centered teaching/learning scenarios. HEIs must initiate and continuously accompany the associated cultural change.

Instructional designers have a crucial role in establishing smart OER environments by integrating the didactic component into informational resources. They need a deep understanding of learning science research and educational AI technologies to effectively integrate them in support of learning (Wiley, 2023). HEIs must ensure that their work is valued, and they have sufficient resources.

Developing and operating smart AI-based OER environments require the participation of many different scientific disciplines (including humanities, computer sciences and natural sciences as well as law and social sciences) and collaboration between research and education. HEIs must create necessary conditions for this, such as setting up interdisciplinary working groups and promoting them accordingly.

While the legal basis for the creation and use of OER is largely clear, using AI raises questions about copyrights and exploitation rights of AI-produced content (Lalonde, 2023) and ethical concerns related to bias. HEIs must develop legal interpretations to provide staff with legal certainty when using AI systems to produce educational materials.

Addressing the benefits and challenges of AI in higher education will concern HEIs even more intensively in the future. They must promote and support research activities related to AI and OER, as well as testing AI

applications in teaching/learning situations also by providing necessary financial and human resources. Those HEIs that create favorable conditions as quickly as possible in this context will not only help shape the future of university teaching but also take a leading role in it.

**Keywords:** oer, open educational resources, ai, artificial intelligence, aied, artificial intelligence in education, oep, open educational practices, smart oer environment

## 1. Introduction

Faculty members, pedagogical experts, and IT specialists have been grappling with the possibilities and difficulties presented by Open Educational Resources (OER) for two decades. Over this time, engagement with OER has evolved into a more interdisciplinary pursuit, and OER have gained increased recognition within higher education institutions (HEIs). OER, defined as "learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others" (UNESCO, 2019), are now fairly well established in higher education.

Aligned with the five core principles of open publishing (retain, reuse, revise, remix, and redistribute) as articulated by Wiley (2014), OER offer numerous advantages that can enhance higher education teaching. However, just as the inherent benefits of OER have been acknowledged for some time, so too have the challenges associated with their creation and utilization. Publications, such as those by Yuan et al. (2008), Hodgkinson-Williams (2010), Wiley et al. (2014), Adil et al. (2022) and Kopp et al. (2022), address both the opportunities and challenges associated with OER, providing valuable insights into this complex landscape.

Artificial Intelligence (AI) has been a subject of research in the field of education for over 30 years (Zawacki-Richter et al., 2019), leading to the establishment of the term "Artificial Intelligence in Education (AIED)." As per Holmes et al. (2019), AIED encompasses a wide spectrum of applications, ranging from AI-powered personalized instructional and dialogue systems to AI-supported exploratory learning, the analysis of student writing, intelligent agents in game-based environments, student-support chatbots, and AI-facilitated student/tutor matching that empowers students to take control of their own learning. AIED, therefore, pertains to the use of AI to support and enhance teaching and learning processes. Current drivers for AIED include learning analytics, predicting academic achievement, and recommending systems for students (Guan et al., 2020; Crompton & Burke, 2023).

Nonetheless, the catalyst for the current heightened involvement with AIED stemmed from the availability of ChatGPT in November 2022 (Chukwuere, 2023). The (potential) impact of AI, particularly text-generative AI, on university teaching suddenly became evident to many, revealing both opportunities and challenges. Guidelines regarding the utilization of ChatGPT swiftly surfaced across numerous HEIs, addressing not only the potentials and risks but also the associated enthusiasm and concerns (Rose, 2023; UNESCO, 2023). Simultaneously, many HEIs issued directives on how to manage ChatGPT and similar AI systems in higher education, although differing perspectives and recommendations for action prevail. This underscores that the use of AIED has not yet been thoroughly explored, and comprehensive (empirical) research efforts are still required, especially in light of the rapid pace of technological development.

OER and AI are both topics already identified as emerging technologies and practices in the Horizon Report 2020 (EDUCAUSE, 2020). Within this context, the question arises as to whether and how OER and AIED are interconnected and what potential benefits can be derived from their combined consideration for teaching and learning. To address this question, this paper introduces the concept of a smart OER environment and

outlines its conceivable components. Subsequently, it delves into the institutional conditions essential for establishing such a smart OER environment and simultaneously provides recommendations on how HEIs can harness OER and AIED as a cohesive and intelligent model for success in the future.

## 2. Building a smart OER environment

Drawing upon the premise that technologies and applications such as AI, cloud systems, Open Data, and digital resource management systems on decentralized networks are influencing the handling of OER (Gröblinger et al., 2021), Downes (2019) anticipates that "technology is going to create some affordances for us that will change the shape of open educational resources within ten to twenty years". Naturally, it is challenging to precisely forecast which technologies will exert what kind of impact and when. However, ongoing developments indicate that attitudes towards OER are likely to change, with new technologies assuming a pivotal role in conjunction with pedagogical and organizational strategies.

Regarding the future development of OER, Wiley (2023) distinguishes between informational resources and educational resources, with the latter involving "an intentional application of knowledge about how people learn." Consequently, OER should not merely feature an open license but also exhibit a discernible pedagogical value. Simultaneously, educational resources should be generated and employed through a more collaborative and cooperative approach, engaging both educators and learners. Wiley (2023) defines "next-generation open educational resources" as those no longer emphasizing learning solely from the content but focusing on the utility or application of the resource.

According to Tlili & Burgos (2022), "researchers and educators have shifted their focus from creating and publishing OER to practices that can be implemented using OER for education". These practices, termed Open Educational Practices (OEPs), are characterized by adaptive and engaging learning and teaching experiences. They foster open collaboration among all stakeholders involved in the learning process and incorporate assessment methods that actively involve students. To fully harness the potential of OEPs, they should be integrated into a suitable learning environment that encompasses all the resources and services essential for facilitating and enhancing the learning process. Achieving this necessitates technologies capable of aiding in the creation, storage, and dissemination of learning materials, assessing and suggesting appropriate learning resources, analyzing and possibly predicting individual learning progress, and automatically evaluating learning performance using relevant data (Ouyang et al., 2022). In this context, it becomes evident that AIED can shed light on OEPs.

The concept presented here introduces a smart OER environment that seamlessly integrates OEPs with the capabilities of AIED. According to Tlili et al. (2021), "current emerging technologies, such as AI and blockchain, can provide new opportunities for placing OER in the epicentre of teaching and learning as regards an open educational approach". Thus, in smart OER environments, various crucial aspects are addressed: Objects within the environment should reference each other for enhanced connectivity; user behavior transparency is essential, allowing insights into how often objects are reused; automatic learning paths are made available based on user behavior; measures are implemented to prevent intentional fraud, such as unauthorized edits to the original authorship when reusing materials. These considerations collectively contribute to advancing OER within the educational landscape.

The smart OER environment is deemed "smart" because it enhances the utilization of OER with AI technologies, thus aiding educators and learners in optimizing teaching and learning processes. Enhanced efficiency in this context pertains to tasks that can be executed more swiftly and effectively by AIED than by human

counterparts. However, it's important to note that improving efficiency does not imply that AIED dictates didactic concepts and methods; rather, it assists teachers and learners in their application.

In this paper, the smart OER environment is based on a holistic approach, which is why it combines multiple elements. On one hand, it integrates innovative pedagogical concepts for creating OER. On the other hand, it requires technical infrastructures to augment the impact of OER on teaching and learning processes. Both the pedagogical and technical approaches are facilitated, supported, and enhanced by AIED. Furthermore, when utilizing OER and AIED, it is imperative to account for cross-cutting issues.

Collectively, these elements constitute the foundational framework of a smart OER environment, hence they may also be referred to as the building blocks. However, there is no single definitive smart OER environment. The sequencing of the building blocks, their prominence, and the extent of their interplay depend on the specific objectives pursued by HEIs, which can vary widely for each institution. For instance, different components take precedence when creating OER compared to evaluating OER quality or enhancing the discoverability of OER. Consequently, the precise configuration of a smart OER environment hinges on the unique requirements and preferences of each HEI, with decisions made individually in alignment with the needs of faculty and learners. As such, the building blocks outlined in the following subchapters do not signify a rigid or recommended sequence for their implementation.

## 2.1 Creating OER

As previously mentioned, the future will witness a transformation in the creation and utilization of OER as these two processes converge. Educators and learners collaborate in the production of OER, engaging in activities such as creating new resources, adapting existing ones, or blending different resources. In doing so, they assume dual roles as creators and disseminators of learning content (Otto & Kerres, 2023). This transformation leads to a shift in OER, transitioning them from static resources to interactive ones (Downes, 2019).

The creation of OER can be quite resource intensive. AIED can support this process by generating text, images, and even videos for original educational content. Large Language Models (LLM) like ChatGPT can prove particularly valuable in this context. They have the potential to significantly reshape the economics of OER creation in terms of time, finances, and human resources (Wiley, 2023). Instructional designers play a pivotal role as prompt engineers when leveraging generative AI. In the use of such AI systems, they articulate requirements in the form of prompts, which the AI subsequently executes (Arvidsson & Axell, 2023). The quality of the outcome largely hinges on the quality of the prompt itself. Thus, the quality of OER generated through generative AI is contingent, not least, on the expertise and experience of those crafting the prompts.

Single OER like graphics, exercise sheets, or videos have the potential to be amalgamated into larger entities such as textbooks or Massive Open Online Courses (MOOCs). AIED serves several purposes in this context. Firstly, it aids in the selection of suitable OER by employing AI algorithms capable of scouring a diverse array of sources for relevant learning materials. Secondly, AI-powered adaptive learning tailors educational content to the unique needs of each learner, thereby ensuring that OER becomes more engaging and effective for a broader spectrum of students. Thirdly, it can facilitate the versioning of OER, showcasing its evolution over time. Consequently, AIED can prove instrumental in curating courses, utilizing search algorithms that collaborate with repositories and recommendation systems designed specifically for this purpose (see chapters 2.2 and 2.3).

AIED can further enhance OER by introducing additional functionalities. These enhancements may serve to expand the reach of OER to new target audiences or to enhance their accessibility. For instance, AI-powered translation tools can swiftly translate OER content into multiple languages, making it accessible to a global audience. AI-driven speech recognition can automatically add subtitles to videos, creating an extra communication channel for learners with hearing impairments. Additionally, AI can improve OER accessibility by automatically generating alternative text descriptions for images, providing closed captioning for videos, and converting text into speech for visually impaired learners.

## 2.2 Sharing OER

"Effective sharing, it turns out, can be hard work " (Kimmons & Irvine, 2023). For over a decade, it has been the state of the art to manage OER and, to some extent, OEP in repositories specifically designed to meet OER requirements (Camilleri et al., 2014). A fundamental rationale for employing repositories lies in their capacity to associate metadata with an object, enhancing its description. It is crucial that this metadata is both ample and well-structured, following established standards. For instance, the Austrian classification of scientific branches (ÖFOS) serves as an illustrative example (Statistik Austria, 2023). This significantly broadens the possibilities of rediscovering and reusing objects at a later time. In the absence of standardized metadata, facilitating exchange between different repositories becomes substantially more complex, ultimately leading to a decrease in discoverability.

Based on practical experience, it is important to acknowledge that OER producers often perceive the collection of such metadata as a significant additional effort, sometimes resulting in the omission of potential OER altogether. To address this dilemma, efforts have been underway to explore the extent to which metadata can be generated automatically. However, the available options thus far have been rather limited and heavily reliant on the degree to which the integration of an OER repository into the broader IT landscape has been implemented. For example, with the appropriate interfaces, it might have been feasible to link data from the course catalog with an OER, thereby pre-populating metadata fields in the repository for producers. Nevertheless, these attempts quickly encountered limitations in terms of what can be automated. To alleviate the burden of metadata creation, there are high expectations for automatic tagging by AIED. It is anticipated that AIED will soon become capable of interpreting and classifying content, making it more user-friendly for searching, discovering, and categorizing educational materials.

Having metadata of both sufficient quantity and quality associated with an OER addresses only part of the challenges. Uggeri et al. (2022) explore the question of whether OER repositories face technological issues, with the answer being both "yes" and "no." On the affirmative side, issues encompass retrieval challenges, limited search engine options, resource scarcity within repositories, errors stemming from manual data entry, concerns regarding the relevance of selected OER, and the absence of standardized metadata, which, in turn, hampers interoperability. Additionally, the study notes that isolated repository spaces often adopt competitive rather than collaborative approaches.

On the other hand, the authors counter that there are now ample technologies available to address these challenges. In particular, AIED is recognized as holding significant potential to enhance interoperability between systems and promote collaboration. They conducted a comparison of ten OER repositories to identify success factors for future OER repositories. Alongside recommendations for enhancing local infrastructures, one clear conclusion emerged: for OER to thrive in the future, interconnected OER ecosystems are essential. However, as noted by Tlili et al. (2021), it is important to consider that "[f]or instance, the standardization of

data coming from multiple and different sources (sensors, log data, voice, etc.) remains a challenge, which affects the analysis of these data to extract useful information".

Sharing is arguably the primary focus for those who are opting to develop OER and engage in OEP. As demonstrated earlier, on one hand, OER necessitates substantial additional information, and on the other hand, existing systems require greater integration to ensure discoverability at a later stage. HEIs are likely heading in the right direction by investing in the establishment of hubs and repositories. Nonetheless, even more significant strides may be necessary to make system boundaries imperceptible, ultimately benefiting users. In this context, AIED can potentially be a transformative factor.

### 2.3   Recommending OER

AIED can aid OER creators and platforms by analyzing user interactions and feedback to pinpoint gaps or areas for improvement in existing resources. This data-driven approach informs the development of new, more effective OER materials. From an educational perspective, contextual recommendations appear highly promising. AIED considers the educational context, encompassing subject matter, grade level, and specific learning objectives. When considering AIED's capacity to monitor a learner's behavior, additional possibilities for recommendation involve collaboration and peer learning. AIED can potentially identify other learners or peers with similar learning interests and facilitate connections among them, fostering collaboration and knowledge exchange within learning communities.

Otto & Kerres (2023) describe that when search results within a local OER repository are unsatisfactory, globally connected open repositories offer the possibility for more comprehensive research. However, they also note that many educators often resort to a basic Google search to find suitable OER, a practice that can be problematic and result in an overwhelming number of potential matches. Molins-Ruano et al. (2019) delve into the critical features of recommendation systems and emphasizes that a crucial aspect of any recommendation system is understanding and meeting the expectations of its users. Certainly, AIED presents the potential for substantial changes in addressing these challenges. AI-generated recommendations can apply to a wide range of areas and processes within the smart OER environment.

It can be anticipated that recommendation systems based on gathered user feedback will soon become established - similar to what we already observe in sales: "If you found this object helpful, you might also like the following." This functionality bears a connection to recommendations for personalized learning paths. AIED can analyze an individual learner's history, preferences, and performance to propose OER content that aligns with their unique requirements and learning style. For instance, if a student is encountering difficulties with a specific math concept, AIED can recommend pertinent OER materials, such as interactive tutorials or practice exercises, to aid in mastering that concept. However, merely suggesting similar OER remains a rather narrow focus. AI-powered adaptive learning platforms, integrated into smart OER environments, could continually assess a learner's progress and adapt the recommended OER content accordingly. As a learner advances, AIED can suggest more advanced resources or provide additional support in areas that require improvement.

Thus, AI can offer highly personalized, context-aware recommendations that enhance the educational experience and facilitate learning processes. Nevertheless (and how shown in chapter 2.5), AI will also play a significant role in promoting transparency while potentially increasing interference in our private lives. Higher Education Institutions (HEIs) must engage in thoughtful and thorough discussions concerning data protection within this context, ensuring that potential benefits are not undermined by personal risks.

## 2.4    Establishing OER quality

Considering Mayrberger et al.'s OER quality model (cited by Zawacki-Richter et al. (2023)), it becomes evident that OER quality is more of a multifaceted issue than a distinct, well-defined building block within a smart OER environment. Various parameters can be employed to gauge the quality of OER. The pedagogical dimension encompasses content creation and instructional design within an OER. Chapter 2.1 delves into how AIED can contribute to content creation. AIED can elevate the quality of produced OER by suggesting enhancements in writing style, organization, and clarity, or by identifying errors and inconsistencies in OER content. Additionally, AI-based plagiarism detection tools can play a role in preserving the integrity of OER by identifying and preventing the use of copyrighted materials without appropriate attribution.

AIED also holds substantial potential to transform and, consequently, improve instructional design (Gibson, 2023). For instance, algorithms facilitate individualized, personalized, and adaptive learning experiences. They support learning analytics methods capable of analyzing learning behaviors and forecasting learning outcomes. Moreover, they aid in the development and administration of self-assessments and examinations. It is worth noting, though, that instructional design plays a pivotal role in the planning and execution of all teaching and learning scenarios, regardless of whether OER is employed in the context or not.

The technical aspect of OER quality encompasses accessibility and usability. Accessibility involves parameters like licensing, reliability, compatibility, and technical reusability. Usability factors encompass a clear structure, user-friendly design, and interactive and collaborative capabilities. Utilizing a suitable technical infrastructure alongside AIED, it becomes feasible, for instance, to analyze user feedback and thus draw conclusions about the quality of individual OER (Tlili et al., 2021). Essential prerequisites for this include OER repositories specifically tailored for this purpose and recommendation systems as detailed in chapters 2.2 and 2.3. In summary, AIED plays a crucial role in enhancing OER quality by providing personalized learning experiences, improving content, ensuring accuracy, and offering data-driven insights for continuous improvement.

## 2.5    Addressing legal and ethical issues

Although many specific questions have not yet been adequately addressed, the Creative Commons licensing model (Creative Commons, 2023) does offer a relatively high degree of legal certainty when it comes to the use of (CC-licensed) OER. However, this certainty primarily pertains to the conditions specified in the licenses, particularly copyright and associated exploitation rights. For example, CC licenses do not determine whether or how OER can serve as training data for generative AI systems. In this regard, labeling with the assistance of the license becomes significant, given the open questions surrounding the protection of copyrights for works used as training data.

Simultaneously, it remains unclear whether AI-generated objects can be licensed under Creative Commons and published as OER. Wiley (2023) cites previous decisions by the US Copyright Office and concludes that "the outputs of generative AI programs will continue to pass immediately into the public domain". However, referencing the North American legal system, Lalonde (2023) takes a more cautious stance, noting that "ho owns the copyright when a work is created by AI is still a gray area, both legally and ethically". Lalonde also raises ethical concerns regarding authorship, such as whether creators of educational materials who invest significant effort as prompt engineers should be credited as authors.

Legal considerations are contingent upon the specific national and international jurisdictions in question. For instance, the handling of personal data for learning analytics purposes is subject to different regulations in the USA or China compared to the member states of the European Union, where civil rights are particularly safeguarded through GDPR compliance and the currently discussed AI Act (European Parliament, 2023). While

data protection undeniably holds significant importance and is highly valued, it can also pose constraints for HEIs when implementing AIED. Otto & Kerres (2023), for instance, observe that data protection and data access rights often hold paramount importance but can simultaneously impede free access to materials and metadata.

In addition to legal compliance, there is a growing need for regulations governing the ethical use of AI, particularly to address concerns related to biases in AI algorithms and the lack of transparency regarding AI decision-making processes (Ouyang et al., 2022). Using the text-generating AI system ChatGPT as an example, Zhou et al. (2023) identify bias, privacy and security, transparency, abuse, and authorship as pivotal ethical concerns. In their set of seven ethical principles, Nguyen et al. (2023) propose ethical guidelines for AIED, which HEIs can subsequently use as a foundation for developing guidelines or policies. Practical guidance for educators has been published by the European Commission, Directorate-General for Education, Youth, Sport and Culture (2022) in the form of ethical guidelines on the utilization of AI and data in teaching and learning. The in-depth discussion of legal principles and ethical guidelines underscores their essential role as foundational elements in the development of a smart OER environment.

## 3. Institutional conditions for establishing a smart OER environment

The extent to which a HEI can establish a smart OER environment, the timeline for implementation, and the necessary resources depend on specific objectives, capabilities, and circumstances. Nevertheless, creating such an environment invariably involves an organizational development process. To ensure the success of this process, it is essential, on the one hand, to foster an innovation-friendly and collaborative environment (Burke, 2022). On the other hand, it requires persuasion, motivational factors, and incentive systems to effectively engage especially those stakeholders who may be critical of the change process. Additionally, it is crucial to set realistic goals when developing a smart OER environment, transparently communicate these goals to all stakeholders, and openly address potential challenges and obstacles.

The actions that HEIs can undertake to facilitate the development and establishment of a smart OER environment are as varied as the components comprising the smart OER environment itself. The approach taken by HEIs in setting up a smart OER environment may vary based on their perceived urgency and the degree to which individual prerequisites have already been satisfied. HEIs can choose to address multiple measures simultaneously or implement them sequentially. It is important to note that the order in which these measures are presented in the subsections does not imply a specific recommended implementation sequence. Nevertheless, it is advisable to conduct a thorough and transparent assessment of existing capabilities, obstacles, expectations, and available resources before embarking on the selection and implementation of specific measures.

### 3.1 Anchoring OER

While this recommendation for establishing a smart OER environment may appear self-evident, its implementation is not without complexity. The utilization of OER remains limited to a small number of individuals at many HEIs, often still characterized as early adopters. Consequently, the challenge lies in transforming OER into a mainstream movement that involves a broader range of stakeholders and universally persuades them of the merits of Open Education (Farrell et al., 2021).

This is built upon an OER strategy outlined in a dedicated OER policy. In its most basic form, such a policy entails the HEI's commitment to OER (and ideally, OEP), offers recommendations for OER usage, and catalogs the institution's own contributions to OER. The policy should be viewed as a "living document" that undergoes continuous enhancements and updates to align with ongoing pedagogical and technical advancements.

UNESCO has released an extensive guide for crafting an OER policy (Miao, et al., 2019), which can serve as a valuable foundation for HEIs.

However, merely raising awareness of the benefits of OER and garnering stakeholder buy-in is insufficient for firmly establishing OER. It is imperative to acknowledge the challenges tied to OER and address resistance earnestly. To foster a positive reception, HEIs must establish suitable support and advisory services, ensuring that educators, who are the primary users, view OER as a means to enhance their teaching endeavors rather than an additional burden. Moreover, incentivizing actions like public recognition for educators who effectively integrate OER into their teaching or the regular dissemination of reports spotlighting successful OER initiatives within the HEI can be highly beneficial.

## 3.2 Developing an AIED strategy

As for OER, an institution-wide strategy is needed for AIED, whereby a similar starting situation can be found here: AIED remains underutilized in most HEIs, and its didactic application is even less explored than that of OER. Furthermore, generative AI technologies like ChatGPT and AI-assisted data analysis, such as learning analytics, still raise significant uncertainties. Therefore, HEIs must initially make informed decisions about which AIED technologies they intend to implement. Subsequently, they should introduce these technologies with utmost transparency and engage all stakeholders in the process.

As extracted from the preceding chapter and outlined by Chen et al. (2020), AIED represents a valuable asset in the realms of both teaching and learning, as well as in educational administration. In their systematic research review, Zawacki-Richter et al. (2019) identify four distinct domains of AI applications: a) adaptive systems and personalization, b) assessment and evaluation, c) profiling and prediction, and d) intelligent tutoring systems. These domains can serve as an initial focal point for Higher Education Institutions (HEIs) embarking on the development of their AIED strategy. Beyond the critical consideration of the selection of AIED applications, taking into account the existing IT infrastructure, it is also prudent to engage in strategic contemplation regarding how to address resistance and what incentive systems can be offered to AIED users. Particular emphasis should be directed toward the target group of students, given that many AIED applications can operate with optimal efficiency only when processing the personal data of students.

## 3.3 Qualifying and valuing staff

When ChatGPT made its debut in HEIs during the early months of 2023, the text-generating chatbot was frequently perceived as a threat rather than an opportunity in the realm of academic teaching. Moreover, misconceptions swiftly arose surrounding the tool's capabilities, often inflated beyond reality. This was primarily attributed to the rapid proliferation of ChatGPT, coupled with a general lack of experience in handling AIED. OER have already found a foothold in HEIs, yet there remains significant uncertainty regarding their utilization, along with a prevalent lack of knowledge regarding the creation of OER.

Uncertainties and a lack of expertise do not naturally foster enthusiasm for OER and AIED, nor do they encourage the exploration and use of related applications. To kindle motivation in this context, it is imperative to provide additional training and advisory services for all target groups, i.e., educators, instructional designers, IT developers, and, of course, students. Providing training programs, workshops, and professional development opportunities can empower everyone involved to acquire the essential skills needed to effectively harness the potential of AIED and OER. To foster a smart OER environment, it is vital that these trainings cover not only didactic and technical aspects but also promote a positive attitude toward openness and knowledge sharing in general. Encouraging educators to openly share their methodologies, algorithms, and tools based on AIED and OER will nurture a culture of collaboration, innovation, and ongoing improvement.

The creation of a smart OER environment involves numerous participants in various roles. It is essential that all individuals engaged in this endeavor not only have access to appropriate training opportunities but also receive institutional recognition. Working with OER and AIED often entails additional efforts and frequently demands above-average motivation. Recognition for those involved can manifest in two significant ways. Firstly, through exceptional offers of support, and secondly, by showcasing their accomplishments throughout the institution. Furthermore, it is crucial to ensure that the contributions of all participants, whether they are educators, IT developers, or instructional staff, are equally valued. A robust smart OER environment can only be established through the collaborative efforts of all participants on an equitable basis.

### 3.4    Encouraging interdisciplinary collaboration

Interdisciplinary collaboration is a fundamental key to the planning, building, and operation of a smart OER environment. This collaboration should occur at all necessary levels, following a holistic approach. At one level, as previously described, it involves the cooperation between educators, students, IT developers, and instructional staff. Another level involves the scholarly exploration of OER and AIED. Here, interdisciplinary collaboration is also crucial, as it addresses not only pedagogical aspects but also technical, legal, and organizational development matters. Additionally, collaboration with other HEIs plays a pivotal role, facilitating cross-institutional knowledge exchange and sharing of experiences. Lastly, partnerships with external entities, such as technology companies, can be immensely beneficial. Such partnerships provide access to cutting-edge technologies, real-world experiences, mentorship, and potential funding opportunities.

Additionally, interdisciplinary collaboration hinges on cultivating the appropriate mindset among all stakeholders - a recognition that research in diverse scientific domains and teaching are equally vital for the effective establishment of a smart OER environment, alongside technical advancements, support services, subject expertise, and pedagogical insights. It falls upon Higher Education Institutions (HEIs) to nurture an environment conducive to such collaboration. HEIs can facilitate this by initiating interdisciplinary projects, creating collaborative spaces and exchange centers, or supporting the formation of research groups. These measures ensure that, for the advancement of smart OER environments, professionals from various backgrounds can convene to exchange knowledge, practical experience, and resources.

### 3.5    Providing resources and expanding infrastructure

Like any institution-wide project, the establishment of a smart OER environment necessitates the allocation of appropriate resources. First, this concerns human resources. One approach involves reallocating individuals with the requisite expertise from other duties, although care must be exercised to ensure that other essential processes and work are not unduly compromised as a result. Alternatively, depending on the budgetary constraints, new personnel may be recruited. In light of the existing shortage of skilled workers, particularly in EU member states, it is crucial to emphasize that HEIs should consider refraining from outdated salary classifications. This adjustment is essential to remain competitive with the private sector when seeking to hire IT specialists, for instance.

Furthermore, financial resources are imperative for the development of a smart OER environment. HEIs should, therefore, offer funding opportunities and supportive mechanisms, such as research grants, innovation funds, or internal initiatives tailored explicitly toward AIED technologies and OER creation. It is worth emphasizing that this funding should be structured with a long-term perspective, ensuring the sustained operation and ongoing enhancement of the smart OER environment even after its initial establishment.

Significant emphasis is placed on expanding infrastructure, particularly in the realm of tools and applications for AIED. In order to harness these resources efficiently, it is imperative to establish robust data management

practices encompassing data collection, storage, analysis, and sharing. This necessitates the availability of robust servers, storage facilities, scalable computing resources, and AI-assisted software applications. In making choices about these components, HEIs must make decisions regarding whether to rely on in-house developments or opt for proprietary systems. Regardless of the path chosen, it is critical to ensure that the new infrastructure is scalable, secure, and interoperable with existing systems. Moreover, systems intended for use by non-technical personnel must prioritize user-friendliness. In addition, cybersecurity measures and the assurance of compliance with data privacy regulations and ethical guidelines must not be overlooked.

### 3.6    Adhering to legal and ethical frameworks

Legal and ethical challenges associated with the implementation of AIED and OER have been thoroughly explored in Chapter 2.5. Accordingly, it is imperative to emphasize the significance of HEIs collaborating with all stakeholders to formulate and offer suitable legal frameworks and ethical guidelines. This endeavor encompasses the resolution of concerns such as data privacy, adherence to copyright regulations, safeguarding intellectual property rights, bias, and the practice of responsible AI. The establishment of unambiguous policies and guidelines will ensure the transparent, ethical, and responsible utilization of a smart OER environment.

### 3.7    Assessing measures

HEIs frequently embark on strategic projects and initiate essential actions, but often fall short in allocating adequate resources for the long-term sustainability of project outcomes. Moreover, they often fail to conduct thorough evaluations of the implemented measures. To effectively establish a smart OER environment, it is imperative to establish monitoring and evaluation processes to assess the impact of these measures. These processes should encompass not only the broader measures proposed here but also more focused assessments on a smaller scale. Therefore, evaluations should extend to individual aspects, including the impact of specific AIED technologies, OER creation processes, and related pedagogical and technological developments.

Monitoring and evaluation processes should encompass feedback from all stakeholders engaged in the initiative and include the assessment of developmental progress against benchmarks established by the institution and expert assessments. Evaluation should be an ongoing endeavor, commencing at the outset of smart OER environment development and persisting throughout its operational lifespan. This approach is essential for identifying evolving needs, preferences, and challenges and, when necessary, promptly adapting implemented measures or introducing new ones. Additionally, it is advisable to initiate concurrent research efforts to scientifically examine the impact, effectiveness, and best practices. Such research significantly contributes to evidence-based decision-making and the continuous improvement of the smart OER environment.

## 4.  Conclusions

This paper introduces the concept of a smart OER environment with the aim of merging innovative approaches to OER and AIED. It is crucial to emphasize that *the ultimate* smart OER environment remains elusive. Smart OER Environments are not closed systems; they are dynamic, individualized, and, in most cases, a work in progress. Nonetheless, for HEIs, it is imperative to contemplate the potential of such a system and endeavor to implement as many of its components as practicable, recognizing that not all elements can be realized, and the system will continually evolve.

In the context of HEIs embarking on the development of a smart OER environment tailored to their specific requirements, the paper outlines valuable building blocks. However, this list does not aspire to be exhaustive but rather serves as a suggestion to employ elements that align with the HEI's needs. It is important to note

that technologies, particularly in the AIED field, are advancing rapidly, rendering the description of these building blocks a momentary snapshot. Conversely, the recommendations in Chapter 3 are universally applicable. They are founded on the premise that the introduction of a new smart OER environment entails an organizational development process. While the measures discussed here revolve around AIED and OER, they can be broadly applied to any change management endeavor.

The paper underscores the numerous benefits of combining OER and AIED while acknowledging the accompanying challenges. Developing a smart OER environment is a resource-intensive and time-consuming endeavor. Thus, it is prudent to implement this process incrementally, involving all stakeholders at each stage. Involving stakeholders is particularly important since HEIs are committing to the concept of open education, which leverages digital technologies to expand educational access and participation by eliminating barriers and offering inclusive, customizable, and enriching learning experiences to all. This mindset is not yet prevalent in HEIs, necessitating persuasive efforts among various stakeholders.

In conclusion, the establishment of smart OER environments is an ongoing process, and HEIs cannot be deemed unsuccessful in their efforts. In the worst-case scenario, they may only implement select measures, methods, and applications. In the best-case scenario, they integrate all the desired building blocks and measures, continually adapting and expanding their smart OER environment. In either scenario, HEIs equip their educators and learners with forward-thinking tools that foster innovation, collaboration, and the enhancement of teaching and learning practices through the combined utilization of AIED and OER. It is evident, however, that HEIs quick to embrace smart OER environments will not only shape the future but also lead the way.

## 5. Acknowledgement

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# Role of Machine Learning in the improvement of teaching and learning: a best evidence syntheses

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## Abstract

Artificial intelligence (AI) has a greater potential to update all areas of life including teaching and learning in a rapid way. In comparison to other sectors, the role of AI in education is far behind since many educators still need to be motivated to adopt AI in higher education. This study a review of research articles published between 2017 and 2023 which incorporates the use of Machine Learning. A total of 31 research papers were selected for analysis using the PRISMA technique, examining the key prediction methodologies employed in these studies and relevant articles. This presented study encompasses an in-depth evaluation of algorithms like: decision trees, random forest, naïve Bayes, support vector machine, gradient boosted tree, artificial neural network, k-nearest neighbor, and logistic regression. These machine learning algorithms have been examined in terms of their scope and significance within the context of this research, only aimed at predicting student and teacher learning performance, high lightening the strength and weakness. Results shows that the Artificial Neural Network model illustrates that students' previous academic achievement is the most frequently utilized attribute for predicting their academic performance. Once again, the study suggests that the classification and regression approach is extensively employed in academic institutions for the purpose of problem classification.

**Keywords:** Artificial Intelligence, Machine Learning, Academic Performance, Performance assessment, Technology Enhanced learning, student-teacher learning engagement, Higher Education.

## 1. Introduction

Education is an essential component for leading a productive and fulfilling life, as it enhances individuals' personal development and fosters the refinement of valuable skills and qualities. Moreover, education is widely acknowledged as an essential requirement for the development of self-confidence and equipping individuals with the necessary tools. Over the course of time, the field of education has encountered various obstacles and difficulties. Various approaches to teaching and learning have been proposed with the aim of enhancing the overall quality of education [1]. Gaining a comprehensive understanding of the fundamental elements that significantly influence students' academic performance can contribute to enhancing the efficacy of the teaching and learning process. Artificial intelligence (AI) technologies possess significant promise as an alternative, hence fostering a novel educational trend. Despite the significant progress made in the field, there exists an ongoing discourse over the optimal model for machine learning when employed in predicting patterns of student performance [2]. The capacity to forecast student performance presents prospects for enhancing educational results and mitigating instances of student-high ratio dropout [3, 4]. Hence, there has been a growing scholarly interest in the development of metrics aimed at detecting indicators of student retention in recent periods [5].In order to enhance the caliber of education, it is imperative to employ predictive measures to determine the academic performance of all students and provide targeted support to those deemed at danger, and failed to achieve their targets. The forecasting of academic achievement has been conducted using a multitude of criteria, encompassing diverse digital traces that mostly students have left on the internet [6].

For several decades, educational research has been dedicated to comprehending and recognizing the various elements that influence the academic performance of university students especially those are at risk [7,8]. Artificial intelligence (AI) systems possess the capability to gather and evaluate students' attributes, enabling them to autonomously adapt instructional materials and deliver them in a manner that aligns with their individual requirements and aptitudes [9,10]. Assessment plays a major role in the educational process, as it furnishes faculty members with crucial insights about students' comprehension levels. This information enables educators to effectively design and administer lessons, while also offering pertinent comments to facilitate learning [11]. Learning progress is important for students in higher education because one of the criteria for a high-quality university is an excellent record of academic achievement, but predicting student progress has become more complex due to the large amount of data in educational databases [12]. Prioritizing the use of student assessment data and pertinent background knowledge is crucial in guiding instructional decision-making, as well as establishing, implementing, and evaluating instructional policies at various levels. [13]. Assessment serves as an ongoing process of progress and as tangible proof of the acquisition of knowledge and skills. This is widely recognized as crucial element of emphasis within the higher education milieu, as they exert influence on several stakeholders, including students, teachers, administrators, and others. Educators allocate a substantial portion of their time to the evaluation and provision of feedback. However, there is a dearth of advancements in devising assessment strategies, ensuring the dependability of feedback, and analyzing the consequential effects of these practices within the realm of higher education [14]. Assessment plays a crucial part in higher education as it enhances the capacity for grading, fosters motivation, improves performance, and facilitates the advancement of learning [15]. The significance and influence of evaluation on student learning in higher education have been underscored by numerous academics. In recent times, the scope of assessment and feedback has expanded to encompass not just the needs and perspectives of students, but also the domains of curriculum creation, instructors' instructional practices, and administrators' decision-making processes. The process of assessment has a crucial role in enhancing students' learning outcomes and serves as a significant determinant of their future achievements [16]. Assessment along with evaluation play a crucial role in measuring the extent to which knowledge is transmitted to students and in understanding the processes of student learning and teacher instruction [17]. The prediction of academic achievement in higher education offers numerous advantages to educators, learners, policymakers, and educational institutions. The attainment of a predictive capability with a reasonable level of accuracy has the potential to enhance the passing ratio of students and overall results. Additionally, it could prevent future academic failures and enhance student retention rates by offering advanced insights into the necessity for positive interventions. Furthermore, it could aid in identifying teaching practices that are more likely to have a positive influence on student learning. By implementing this approach, teachers would have the capacity to create flexible instructional resources and provide feedback based on student acceptance of knowledge, thereby guiding students' educational progress in the right way. Despite the presence of multiple reviews that mainly concern performance prediction[18], only a limited number of them specifically address the viability of integrating various student attributes and artificial intelligence especially machine learning techniques to enhance the accuracy and precision of overall academic performance predictions, academic accomplishment. Hence, the primary aims of this study are to thoroughly research, quantify, and examine the available literature published from 2017 to 2023 pertaining to Artificial Intelligence especially machine learning techniques, and their applications in predicting student and overall academic performance at large.

## 2. Background / Literature Review

There are appears to be an increasing scholarly interest in predicting teaching and learning outcomes within educational institutions. The result has led scholars to collectively strive towards identifying the potentially

influential factors that affect learner performance and elucidating the reasons behind students' declining performance, which in turn impacts overall academic achievement. The practice of academic advising holds significant importance within the realm of higher education, since it necessitates a comprehensive comprehension of students' talents and the structure of the curriculum in order to effectively attain its desired objectives. [19]. In recent times, there has been a growing trend in the utilization of artificial intelligence methodologies across multiple academic institutions. [20, 21]. The utilization of information technology has undeniably exerted a significant influence on the field of education, manifesting itself in various ways. The objective of examining the scope of Artificial Intelligence in Education is to determine the degree to which different types of AI have influenced or affected various aspects of the educational field and in particular on the domains of school administration and management, students' output, as well as pedagogy and educational attainment [22, 23, 24]. The research is anticipated to demonstrate that artificial intelligence (AI) has enhanced the efficiency and efficacy of administrative duties within the field of education, while also bolstering the overall effectiveness of instructional practices and learning outcomes. This research endeavor seeks to expand the current body of knowledge by exploring various theories and empirical discoveries in this field. In order to benefit academics, professionals, and policymakers, institutions of higher education and the education sector will cultivate the use of evidence-based practices in decision-making and leadership [25]. The topic of management decision quality represents a significant challenge now confronting higher education institutions. The policies, programs, and activities that higher education institutions contemplate are influenced by strategic decisions made by these institutions. Machine learning is a burgeoning field within the realm of artificial intelligence that leverages various algorithms to analyze data and enhance comprehension of the information within a given context [26]. Extensive study has been conducted to explore and establish assessment systems and approaches that can successfully facilitate the process of learning and teaching. However, there is a scarcity of study examining the potential utilization of learning analytics approaches in the assessment process, particularly on the prevalent artificial intelligence and machine learning algorithms employed for enhancing student achievement [27]. The prediction of academic performance among university students is associated with a multitude of advantages. One of the most notable advantages is the enhancement of student success rates. University administrators depend on the timely identification of students who are deemed at-risk, as the academic achievement of a university's student body serves as a significant indicator utilized to assess the institution's effectiveness [28]. Another advantage that can be observed in forecasting the success of students is the decrease in student attrition. Student attrition refers to the decline in the number of students, commonly known as dropouts. The phenomenon of student attrition is indicative of a misallocation of resources [29]. New challenges encountered by subject faculties and students, as well as the impact of evolving government policies and regulations within the educational sector. There is a prevalence of diverse viewpoints and challenges around the use of artificial intelligence within the educational sector [30]. The state of art on the evaluation of the machine learning algorithms in predicting student performance on tests presents some previous works. These papers move from specifically focusing on identifying students who are at a heightened risk of dropping out from the course [31] and in evaluating different machine learning algorithms in predicting the academic success of students in a certain course [32]

Regarding the reviews in the field some proposals are present on the literature with different accents. An important systematic literature review (SLR) was conducted over a span of ten years (2010-2020), utilizing a dataset consisting of 176 publications. The primary objective of this review was to examine the relationship between machine learning and the prediction of student accomplishment, while also identifying the limitations and possible remedies within the current body of research. The findings of the study revealed that a significant majority, specifically 62%, of the research conducted mostly employed categorization methodologies. The analysis additionally revealed that 76.60% of the studies were done utilizing datasets sourced from higher

education, whereas 23.40% of the studies relied on datasets from basic education. The research findings revealed that the most significant factors in predicting academic achievement were students' behaviors, demographics, and social lives. This study emphasizes the existing evidence of the marginalization of data pertaining to educational settings with lower levels of academic attainment [33].In a similar vein, A recent systematic literature analysis was conducted with the objective of identifying algorithms that can be utilized to predict student performance and enhance learning. A comparative analysis was conducted on ten separate algorithms, evaluating their predictive accuracies in relation to student performance. However, it was shown that the selection of optimal algorithms for forecasting student accomplishment posed challenges due to the diverse range of factors utilized by various researchers in the existing body of literature. Furthermore, the authors expressed their perspective on the influence of several socioeconomic elements, namely family finances, parental education level, and the work status of parents or students, on the academic achievement of learners. However, it has been found that these elements are often overlooked in the prediction of student success [34].A total of 56 publications were evaluated in a systematic literature review (SLR) using a set of 10 research quality evaluation questions as a framework. Among these publications, only 34 papers provided information on the features and their significance in predicting student performance. The study focused on categorizing the traits into three main groups: demographic, academic, and behavioral. As stated in the reference [13], the practicality of selecting machine learning models and predicting academic accomplishment in students can be enhanced by standardizing predictions using benchmark datasets. Nevertheless, the research was unable to establish a coherent methodology for determining the most pertinent factors to enhance performance and reduce learner attrition [35].

## 3. Procedures and Criteria for doing a Literature Search.

To ensure uniformity in the evaluation of diverse research pertaining to the specified subject, it is imperative to conduct a comprehensive systematic literature review (SLR) employing an unbiased methodology. In order to conduct a standalone systematic literature review (SLR), the approach proposed by [36], which consists of three distinct stages, namely the review plan, the execution of the review, and the reporting process, was chosen. Additionally, the methodology suggested by [37] was also incorporated. This study introduces a complete and standardized procedure for conducting a systematic literature review through the utilization of two distinct methods. Although the primary focus of this study lies in educational data mining (EDM) research, its level of detail renders it valuable and adaptable to scholars across several social science disciplines. Figure 1 displays the comprehensive flowchart illustrating Okoli's criteria for conducting a systematic literature review.



Figure 1: Flowchart Depicting Okoli's guide for systematic review.

A systematic structured review was undertaken to characterize the most recent seven-year publications of works on success of students in learning using machine learning techniques. Beginning of each review process necessitates careful planning. Thus, it is vital to ascertain and develop a meticulously crafted strategy for the evaluation procedure [36].

Table 1

The criteria for formulating systematic literature questions are as follows: [36].

| Criteria | Detail |
|---|---|
| Population | Institutions of higher education. |
| Intervention | Explores the various methods, algorithms, and approaches utilized in the field of predictions. |
| Outcome | Optimal performance indicators, primary characteristics or elements, and efficacious prediction methodologies or approaches. |
| Context | To examine strategies for enhancing education and achieving optimal performance among students. |

The primary objective was to include a comprehensive range of articles about the research goals throughout the time frame of 2017 to 2023. In addition, rules are established to determine whether the research work should be included or excluded from the analysis.

**3.1.2 Conditions for inclusion**

1. This study examines scholarly articles that focus on the prediction of student-teacher learning enhancement for academic achievement.

2. Investigates the impact of machine learning (ML) techniques, methods used for student and teacher learning enhancement for academic performance.

3. The eligibility criteria for articles are those that have been published throughout the time frame of 2017 to 2023.

4. Research papers written in the English language are exclusively regarded as valid and credible.

5. Submissions and research articles in journals with peer review or conferences.

**3.1.3 Conditions for Exclusion**

1. Research work that does not use machine learning methodologies, algorithms and methods.

2. Research papers involving redundant entries.

3. The titles, abstracts, and content are not related.

4. Papers based on suggested methods or that did not conduct experiments

5. The methodological research guides or handbooks that have a wide scope and do not utilize machine learning was not included in the analysis.

**3.1.2. Research Questions**

According to the reference provided [36], it is essential to consider the population, intervention, outcomes, and context (PIOC) perspectives while formulating research queries. The research queries criteria are shown in Table 1. According to the data shown in Table 1, the primary inquiry in the context of systematic literature review (SLR) would revolve around determining the comprehensive scope of research encompassing student-teacher and education environment attributes, along with the suitable machine learning (ML) techniques for predicting of student-teacher learning outcomes for academic performance enhancement.

The aforementioned specific analyses were formulated in answer to these specific research questions (RQ).

**RQ1.** What are the often-applied characteristics by academics in the prediction of teacher-student learning outcomes for academic performance enhancement?

**RQ2.** What machine learning techniques, methods are commonly employed by researchers for the prediction of learning outcomes for academic performance enhancement?

**RQ3.** Which algorithms or strategies are most effective the prediction of teacher-student learning outcomes for academic performance enhancement?

## 3.2. Conducting the assessment

The primary source of information and the method of research employed in this study will be discussed in this section. The utilization of reliable and carefully crafted sources of information, as well as the formulation of well-constructed search queries, are imperative in order to effectively accomplish the objectives and attain the desired consequences of this research endeavor.

Table 2

Publications are initially sourced from following top ranking databases.

| Identifies | Databases | Date of Access | URL | Count |
|------------|-----------|----------------|-----|-------|
| DBA1 | Scopus | 19/08/2023 | https://www.scopus.com/ | 98 |
| DBA2 | Google Scholar | 19/08/2023 | https://scholar.google.com/ | 45 |
| DBA3 | Science Direct | 19/08/2023 | https://www.sciencedirect.com/ | 24 |
| DBA4 | IEEE explorer | 19/08/2023 | https://ieeexplore.ieee.org/ | 14 |
| DBA5 | Springer Link | 23/08/2023 | https://link.springer.com/ | 08 |
| DBA6 | ERIC | 23/08/2023 | https://eric.ed.gov/ | 08 |
| DBA7 | EBSCO | 23/08/2023 | https://search.ebscohost.com/ | 12 |

A comprehensive and meticulously planned search was conducted in order to address the research specific research queries and questions. During the period from April 11 to August 15, 2023, a series of searches were conducted across seven distinct online databases, namely Scopus, Google Scholar, Science Direct, IEEE Xplorer, Springer Link, ERIC and EBSCO. A subsequent study was carried out from August 15 to 30, 2023, with the aim of identifying any potential publications pertaining to the subject matter that were produced within the same years. For the purpose of to enhance the retrieval of accurate top rated relevant articles, a range of search query formats, such as key phrases, Boolean operators, and wild card operators, were devised, compiled in diverse combinations, and implemented. This was done to assure the inclusion of pertinent articles in the search results. Several details examples are as follows:

*"performance OR assessment OR evaluation" AND "machine AND learning" AND "artificial AND intelligence" AND "education AND student AND higher AND education OR academic"*

Furthermore, author presents in a Table 2 the databases utilized in the study, together with the corresponding specific dates and the total no of count of research papers obtained for the purpose of the review and further details queries related to teacher-student learning outcomes for academic performance enhancement. A detailed systematic search was carried out to compile an extensive assortment of studies for subsequent analysis. The utilization of Rayyan.ai was implemented to effectively manage and supervise citations, eliminate any instances of duplication, and accurately determine the respective dates of publication. The bibliographies provided comprise research that nearly conforms to the required criteria for inclusion. In the initial phase, a total of 242 papers were retrieved from seven databases. Subsequently, 43 duplicate papers were identified and removed. Additionally, 99 papers were excluded based on their titles, while 31 papers were eliminated after evaluating their abstracts. Furthermore, 38 papers were excluded due to their failure to meet the criteria for inclusion and exclusion, as well as quality assessment. A total number of 31 research papers had been picked for inclusion in the study after applying the predetermined criteria for inclusion and exclusion. These papers were then further divided into different groups based on the years in which they were published. Table 3 displays the yearly count of publications. The review has conducted an in-depth analysis of all the publications referenced in the study. Overall, after conducting a duplicate screening process, a total of 43 publications were excluded from the dataset. Based on the proper screening criteria for titles, a total of 99

articles were eliminated also. Additionally, after reviewing the abstracts, 31 publications were omitted. Furthermore, 38 publications were rejected following a thorough detailed examination of the complete text and a comprehensive study of the content and their attributes. A total of 31 papers were included in the analysis.



**Identification of studies via databases and registers**

**Identification**

Recored identified through Scopus Database Searching (n=98)

Additional records identified through other sources like EBSCO=12,ERIC=08,IEEE=14,Science Direct=24,Springer Link=08, Google Scholar = 78

**Screening**

Records after duplicates removed (n =199 )

Records Filtered on the baisis of Title (n =100)

Records excluded (n = 99 )

Records Filtered on the basis of Abstract (n =69)

Records excluded (n = 31 )

**Eligibility**

Full-text articles assessed for eligibility (n =31)

Full text article excluded by not fulfilling inclusion & exclusion and quality assessment criteria (n = 38 )

**Included**

Studies included in Synthesis (n =31)

Figure 2: A modified study screening and selection process adopted from [36,37].
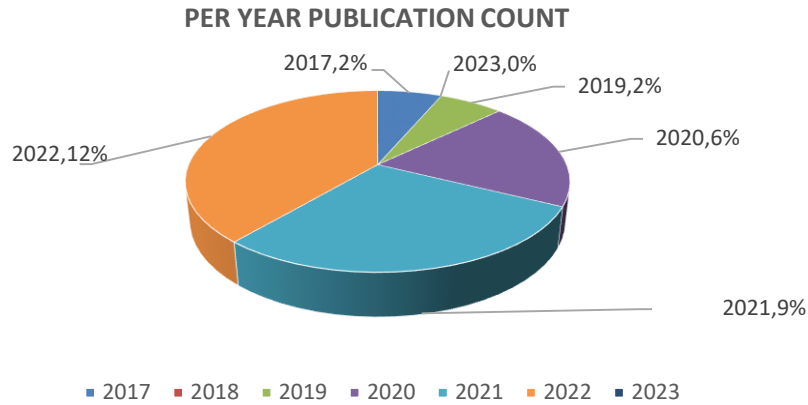
**PER YEAR PUBLICATION COUNT**



Fig 3.3. Analysis of publications on students-teachers learning for academic performance

**DATABASE WISE PUBLICATIONS DISTRIBUTION AFTER SCREENING**
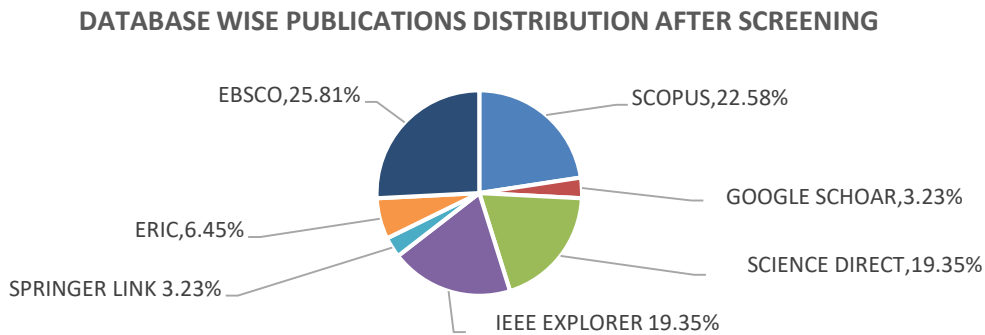


Fig 3.4. Database wise publication distribution after screening.

## 4. Result and Discussion

Table 3: Study's publications were selected based on their year of publication.

| Year of publication | References | Count No. of Papers | % Count |
|---|---|---|---|
| 2017 | [39,40] | 2 | 6.45% |
| 2018 | - | 0 | - |
| 2019 | [42,44] | 2 | 6.45% |
| 2020 | [41,43,45,46,47,48] | 6 | 19.35% |
| 2021 | [49,50,51,52,53,54,55,56,58] | 9 | 29.03% |
| 2022 | [57,59,60,61,62,63,64,65,66,67,68,69] | 12 | 38.31% |
| 2023 | - | 0 | - |

The distribution of the included publications by year is shown in Figure 3. From the figure, it is realized that, after a sharp reduction in published articles from 2018 to 2019 in relation to students' teacher and learning performance of academic prediction, the number of articles increased dramatically from 2020 through to 2021. This shows that numerous academics have recently become interested in using ML techniques to predict enhancement of students-teacher and learning performance of academic prediction. Figure 3 shows that the majority of the included publications were released in 2022 (N = 12, 38.31%).

The assessment of learning outcomes in the reviewed studies for both students and teachers is frequently predicated upon two fundamental factors. This area encompasses the qualities and characteristics of data sources, as well as the methodologies utilized for evaluating data connected to academics in order to detect

patterns, trends and create projections [38]. The interpretation of the results is predicated upon the research objectives stated in the study.

Table 4: Findings of Numerous Researchers in the field of overall academic performance

| Ref No. | Findings |
|---|---|
| 39 | Assist tutors in providing proactive one-on-one advice to their learners based on data mined from academic records of students using machine learning techniques. Rovira et, al (2017) |
| 40 | Assess the potential benefits of a multidisciplinary approach by using machine learning to estimate course outcomes for specific students, with a focus on early identification of high-risk students. Wham et,al (2017) |
| 42 | A system of rules that can identify students who are at danger of dropping out or transferring to another degree and who should receive personal counselling and support has been developed using a machine learning technique. Rodríguez-Muñiz et al (2019) |
| 43 | The goal of the study is to help institutions create the framework needed for pedagogical support, facilitating higher education decision-making processes towards sustainable education using machine learning techniques. Waheed et al (2020) |
| 44 | Implement technology into their current teaching methods in order to improve instruction and learning, and advise using machine learning algorithms to anticipate and categorise student performance.. Sekeroglu et al (2019) |
| 45 | An enhanced multi-label classifier and a hybrid regression model that improves the accuracy of forecasting student academic performance as future grades in various courses. Alshanqiti et al (2020) |
| 46 | Using various machine learning methods, the proposed recommender system delivers additional suggested actions for enhancing students' learning experiences. Yanes et al (2020) |
| 47 | A reduced training vector-based support vector machine (RTV-SVM) that can reliably and promptly identify at-risk and marginal learners. Chui et al (2020) |
| 48 | To use machine learning algorithms to forecast academic achievement after taking into account factors that will reduce dropout rates and make learning more individualised and adaptive. Oreshin et al (2020) |
| 49 | The knowledge of the students is used by the ensemble classifiers with a variety of machine learning methods to forecast the students' level of knowledge acquisition. Ahamad et al (2021) |
| 50 | Artificial intelligence (AI) and machine learning (ML) are useful technologies, according to the research investigation establish a collaborative learning atmosphere, enhance student skills, and provide a welcoming setting for research. Ilić et al (2021) |
| 51 | At the end of the school year, students are guided in choosing a course to take based on their interests and skills, and machine learning techniques are used to suggest the ideal course. Tarik et al (2021) |
| 52 | The instructor can notice a student's struggles during the course and encourage them by sending e-mail reminders, course messages, or setting up an online meeting based on the feedback from the intelligent predictive system. Ayouni et al (2021) |
| 53 | The most accurate predictive model based only on academic data, and as such, it must have the greatest amount of knowledge-inferring potential.. Fernández-García et al (2021) |
| 54 | A variety of machine learning (ML) and deep learning (DL) methods are used to train and test the predictive model to identify student learning behavior based on study characteristics. Adnan et al (2021) |
| 55 | The goal of this research is to create a system that can forecast student performance and assist teachers in implementing timely corrective interventions. Rafique et al (2021) |

| 56 | The LMS log entries that most influence the students' performance. By using a clustering algorithm. Analyzing the interaction patterns of each cluster, we find that those patterns are repeated in all the early stages of the course. Riestra-González et al (2021) |
|----|------|
| 57 | In order to reduce failure, boost success, and better manage resources in tertiary institutions, a machine learning approach was applied. Yakubu et al (2022) |
| 58 | The efficiency of the suggested models is examined when a machine learning algorithm is utilized as a tool for the early detection of students' challenges in the specific courses in which they are enrolled. Latif et al (2021) |
| 59 | In order to forecast the behavioral components of teaching and e-learning for students in virtual education systems, a Random Forest based categorization model of machine learning was built. Jokhan et al (2022) |
| 60 | A framework based on machine learning for forecasting and predicting student performance using a number of methods to gather valuable data about the traits of students. Pallathadka et al (2022) |
| 61 | Based on machine learning approaches, the process can anticipate different sorts of teachers, find useful teaching roles and activities, and exploit the behavioral data automatically acquired from lecturers by the artefacts. Shi et al (2022) |
| 62 | To determine the different perspectives that instructors and students have on the use of AI in personalized learning. The findings of this study help to direct the development and application of personalized learning strategies. This shift could be brought about with the use of AI and machine learning. Al-Badi et all (2022) |
| 63 | The proposed ML models might have been more accurate overall if additional factors, such as research activity, marital status, and living circumstances, had been explored. Baashar et al (2022) |
| 64 | The success of educational institutions depends on the performance of its students. When utilising machine learning algorithms to predict student performance, academic, demographic, internal evaluation, and family/personal traits were the most common input variables (i.e., predictive features) used. Alsariera et al (2022) |
| 65 | This work contributes to the early identification of students who are likely to fail by identifying the most useful machine learning techniques. Yağcı et al (2022) |
| 66 | One of the promising forecasting technologies that has the potential to improve accurate academic forecasting and help the education sector organise itself and make better decisions to improve the quality of education. Onyema et al (2022) |
| 67 | To predict a student's academic performance in advance so that educational institutions and parents can make proactive decisions to guide youngsters towards the most acceptable features and the most effective Machine Learning Model. Chakrapani et al (2022) |
| 68 | This study aims to outline the most popular machine learning and artificial intelligence algorithms for student success. Hooda et al (2022) |
| 69 | Concerned about how instructors and students may feel psychologically when artificial intelligence takes over. Hemachandran et al (2022) |

**RQ1: What are the often-applied characteristics by academics in the prediction of teacher-student learning outcomes for academic performance enhancement?.**

Various research has elucidated a range of attributes that impact the improvement of education and the precision of predicting teacher-student learning outcomes for academic performance enhancement. Despite being assigned different labels, numerous traits possess similar meanings and can be consolidated into a singular entity. Course Learning Outcomes' Assessments, Student's Engagement Level, performance of

coursework and full semester, virtual learning environment enhancement, enhancing learning and teaching, student's learning engagement level, number of completed learning activities, students failed to complete course or program, initial or early-stage dropouts, demographics, enhancement of learning environment are just some specific examples. A total of 31 specific important papers were examined in the course of this research. In 29.03% of instances, scholars used attributes enhancing learning and teaching. Course learning outcomes assessment's characteristics came in second with 22.58%, followed by virtual learning environment enhancement with 12.9%. Moreover, student engagement level came in third with 9.68%. The performance of coursework and full semester had the fewest occurrences of 6.45%, while number of completed of learning activities, social network information, student failed to complete course or program, initial or early dropout, demographics characteristics, enhancement of learning environments each accounted for 3.23% each. Fig. 5 suggests that the number of researchers strongly believe that specific indicators of enhancing learning and teaching are crucial determiners of academic performance success.

Table 5: Various attributes are commonly utilized in the prediction of enhancements in academic learning performance amongst students and teachers.

| Attributes | Freq. | Reference |
|---|---|---|
| Enhancing Learning and Teaching | 9 | [44,50,55,60,62,64,66,67,68] |
| Course Learning Outcomes' Assessments | 7 | [39,46,51,58,59,63,65] |
| Virtual Learning Environment Enhancement | 4 | [43,49,54,61] |
| Student's Engagement Level | 3 | [40,41,52] |
| Performance of coursework and  full semester | 2 | [42,47] |
| Number Of Completed Learning Activities | 1 | [45] |
| Social Network Information | 1 | [48] |
| Student's Failed To Complete Course Or Program | 1 | [53] |
| Initial Or Early Stage Drop Out | 1 | [56] |
| Demographics | 1 | [57] |
| Enhancement of Learning Environment | 1 | [69] |
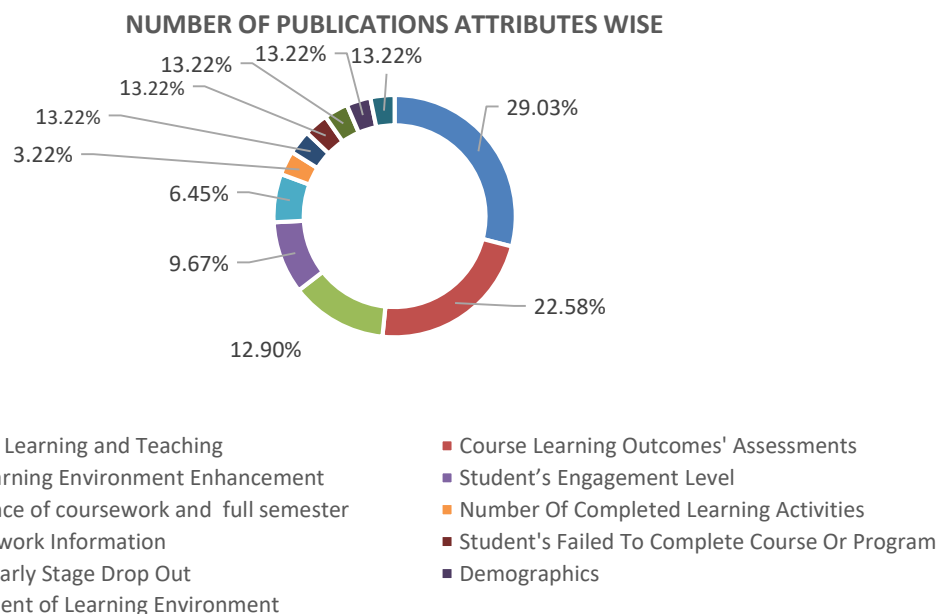


Figure 5: Analysis of attributes used by authors for prediction of academic performance on students-teacher learning

Furthermore, as depicted in Figure 5, the performance indicators have demonstrated that the best attributes re observed with the greatest frequency (enhancing learning and teaching = 29%). Also, as seen in Table 5, a variety of specific variables have been found to be the best indicators of academic performance. Although the study activity in the domain of academic performance consisted of 31 articles, only four studies [44, 46, 60, 62] stood out prominently. The majority of studies indicate that students' and teachers' academic success is mostly influenced by elements such as their grades, exam scores, overall results, level of study involvement, teachers success rates, teacher evaluations, assessments, techniques, and their overall rankings. This remark opposes a previously published review article [40, 48, 51, 58, 65], which claims that the grade point average (GPA) was found to be the most influential variable in forecasting the overall success of student-teachers, specifically in terms of their academic achievements. This assertion holds validity as the primary means of assessing academic achievement typically involve grades, as well as scores obtained from examinations and quizzes. These assessments ultimately contribute to the total outcome, which in turn can influence the performance and outcomes of educators. Once again, it is imperative to recognize that the assessment of students' and teachers' learning success should not be exclusively based on their rankings, as this evaluation encompasses other factors as well like Enhancing Learning and Teaching, Course Learning Outcomes' Assessments, Virtual Learning Environment Enhancement, Number Of Completed Learning Activities, Social Network Information, different school levels performance, Student's Failed To Complete Course Or Program ,Demographics, Enhancement of Learning Environment, which of them are mostly do not use only for the ranking system for performance .

**RQ 2: What machine learning techniques, methods are commonly employed by researcher for the prediction of learning outcomes for academic performance enhancement?**

Table 6: Distribution of publications across the most frequently employed methodologies in predicting students-teacher academic performance enhancement per method.

| Features | Classification | Regression | Classification & Regression Both | Clustering | Other |
|---|---|---|---|---|---|
| Enhancing Learning and Teaching | Yes [55] | Yes [50] | Yes [44],[60],[64], [66],[67],[68] | No | Yes [62] |
| Course Learning Outcomes' Assessments | Yes [39],[46] | Yes [51] | Yes [58],[59],[63],[65] | No | No |
| Virtual Learning Environment Enhancement | Yes [69] | No | Yes [43],[54],[61] | No | No |
| Student's Engagement Level | Yes [41] | No | Yes [40],[52] | No | No |
| Performance of coursework and full semester | Yes [42],[47] | No | No | No | No |
| Number Of Completed Learning Activities | No | No | Yes [45] | No | No 0 |
| Social Network Information | No | No | Yes [48] | No | No |
| Student's Failed To Complete Course Or Program | Yes [53] | No | No | No | No |
| Initial Or Early Stage Drop Out | No | No | Yes [56] | No | No |
| Demographics | No | Yes [57] | No | No | No |
| Enhancement of Learning Environment | No | No | Yes [69] | No | No |

## DISTRIBUTION OF PUBLICATIONS AMONG THE MOST WIDELY USED METHODS IN PREDICTING STUDENTS-TEACHER ACADEMIC PERFORMANCE ENHANCEMENT PER METHOD.
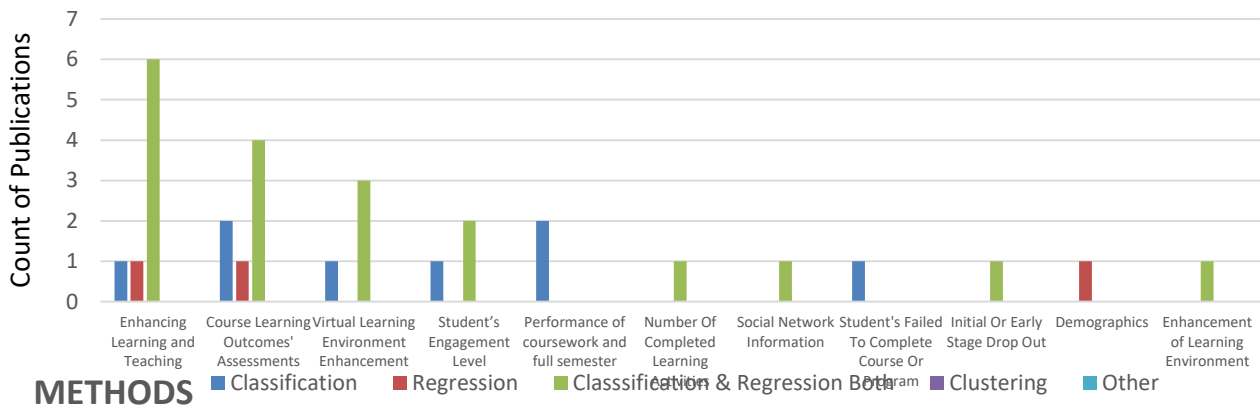


Figure 6: Distribution of publications among the most widely used methods in predicting students-teacher academic performance enhancement per method.

**RQ 3: Which algorithms or strategies are most effective the prediction of teacher-student learning outcomes for academic performance enhancement?**

This literature review utilizes a diverse array of current existing machine learning algorithms. This implies that there may exist alternative approaches for implementing prediction models in future research endeavors. Furthermore, it is common practice in research studies to evaluate multiple models in order to identify the most suitable model for a specific dataset and for more optimal level of result in the sense of accuracy.

Among the top level algorithms widely employed by researchers to estimate overall student-teacher learning outcomes for academic performance enhancement are, Decision Tree, Naïve Bayes, Gradient Boosted Tree, Artificial Neural Network (ANN), Random Forest (RF),Logistic Regression, K-Nearest Neighbor, Backpropagation, Catboost and Support Vector Machine (SVM) [80].

Table 7: In addition, there are several more approaches commonly employed to enhance the outcome. The subsequent content provides concise descriptions and explanations of the algorithms, procedures, and other pertinent strategies employed in the context of student-teacher learning outcomes with the purpose of enhancing academic performance.

| Algorithms | Count of References | Reference |
|---|---|---|
| Decision Tree | 2 | [42],[48] |
| Random Forest | 4 | [39],[51],[54],[59] |
| Naïve Bayes | 1 | [56] |
| Support vector Machine | 4 | [45],[57],[60],[67] |
| Gradient Boosted Tree | 2 | [40],[53] |
| Artificial Neural Network | 7 | [43],[44],[52],[61],[63],[64],[66] |
| K-Nearest Neighbor | 2 | [46],[65] |
| Logistic Regression | 1 | [57] |
| Hybrid/Ensemble | 4 | [47],[49],[50],[55] |
| Others (Anova, U Test and Independent Test., I-FCN,GAN) | 4 | [41],[62],[68],[69] |

**METHODS AND TECHNQUES WISE COUNTS / REFERENCES**
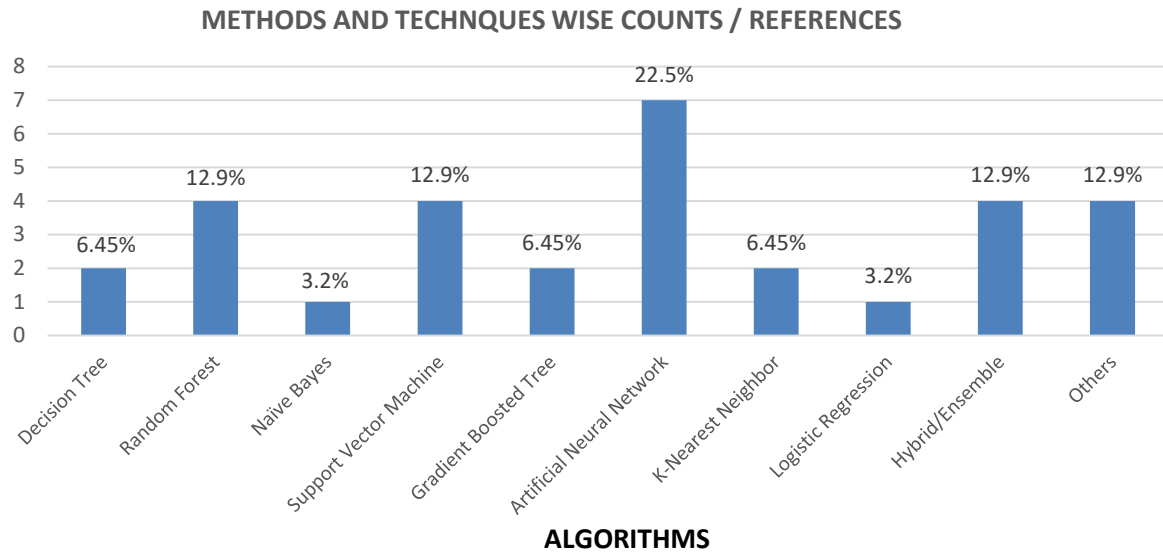


Figure 7: Distribution of algorithms used in the selected papers on students-teacher academic learning performance enhancement.

## 4.1. The Decision Tree (DT) algorithm

The initial stages of the decision tree categorization approach involve the construction of the tree and subsequent pruning [71]. The branches emanating from the internal nodes of the tree represent the outcomes of a test or condition, whereas the external nodes or leaves of the tree correspond to class labels [72]. The decision tree (DT) algorithm is the widely utilized method among the publications included in the present study.

## 4.2. The Random Forest (RF) algorithm

Random Forest (RF) is a commonly employed supervised ensemble machine learning (ML) method that finds extensive application in both classification and regression tasks. Random Forest (RF) operates by initially training a decision tree and afterwards generating a class output, which corresponds to the mode of the individual tree. The present study revealed that a total of four out of the thirty-one studies examined incorporated the Random Forest (RF) classifier in their datasets to forecast and improve academic performance.

## 4.3. The Naïve Bayes (NB) algorithm

The Naive Bayes algorithm simplifies the procedure for learning by assuming that the variables are independent of a particular class, while also providing a probabilistic interpretation of categorization. While autonomy is generally an inappropriate assumption, it is worth noting that the NB classifier often exhibits superior performance compared to more sophisticated classifiers in practical applications. In their study, [73] observed that the Naive Bayes (NB) algorithm demonstrated strong performance in analyzing the academic performance of university students. Furthermore, they noted that the NB algorithm also exhibited favorable predictive capabilities when used to the task of forecasting the achievements. Out of the total of 80 publications examined, a subset of 12 articles employed the Naive Bayes (NB) algorithms in order to make their predictions.

## 4.4. The Support Vector Machine (SVM) algorithm

The Support Vector Machine (SVM) algorithm is employed in the field of education to monitor and assess learner participation and engagement inside online courses. Machine learning has been widely recognized as one of the most reliable and efficient algorithms in the majority of its applications.

## 4.5. The Artificial Neural Network (ANN) algorithm

The ANN algorithm was developed with the purpose of emulating the operations of biological neural networks. A neural network employs a connectionist approach to computational processing, wherein it consists of a

network including interconnected artificial neurons. The network normally acquires knowledge of the link weights by the utilization of readily available training patterns. The performance of the network can be improved through iterative updates to its weights. Out of the total of 31 articles that utilized the Artificial Neural Network (ANN) methodology, a subset of 7 articles demonstrated successful application in predicting student performance.

### 4.6. K- The K-Nearest Neighbor (KNN)

The K-nearest neighbors (KNN) method is seen to have the lowest deployment rate among the algorithms reviewed. The K-Nearest Neighbors (KNN) algorithm is classified as a type of Semi-Supervised Machine Learning technique. This study only examined two articles.

### 4.7. The Logistic and Linear Regression (L/LR) algorithm

In comparison to logistic regression, which predicts the probability of many outcomes and allows for categorical predictions, linear regression predicts a continuous valued outcome based on a linear combination of variables. Table 7 is a compilation of 01 out of 31 scholarly works that utilized logistic regression methodologies and achieved favorable outcomes.

### 4.8. The ensemble/hybrid algorithms

One of the challenging aspects in prediction models pertains to the identification of effective strategies that can yield satisfactory levels of prediction accuracy [74]. In order to get the utmost precision, a multitude of scholars have put forth the hybrid/ensemble methodology, which amalgamates many machine learning techniques. The term "hybrid/ensemble techniques" refers to the amalgamation of multiple machine learning algorithms, as defined by a scholarly source [75]. This study employed a combination of algorithmic tools to examine students at risk in a particular course and forecast their academic performance (76, 77, 78). Overall prediction of academic performance also effects on ranking and assessments of teachers and their methods of teaching, output results.

### 4.9. Other Methods/Techniques

Further to the algorithms and techniques discussed earlier, four articles have reported high accuracy rates using methods such as ANOVA, U Test, Independent Test, I-FCN, and generative adversarial networks.

### 4.10 Population gap specifically identified in current study.

The existence of a population gap is a widely recognized imbalance among the academic community. There exist consistently marginalized populations that have received insufficient attention in terms of research or adequate representation in previous studies. Examples of such populations include the impact of internet speed, the influence of low-level learning environments, gender-based discrimination, racial and ethnic disparities, and age-related factors, teachers' behavior, teacher's biasness, lack of advance skills of teachers. The user has provided a numerical reference without any accompanying text or context.

The papers under consideration have utilized four primary criteria, including students' academic performance, previous education, certain personal attributes of students, and logs of e-learning interaction activity.

Furthermore, the learning performance of student-teachers is a dynamic process that can either exhibit growth or decline with time. The importance of considering the effectiveness of predictors on real-time dynamic data should be duly acknowledged.

### 5. Conclusions

The present study has successfully identified several key findings in the literature about the utilization of machine learning techniques on data related to students and teacher learning. These findings shed light on the critical elements that impact academic achievement. The Artificial Neural Network model illustrates that students' previous academic achievement is the most frequently utilized attribute for predicting their academic performance. Once again, the study suggests that the classification and regression approach is extensively employed in academic institutions for the purpose of problem classification. Additionally, it was

observed that the random forest and support vector machine exhibited the greatest frequency of utilization as a machine learning technique in the context of predicting students'- teachers' for academic performance. The study additionally underscores deficiencies in both the scope of population coverage and the practical understanding within research pertaining to machine learning and the prediction of students' teacher's outcome for academic achievement. This paper provides a comprehensive analysis of the potential applications of machine learning (ML) in forecasting academic achievement, specifically in the context of predicting students' and teachers' learning outcomes. Researchers may find Table 7 and Figure 7 valuable in strategizing their approach to the preliminary phases of their study and assessments. However, it is likely that numerous academics attributes will address the issue in the forthcoming years, exploring alternative and innovative methodologies, given the significant level of attention to this problem of academic performance enhancement in context of students-teachers outcomes has garnered in contemporary times.

## 6. Recommendations

The recommendations for education administrators and researchers encompass a substantial array of traits that are deemed more pertinent by specialists in the field.

However, while reviewing the existing research, it becomes evident that numerous traits have been overlooked in previous investigations. The identification of key attributes such as enhanced learning and teaching processes, assessments of course learning outcomes, an improved virtual learning environment, student engagement levels, performance in coursework throughout the semester, the number of completed learning activities, student attrition rates, early stage dropouts, an enhanced learning environment, and study methods can contribute to the accurate classification of student-teacher learning outcomes for the purpose of performance prediction and overall improvement.

Once more, it is advisable for education administrators and other relevant entities to utilize the suggested list of potential attributes for students-teachers learning in order to effectively employ suitable strategies (academic intervention schemes) that target students' academic deficiencies, as proposed in scholarly literature. This approach aims to enhance overall academic performance and advocate for improved teaching methodologies and teacher competencies. This can be achieved by implementing the proposed models developed by academics to identify probable factors that may impede a student's or teachers overall academic performance, hence narrowing the gap in practical knowledge.

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# Student Engagement

# The new kind of metastudent and the role of gamification in all learning environments

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**Abstract**

The new digital era forms a new reality and create new needs. The learners are born in a total different and digital environment therefore they need an education with modern technological aspects. I call them "metastudents" and I propose gamification as a tool to ensure their motivation towards all learning environments.

**Keywords**

Digital, metastudent, gamification, ChatGPT

The distinction of human beings in generations is an old practice…To be precise…it's ancient ! Hesiod first referred to generations and separated them into gold, silver, copper etc. Nowadays, the birth time is that element that puts someone in a certain generation:

*Baby Boomers (1946-1964)*

*Generation X (1965-1980)*

*Generation Y (1981-1995),* Millennials or Net Generation

*Generation Z (1996 – 2010)* (well known as dot com kids and i-gen)

*Gen Alpha* named by the social researcher Mark McCrindle. It includes children born after 2010 ( the birth date of Instagram) and they will be born by 2025. It is predicted to be the longest to live, the richest, the best educated and surely the most depended on technology . This generation is also well known as «Generation Glass» because of the interaction with the glass screens. After all, It seems that "teenagers" have gone and they have been replaced by "screenagers".

So, the 21<sup>st</sup> century has brought several gifts transforming "reality" into a term under discussion. Social media, artificial intelligence and other digital tools are used in all fields from everyday life to economics, politics and business.

In this context, a new type of student has been formed, the **metastudent.** By this term, I describe the student of the new era who is born during the era of social media boom, dedicates a great amount of time to screens, lives between the physical cosmos and the digital one.

Under these circumstances, someone may pose this question towards education: Where have you been? The research has revealed that students lose their interest in learning because the teaching process does not

include technology which comes against their everyday life. All aspects of contemporary life include digital methods for online shopping/payments, e-learning, amusement.

Therefore education must find its role in order to achieve a win-win deal between learners, instructors and learning.Towards this direction upskilling and reskilling are required and gamification must have an exceptional thesis in the modern world.

According to (Deterding et al., 2011) gamification is the use of game design elements in non-game contexts. "When people are playing, the take risks they would not ordinarily take. They experience failure not as a crushing blow but as an idea they tried that didn't work. Play transforms problems into challenges, serious into fun, one right answer into many possible outcomes. By not limitting yourself to one right answer you open yourself to contemplating outcomes you never might have imagined".

Indeed, the fear of making mistakes may be deeply rooted in childhood traumas, back when perfect parents were expected to have perfect children, and they didn't tolerate mistakes or, even worse, reacted badly to them. Furthermore, ego, which is rooted in the word "I," inherent in human existence, doesn't easily embrace the possibility of making mistakes. On the contrary, many successful individuals, according to Western cultural standards, admit that they never feared mistakes, which allowed them to take risks. Therefore, gamification frees people from anxiety. Let's remember that wonderful movie... "La vita è bella" (Life is Beautiful)! The game, even in times of war, made it bearable!

Gamification is a tool in both the instruction and the assessment. My personal experience has to do with gamification as an evaluation method in classics (ancient Greek and latin language). It has been magnificent and revealing. Students of high school, who were indifferent towards the lesson of ancient Greek language and culture and they were getting low scores in ordinary tests, once they began to involve themselves in evaluation through gamification, they got enthusiastic. All that was needed (for them) was their smartphones, QR code scanner and…the game was ready! These students ended up getting high scores and hitting the first place in the winners' board.

Nevertheless many many instructors are still, at least in Greece, very fearful towards digital tools and they insist on avoiding the use of gadgets like smartphones during their lectures. An objection that is usually voiced is that "a quiz or an online game may be a homework" and an analog form of assessment is more accurate and reliable.

But is it so? "A professor in America used the example of a store's inventory check. It is a necessary process as it provides an accurate picture of profits or losses. However, during the inventory check, the store must remain closed, so it does not perform its initial function, which is to sell products. Assessing learners is similar to this process. It is necessary, but during it, learning stops. However, if this process is done using gamification, it proves that learning never stops!"

In the course of the game, the learner continuously receives feedback on progress, so mistakes are not fatal nor do they actually cost, as they are given the opportunity to correct them below. If the game's settings allow everyone to play the game as many times as they want, thereby improving their score, then the results are even more impressive.

Furthermore, during the process of analog assessment, the individual operates by him/her self, essentially becoming isolated, and as a result, another essential function of education, which is socialization, is disrupted. This dimension of education is so crucial at every age that terms like "individualization" are now

considered outdated and unscientific, replaced by others like "adaptive." On the contrary, gamification, from its very inception, involves interaction with others based on competition to determine the winner.

And interaction is surely of great importance!

The 4C, as the essential skills of all people of the 21$^{st}$ century, are creativity, communication, collaboration, critical thinking. All educators are looking for ways to help learners acquire these skills in the most cost-effective manner... This means that, in financial terms, we aim to invest a sum as capital and expect it to yield us the maximum profit. Technology greatly assists in this regard! In fact, the new acronym demanded by the modern reality is SMAAC, which stands for social, mobile, analytics, AI, cloud technologies.

Many things are changing, but the goal always remains socialization as a requirement since learning has a social character. A significant chapter has now opened, that of artificial intelligence, including ChatGPT. Undoubtedly, even this way of acquiring knowledge or information involves communication characteristics. Even ChatGPT, in case of misunderstanding by the user, has the "gentle courtesy" to ask if it should rephrase to make it better understood.

Someone might argue that gamification is only suitable for children. But isn't this the elusive dream of humanity? To remain a child forever, meaning to have joy, to see everything as if it were the first time, to feel fearless, and to play continuously with friends, trying, alone or in a group, to win the prize, even if it is an honorary title, like "the leader." I'm glad that gamification is mentioned in prominent forums and is slowly being used in higher education, such as at the Economics Department of the University of Athens. Employee performance and relationships among staff would further improve if gamification were incorporated into business practices.

Speaking of innovation, let's not forget that at the center of it all is the human being. Earlier, I described the metastudent.

Every coin has two sides, and in this case, the characteristics exhibited by this new type of student may seem unfamiliar to people from older generations. Specifically, due to the time spent in front of screens, the learner has become accustomed to receiving information accompanied by visuals and sound. Reading analog books is not to their liking. They struggle to engage in processes that don't involve screens, they don't read literature, and they lack patience when required to read or write a lengthy text. They become anxious when they don't have their mobile device with them, which often leads to problematic behavior in entirely analog environments.

Could these characteristics be truly problematic? Should humanity be concerned? Or are those researchers sounding the alarm simply products of another era, another way of upbringing and thinking, metaphorically speaking, "outdated software"? I believe that in the end of the journey, which I fear we ourselves won't witness (let's not forget that today is the archaeology of the future), what should matter is the human being, their essence. What is it? Thought? Language? Emotion? Coexistence? Let's not forget Aristotle's statement that man is a political animal; otherwise, if man remains alone,  becomes either a beast or a god. Who will answer this question? Only those who "rise above." Those who don't hold a magnifying glass but maintain distance... And this requires time... And this requires patience... Let's not forget, in our ambition to stand out, to offer something new, that "Saturday was made for man, not man for Saturday." As long as we keep asking questions, we can remain calm. Because, as the first philosophers demonstrated, what matters is the question, not the answer... Moreover, today, artificial intelligence can potentially provide the answer. Once

we said, "cogito ergo sum," I think, therefore I am. Today, when others can think on our behalf, may be preferable to say "to question is to exist".

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# Investigating Student Engagement With Online Interactive Learning Tools At Level One, As Well As The Actual And Perceived Value Of These Resources.

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## Abstract

The often-cited Chinese teacher and philosopher, Confucius, noted "*I hear and I forget, I see and I remember, I do and I understand*" (The Open University 2019). Born in 551 BC, Confucius would never have considered the application of this principle to digital education! However, in responding to an article by Hilliard and Stuart (2019), Dr Ruslan Ramanau, in his blog post *Designing Online Learning for Interactivity*, attached importance to personal interaction and interactivity within a blended learning online writing course and noted that a greater proportion of online activities may lead to a more interactive learning experience.

Our recent scholarship project sought to gather detailed information on how level 1 law and business students are using online interactive resources, gathering data through a survey and then a series of student focus groups. The aim of the study was to identify whether Level 1 business and law students engage in active online study and the extent to which they value these opportunities to learn through practical application.

Using data gathered from a questionnaire and through in-depth focus group discussions, this paper will evidence that students engage positively with interactivities and value them as an important part of their learning experience. Students expressed preferences for short activities that can be undertaken during small windows of study time and provide immediate feedback. Variety is key to engagement. However, where engagement is lacking, the key barriers are time constraints and a lack of access to effective IT. Students were also reluctant to engage in activities felt to be insufficiently challenging. The full list of eight key recommendations for course authors will be presented at the conference.

Findings and recommendations detailed in the presentation have, to date, helped to inform the ongoing development of modules within the Faculty of Business and Law, as well as influencing practices at a number of universities in the United Kingdom.

**Keywords:** Engagement, interactive, digital learning, student experience, Supported online distance learning

## 1. Literature Review

As far back as 1998, Wilbur noted that "Concurrent with the phenomenal growth in online learning, stakeholders in education continue to demand greater accountability and evidence of effectiveness in teaching" (Wilbur, 1998 as cited in Robinson and Hullinger, 2008). Since then, there has been research into online learning methods and their effectiveness. However, this traditionally focused on comparisons between the digital and face-to-face environment and whether the former can successfully replicate the latter. In 2001, Palloff and Pratt noted that "*Research in this area tends to focus on whether online learning is as effective as face-to-face learning in achieving learning outcomes. Studies on the effectiveness of online learning fall into*

*three broad categories: (a) students' outcomes, focused on test scores and grades; (b) student attitudes about learning; and (c) overall student satisfaction with online learning. Findings largely support the view that the learning outcomes of students online are similar to those in face-to-face settings*" (Palloff & Pratt, 2001, as cited in Robinson and Hullinger, 2008).

Bucy (2003) commented on the volume of research that focuses on comparisons between traditional and online courses and concluded that, "*Rather than using research to help replicate what is done in the traditional classroom, researchers should focus on identifying what is done well in the online learning environment. Research should determine whether they (the students) are learning what we intended them to learn-NOT whether they are learning the same as in traditional methods*" (Robinson and Hullinger, 2008).

Research into student engagement highlights that engagement pertains to *"the efforts of students to study a subject, practice, obtain feedback, analyse, and solve problems*" (Kuh, 2003 as cited in Robinson and Hullinger, 2008). It is a *"multifaceted concept that encompasses behavioural, emotional, and cognitive aspects (Fredericks, Blumenfeld, & Paris, 2004). Behavioural engagement refers to participation and includes involvement in academic, social, or extracurricular activities. Emotional engagement encompasses affective reactions to teachers, classmates, and the institution in which the learning occurs. Finally, cognitive engagement incorporates thoughtfulness and willingness to exert the effort to comprehend subject matter and master skills (Fredericks et al., 2004)"* (Muir et al., 2019). Additionally, dimensions of engagement in the online context include level of academic challenge, active and collaborative learning, student-faculty interaction, and enriching educational experiences. (Kuh, 2001 as cited in Muir et al. 2019).

According to Anderson (2003) (as cited by Muzammil, 2021), student engagement and interaction is essential to student success in online learning. *"...Student success becomes critical in online environment since this environment encourage students to depend mostly on their ability to learn. Verneil & Berge (2000) has shown that student success in online learning mostly supported by their activity during learning process."* (Muzammil et al, 2021). Bernard et al. (2009) (as cited by Muzammil, 2021) highlight three types of interaction: *"those...between students, interaction of student to instructor, and interaction of student to content."* Engagement is critical to student learning and student satisfaction (Martin & Bolliger, 2018 as cited by Muzammil et al, 2021).

*"The best way to increase student engagement is to create collaboration and interaction elements (Bouta et al., 2012; Yilmaz, 2020). In this sense, learning analytics based metacognitive feedback support is thought to improve student engagement... The student interacts with the teacher through feedback"* (Karaoglan and Yilmaz, 2022). In providing such feedback a personal learning environment is created by tailoring feedback to student need.

In considering student engagement through multimedia technology Wankel and Blessinger (2013) (as cited by Uçar, & Kumtepe, 2021) identify two prominent principles. Firstly, *"More interesting and engaging environments can be created by presenting instructional messages and activities in various media forms and modalities. Easily understandable, rich, dynamic, and meaningful content and pedagogies that appeal to different senses can be developed. Thus, the initiation of student participation, motivation and interest can be supported."* Furthermore, *"Multimedia technology has the potential to increase cognitive attention and emotional interest in the subject to be learned. These media can ensure consistent and authentic representation of information. On the other hand, they can be prepared following modern learning theories that explain how a person learns and explaining that human emotions and social behaviors are related to information processing."*

## 2. Introduction

This paper considers the extent to which Level 1 students in Business and Law are making use of interactive activities within the online module materials. Such activities include (but are not limited to) reflective activities, multiple choice questions and drag-and-drop exercises. The aim was to establish, using data, the level of usage and follow this up with a questionnaire for students and a series of focus groups to ascertain the way in which students are using the interactive materials and the value they attach to these.

Significant module development is currently taking place across both the business and the law school. The outcomes from this project have already influenced module development and continue to inform decisions by modules authors on the incorporation of digital interaction. Finding are enabling module teams to build resources in a way which is most effective for students' overall achievement and progression, enhancing the overall student experience by presenting materials in an engaging and motivational way and ensuring that study time is most effectively applied.

**Why Level 1?**

The modules considered within this project are:

- B100 – An Introduction to Business and Management
- W101 – An Introduction to Law

These are the first modules Open University students will study when embarking on an undergraduate business or law degree and so, for many (though not all) students, these modules represent a first experience of distance learning. In looking at level 1 engagement it is possible to ascertain whether the way in which students interact with online materials changes as they settle into their course; does the time spent on these activities and the value attached to them alter as students become accustomed to distance learning?

Students from the February 2020 intake were invited to take part in the survey and focus groups as they had recently completed these modules at the time student engagement was sought.

**Activities Included**

The paper will not consider engagement of live tutorials and focuses on those activities built into the online module materials. A review of the activities across Level 1 show that the following are included on B100 and W101.

Table 1: Activities and number of examples

| Type of activity | Number of examples on B100 | Number of examples on W101 |
|---|---|---|
| Free-text* | 91 | 114 |
| Tick-box | 8 | |
| Drag and Drop | 12 | 11 |
| Polls | 1 | |
| Interactive diagrams | 1 | |
| Forum discussions | 15 | 1 |
| Multiple choice questions | 2 | 17 |
| Research exercise | | 15 |

**\* Free-text activities** are by far the most frequently used activity type on both courses and allow students to type their own response to a task into a text-box. Generic feedback is then provided. These activities are varied in nature and include, for example, providing initial thoughts on a topic at the start of a unit, commenting on or summarising content from an audio or written resource, short answer questions, reflecting on a resource, answering questions on a case style or scenario or structuring an answer to a question.

## 3. Research Methods and Design

Initially data was sought on the number of interactions with each activity on the VLE. This was to be a starting point, indicating the most used type of activities. The researchers were aware that this would be limited in scope as, whilst a student may have clicked on an activity, the extent to which they had engaged would be unclear. For example, it is possible for a student to put a very limited amount of text into a freetext box in order to obtain the feedback.

Unfortunately, obtaining the data was a significant barrier to the research. Whilst data is available showing the number of times a page has been accessed, this cannot be broken down to show interactions with specific activities. Therefore, to fully answer the research question: 'Investigating student engagement with online interactive learning tools at level one, as well as the actual and perceived value of these resources' the researchers adopted an epistemological research philosophy. The most suitable approach then emerged as a deductive mixed methods approach allowing for quantitative data to be collected through questionnaires and qualitative data to be obtained through focus groups.

**Questionnaire**

The aim of the questionnaire was to gather quantitative data from as many students as possible and so this was sent to all students who had completed the module but had not either opted out of surveys or been contacted recently for their comments/opinions on another project. The sample was reduced to 1,679 students who had completed B100 and 1,072 students who had completed W101 in the February 2020 presentation. A prize draw was offered as an incentive for students to complete the questionnaire as it was recognised that a larger sample of students might result in a more accurate analysis being available.

Questions asked were designed to ascertain:

1. Which activities students used
2. Which activities they felt benefitted their academic development (both knowledge and understanding and academic skills)
3. Whether the way in which they engaged with the activities changed throughout the course

**Questions**

The first question students were asked was whether they had completed B100 or W101. This was to enable a break down the data to identify any similarities or differences between the way in which business and law students approach interactivities.

Students were then asked whether this was the first module they were studying at the Open University. This was important to know as part of the research plan was to focus on whether students changed their approach to the tasks set as they worked through the module and became accustomed to distance learning.

Where students had studied an Open University module before they may already have become accustomed to using online resources and so this may have skewed any findings.

The questionnaire then went on to focus on specific activities. The third question was structured to enable the collection of data on student preferences for each type of activity within a single question as noted in Figure 1 below. A free-text option was then provided for students to identify any other type of activity they used and wanted to comment on.

| | Very Valuable | Fairly Valuable | Not Very Valuable | Not at All Valuable | Not Applicable (I did not use this type of resource) |
|---|---|---|---|---|---|
| Quizzes/multiple choice questions | | | | | |
| Drag-and-drop | | | | | |
| Completing tables and diagrams | | | | | |
| Case studies | | | | | |
| Reflective activities | | | | | |
| Typed response answers | | | | | |
| Forum activities | | | | | |
| Links to Study Skills materials | | | | | |

Please rate how valuable you found each type of interactive resource.

Please don't select more than 1 answer(s) per row.

Figure 1: Questionnaire example, preferences

To assess whether the time spent using interactivities changed throughout the module, students were asked to indicate whether time spent had increased, decreased or remained consistent. A free-text box was also provided for students to explain their reasoning for any variation.

In addition to the time spent, students were also asked whether the way in which they engaged with the activities altered as they progressed through the course, again giving a free-text box so that reasoning could be provided.

Finally, students were asked to indicate whether interactivities had enhanced their learning experience and were provided a free-text box for any additional explanation to be provided.

**Focus Groups**

Within the questionnaire, students were asked if they would like to be considered to take part in focus groups, the purpose of which was to add greater depth to the information gathered through the questionnaire. Again, an incentive was offered to students to take part to encourage the widest possible pool of students to volunteer. It was hoped to invite students from a variety of grade bands to take part, as well as ensuring a gender mix.

Four focus groups were conducted; two groups for students on each programme. The intended groups size was five students per group, but some groups were smaller due to cancellations and non-attendance. This also meant that not all groups had a mix of grade bands. As evident in Table 2 below, the groups were made up as follows:

Table 2: Focus group composition

|  | Sex | Final module grade |
|---|---|---|
| **Group 1 – Law students** |  |  |
| Student 1 | F | 76 |
| Student 2 | F | 63 |
| Student 3 | M | 84 |
| Student 4 | M | 87 |
| Student 5 | F | 51 |
| **Group 2 – Business students** |  |  |
| Student 1 | F | 66 |
| Student 2 | F | 77 |
| Student 3 | M | 84 |
| **Group 2 – Business students** |  |  |
| Student 1 | F | 79 |
| Student 2 | M | 77 |
| Student 3 | M | 78 |
| **Group 2 – Law students** |  |  |
| Student 1 | M | 58 |
| Student 2 | F | 87 |

## Data analysis and findings

The questionnaire was sent to 2,751 students (1,679 B100 and 1,072 W101). 1,142 B100 and 548 W101 students we removed from the research sample as they had either opted out of marketing or had recently been surveyed about another project. Our sample size of 2,751 was sufficient in size to allow our data credibility. 169 students responded to the survey (94 B100 and 75 W101).

B100 and W101 are both introductory mandatory 60 credit modules. One objective of the study was to assess whether the way in which students used the activities altered as they became used to online study. Students who had studied other modules before B100 or W101 would already have become accustomed to online study and resources and so, at the research design phase, it was considered valuable to be able to identify whether the respondents were new to study with the Open University or whether the module (B100 or W101) was their first module of study. The researchers predicted that the responses from new students would outweigh the responses from students for whom these modules where not their first module of study at the Open University. This initial prediction was proved correct (see figure 2) when the responses were received, B100 68 of the 94 responses came from new to study at the Open University and with W101 63 of the 75 responses.
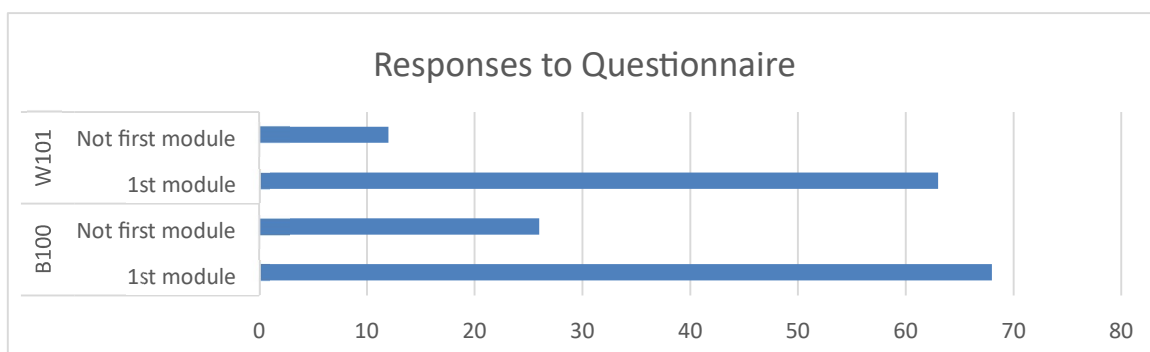
Figure 2: Responses to questionnaire

**Preferred Interactive Resources**

Data from the questionnaires demonstrates that all groups of students feel that forum activities are the least valuable type of interactivity. Both new and returning B100 students placed case studies at number three with 90% (1st module) and 96% (not 1st module) finding them either very or fairly valuable. This is the only commonality in the top three between new and returning students on B100 with new students preferring quicker drag-and-drop and quiz style activities to test knowledge while returning students preferred skills development activities and completing more detailed diagrams and tables more highly. Interestingly the W101 data exhibits strong trends with the top four most valued interactivities remaining in the same position when comparing the different stages of student study. There is a notable difference between first time students and returning students in relation to typed response questions with 84% of new W101 students finding these very valuable or fairly valuable, compared with 58% of returning OU students.

Table 3 – How valuable are interactive resources to business students?

| B100 | | B100 | |
|---|---|---|---|
| 1st module | Very or fairly valuable | Not first module | Very or fairly valuable |
| Drag and drop | 94% | Links to study skill activities | 97% |
| Quizzes/multiple choice | 92% | Completing diagrams and tables | 96% |
| Case studies | 90% | Case studies | 96% |
| Completing diagrams and tables | 88% | Quizzes/multiple choice | 88% |
| Typed response answers | 88% | Drag and drop | 87% |
| Links to study skill activities | 85% | Typed response answers | 84% |
| Reflective activities | 82% | Reflective activities | 81% |
| Forum activities | 69% | Forum activities | 81% |

Table    4 – How valuable are interactive resources to law students?

| W101 | | W101 | |
|---|---|---|---|
| 1st module | Very or fairly valuable | Not first module | Very or fairly valuable |
| Case studies | 98% | Case studies | 92% |
| Links to study skill activities | 98% | Links to study skill activities | 92% |
| Quizzes/multiple choice | 97% | Quizzes/multiple choice | 92% |
| Drag and drop | 93% | Drag and drop | 83% |
| Typed response answers | 84% | Completing diagrams and tables | 83% |
| Completing diagrams and tables | 81% | Reflective activities | 72% |
| Reflective activities | 75% | Typed response answers | 58% |
| Forum activities | 57% | Forum activities | 50% |

**Time Spent**

In relation to the time spent on interactivities, the majority of students reported that this remained consistent throughout the course. This was the case regardless of the course students were enrolled on, or whether they were a first-time OU student or had studied before.

Table 5 – Changes in time spent on interactive resources as the course progressed

| | B100 first-time OU students | B100 not firsttime OU students | W101 first-time OU students | W101 not firsttime OU students |
|---|---|---|---|---|
| Time spent increased | 13 (19%) | 7 (27%) | 18 (29%) | 2 (17%) |
| Time spent decreased | 13 (19%) | 3 (12%) | 7 (11%) | 0 |
| Time spent remained consistent | 42 (62%) | 16 (62%) | 38 (60%) | 10 (83%) |

Where students identified that they spent more time on activities as the course progressed, this was attributed to:

- Study becoming increasingly challenging,
- The nature of the activities becoming more time consuming (for instance the inclusion of video material),
- Feeling increasingly motivated by positive outcomes and feedback,
- Developing the skills needed to complete tasks more thoroughly,
- Increased confidence,
- Revisiting activities from previous units
- Attaching greater value to the activities as the course progressed.

Of those who decreased the amount of time they dedicated to interactivities as the course progressed, reasons given included:

- Workload at particular points in the module, for example around the time an assignment was due less time would be dedicated to interactive learning
- Other resources were considered more valuable
- A change in personal circumstances which reduced available time
- Less time was required as students became more familiar with the mode of learning • A drop in motivation and enthusiasm

**How did students engage with the materials?**

The intention in asking this question was to assess the way in which students interacted with the activities themselves. For instance, were they more or less inclined to use the activities in accordance with the instructions as they progressed through the course? Did they revert to bullet-point answers rather than full text? Did they access the feedback without first completing the activity? Did they change from using written notes to using the online text boxes provided or vice versa?

The question was framed widely so as not to lead students towards a particular answer and, it seems, rather too widely as it became apparent from the comments that it was not interpreted by students in the manner anticipated. Many students commented again on the time spent on activities and the activities they especially enjoyed (covered above). However, whilst the question was interpreted slightly differently than the way intended, some useful comments were made and are detailed below.

For completeness, the following table shows initial responses from students on whether the way in which they interacted with the resources altered throughout the course. As explained, however, this data is of limited value owing to the wide interpretation of the question.

Table 6 – Did the way in which students used activities changed as they progressed through the course?

|  | B100 first-time OU students | B100 not firsttime OU students | W101 first-time OU students | W101 not firsttime OU students |
|---|---|---|---|---|
| Changed | 24 (36%) | 6 (23%) | 18 (29%) | 4 (33%) |
| Did not Change | 43 (64%) | 20 (77%) | 44 (71%) | 8 (67%) |

Additional comments from students on the ways in which they used activities changed:

- Confidence gained in certain activities and the resources increased. For example, students reported feeling more confident to use forums, more familiar with the resources and so more inclined to use them thoroughly and had a greater level of understanding what was required so drafted more detailed answers to free-txt questions.

- Later in the course the activities were used for consolidation and revision, particularly to help with assignments.

Table 7 - Overall, did students feel that the interactivities enhanced their learning?

|  | B100 – First OU module studied | B100 - not first OU module studied | W101 - first OU module studied | W101 - not first OU module studied |
|---|---|---|---|---|
| Yes | 62 (93%) | 26 (100%) | 60 (95%) | 11 (92%) |
| No | 5 (7%) | 0 | 3 (5%) | 1 (8%) |

The above shows that the vast majority of students felt that the interactivities enhanced their experience of the course and their learning. Of those who did not, few reasons were given, However, one student commented that they did not feel sufficiently challenged by the course: "*Nothing in the open University is extensive enough, I need so much more practise and help.*". Another student stated that some activities were useful but that others were not: *"I used drag and drop/tables/typed text more to test my own knowledge. The reflection activities were a waste of time so I did not use them at all. Case Studies could have been more present and more detailed in order to have been more helpful."*

Student comments on why they found interactivities a valuable part of their study materials could largely be sorted into the following five categories.

### 1. Feedback

Student found it useful to be able to receive feedback on a formative task and identify where and how they could improve without waiting for a tutor response. One student noted that *"even if you didn't complete the tasks you could still learn from the answer"*, evidencing another way in which students were making use of activities. Other comments included:

- o *"... it provides live feedback with explanations that help make sense.... Personally, I found the case study with videos and then follow up questions most useful, with the feedback after each answer."*

- o *"It tests your knowledge and gives immediate feedback so that you know if you are on the right thought process."*
- o *"Using interactive resources makes it easy and quick to complete tasks, as well as getting feedback quickly without having to wait for the tutor to answer."*
- o *"It offers an opportunity to put learning into practice without any 'cost'".*

### 2. Skills development

Students identified particular skills that had been developed through the use of interactivities, including writing and communication skills and critical thinking. Comments included:

- o *"I was able to produce better quality assignments. It really helped with knowing how to reference better, which for me is a nightmare."*
- o *"I've improved on my writing skills"*

o *"It allowed critical thinking to form through interacting with students"* o *"It helps you to explain something in more details"*

o *"It has helped me locate relevant information when needed and to write more concisely."*

### 3. Active engagement with the materials

The tasks helped students to engage actively with the course materials and apply the knowledge they had acquired from their reading. Comments included:

o *"I find that the interactive resources suit my approach to learning- it is experimental and you figure things out as you proceed through the module."*

o *"It increases the engagement rather than just reading alone"*

o *"Made me feel like I was taking part in learning and I understood things more"*

o *"For me, it has provided an interactive method of applying my knowledge to a situation and has reinforced my learning significantly."*

o *"I do not always complete the activities but only when I want to gain a deeper insight. Overall I feel that the activities are a great value as the make studying less passive and the module material is presented in a 'friendly' way."*

### 4. Checking understanding and consolidating

Students found it beneficial to complete tasks at points in the course where they needed to consolidate knowledge and check that they have understood the material.

### 5. Variety

Students found that a variety of learning activities helped to keep them engaged with their course and made it more interesting and fun to study. Comments included:

o *"With home learning you need to have different experiences other than reading, to keep the course interesting & engaging."*

o *"It was very interesting and fun experience, different to just reading the material and making notes"* o *"They kept the content light and enjoyable"*

o *"It keeps my interest and changed frequently to keep my engagement in my studies."*

o *"I found the interactive resources helped to better engage with the materials and made allowances for different learning styles."*

**Focus Group Discussions**

Each focus group was shown a series of examples of interactive resources. Students were invited to discuss resources from their own course but were also shown resources from the other module to consider whether these would have been useful to them. Below are comments first from law students and then business students.

*Law*

Law students attending the focus groups achieved overall grades for W101 ranging from 58% to 87%. However, it is worth noting that those attending the focus groups were all highly engaged students who advised that they had made use of most or all of the activities within the unit. This may not be representative of the overall student body but is a common limitation of focus groups; those students prepared to input are often very engaged with their studies.

### Free-text activities

Students reported using these in different ways. Some students would complete them in full before revealing the feedback, others would type bullet point answers and one student advised that they would think about the answers but sometimes just type "test" in the text box so that they could reveal the feedback. However, all agreed that the feedback was an essential component. This allowed them to see what they might have missed within an answer and provided advice on what was relevant to the question, which was useful when preparing assignments.

In relation to skills development, students advised that the word limits were useful to them as it helped to build the skill of writing succinctly and "*get to the point*". It was also useful preparation for the assignments, which are subject to strict word limits.

One participant stated that the scenario-based activities were extremely helpful in terms of being able to apply the law to a set of facts; "*I made a right pig's ear of this to start with, but the feedback showed up my errors and I was able to work on the skills*".

Another participant particularly valued activities requiring them to make notes on a given resource or pick out relevant information. They advised "*I can now focus on the key points and avoid waffle*".

Students found it especially useful that they were able to return to activities later to review their answers and refresh their memory.

Whilst useful, students did note that these activities were time consuming with one stating that, where time is short, they would skip the free-text activities but still engage with quicker ones like drag-and-drop and multiple-choice questions (discussed below). Students also advised that they preferred to see the free-text activities within the main body of the course materials and not used as consolidation tasks. Again, they preferred the use of quicker multiple-choice questions to identify gaps when consolidating.

### Drag-and-drop

Students unanimously likes these activities. They felt they were fun and a good way to check understanding. The fact that they can be completed relatively quickly meant that students could complete them in small amounts of study time they had available. The only difficulty students experienced was when the formatting meant that they had to scroll up and down to see the whole activity. This also made it difficult to "drop" items in the right place.

### Multiple-Choice Questions

Students valued these to check their understanding, recap topics, consolidate and identify any gaps in learning. One student advised that these questions were good when time is limited as the activities could be started and returned to later. Another advised that these types of questions helped them to develop the skill of reading questions very carefully to ensure that the correct answer was selected.

One student stated that they would "*like to see more short activities*".

### Grids and diagrams to complete

The completion of grids received a mixed response. One student said that they always use a grid when planning answers to problem questions while another preferred using mind maps and so did not really engage with grids.

Students were shown an example of a diagram for completion from the B100 materials, and some said they would find this helpful, particularly if they were able to download it and retain it within their notes. Overall, the completion of these types of activities seemed to vary depending on students' preferred methods of notetaking and planning.

### Forums

Students were reticent about forum activities. Some advised that they liked to engage with the forum whilst others stated that they preferred to discuss the course with those they were friends with outside of the OU forums. There was a general nervousness about posting on discussion forums where other students could read and comment on work. Students liked the fact that this was optional on W101 and did not contribute to their overall module grade.

### External resources and library research

Students advised that they experienced some difficulties with website links as some had changed or been removed. They like this type of resource but find it frustrating when a link did not work.

W101 students were given activities to help them use legal databases to access specific materials via the OU online Library. Students said that this was useful and that the step-by-step guidance is essential to help them build the skill of finding resources in this way. One student advised that they revisited these activities as a reminder of the process to follow to find resources. However, it was felt that too many of these activities would cause students to get "*bogged down*" as they would have to keep going outside of the course materials at a stage where this was not yet required.

### Time spent

Participants reported that the time they spent engaging with online activities did not change significantly throughout the course. Where they found they had little time available they would focus on the shorter activities but generally would complete most. It was agreed that having a suggested length of time to spend on each activity was a useful feature, one student commenting that it stopped them "*spending an hour and a half on a 20 minute activity*". Another student said that they often spent longer on each activity than the time suggested but agreed that the timings were a useful guide.

### Business

Business students attending the focus groups received overall grades for B100 ranging from 66% to 84%.

### Free-text activities

Like the law students, business students valued the feedback provided, which allowed them to reflect on their answers. One participant confessed that they "*could be tempted to cheat*"! However, the fact that the feedback was being accessed and used to consider how to successfully answer a question was still a useful resource.

The way in which students used the activities varied, some using the text box provided while others preferred to write their answers onto paper in the form of a mind map and then type a more limited amount into the box. One student advised that they "*rarely complete the online activities. I will watch the video or read the case study but rarely complete them. I think about them and then just click reveal feedback... to see if it matches my thoughts*". It is clear, however, that all students engaged with the feedback regardless of the way in which they used the text box provided and agreed that this was the most useful aspect of the activities. It was agreed that the feedback gave greater insight into areas students might not have considered and provided immediate guidance where they were struggling. It was also a resource for students to return to when preparing assignments.

Students agreed that word counts, particularly for short answer questions, would be useful preparation for TMAs by giving practise at writing succinctly. One participant also noted that this would also be a useful guide as to how much information to include for students who have not studied for a while.

### Videos

B100 students were asked to comment on an activity where they were required to watch a video. Responses to this were mixed with some enjoying the audio/visual component but on advising that they tend to use the transcript instead. Students who watched the resource would take notes and then use these notes to complete the activity. One student advised that they would prefer multiple choice questions to text-based activities to help identify and consolidate the key aspects of the resource.

### Drag-and-drop

Students reported that they enjoy this sort of activity. They are good for defining terms and to "*get the brain working*". They are particularly useful as a short activity to consolidate knowledge.

The only negative comments about drag-and-drop activities related to functionality. One student found it annoying that they could not be accessed on the study app and another advised that they do not always work well on an iPad.

### Multiple choice questions

There were mixed feelings about multiple choice questions on B100. Some students advised that they would be useful to pick out points from a resource. However, the activity displayed in the focus group was a surveystyle questions where students were asked whether they agreed or disagreed with statements. Some students enjoyed this whilst one felt it was "*not useful for learning*", and another stated that they avoided this type of activity because they "*always ended up in the middle*" not having strong feelings either way. It was generally agreed that multiple choice questions could be useful but that it "*depended on the context*".

### Interactive diagrams

Students advised that these were "*quite good*" and "*useful when looking at concepts*" but could be "*a bit fiddly*" to complete online. That said, their transferability to the workplace was recognised with one student stating that they sometimes blank out the contents and apply them within the workplace.

### Websites and databases

Students enjoyed looking at external resources but agreed that it would be much easier if the links opened up in a separate tab as it is very difficult to navigate back to the course page and they would like to have both resources open at once.

B100 students were asked if they would enjoy having library activities to complete and they agreed that a requirement to search the library would be useful as opposed to being provided with links to all the required resources.

***Forum activities***

It is a compulsory element of B100 to take part in forum discussions and these form part of the assessed work.

Only one student was particularly positive about forum activities, advising that they "...*found these really helpful... (there was) a fair amount of healthy discussion about different ideas on my tutor group forum... it makes you see different views*".

Other students advised that they find the forums "*intimidating*" and "*painful*". One student stated that they "*do the forum activities but don't like responding to others*". Another said that they "*read what others have written and don't comment*". There was also a feeling that students "*just agree*" and "*piggyback off peers' responses*", and that this diminishes the value of the discussions.

**Conclusions drawn from the focus groups**

- Students value the feedback provided. This can be used in different ways depending on how students decide to engage with the activity.
- Word counts are a good means of helping to develop the skill of writing succinctly and including only relevant information.

- Students enjoy short activities such as drag-and-drop and will engage with these even if time is short. Students would like to see more short activities being built into the module materials.
- Multiple choice questions are popular when used to consolidate, check knowledge and identify gaps. They can also help students to develop the skill of identifying what a question is asking.
- Diagrams and grids are used to a varying degree by different students depending on their preferences for note-taking and planning answers.
- External resources such as videos and websites are a good means of variation but are, again, used in different ways by students depending on their preferences for learning.
- Students value the opportunity to engage with the library resources.
- The least valued type of activity is contributing to group forums. Whilst some students find the discussion useful, the majority attending focus groups did not like contributing and reported limited value in the discussions.
- Students found it frustrating when tasks were difficult to complete for technical reasons, and when links were not working.

One student summed up the discussions best in stating that the "...*variety of interactivities helps me enjoy learning*".

### 4. Summary and Recommendations

Both the questionnaire and focus groups demonstrate that, on the whole, students value the inclusion of the interactivities within their course materials, and that they engage with these to the extent that they are able. Where interaction increased it was as a result of growing motivation and confidence in the course, as well as the more time-consuming nature of the activities available. Students reported that the variety of activities, as well as the need to undertake tasks rather than purely reading and note-taking, led to more engaged and active learning. Restrictions on engagement generally related to the time students had available. Those students reporting that they did not value the activities cited the fact that they did not find them sufficiently challenging.

One of the main motivators for students in completing interactivities is the availability of immediate feedback, which builds students' confidence in their answers, allowing them feedback and guidance without awaiting the outcome of an assignment and allowing them to recognise gaps in their own learning without the "cost" of this affecting their overall grade. Students also advised that this feedback enabled them to build skills and that the activities served as a useful point of reference when completing assignments.

Comments show that students like to engage with a variety of different types of activities. Free-text answers are seen as a useful means of developing skills and receiving feedback. Multiple choice questions are useful to check knowledge and consolidate; students prefer to see these at the end of units. However, students also find it useful to have shorter activities, for example drag-and-drop activities, within the materials to break up the reading, add some fun, check knowledge, and allow them to undertake a useful activity within a small amount of available study time. Generally, students wanted to see more of the shorter activities being used.

The most common barrier to using the activities are computer issues including the lack of availability of the activities on different devices, activities not being able to fit on the screen resulting in tricky scrolling, links opening in separate tabs resulting in navigation difficulties and not being able to access activities using the OU Study app.

Based on the above findings, recommendations to course authors are:

1. Ensure that interactivities are an integral consideration when authoring materials. These are highly valued by students, but the use and placement are factors in determining engagement.
2. Variety is key. It is advisable to include a number of short activities throughout the materials, but also longer drafting activities to help students to develop skills. Multiple choice questions are highly valued as a means of checking knowledge and reflecting on which areas of a unit to re-visit.
3. When considering the use of forum activities (and in particular compulsory posts on forums) ensure that there is real value to the students in terms of their intended outcome. Students can find these activities daunting and often lacking value. However, where there is genuine discussion generated and a link building a skill such as critical engagement, they can be viewed as useful.
4. With time being a key constraint, consider the length and depth of activities within the wider context of the course. If, for instance, it is a heavy reading week or an assignment is coming up, students are less likely to have the time available to complete lengthy activities but may still engage with shorter interactions.
5. Consider whether it is appropriate to include additional, optional activities to challenge those who may require an additional content and depth to keep them engaged and motivated.
6. Ensure that feedback is provided for activities students have undertaken, and that this is sufficient to help them reflect on where they have achieved what was required, and the improvements that they could have made.

7. Be sure to include an indication of how long an activity is likely to take, as well as a suggested word count where the activity requires the use of free-text.

8. Liaise with the relevant department (in the Open University: Learning Design Team) if you are unsure of how an intended activity will function, or how it will appear so that activities can be drafted in a way enables them to be visible on one screen without scrolling.

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# Morphological Awareness with digital gamification tools

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## Abstract

In recent years, there has been an intense reflection on ways to improve students' levels of language awareness, especially in small classes. In particular, morphological awareness is of apparent interest, as this meta-linguistic ability focuses on semantic units, such as morphemes, and its development requires the integration of many aspects of linguistic awareness (phonological, semantic, syntactic, orthographic) to achieve literacy of the person (Siegel & Lipka, 2008; Grigorakis & Manolitsis, 2021). Various research findings on Morphological Awareness (MA) show that its different aspects do not develop at the same rate in children. Thus, inflectional morphological awareness develops faster, followed by the synthesis of morphological awareness. In contrast, productive morphological awareness grows slower, as shown by research data from English, Chinese, and modern Greek (Kuo & Anderson, 2006; Tsesmeli & Seymour, 2006). Consequently, synthetic and productive morphological awareness develops parallel during the students' studies in Primary Education. The productive morphology, however, also shows signs of progress in older students, reaching the Secondary School, specifically the Gymnasium (Casalis & Luis-Alexandre, 2000). The modern educational practice, which has now definitively integrated digital resources and digital tools into every learning process, seeks, on the one hand, to attract students' interest and, on the other hand, their gradual autonomy in discovering and consolidating knowledge. In this context, gamification borrows elements from the design philosophy of electronic games and "builds" learning activities to make them more enjoyable and, above all, more effective (Salen & Zimmerman, 2004; Deterding et al., 2011; Smith & Abrams, 2019). Morphological awareness activities, mainly production, and composition, are structured on digital gamification tools, such as Kahoot, Quiziz, ClassDojo, Classcraft, Socrative, and Nearpod. The suggested exercises refer to segmentation, awareness of the number of morphemes, manipulation of morphemes to construct new words, and finding the meaning of unknown words through morphemic analysis. The current paper will present digital tools suitable for cultivating or evaluating student's morphological awareness.

**Keywords:** morphological awareness, digital tools, gamification.

## 1. Introduction

Morphological Awareness is defined as the individual's conscious knowledge of the morphological structure of the language he speaks and his ability to manipulate this structure with intent. It includes the element of cognitive manipulation of morphological units (Magoula & Katsouda, 2011; Manolitsis et al., 2009). Kuo and Anderson (2006) describe it as the ability of a student or adult to break down spoken language into morphemes, consciously manipulate these morphemes, and combine them according to the word formation rules of his language. It is based on morphological knowledge, with which, however, it has yet to be identified since its appearance requires a conscious thought about the morphological structure of words (Manolitsis et al., 2011).

The definition of Morphological Awareness, as in other meta-linguistic domains, is generally used and covers a wide range of morphology-related abilities. Morphological Awareness, however, is "constructed" by the awareness of the three morphological processes: the awareness of inflection or inflectional morphological awareness, the awareness of production or productive inflectional awareness, and the awareness of the morphology of the composition (Magoula & Katsouda, 2011). Various types of research at an international level refer to the relationship of morphological awareness to the acquisition of literacy, specifically reading, writing, and vocabulary. In many alphabetic systems, as in Greek, it is impossible to learn to write and read without considering morphemes, thus recognizing the value of morphological awareness. In many alphabetic and non-alphabetic languages, such as English, French, Chinese, Arabic, Hebrew, and Czech, the importance of morphological awareness and its relation to learning difficulties and phonological awareness has been studied (Davis & Bowers, 2006; Seymour, 2005;).

Inflectional morphology refers to the analysis of the grammatical function of a word according to the syntax of the sentence. Inflectional morphemes indicate syntactic or semantic relationships between words in a sentence without changing the meaning or grammatical category of the subject. For example, in the Greek language, the endings -os -a, -i, etc. of nouns indicate gender, number, and person and are inflectional morphemes (Douklias & Konstantinidou, 2010). Productive morphology consists of adding affixes before (prefixes) or after the subject (suffixes) and is characterized by a wide variety of types and functions, compared to inflectional morphology, which is more limited and slows down its development. Each productive morpheme can only be combined with specific categories of subjects. Thus, while inflectional morphology begins in preschool age and the most important rules have been mastered in the first years of elementary school, the acquisition of productive morphology develops later. It involves a longer developmental path (Douklias & Konstantinidou, 2010).

## 2. Morphological theory and language development

Morphological theory moves into five main fields. Those are:

1. The recognition of the word as a grammatical category that has a central position in the language and is easily recognized by speakers as a distinct unit,
2. The recognition of morphemes as the minor pieces of the word that have a form and meaning,
3. The morphological processes (with the main ones being the composition of lexical morphemes, production through prefixes and suffixes, and inflection),
4. The relationship of morphology and its interaction with the other levels of language analysis: phonology, syntax-semantics, and
5. The typology of languages according to their morphological structure: if they are analytic, they consist of free morphemes or synthetic, if words consist of more than one morpheme (Giannoulopoulou, 2015).

In research carried out in Greek, various findings were presented regarding the relationship between morphology and correct writing. According to Diakogiorgi, it appears that children from the age of 6 are sensitive to morphological violations (Magoula, 2000). Also, other research has shown that 1st-grade children use at least three strategies to write correctly: phonological, morphological, and memorization. Morphological strategy use improves with development. Thus, errors in final morphemes are significantly reduced in the final grades of elementary school (Douklias & Konstantinidou, 2010).

Harris & Giannouli (1999), after their research, argue that syllabic and morpho-syntactic awareness is necessary for the spelling of words with a morphological ending, without of course, having this meaning that at a young age, children can apply the morphological rule in cases of new words. Bryant, Nunes, and Aidinis (1999), in

their comparative research in English, French, and Greek in 2nd to 5th-grade children, concluded that in Greek, there is a direct relationship between morpho-syntactic awareness and the acceptance of morphemes as units spelling. Also, morphological strategies develop over two years from the time children begin to learn to read and write since children follow spelling patterns that show a clear awareness of the influence of morphology on orthographic writing in the 4th and 5th grades (Magoula & Koutoumanou, 2009). Nunes & Bryant (2009), during their research on the combination of phonological and morphological awareness in the development of literacy in the English language, came to the following conclusions: a) There is an effective intervention in reading at later stages for children with dyslexia, b) There is a dual pathway model for literacy acquisition through both phonological and morphological awareness, which helps both proficient and poor readers and c) Phonological awareness enhances reading while morphological awareness enhances spelling.

## 3. Literature regarding gamification

In the modern digital age, where electronic games are one of the most basic forms of entertainment, students of all levels are "open" to using the mechanisms that characterize them in their daily activities unrelated to entertainment. In its search for new approaches that will arouse the interest of learners and the desire to learn, the educational community has turned to these mechanisms, trying to exploit them to make schoolwork more fun and, therefore, more effective.

Gamification is using various game mechanisms and elements such as scores, prizes, competitions, and challenges in activities that are not directly related to them but aim to improve the learning experience. If utilized correctly in the educational process, these elements can dramatically increase student interest and engagement to achieve better learning outcomes (Kapp, 2012).

Gamification is neither a game nor learning through play (Game-Based Learning) nor aimed at entertainment. On the contrary, it remains focused on the learning goals. It is a different approach to learning, with the concept of play. While in Game-Based Learning, we have the game itself as a means of teaching, in gamification, we have the mechanisms and elements that govern a game. It targets intrinsic motivation by using extrinsic motivation tools such as virtual medals, badges, gifts, avatars, and achievements. Kapp (2012) defines it as the means to add, interaction, participation, and immersion that will lead to a good learning result" (Kapp, 2012, p. 7).

## 4. Why apply gamification in education?

"One learns more in an hour of play than in an hour of discussion." – Plato –

Students' reduced interest in engaging in learning processes is a problem observed in most developed countries at all levels of education. Boredom and apathy are the main reasons for the insufficient participation of students in the classroom (Shernoff et al., 2014). In addition, as noted by Huang & Soman (2013), the enjoyment offered by technology in electronic games, social networks, and the Internet distracts their attention from school duties.

Modern studies showed that in the E.U., 74% of young people use the Internet daily at home, and only 21% use the Internet at school (Mascheroni & Ólafsson, 2014). The average age of first contact with the Internet in 2014 was eight years. For a child who has incorporated technology into his daily life, the classroom that has unfortunately been unable to keep up with these technological advances is dull and old-fashioned. This problem was solved by introducing ICT in education, even using electronic games.

Gamification, as a next step after using electronic games, came to contribute to increasing students' interest in the classroom. It was based on the idea that if electronic games attract interest, then introducing the elements

that make them attractive into education could also make education an exciting process (Wu, 2018). Its introduction into the educational process promises to motivate students to participate, turning the school into a more pleasant environment (Gibson & Jakl, 2015). By transferring the elements that offer pleasure to the player into the classroom from the world of games, it seeks to offer the same pleasure to the student without using the game itself. It began to be mentioned as a didactic approach in the second decade of the 2000s (Smith & Abrams, 2019).

## 5. Relationship of games to education

A basic theory that studies human motivation is Behaviorism. Behaviorism deals with the observation of human behavior and relies heavily on the idea of rewards to reinforce a desired behavior. Gamification provides excellent variety in how incentives and rewards are delivered.

The integration of gamification in education is based on some fundamental characteristics shared with games (Sanchez et al., 2017). In games, there is always a definite purpose: winning. The player fights for this goal by trying to overcome some obstacles. In education, learning is the eminent goal. The learner has to achieve this goal by overcoming obstacles and doing activities gradually enriched with new knowledge.

It moves from one level to a more difficult one. Tracking a player's progress within the game is crucial because it also determines their evolution. The degree of difficulty of the activities increases. The learning path that the learner will follow depends on the knowledge he has acquired and his abilities (Glover, 2013). Gamification is not directly related to knowledge and skills. However, it motivates and reinforces behaviors that can lead to acquiring knowledge and skills (Hsin-Yuan Huang & Soman, 2013).

Although gamification is not new, the appropriate conditions for its implementation in school classrooms have recently been presented. A critical factor was the skyrocketing popularity of electronic games, which reached the point of surpassing other entertainment industries such as cinema. At the same time, the emergence of WEB2.0 with a multitude of applications and social networking platforms created a new category of players who can play anywhere with anyone with mobile devices (Social games). The creation of these games has contributed to the spread of gamification (Hamari & Eranti, 2011).

## 6. Research on the application of gamification

Simões, Redondo, and Vilas (2015) did action research applying gamification to a social learning platform, Schoooool.com, which was a platform where young students were able to read, write, draw, play and create digital material in collaboration with their classmates, designed so that students learn more independently. The research, which had a sample of 26 Portuguese primary school students, showed that using the platform with gamification elements helped the students and that gamification in a technology-enriched learning environment can contribute to student engagement and motivation.

Using gamification, Jones, Madden, and Wengreen (2014) tried to increase the consumption of fruits and vegetables in elementary school students from the 1st to 5th grade. The intervention they designed had storytelling elements, where heroic characters (students) were rewarded whenever the whole school had to meet a specific fruit and vegetable consumption target. The gamified intervention lasted one month, during which fruit and vegetable consumption increased by 33%–39%. The research also showed that the students had fun with the way the process was implemented.

Kickmeier-Rust & Albert (2013), using gamification mechanisms, designed a tool for teaching the act of multiplication to a sample of 58 students in grades B and C of primary school in Austria. This tool provided formative feedback not only on the correctness of the answer but also on what skills the student has or needs

to improve. Gamification elements such as competition, levels, feedback, and score were used. According to research results, even the simplest form of gamification has the potential to enhance student motivation and engagement.

In a study that took place in Zagreb (Aleksic-Maslac et al., 2017) in order to measure the use of gamification in the lectures of professors of the School of Economics and Management, it emerged that from 50% of the participation of the total sample of professors, the 32% used gamification in their lectures. Based on the above result, an attempt was made to identify why they do not apply gamification and to what extent the 32% who do apply it are satisfied.

Of those who do not implement gamification:

- 54% stated their lack of familiarity with the relevant tools as the reason
- only 2.3% that it does not fit as an approach to the subject they teach.
- Among those who do not use gamification: ○ 92% consider including this specific approach in their future educational interventions.
    - ○ 67% of those who implement it started after training to learn the relevant tools to introduce the approach into the classroom.

According to the study, all of them consider gamification necessary in terms of its ability to motivate students. 50% rated it with five on a Likert scale from 1 to 5, and the remaining 50% with 4 (Aleksic-Maslac et al., 2017, p. 77).

In the same research context, the degree of student satisfaction with using gamification in lectures was studied. The survey was conducted in the 2016-2017 academic year, and 20% of undergraduate students participated. Students expressed their satisfaction with using gamification in their education on a Likert scale from 1 to 5. From this measurement, it emerged that:

- 67% expressed their satisfaction with a grade of 5
- 27% with grade 4.
- A minimal percentage, 5%, expressed satisfaction with a grade of 3, and only 1% expressed that they did not like the approach (Aleksic-Maslac et al., 2017, p. 77 - 78).

The above research shows the enthusiasm that gamification causes in the trainees and the massive acceptance of it by the teachers, who, in a large percentage, integrate it or are thinking of integrating it into their teaching in the future. It also shows a significant gap in informing the educational community about modern WEB 2.0 tools for gamification and how they can take advantage of them.

## 7. Gamification platforms

As it was mentioned above, modern students learn differently. At the same time, the learning process needs to be self-orientated. These two needs are targeted by Web 2.0 platforms, one of the most common used is "Kahoot!". It is a comprehensive range learning platform based on a behavioral approach (Kilipatrick et al., 2022; Plump & LaRosa, 2017). It is commonly used as an adequate tool to strengthen students' self-confidence while dealing with various exercises, simple or complex. Other researchers have found significant effects on the scores of the groups that have used Kahoot! as a learning tool (Iwamoto et al., 2017) and that it can also be used effectively as a vocabulary-learning strategy (Göksün & Gürsoy, 2018).

"Quizziz" has proven exciting and promising among those game-based platforms used in education. It is a Web 2.0 tool that is extra popular in assessment. It has also been used in virtual language lessons during the pandemic of COVID-19 and as a means of enhancing motivation towards language learning (España-Delgado, 2023). The "debriefing" from the student side measured by España-Delgado (2023) in a private school in Colombia showed that the specific platform outnumbered "Kahoot!" and "Quizalize" due to its appeal and the engagement it caused to the students.

Another popular platform is "ClassDojo," which in 2016 had 2.4 million teacher accounts covering 53 million students in 180 countries (Gooch et al., 2016). The platform is easily customized depending on needs or teaching practices and allows the creation of badges by the teachers to motivate their students accordingly (Yuen, 2021). The feasibility of the system to work on a tablet is an add-on. The platform was used with quite a success from teachers towards dyslexic students going from primary to secondary education. Other studies state that due to its teacher/student-friendly system, teachers could use variations of pedagogical approaches with creativity, which significantly affected these students in the best way (Dillon et al., 2019).

Using another gamification platform, such as "Classcraft," to support any school lesson has received much attention over the past few years. According to various surveys, its fundamental purpose is facilitating students' participation, teamwork, and engagement. Besides, it authorizes teachers to gamify a complete course and add only distinguishing gamified activities or modules. Membrive and Armie (2020) implemented Classcraft in an English as a second language university course, exemplifying that the platform increased students' involvement in learning and collaboration. As well as these, Bizota and Makri (2022) employed Classcraft in an integration classroom of a Greek primary school with eight refugee students aged 9 to 11. All students came from different linguistic backgrounds. The findings indicated that the game elements that impacted students' engagement were competition and collaboration. Most learners attained the scenario's language goal, displaying that gamification can promote language development and, precisely, morphological awareness if adjusted to students' language level (Bizota & Makri, 2022, p. 662).

Socrative is also an alternative learning platform with practical use in the classroom. Among its more relevant uses are creating quizzes, questionnaires with a time limit, and exit tickets that give the students results rankings (Carrión Candel & Roblizo Colmenero, 2022). All three kinds of quizzes take the format of either simple or multiple-choice answers. As an online student response system, it permits students to respond in real-time from their digital devices. It can also be used as an evaluation questionnaire to focus and discuss students' time troubleshooting learning areas (Muir et al., 2020). Ciampa (2017) pointed out through some interviews she conducted with teachers in her case study that immediate feedback provided through Socrative helps teachers save time in grading and resources (i.e., paper). In terms of language development, she also suggested that students should be taught to use sources like visual, video, and auditory material, which can be very helpful in unlocking the meaning of discipline-specific vocabulary instead of putting them in a position to decode linguistic text. This strategy can increase their opportunities to respond to teamwork and collaboration. Hovey et al. (2019) suggested using response cards via Socrative while children think and prepare their answers. Those cards could be preprinted pictures, signs, or erasable whiteboards that students hold to respond to teacher questioning. Bahari et al. (2021) proposed a three-stage model to assess students' achievements using Socrative or any other online student response system. It requires teacher observation, learner self-selection - teacher assignment of different assessment tools, and formative analysis of students' performance.

## 8. Conclusions

This paper presents the given literature concerning morphological awareness and digital gamification tools and how this kind of linguistic awareness can be enhanced. Modern research discusses the need to use gamification

platforms to assist students' learning process. Students' motivation and collaboration are the most common positive outcomes of using gamification platforms. The teacher's role seems also to be differentiated; instead of lecturing, he/she tries to think of ways of making his lesson more intriguing for the students through gamified targeted learning activities. These mentioned aspects could be observed in upcoming conducted surveys.

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# Mobility and Internationalization

# Unveiling a Structured Methodology for Needs Analysis in Erasmus+ Initiatives: How Do PARADIGM Tools Enhance Internet of Things and STEM in Environmental Education

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## Abstract

This paper aims at unveiling an innovative methodology for needs analysis, intended to serve as a beacon for future Erasmus+ initiatives. The nucleus of this discourse is the PARADIGM project, an enterprise propelled by the Erasmus+ KA2 program, within which we orchestrated a comprehensive scientific needs analysis to decipher the pedagogical and technological implications of the PARADIGM tools.

The first step in our methodology involves an in-depth exploration of the present-day milieu of IoT and STEM education, highlighting their integral role as pedagogical vehicles in fostering environmental awareness and digital activism. This exploration was informed by our first research, a literature review previously presented at 15th annual International Conference of Education, Research and Innovation, setting the directional course of our scientific needs analysis.

As we advanced in our methodology, we integrated insights from our second study, an experimental research piece involving pre and post-tests, slated for presentation at the 2023 IEEE ASEE Frontiers in Education Conference. This critical component added depth to our needs analysis framework. The data gathered and insights drawn from this experimental study served as a linchpin in assessing the tools' effectiveness, offering valuable metrics to inform future refinements, interventions, and enhancements.

During our needs analysis, we have unearthed the substantial impact of PARADIGM tools in enhancing educators' preparedness to adopt and integrate advanced teaching methodologies. The synergy of IoT technologies and data-driven tasks empowers educators to devise immersive learning scenarios, enriching students' understanding of environmental phenomena and their resulting consequences.

Broadening the scope of our needs analysis to incorporate broader societal considerations, we acknowledge the potential of PARADIGM tools as enablers for fostering sustainable practices and informed decision-making, thus making strides towards the formation of an environmentally mindful society.

In conclusion, this paper meticulously analyzes the pedagogical and technological impacts of the PARADIGM tools. It reinforces the robustness of the needs analysis framework conceived and applied by the Paradigm European partners. Additionally, it outlines a blueprint for a forward-looking research needs framework tailored to Erasmus+ KA2 projects. This academic endeavour represents a significant advancement in harnessing the potential of IoT and STEM in environmental education. These advancements are substantiated by references to our previously presented research papers.

**Keywords:** Needs analysis, Erasmus+ initiatives, PARADIGM tools, IoT and STEM, environmental education.

## 1. Introduction

In the evolving landscape of higher education, the intersection of technology, teaching methodologies and global trends heralds a new era. Among the technological advancements, the Internet of Things (IoT) emerges as a pivotal force, propelling innovations in STEM education. He, Ji, and Bobbie's (2017) research underscores the role of IoT as a foundational learning structure that augments STEM undergraduate education. This perspective aligns with Burd et al.'s (2018) insights on the transformative influence of IoT in undergraduate

computer and information science courses. Contemporary universities, as highlighted by Al-Zoubi et al. (2022) are acknowledging the promise of IoT, with some even introducing specialized Bachelor Degree Programs in IoT Engineering.

This educational metamorphosis is not confined to tertiary institutions. IoT instructional tools are becoming ubiquitous in STEM classrooms, marking a shift from traditional methods and setting the stage for future educational paradigms, as illustrated by Fidai et al. (2019). As IoT redefines teaching approaches, a holistic comprehension becomes imperative. Abichandani et al. (2022) offer an in-depth exploration of IoT's curriculum, teaching strategies, and evaluation in STEM, shedding light on its multifaceted contributions. Similarly, Underwood and Finney (2022) introduced the 'Intranet of Things' concept for educational purposes, underscoring the significance of localized, internal networks in academic environments.

In primary and secondary schooling, Vakaloudis (2020) and team have pinpointed both the challenges and success strategies when empowering educators with IoT tools for STEM instruction. This integration is also resonating in the e-learning sphere, with scholars like Zahedi and Dehghan (2019) affirming the efficacy of elearning platforms powered by IoT. Concurrently, educational entities are rolling out training initiatives to cultivate a new cohort of creators adept at leveraging the capabilities of IoT.

Yet, the discourse is not solely about technological assimilation; it is about grasping the broader context. Bouezzeddine's (2022) insights into the inception of Industry 5.0 provide a fresh perspective on global engineering education, emphasizing the symbiotic relationship between technology, industry and teaching methodologies. Even foundational courses, like the one on microcontrollers detailed by Rowland and Sundaram (2021), are integrating IoT elements. Looking ahead, the role of recommender systems in education, as explored by Manouselis et al. (2012), might be pivotal for tailoring individualized learning experiences through IoT.

To effectively integrate these advancements into STEM education, it is imperative to undertake a comprehensive needs analysis. Such an analysis ensures that the pedagogical strategies employed are not only innovative but also tailored to the specific requirements of the learners and the curriculum (Osman et al., 2023). A meticulous needs analysis forms the bedrock of successful curriculum development and pedagogical strategy formulation in STEM education (Berger, 2023). Furthermore, without a thorough understanding of the educational needs, even the most advanced technological tools might fail to achieve their intended impact (Schueller, 2022).

The convergence of IoT and education is promising, serving not merely as a practical tool but as a catalyst for pedagogical innovation and global scholarly dialogue. The path forward, while fraught with challenges, is teeming with potential.

Based on the above, this paper endeavors to unveil a groundbreaking approach for needs assessment, envisioned as a guiding light for subsequent Erasmus+ endeavors. Central to this discussion is the PARADIGM project, a venture championed by the Erasmus+ KA2 program. Within this framework, we conducted an exhaustive scientific needs analysis to unravel the pedagogical and technological nuances of the PARADIGM instruments.

## 2. The PARADIGM Project: Bridging IoT-STEM Education and Environmental Sustainability

The educational landscape is continually evolving, and at its forefront is the PARADIGM project. This initiative seamlessly blends sustainability, community engagement, and technological advancements, aiming to instill a sustainable ethos within students and the broader community. More than just an academic venture, the

PARADIGM project represents a comprehensive approach that melds theoretical insights with tangible applications.

A cornerstone of the PARADIGM initiative is the educators' involvement. Their journey within the project commences with an in-depth familiarization with the primary tools integral to the initiative. The first of these tools is the e-training course, designed to elevate environmental awareness among educators. This course not only provides analytical insights into ecological challenges but also offers pedagogical strategies, ensuring educators are well-equipped to lead citizen science initiatives and foster student engagement.

Following the e-training course, educators delve into two additional tools that ensure they are adeptly prepared to guide students through hands-on activities. These activities, rooted in real-world scenarios, draw from pedagogical models tailored for experiential learning. Each tool, unique in its functionality, is woven into the curriculum, enabling educators to navigate students through its nuances.

The project unveils the IoT-STEM Based Environmental Observatories Framework. This groundbreaking framework is instrumental in shaping the PARADIGM Observatories. Furthermore, it champions the assimilation of DIY Kits within educational environments. Here, educators are equipped with a structured methodology, guiding students in the collection, analysis, and interpretation of environmental data. This empirical strategy is enriched by scenario planning modules, empowering students to conceptualize and craft potential ecosystem interactions derived from their data-driven insights.

As the project advances, it heralds the inception of the Citizen Science Platform, christened as the PARADIGM Virtual Maker Space and Repository. This platform transcends being a mere digital interface; it emerges as a collaborative epicenter for environmental exploration. Participants are beckoned to undertake advanced studies, fostering dialogues anchored in data and encouraging the proposition of evidence-backed solutions. Additionally, this platform serves as a conduit for research dissemination, embracing diverse multimedia avenues, from vodcasts and podcasts to digital narratives.

## 3. Need Analysis in Paradigm project

The PARADIGM project emerges as a pioneering initiative in the seamless integration of the Internet of Things (IoT) within the educational domain. With the surge in the ubiquity of IoT devices, particularly in secondary school STEM curricula, there's an increasing emphasis on ensuring educators are not only well-versed with the technical intricacies of IoT—including its systems, hardware, and software—but also possess the pedagogical prowess to effectively convey this knowledge to students (Burd et al,2018; Al-Zoubi et al., 2022).

At the onset of the PARADIGM project, a rigorous systematic research review was undertaken. This comprehensive literature review is presentred in "Leveraging the Internet of Things towards raising environmental awareness in European classrooms" by Kouvara et al. (2022). Systematic reviews, as highlighted by Abichandani et al. (2022), offer a structured approach to assessing existing literature, ensuring that the project's direction aligns with the evolving demands of modern-day education. This endeavor was further bolstered by foundational research by Fidai et al., (2019), emphasizing the importance of a holistic understanding of the subject matter.

To gauge the tangible impact of the project, the subsequent phase adopted an experimental research methodology, a standard in empirical studies as noted by Sanders (2012). This phase involved pre and postengagement evaluations, complemented by educators. Feedback collated from fifty educators across Greece, Spain, and Cyprus underscored a significant enhancement in their grasp of IoT, attesting to the efficacy

of the PARADIGM tools. These pivotal findings are meticulously detailed in "Why Re-focus on IoT in education? Evidence of the PARADIGM Project" by Kouvara et al. (2023).

While the feedback illuminated the educators' augmented capability post-training, it left certain areas unexplored, notably the broader ramifications on the STEM curriculum and the overall quality of IoT instruction. To bridge this knowledge gap, the project's third phase is poised to undertake a sweeping evaluation of classroom projects, encompassing a broad spectrum of educators. This in-depth assessment will delve into the nuances of training's influence on curriculum design, classroom dynamics, and educators' foundational tech acumen.

Central to this evaluation is Bloom's Taxonomy, a renowned model that categorizes cognitive skills. Projects will be meticulously evaluated for their congruence with this taxonomy, shedding light on students' cognitive immersion during the projects. Upon project completion, educators' insights will be aggregated through questionnaires. When juxtaposed with the Bloom's Taxonomy assessment, this feedback will paint a holistic portrait of the project's triumphs in realizing its pedagogical aspirations (Rahmawati, et al., 2021).

## 4. Conclusions

The PARADIGM initiative, underpinned by the Erasmus+ KA2 program, stands as a proposed need analysis model in the realm of educational research frameworks, aiming to elucidate the integration of Internet of Things (IoT) technologies within STEM pedagogy, with a pronounced emphasis on environmental education. This framework is anchored in its rigorous methodology for needs analysis, meticulously crafted to provide researchers with insights into the pedagogical and technological intricacies of embedding IoT within STEM curricular structures.

In the contemporary educational research landscape, the role of IoT in STEM pedagogy is undergoing significant scholarly attention. While its prominence is evident in higher education research, there's a burgeoning interest in its implications for primary and secondary educational settings (Abichandani et al. (2022). The framework underscores the potential of IoT as a pivotal tool in research, especially in its capacity to foster environmental cognizance and catalyze digital activism in educational settings (Tabuenca, 2023).

The methodological approach delineated by the PARADIGM framework is comprehensive, offering researchers a blend of qualitative and quantitative research modalities. It commences with guidelines for an exhaustive literature review, setting the foundational context and provides pathways for experimental research, suggesting the use of pre and post-test evaluations to ascertain the effectiveness of IoT tools in educational settings (Torres-Carrión, 2018). This multifaceted approach ensures that the framework remains adaptable and aligned with evolving educational research imperatives.

A salient feature of the framework is its emphasis on the transformative potential of IoT tools in pedagogical research. These tools, as highlighted, not only offer researchers a lens to examine educators' adaptability to advanced pedagogical strategies but also provide avenues to explore the creation of immersive learning environments and their impact on students' comprehension of environmental dynamics (Tabuenca, 2023).

Beyond the microcosm of the classroom, the framework extends its implications to the broader societal context, advocating for research into sustainable practices and informed decision-making in education (Altan, 2018). By equipping researchers with the tools and methodologies to delve into these areas, the initiative plays a pivotal role in shaping research agendas that focus on environmentally conscientious education.

Furthermore, this framework not only furnishes insights into the current nexus between IoT and STEM pedagogy but also sketches a prospective research trajectory, specifically tailored for Erasmus+ KA2 projects. This strategic outline serves as a scaffold for future research endeavors, spotlighting the untapped potential of IoT in the educational research domain.

While the integration of IoT in pedagogical research is laden with promise, the framework acknowledges inherent challenges. It emphasizes the need for a comprehensive needs analysis, ensuring that technological innovations are synergistically aligned with pedagogical research objectives, catering to the multifaceted needs of 21st-century educational landscapes (Leavy, 2021).

In summation, the PARADIGM framework offers a robust foundation for educational researchers, where technological innovations and pedagogical strategies converge to inform research directions. Through its detailed methodology for needs analysis, it sets a benchmark for future Erasmus+ research initiatives, charting a course towards a future where technology and pedagogy synergistically contribute to the evolution of a sustainable and informed educational research paradigm.

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# Enhancing teachers' competencies

# Implementing teacher training model in HE to support adolescents' career planning: The NEFELE Erasmus+ project

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**Abstract**

Although teachers' provision of support for students' career planning should be a part of the teachers' duties, there are still relatively few qualifications and Continuing Professional Teacher Development (CPTD) courses that support teachers in gaining the skills needed for this role. The NEFELE Erasmus+ KA2 project aims to enhance Higher Education practices by developing, implementing and validating an innovative training model to guide teachers in applying career guidance practices.

NEFELE proposes a training model offered online through Massive Open Online Courses (MOOC). Moreover, during the MOOC lessons, teachers will be trained to use the NEFELE game, based on the Tangible User Interfaces (TUIs), as a supportive technology they can use in the classroom with their students to enhance career planning.

**Keywords:** career development, career guidance, career-related teacher support, MOOC, digital game

## 1. NEFELE Project overview

### 1.1 Context, background and needs

Across the EU Member States, there are 17 million young people who are neither in employment nor in education and training (NEET). The 21st century is marked by a rapidly changing global economy, economic crises, and numerous challenges like technological evolution in a post-industrial society. These factors are considered risk factors for the younger generation as they construct their future career paths, transition from school to work, and face the risk of social exclusion and marginalization.

According to Eurostat (2023), the NEET problem is demanding because it has two significant implications: on a personal level, young people are more likely to experience social exclusion, and on a societal level, they represent a substantial loss in terms of untapped productive potential and high welfare costs. Therefore, a preventive perspective of intervention appears to be needed to ensure a more adaptive school-to-work transition.

Psychological literature highlights that in these economic, social and political era adolescents face difficulties when they are called upon to plan their career plans: fear, insecurity, and anxiety often replace the experiences of trust, security, and hope (Parola & Donsì, 2017; Ricci Bitti & Zambianchi, 2011). Moreover, the existing literature has established a strong link between the NEET status and well-being and mental health (for a review, see Bartelink et al., 2019).

In light of this scenario, it is crucial to support adolescents by promoting a positive vision of the future and encouraging them to be proactive. This involves stimulating their ability to manage changes adaptively, enhancing hope and optimism for a meaningful future.

The educational system, as a social elevator responsible for the formative and human growth of individuals, may be an active promoter of career development (Parola et al., 2023). Teachers are called upon to provide students with support for developing career skills to cope with the changing context.

### 2.1 Teachers' duties in students' career development

As a holding environment, school and teacher have the critical function of "scaffolding" student career construction. On the one hand, the educational system will have to prepare students to master career transitions and provide new skills and ways of learning. On the other hand, individuals might be more active in

the creation of their occupations, in the directions of their active lives and in choosing the type of role that they have in their society.

In other words, the educational system should act on two entwined levels:

> *1. increasing new skills and competencies to manage career transitions in today's society.*
> *2. enhancing hope and optimism for the future in the school environment by promoting career exploration.*

Education is supposed to deliver the competencies and skills to prepare people for their participation in society and live successfully, taking into account that these competencies and skills in demand change over time. Activities that promote career exploration may be integrated into school curricula, and teachers play an important role in developing students' career skills and promoting positive resources. So, it is important to transform educational systems into a good environment for career development. Also, in the educational setting, career interventions must consider the labor market conditions and the specific characteristics of the educational system of the country where adolescents grow up.

The role of teachers in supporting students' career construction is defined as 'career-related teacher support'. This term encapsulates the comprehensive support that teachers provide to students regarding career development. It includes efforts such as invested effort, positive regard, positive expectations, and accessibility (Wong et al., 2021), all aimed at helping students plan their careers effectively. Specifically,

- *Invested effort*, i.e. taking actions that would support the future success of students.
- *Positive regard*, i.e. developing an emotional connection to students and genuinely caring for students' needs.
- *Expectations*, i.e. communicating their positive expectations on students' future educational and vocational success.
- *Accessibility*, i.e. being perceived by students as willing and readily available to attend to their needs when they seek career information or support.

Career-related teacher support falls within the teacher's duties. As recommended by the Council conclusions on European teachers and trainers, "teachers need to be supported to cope with the increasing demands on their jobs such as (...) providing support and guidance to their learners" (2020, p.45).

Despite this, traditional higher education courses often do not equip teachers with the necessary tools and knowledge to fulfil this crucial role. Moreover, according to the European Lifelong Guidance Policy Network, the information about career guidance addressed in Initial Teacher Education (ITE) must be expanded across Europe in Higher education (HE).

### 3.1    NEFELE actions

NEFELE stands for Neet prevention in Educational systems through positive Future vision Enhancing Learning and teacher Education. But that's not all! The acronym itself is a metaphor for the goals of the project: NEFELE (from ancient Greek, Νεφέλη) in Greek mythology is a nymph of the clouds. It is the name given to a 'magic cloud', which was modelled by Zeus and guided by the appearance of Era. Providing adolescents with space to look at and shape the clouds metaphorically is meant to be a way to train their aspirations.

NEFELE's efforts are primarily focused on Teacher Education. The main aim is to enhance HEs practices by modelling innovative methodologies for pre-service teachers that can be useful to support adolescents' career construction and a positive vision of the future. The innovative methodologies jointly use Massive Open Online

Course (MOOC), Tangible User Interfaces, and Open Educational Resources. Specifically, the NEFELE transversal activities were structured in 4 project results (PRs):

- *PR1 - EU Framework of Career Development in Teacher Education*
- *PR2 - NEFELE MOOC*
- *PR3 - NEFELE BOX*
- *PR4 - NEFELE OERs SHARED PLATFORM*

## 2. NEFELE MOOC

### 4.1 NEFELE training model

The NEFELE training model, based on the PR1 "EU Framework of Career Development in Teacher Education" (for more information about the framework, please see https://zenodo.org/records/7553717) provides pre-service teachers with the knowledge and tools necessary to take the role of supporting adolescents' career development while fostering their well-being (Figure 1).
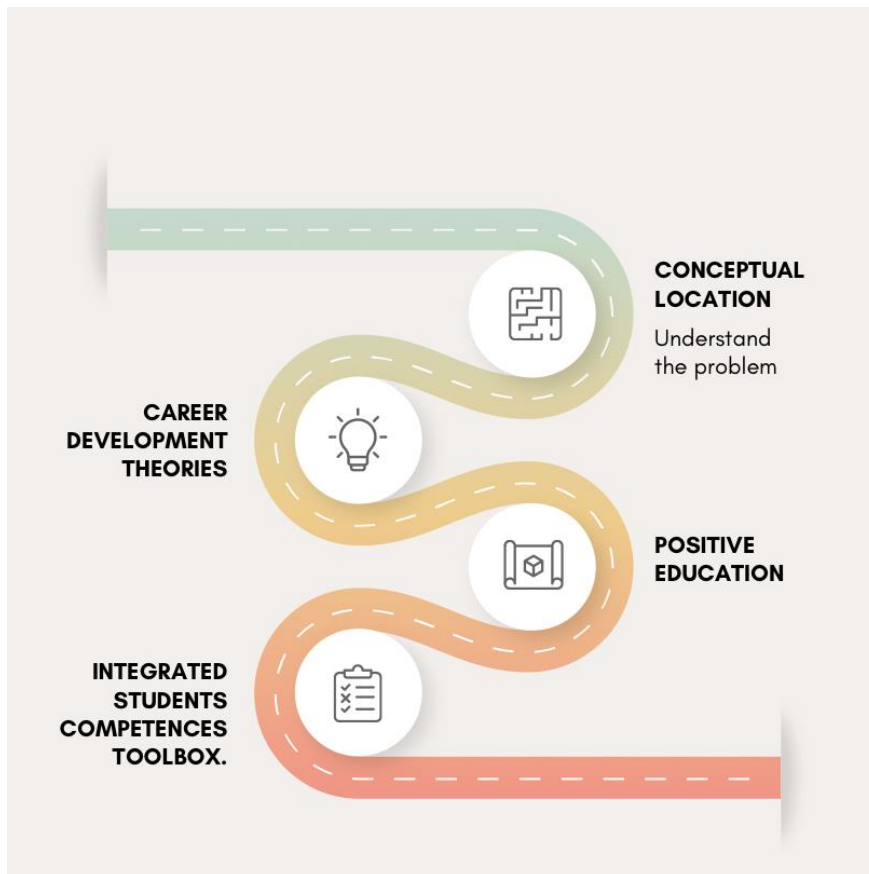


Figure 1: NEFELE training model

In knowledge domain, teachers will learn useful frameworks (to grasp adolescent career development, i.e. the Career Construction Theory (Savickas, 2009, 2013) and the Positive Youth Development (Seligman, 2009; Waters & Loton, 2019) that underlines the relevance of enhancing individual resources and strengths as protective factors for coping with society's challenges. The interplay of career theories ad positive psychology is critical and crucial to identify factors that can contribute to successful career choices and improved mental health during adolescence. The Career Construction Theory (Savickas, 2009, 2013) provides the scaffolding for understanding the narrative nature of career development, while the Positive Youth Development (PYD)

framework (Seligman, 2009; Waters & Loton, 2019) emphasizes the importance of fostering individual strengths to mitigate societal challenges.

Career Construction Theory (CCT), articulated by Mark L. Savickas in 2009 and further refined in 2013, is pivotal to the NEFELE training model's conceptual structure. CCT posits that individuals construct their careers by developing and using vocational self-concepts to navigate work roles and occupational environments (Savickas, 2009). The theory is anchored in the broader context of constructivist psychology, which contends that people shape their reality based on their experiences and internal narratives. Savickas' (2009, 2013) contributions to the field of career development are grounded in the tenets of life design counseling. This approach to career guidance is responsive to the fluid nature of modern career paths, characterized by frequent changes and transitions. Life design counseling, as Savickas (2013) suggests, aids individuals in weaving their life stories into meaningful patterns to articulate a career that reflects their self-concept and aspirations.

The narrative nature of CCT is rooted in the understanding that individuals make sense of their vocational experiences through storytelling. This process involves identifying personal skills, values, and interests and integrating them into a coherent narrative that provides direction for career decision-making (Hartung, 2013). Within the NEFELE training model, this narrative approach is vital as it offers a framework through which students can explore and understand their evolving vocational identities.

Moreover, CCT addresses the role of adaptability in career development. Savickas et al. (2009) underscore the importance of career adaptability as a psychosocial construct that enables individuals to cope with the tasks, transitions, and traumas of vocational behavior. This construct is essential for students navigating the uncertainty of career choices and the demands of the 21st-century workplace.

In applying CCT within the NEFELE training model, teachers are encouraged to foster an environment that supports career adaptability by engaging students in reflection, exploration, and storytelling. The use of narrative methods in career counseling is supported by empirical research, which suggests that narrative interventions can significantly enhance career adaptability (Rehfuss, 2009; McMahon, Watson, Chetty, & Hoelson, 2012).

Educational strategies based on CCT might include reflective exercises, such as autobiographical writing prompts or future self-visualization activities, which are designed to help students articulate their values, interests, and goals. The NEFELE training model incorporates these strategies to provide students with a foundation for making informed and meaningful career choices that resonate with their personal narratives and life themes (Savickas, 2011; Maree, 2015).

At the same time, PYD is a deliberate counterbalance to earlier deficit-focused models that viewed adolescents primarily in terms of risk and pathology. Instead, PYD emphasizes the importance of providing supportive environments and positive experiences that promote the development of competencies, confidence, character, connection, and caring—often referred to as the "5 Cs" of PYD (Lerner et al., 2005).

Seligman's (2009) work on positive psychology has significantly influenced PYD. He articulates a well-being theory anchored in the acronym PERMA, which stands for Positive Emotion, Engagement, Relationships, Meaning, and Accomplishment. These elements are considered essential for individuals to thrive and are highly pertinent to adolescents as they navigate their formative years (Seligman, 2011).

Waters and Loton (2019) further expand on the application of positive psychology in educational contexts, underscoring the transformative impact that a strength-based approach can have on student well-being and achievement. Their research demonstrates that when educational settings foster these positive elements, adolescents are more likely to flourish and exhibit resilience in the face of adversity.

The PYD framework, informed by these principles, is thus not merely about mitigating risk but about promoting optimal development. It is constructed on the understanding that positive outcomes in youth are best achieved by leveraging their inherent assets and by actively working to cultivate a supportive context that encourages healthy growth (Lerner et al., 2005; Lerner et al., 2018).

The NEFELE training model incorporates the PYD framework to enable pre-service teachers to create and capitalize on opportunities that foster the development of young people. The goal is to equip these emerging educators with the strategies and tools to nurture an educational ecosystem that recognizes and cultivates the inherent potential in each adolescent (Lerner et al., 2015).

In the context of career development, integrating PYD within the NEFELE model facilitates a strengths-based approach, assisting students in identifying their unique abilities and interests, and harnessing these for their vocational journey. By doing so, it prepares students not just for successful careers, but for lives that are rich with meaning and satisfaction, reflecting the broader scope of Seligman's PERMA model (Seligman & Csikszentmihalyi, 2000).

The confluence of career construction and positive psychology is instrumental in recognizing determinants of sound career choices and mental health during adolescence. This synergistic perspective is endorsed by Parola & Marcionetti (2023), who posited that the application of positive psychology within career theory could accentuate adolescent well-being. Positive psychology then can enrich the career construction theory and provide a fruitful focus on adolescents' well-being (Parola & Marcionetti, 2023).

Psychological frameworks are also enriched by the European competences frameworks that set out the skills useful and necessary for the school-to-work transition. As a "students' competences toolbox" NEFELE refers to the Digital Skills Framework (DigCom; Vuorikari et al., 2016, 2022), Entrepreneurship Competences Framework (EntreComp; Bacigalupo et al., 2016), the Personal, Social, and Learning to Learn Framework (LifeComp; Sala et al., 2020) and the most recent European sustainability competence framework (GreenComp; Bianchi et al., 2022). These sets of competences can be the basic competences needed for today's students.

Digital competence involves "the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking." (Council Recommendation on Key Competences for Life-long Learning, 22 May 2018).

Life competences are defined as "the ability to reflect upon oneself, effectively manage time and information, work with others in a constructive way, remain resilient and manage one's own learning and career". More specifically, it "includes the ability to cope with uncertainty and complexity, learn to learn, support one's physical and emotional wellbeing, to maintain physical and mental health, and to be able to lead a health-conscious, future-oriented life, empathize and manage conflict in an inclusive and supportive context". (LifeComp; Sala et al., 2020)

Entrepreneurship is defined as a transversal competence and "is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social (EntreComp; Bacigalupo et al., 2016).

Finally, green competences refer to "prioritizing the needs of all life forms and the planet by ensuring that human activity does not exceed planetary boundaries", while "sustainability competence empowers learners to embody sustainability values, and embrace complex systems, in order to take or request action that restores and maintains ecosystem health and enhances justice, generating visions for sustainable futures" (GreenComp; Bianchi et al., 2022).

Transitioning from theory to practice, the NEFELE model advocates for hands-on engagement through Tangible User Interfaces (TUIs), which facilitate experiential learning within educational settings. The NEFELE Box operates as a TUI, enabling laboratory activities that encourage storytelling and the design of sustainable and inclusive futures in classroom environments.

The Educational Digital Storytelling modality, enabled by the TUIs in the NEFELE Box, is pivotal in reinforcing critical skills and in raising awareness about the spectrum of life paths available to students. It is a catalyst for constructing and refining a collective vision for the future, fostering optimism and hope—a sentiment echoed by Parola et al. (2022, p. 125).

In the practical domain, the training model involves learning useful tools for teachers to foster adolescent career development in the classroom based on Tangible User Interfaces. The TUIs approach guarantees laboratory activities for adolescents in the classrooms designed to create an environment that stimulates storytelling and design a sustainable and inclusive future for all. In this regard, the Educational Digital Storytelling allowed through the TUI "can serve as a tool in educational systems to strengthen and foster the necessary skills as well as awareness of the choices available for oneself, to design and continuously improve a collective vision of multiple possible futures and ways of being both individually and collectively, to foster students' optimism and hope about their future" (Parola et al., 2022, p. 125).

The NEFELE Box is an embodiment of the training model's emphasis on competences and career development. It translates theoretical concepts into practical tools, thus serving as a bridge between the cognitive assimilation of frameworks and the tangible execution of these concepts within the learning environment. The Box is integral to the NEFELE model, as it operationalizes the abstract elements of career theories and competences frameworks into concrete learning experiences enhanced by storytelling. The NEFELE Box's use of storytelling and interactive activities as pedagogical strategies is rooted in the understanding that narratives are powerful tools for learning and development (Rossiter, 2002). Through storytelling, students can explore their identities, values, and aspirations in a structured yet personal way. The NEFELE Box thus becomes a medium for holistic development, combining academic, personal, and socio-emotional competences in a narrative framework.

By integrating digital, entrepreneurship, life, and sustainability competencies into its design, the NEFELE Box emerges as a multi-faceted tool that addresses various dimensions of a student's development. Its application through storytelling and interactive activities promotes a holistic approach to career development, where academic, personal, and socio-emotional competences coalesce to prepare adolescents for future challenges and opportunities.

### 5.1 NEFELE MOOC

The training model is delivered online through Massive Open Online Course (MOOC). The MOOC is available for pre-service teachers to provide additional learning for HE students. Specifically, the NEFELE MOOC entitled "Promoting students' career development at school" aims to give users (pre-service teachers as a primary target group) the knowledge and tools necessary to support students' career development while fostering their well-being.

The MOOC is based on Moodle 4.0, parameterized accordingly for the purpose of the course and its particular characteristics. It was developed following a collaborative team-based methodology for MOOC development (Spyropoulou et al., 2019) which is based on the ADDIE Model (Analysis, Design, Development, Implementation and Evaluation) (Molenda, 2013). More specifically, at the *analysis phase* the educational problem of the course is analyzed in order to specify the purpose of learning, the knowledge domain, the main learning goals and the learner's profile. In the design phase, detailed educational objectives are defined; this is one of the most essential topics in the design process. The *development phase* includes the production of the educational content and material based on the design realized in the previous phase. The learning objects are developed as conceived in the previous phase and are adapted to the MOOC platform. More specifically, educational videos and additional educational materials of versatile formats are developed, including: a) Educational Video, b) Presentation, c) Hypertext, d) Document, and e) Quiz. During the *Implementation phase*, the educational process is implemented as designed and developed in the previous phases. The *evaluation* of the proposed methodology is carried out at two levels-directions. On the one hand, a formative evaluation must take place at every phase while the final evaluation takes place at the end of all phases.
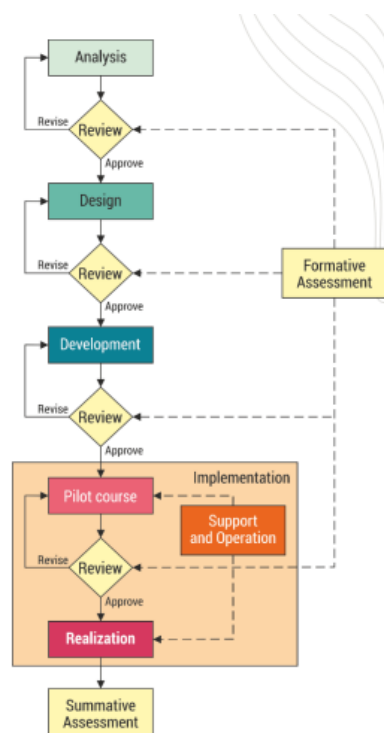


Figure 2: The ADDIE Model

By using this reference model all structure and content of the MOOC was developed. Upon development, the MOOC was realized in a grid sections format, with each session representing a module. The MOOC spans in 5

modules. Each module is divided in 2 to 4 units. Each module is followed by a detailed description and the learning objective so that it is clear to the trainees what they are going to find in the learning material
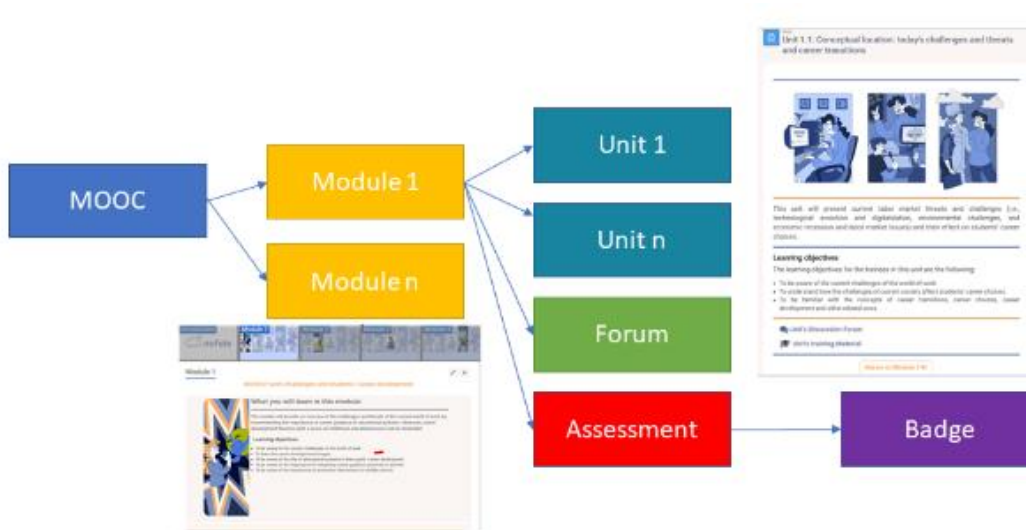


Figure 3: The Structure of the Course

The units include learning activities, which are further split into learning objects that provide the training content. The material of each unit is presented in a linear format where the trainee will receive the information in a specific order that has to be provided.



Figure 4: The Structure of a Unit

All the learning objects are delivered digitally in various forms (presentations, videos, study documents, interviews, activities etc.) and are available online. Each content appears on the screen while for all video

material is accompanied by subtitles. Transcript and relevant material are available for all videos for download to make easier the learning process offline.

Concerning the communication, participants can join a community of peers by participating in open discussions and active interaction through a forum on each unit. Online chat is available on the platform for trainees to be able to chat not only with their peers but also with the tutors/content creators of the course in order to deepen their knowledge to the subject.

The educational environment of the MOOC is designed in that way so that to be accessible through a personal computer, a tablet, or a smartphone, connected to the internet, equipped with standard audio and visual peripherals (microphone, speakers, web camera).

The learners are going to be registered through a google form and upon initiation of the course they will receive their credentials. As they logon in the platform they will find a courses manual, a syllabus, an introductory video and the Nefele Handbook. These tools will help them navigate through the course and follow the learning activities.

An assessment will follow the learning material of each module. The assessment is based on close-ended questions (Multiple Choice/ True-False) on which the trainnees will be evaluated on the material of the unit. Badges will be awarded to those that achieve a certain grade on the quizzes. Each successful alumni of the MOOC will receive a certification of completion.

The MOOC was realized in a grid format and each session representing a module. The MOOC is composed of 5 modules ("World of work challenges and students' career development", "Supporting students' career development, "Students' well-being", "Innovative teaching-learning practices", and "The NEFELE Box").

The users can register online and receive MOOC credentials. In the platform, students will find a course manual, a syllabus, an introductory video and the NEFELE Handbook. The MOOC incorporates both formative and summative assessments. Formative assessments occur at the end of each module, allowing participants to gauge their progress. A summative assessment concludes the course.

The assessment uses close-ended questions, i.e. Multiple Choice and True-False to assess the degree in which the students have achieved the learning objectives of the unit. Successful completion of each module leads to the awarding of the badge, recognizing participants' achievements. A certification of completion is granted at the end of the MOOC, signifying their competency in career-related teacher support.

## 3. NEFELE game

In the NEFELE project our goal is to sustain career development through gamification and storytelling, both enhanced by TUI paradigm and NFC technology tools.

The goals are to design and develop new learning and teaching methods and approaches to be widespread through open and distance learning. This new kind of training for teachers will support teachers and other education professional in guiding their students through their career decision process. So, the tools we are using are innovative teachers' methodologies, supported by the use of an Authoring tool software and an Android app integrated with tangible user interfaces.

The technological tool has to be intended as one of many agents involved in the learning context. Our methodological approach is SPAF – Situated Psychological Agents Framework – an agents model that aims to

define an educational or psychological context to detect those aspects that could be enhanced using technology (Ponticorvo et al., 2017; 2019). Technology becomes an agent in the context and its aim is to empower and support the already existent learning process.

Our primary goal is to create a learning experience that can be easily adapted to any specific need or educational goal. In NEFELE project what we propose is a hybrid approach, which puts together digital and tangible technology to create a whole experience based on the strengths of both approaches. In this way, traditional learning contexts and experiences can be enhanced to obtain greater results, thanks to the higher engagement and motivation supported by specific technological and tangible tools.

We can consider Tangible User Interfaces as input tools integrated in Augmented Reality systems: thanks to them, the user has the possibility to interact with digital reality through the manipulation of commonly used physical objects. T.U.I. are a very intuitive and easy way to link together digital and tangible worlds, to support learning based on the strengths of both approaches. An intuitive example of TUI that we use every day is the mouse: a physical and tangible object used to control the digital information contained in a digital graphic interface. Moving and touching the mouse, we have the opportunity to move and explore digital reality. In NEFELE project we will exploit this paradigm to set the learning experience in a system in which the user interacts with both digital and tangible worlds.

The technology chosen for NEFELE project is one of the most affordable and easy way to transform any kind of object into Tangible User Interfaces: the NFC system. We are talking about a communication system, that works in near distance. We can already find it in our daily life, being the same technology that allow us to make contactless payments with our credit cards or smartphone. The system is based on an interaction between sensors and antennas. The sensors, in the form of small sensitive labels to be applied directly to the materials, represent a very cheap and easy to use resource. Each sensor can contain information that is read by a special antenna that can be connected to a PC or that is integrated into almost all smartphones and many tablets.

The information transmitted is an input that interacts with the software and starts the reproduction of a multimedia content that acts as a feedback to the interaction. Any kind of tangible object, once enhanced through the sensor, become a Smart Object which can interact with specific surfaces. The digital learning experience becomes multisensory, multimodal and actively includes the environment in which it is inserted.

The NEFELE box will contain different kind of educational material, such as: 30 Job cards, enhanced with NFC tags; 10 customizable Job cards, enhanced with NFC tags; an enhanced game board; 7 Competences and Support cards, enhanced with NFC tags; Infographic material about subtopics for each competence; 20 default game scenarios; Instructions manual; the NEFELE App for smartphone and the Authoring tool software for Windows devices. The gamification approach becomes real thanks to the NEFELE app. NEFELE App is a board game enhanced with NFC technology. The game experience puts together Tangible material and Digital media and feedbacks. The final goal of each game session is to guess a mysterious job listening to the least number of clues. The effort asked to the students is to reflect on competences, strengths and their declination in different job careers.

On the other side, an authoring tool (Figure 5) has been implemented to support the co-creation. Thanks to the software students and teachers will be able to create customized game scenarios. In each scenario random competences' levels will be applied to several job. This will help to focus on the characters and their resources to find a creative way to apply them to a specific career. The last section involves the user in a role-play. Also, the educational content will be constantly available.
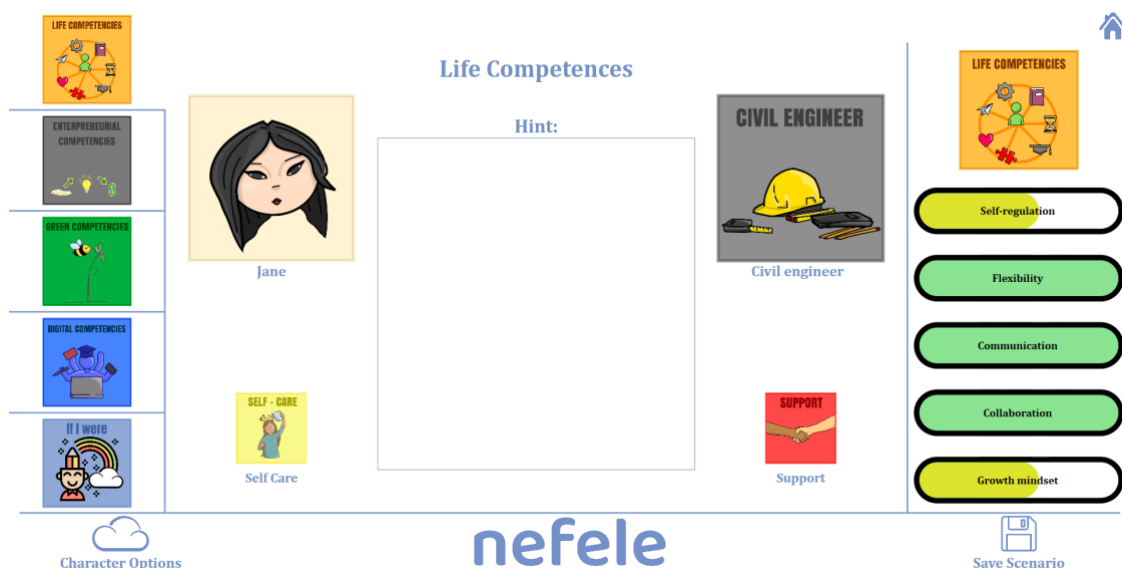
Figure 5: NEFELE Editor

## 4. Conclusions

The NEFELE training model aims to map the landscape of career developmental and positive psychology paradigms, jointly with the EU framework of competences, to provide a roadmap for pre-service teachers.

Given the need for programs in this direction to tackle the NEET phenomenon, the project, with its dissemination activity, hopes to disseminate the training model as widely as possible for future use in curricula in HEs.

Lastly, the model is designed for all teachers to continue their professional training and staff involved in educational systems, i.e. principals and career practitioners.

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# Digital Competences And Higher Education Teachers' Responsiveness In The Contemporary Context

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## Abstract

The huge changes observed in modern societies are largely inscribed in the sphere of globalization and the 4th Industrial Revolution, with technologies playing an essential role in all areas of human living. In this vein, this quantitative study seeks to investigate the self-evaluation of 242 teachers, who worked in higher education during the academic year 2021-2022, regarding their digital proficiency in the use of technologies in the education of their students. For the needs of the study, an electronic questionnaire was constructed which was based on the CheckIn self-assessment tool of the European Framework for the Digital Competence of Teachers (DigCompEdu). DigCompEdu is a scientifically valid framework provided by the Joint Research Center of the European Commission. The questionnaire consisted of five sections: demographic data (gender, age, scientific field of teachers, grade and years of teaching experience), professional digital skills, pedagogical digital skills, students' digital skills development skills and the use of digital technology in student education. The sample was selected by stratified random sampling to ensure that the composition of the sample of teachers would be representative of the departments where they teach. The reliability index for overall digital proficiency is particularly satisfactory (Cronbach's Alpha=0.931>0.70). Data analysis was performed using descriptive and inductive statistics with IBM SPSS v.28 and Microsoft Office Excel 2021 software applications. Percentages, frequencies, mean value and standard deviation were calculated and presented in tables and figures. Testing for normality of variables for skills was done with Kolmogorov-Smirnov, convexity and skewness indices, and histogram tests. The results showed that there is no normal distribution of the variables. The Spearman's rho correlation coefficient, the non-parametric Mann-Whitney U test, the non-parametric Kruskal-Wallis H test and the non-parametric Wilcoxon test were used to investigate the correlations between variables. The analysis of the data shows that respondents in all dimensions of digital proficiency are at the Independent level (B1). In alignment with the general characteristics of the B1 level, teachers experiment with digital technologies in different contexts for different purposes by integrating them into many of their practices. They use them creatively to enhance various aspects of their professional practice and are willing to expand the scope of their practices. However, they are still working to understand the tools that work best in different situations and

adapt digital technologies to pedagogical strategies and methods. Regarding the level of the direct self-assessment of the existing digital competence of the participating teachers, the results record a high level of digital competence (C1, Experienced). They consider themselves to have a comprehensive approach while using technology to enhance professional and pedagogical practices. They can also rely on a wide range of digital strategies and are able to choose the most appropriate one for each occasion. Finally, they are constantly thinking about further development in their practices and are informed about new developments and ideas which they exchange with their colleagues.

**Keywords:** higher education, professors, educators, digital competence, DigCompEdu, technology.

## 1. Introduction (Calibri, 12 pt, bold)

Technologies play an essential role in the upcoming 4th Industrial Revolution, since the unprecedented level of automation and connectivity powered by artificial intelligence, big data, robotics and the internet of things is now a reality.

Such a perspective changes the lives of everyone, as social beings, as citizens, as scientists, as consumers and as professionals, emphasizes the need for adjustments in education and foreshadows the upheavals of the future (Karanikola, Taxa, & Panagiotopoulos, 2022). According to the OECD (2018, p. 3-4), education needs to "do more than to prepare people for the world of work; it needs to equip students with the skills they need to become active, responsible and engaged citizens".

Thus, the survival of individuals is significantly linked to the development of appropriate and right skills, as skills are inextricably linked to the human ability to develop, evolve, adapt and prosper (Palaiologou & Karanikola, 2023; Panagiotopoulos, Karanikola, & Zogopoulos, 2022).

This brings us to the emergence of Education 4.0, a contemporary term used by theorists to describe the various ways in which technology could be integrated into the educational space. According to Fisk (2017) and Asiz (2018), Education 4.0 can take place everywhere and anywhere. Thus, students are getting more involved in the learning and teaching process, and experiencing situations of practical learning, guidance and collaboration. In this context, "theory becomes practice, students become more independent, think critically and jump to conclusions" (Panagiotopoulos & Karanikola, 2020:108).

Acquiring the right mind-set and skill-set, and exploring their perceptions, dispositions and attitudes towards the use of technology are important perquisites for teachers' readiness (Terrell & Lindsey, 2009). In this vein, educators should feel comfortable working in digital environments, use emerging learning technologies in education, integrate technology into curriculums, communicate effectively with their students, personalize learning and encourage students' creativity, innovation and social interaction (Aly, 2019; Aoun, 2018; Panagiotopoulos & Karanikola, 2020; Sudlow, 2018).

In light of this, the official texts and policies of international organizations recognize the decisive role of higher education in individual, social, economic development and well-being, in the provision of highly qualified human capital but also in the promotion of research, production and development of the appropriate skills (Chaleta et al., 2021).

Abiding by that, the European Commission's renewed agenda for higher education, adopted by the Commission in May 2017, identifies four key objectives: addressing future skills mismatches and promoting excellence in skills development, creating autonomous and connected higher education systems, ensuring that institutions of higher education contribute to the innovation and support of effective and efficient higher education systems.

In addition, the European Strategy for Universities of the current decade recognizes the major role of higher education institutions in the digital transition and through the Digital Europe programme, and provides

specialized education and training programs in cutting-edge digital technologies and interdisciplinary courses in artificial intelligence, cyber security and high performance computers.

As further actions, various models have been proposed to analyze and define the digital skills of educators and teachers, such as the European Union Framework on the Digital Competence of Educators (DigCompEdu), the International Society for Technology in Education Framework (International Society for Technology in Education), the UNESCO Framework for the Technological Competence of Teachers and the National Institute of Education and Training Technology of Educators Framework (Cabero-Almenara et al., 2021).

In alignment with the aforementioned aspects, this research study seeks to explore the level of higher education tutors' self-perceived digital competence in terms of professional digital competences, pedagogical digital competences and the competences they possess to facilitate the development of students' digital skills. The elaboration of this research is considered to be important as at national level there is a limited number of similar studies in the field of the tertiary education (indicatively: Armakolas et al., 2023; Karalis & Raikou, 2020; Vogiatzaki, 2019). By analyzing and interpreting these primary research data we hope to enrich the relevant literature, since there has been a growing international research interest in this field during the last decade (indicatively: Benali et al., 2018; Cabero-Almenara et al, 2020; Crompton, 2017; Gallego-Arrufat et al., 2019; Redecker & Punie, 2017; Dias-Trindade et al., 2020).

## 2. Methodology and research questionnaire

This research study seeks to shed light on higher education tutors' perceptions on their digital proficiency in the use of technologies, by following the quantitative methodology approach. Quantitative studies entail more than just the use of numerical data, as researchers pose questions to be examined and define the procedures that should be followed throughout the study. They also identify a sample of participants large enough to provide statistically meaningful data (Bryman, 2016; Gay et al., 2012). The accessible population of this study was the higher education tutors in the faculties of Humanities, Engineering, Mechanics, Economics, Management and Health Sciences of the Ionian University and the University of Patras during the academic year 2021-2022. The sample consisted of 242 participants and was selected by applying stratified random sampling to ensure that the composition of the sample would be representative of the departments where they teach, and large enough to provide statistically meaningful data (Babbie, 2015).

Thus, tutors were called to respond to the following research question: What is the level of their self-perceived digital competence in terms of professional digital competences, pedagogical digital competences and the competences they possess to facilitate the development of students' digital skills?

For the needs of the study, an electronic questionnaire was constructed which was based on the CheckIn selfassessment tool of the European Framework for the Digital Competence of Teachers (DigCompEdu). DigCompEdu is a scientifically valid framework provided by the Joint Research Center of the European Commission, and distinguishes six levels of competence progressively evolving, aligned with the language competence levels of the Common European Framework of Reference (CEFR). Specifically: A1 (Beginner), A2 (Basic), B1 (Independent), B2 (Expert), C1 (Experienced), C2 (Excellent) (DigComp, 2022).

The questionnaire consists of five sections: demographic data (gender, age, scientific field of tutors, grade and years of teaching experience), professional digital skills, pedagogical digital skills, tutors' capability to facilitate students' digital skills, and the use of digital technology in student education.

### 2.1 Reliability, validity and ethics of the research study

According to relevant research findings, the DigCompEdu Checkin questionnaire presents a very satisfying internal consistency, with a Cronbach's Alpha coefficient > 0.90 (Benali et al., 2018; Ghomi & Redecker, 2019). What is more, the research tool has been measured in a survey with 2.262 university professors in Andalusia, where high indicators of reliability and validity with the confirmation of its factor structure were found (Cabero-Almenara et al., 2020). The findings of Dias-Trindade and her colleagues (2019) are similar as well. Regarding the reliability of the present research, the reliability index check (Table 1) for the domains of digital competence shows satisfactory results, with the Cronbach's Alpha index ranging from 0.743 to 0.868, i.e., >0.70. Also, the reliability index for overall digital proficiency is highly satisfactory (Cronbach's Alpha=0.931, i.e., >0.70) (Bryman, 2017).

Table 1: Credibility Check for Digital Proficiency

|   | Digital Proficiency Sectors | Number of Variables | Cronbach's Alpha |
|---|---|---|---|
| 1 | Professional competence/activity | 4 | 0.743 |
| 2 | Use of digital resources | 3 | 0.756 |
| 3 | Use of digital technology in teaching & learning | 4 | 0.759 |
| 4 | Use of digital technology in evaluation | 3 | 0.764 |
| 5 | Digital empowerment of students | 3 | 0.780 |
| 6 | Facilitating students' digital proficiency | 5 | 0.868 |
|   | Overall Digital Proficiency | 22 | 0.931 |

It is also worth mentioning that the questionnaire was piloted in order to identify any ambiguities, misinterpretations and errors. The face validity of the research was checked based on the matching table of the research tool with the research purpose and the research questions (Gay et al., 2012).

Ethical considerations played a significant role as well. Specifically, the researchers had the responsibility to behave in a trustworthy manner, and the participants were expected to behave in the same way by providing reliable responses. In addition, assurances were given that the participants would not be harmed physically, mentally or socially, and they were provided with a cover letter, the purpose of which was to alert them about the questionnaire and give the details of the requested actions on their part. In addition, specific information, such as the research topic and incentives, was conveyed and influenced the respondent's decision to deny or cooperate fully and accurately with the survey task. Any information or data that were collected were strictly confidential and limited to people directly involved in conducting the research. Study participants had complete anonymity and their identities were kept hidden (Bryman, 2016; Cohen et al., 2007).

## 3. Research findings

### 3.1 Demographic data

To begin with, 57.9% of the participants are male and 42.1% female. The majority of participants belong to the age groups of 41-50 and 51-60 years old. Their scientific field is related to the Humanities by 33.1%; to the Sciences, Economics and Information Technology by 28.9% and to the Health Sciences by 9.1%. Regarding the

rank/qualification of the participants, 69.4% are faculty members; 12.4% are research associates, lecturers/academic fellows; 10.7% are laboratory teaching staff members; 5% are specialist educational staff members, and 2.5% are special technical laboratory staff members. Regarding the years of their teaching experience, 45.5% have between 11-20 years; 30.6% 21 years and above; 24% 1-10 years.

### 3.2 Tutors' professional digital skills

Higher education tutors appear to be at a medium level of professional digital competence (B1-Independent), with 38% at B1 level (Independent); 33.1% at B2 level (Expert), 14.9% at A2 level (Basic), 7.4% at C1 level (Experienced) and 6.6% at A1 level (Beginner). Specifically, in terms of professional communication skills, the vast majority of the sample systematically select, adapt and combine different digital solutions in order to communicate effectively, while only 5% reflect, discuss and develop their communication strategies in advance. In addition, their professional collaboration ability is supported by the following elements: 33.1% communicate with colleagues/faculty in collaborative environments or use shared drives; 25.6% exchange ideas, experiences and material with colleagues/faculty outside their organization (e.g., on an online professional network); 21.5% sometimes exchange material with colleagues/faculty (e.g., via email) and 18.2% co-create material with other colleagues/teachers in an electronic network.

In terms of their reflective practice, 43.8% use various resources to develop their digital teaching skills and 29.8% discuss with colleagues/teachers how digital technologies can be used to promote innovation and improve teaching practice.

Finally, as far as their digital competence of continuing professional development is concerned, it was recorded that most of the participants have participated in some online training programs (Table 2).

Table 2: Distribution of percentages and frequencies of tutors' professional digital skills level

| Tutors' professional digital skills | | | |
|---|---|---|---|
| I systematically use different digital channels to improve communication with students and colleagues/faculty. | | **(%)** | **N** |
| Communication | I rarely use digital communication channels. | 0.8 | 2 |
| | I use basic digital communication channels (e.g., email). | 9.1 | 22 |
| | I combine different communication channels (e.g., email and blog or the website of the educational organization). | 27.3 | 66 |
| | I systematically select, adapt and combine different digital solutions to communicate effectively. | 57.9 | 140 |
| | I reflect, discuss and develop my communication strategies in advance. | 5.0 | 12 |
| Total | | 100 | 242 |
| I use digital technologies to collaborate with colleagues/teachers inside and outside the educational organization. | | **(%)** | **N** |

| Professional Co-operation | I rarely have the opportunity to work with other colleagues/teachers. | 1.7 | 4 |
|---|---|---|---|
| | I sometimes exchange material with colleagues/teachers (e.g., via email). | 21.5 | 52 |
| | We work with colleagues/teachers in collaborative environments or use shared drives. | 33.1 | 80 |
| | I exchange ideas, experiences and material with colleagues/faculty outside my organization (e.g., in an online professional network). | 25.6 | 62 |
| | I co-create material with other colleagues/teachers on an online network. | 18.2 | 44 |
| Total | | 100.0 | 242 |
| **I am actively developing my digital teaching skills** | | **(%)** | **N** |
| Reflective practice | I rarely have time to practice my digital teaching skills. | 4.1 | 10 |
| | I improve my skills through reflection and experimentation. | 9.1 | 22 |
| | I use various resources to develop my digital teaching skills. | 43.8 | 106 |
| | I discuss with colleagues/teachers how to leverage digital technologies to promote innovation and improve educational practice. | 29.8 | 72 |
| | I assist colleagues/teachers in developing their digital teaching strategies. | 13.2 | 32 |
| Total | | 100.0 | 242 |
| **I participate in e-learning opportunities, e.g., online courses, massive open online courses (MOOCs), webinars.** | | **(%)** | **N** |
| Continued professional development | This is a new area that I have yet to look into. | 9.9 | 24 |
| | Not yet, but definitely interested. | 17.4 | 42 |
| | I have participated in online training once or twice. | 26.4 | 64 |
| | I have tried several different online training opportunities. | 24,8 | 60 |
| | I frequently participate in all kinds of online training. | 21,5 | 52 |
| Total | | 100,0 | 242 |

## 3.3 Pedagogical digital skills

According to the survey findings on digital resources respondents' ability to select digital resources, most of them are able to compare and evaluate digital resources based on a set of important criteria (e.g., reliability, quality, appropriateness, design, interaction, appearance, suitability), while only 2.5% rarely use internet to find digital resources. Furthermore, their ability to create digital resources is visible by the fact that 36.4% create only digital presentations; 34.7% create different types of digital resources, and 24.8% create and customize complex interactive digital resources.

Regarding their ability to manage digital resources, most of them protect personal data files by using a password or protecting some personal data. In this vein, 42.1% use digital tools to systematically enhance teaching; 21.5% use a variety of digital resources and tools in their teaching, and 18.2% use the basic operation of the available equipment (e.g., digital whiteboards or projectors). It is also worth mentioning that most of them regularly monitor and analyze the online activity of their students, while 7.4% do not use any digital environments.

In terms of their ability to learn collaboratively by using digital technology, it was recorded that 43% encourage students' teamwork to search for information online or present their results in a digital form. As far as their ability to use self-regulated learning through digital technology is concerned, the vast majority use a variety of digital tools to help students organize, document or reflect on their learning.

In terms of the respondents' ability to assess by using digital technology (Table 3), the results show that most of them use digital tools (e.g., a quiz) to check and monitor student progress. In addition, 47.1% analyze only academically relevant data (e.g., performance and grades); 27.3% review student activity and behavior data in order to identify those who need additional support; 39.7% sometimes use digital ways of providing feedback (e.g., automatic grading in online quizzes, comments in online environments); 25.6% provide feedback to students but not in digital form and 22.3% use a variety of digital feedback media.

Table 3: Percentages and frequencies of self-estimated level of tutors' evaluation ability

| | Digital evaluation | | |
|---|---|---|---|
| I use digital assessment tools to monitor students' progress. | | (%) | N |
| Evaluation strategies | I do not monitor student progress. | 5.8 | 14 |
| | I monitor student progress regularly but not digitally. | 20.7 | 50 |
| | Sometimes I use a digital tool (e.g., a quiz) to check student progress. | 29.8 | 72 |
| | I use a variety of digital tools to monitor student progress. | 28.9 | 70 |
| | I use a variety of digital tools to monitor student progress. | 14.9 | 36 |
| Total | | 100 | 242 |
| I analyze all the data available to me to effectively identify students who need additional support. | | (%) | N |
| Evidence analysis | These data are not available and/or it is not my responsibility to analyze them. | 9.1 | 22 |
| | I only analyze academically relevant data (e.g., performance and grades). | 47.1 | 114 |

| | | (%) | N |
|---|---|---|---|
| | I review data on student activity and behavior to identify those who need additional support. | 27.3 | 66 |
| | I regularly monitor all available data to identify students who need additional support. | 12.4 | 30 |
| | I systematically analyze data and intervene in time. | 4.1 | 10 |
| Total | | 100.0 | 242 |
| I use digital technologies to provide effective feedback. | | **(%)** | **N** |
| Feedback | Feedback is not necessary in my work environment. | 1.7 | 4 |
| | I provide students with feedback to but not in digital form. | 25.6 | 62 |
| | I sometimes use digital ways to provide feedback (e.g., automatic grading in online quizzes, comments in online environments). | 39.7 | 96 |
| | I use a variety of digital feedback media. | 22.3 | 54 |
| | I systematically use digital approaches to provide feedback. | 10.7 | 26 |
| Total | | 100.0 | 242 |

In addition, 24.8% consider that their students do not face any difficulties with the use of digital technology and 21.5% discuss the possible obstacles with students and design solutions. In terms of their ability to differentiate and personalize, 35.5% consider that all students are asked to do the same activities; 25.6% use, whenever possible, digital technologies to offer differentiated learning opportunities, while 19% provide students with suggestions for additional digital resources.

Finally, they attempt to actively engage students mainly by providing motivating stimuli during teaching (e.g., videos, animations) (29.8%), and by motivating them to participate in teaching with digital technologies (28.9%).

### 3.4 Skills to facilitate the development of students' digital skills

In terms of information and media literacy, 30.6% discuss with students how to verify the accuracy of information and 24.8% occasionally remind students that not all information on the Internet is reliable. In addition, 42.1%, state that students use digital communication and collaboration while interacting with each other, and 28.9% argue that their students create digital content as an integral part of their studies.

Regarding the responsible use of digital technology, 33.1% explain the basic rules of safe and responsible behavior in online environments and 24.8% inform students that they should be careful while posting personal information online. Finally, 38.8% maintain that they occasionally encourage students to use digital technology to solve problems, while 14.9% consider that they rarely have the opportunity to develop students' digital problem-solving skills.

### 3.5 Use of digital technology in student education

To begin with, it is worth mentioning that the vast majority of tutors (93.4%) express a positive or very positive attitude towards the use of digital technology. The mean value for the teachers' attitude to the use of digital technology is 5 (Very positive).

Regarding the percentage of digital technologies use before the Covid-19 pandemic (Table 4), 28.9% tutors used them at a rate of 26-50%; 20.7% at a rate of 11-25%; 14.9% at a rate of 76-100% and 11.6% at a rate of 0-10%.  The mean value of the percentage of digital technologies use before the pandemic crisis is 3 (26-50%). Simultaneously, this percentage appears increased during the academic year 2021-2022, since the mean value is 4 (51-75%).

Table 4: Percentage of digital technologies use before the Covid-19 Pandemic.

| | At what percentage of your teaching time did you use digital technologies before the Covid-19 pandemic? | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-10% | 11-25% | 26-50% | 51-75% | 76-100% | Total | M.V | S.D. |
| Percentage of digital technologies use before the pandemic | 11.6% | 20.7% | 28.9% | 24% | 14.9% | 100% | 3 | 0.079 |
| | 28 | 50 | 70 | 58 | 36 | 242 | | |

When it comes to teachers' and students' digital tools for teaching and learning, the majority mainly use Presentations, Video projection/audio playback, Video/audio production, Online learning environments, Digital quizzes or polls, Interactive applications or games, Digital posters, mind maps, planning tools.

Regarding the University's role in supporting and using digital technologies, 63.6% of the respondents agree that both the Ionian University and the University of Patras promote the integration of digital technologies in teaching; 62.0% agree that they are provided with the necessary technical support; 76.8% agree that students have access to digital devices and 76.9% agree that Internet connection is reliable and fast.

The findings of the survey on the personal use of digital technologies as reflected in the following table (Table 5), reveal that the participants agree or strongly agree (94%) that it is easy for them to use a computer or other technical equipment at work. Also, the majority (93.4%) agree or strongly agree that they use internet extensively and effectively.

Table 5: Personal use of digital technologies

| | How would you describe yourself in terms of using digital technologies? | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Totally disagree | Disagree | Neither agree nor disagree | Agree | Totally agree | Total | M.V. | S.D. |

| 1) I find it easy to work with computers and other technical equipment | 0% | 0.8% | 5% | 39.7% | 54.5% | 100% | 4 | 0.041 |
|---|---|---|---|---|---|---|---|---|
| | 0 | 2 | 12 | 96 | 132 | 242 | | |
| 2) I use Internet extensively and effectively | 0% | 1.6% | 5% | 31.4% | 62% | 100% | 5 | 0.043 |
| | 0 | 4 | 12 | 76 | 150 | 242 | | |

Regarding the correlation of the direct self-assessment of the existing digital competence of tutors with gender, scientific field and teaching experience, no statistically significant correlation was found. A statistically significant correlation was found between the scientific field and the years of teaching experience of the participants. Regarding the scientific field of tutors, a statistically significant correlation was found in three out of six dimensions. Those who belong to the scientific field of Humanities use digital technology in learning to a greater extent than those who belong to the scientific field of Positive Sciences and those who belong to the scientific field of Economics and Informatics. This finding differs from those of other studies (Fernandez-Cruz & Fernandez-Diaz, 2016; Ghomi & Redecker, 2019), according to which Information Technology teachers present a higher level of digital competence than teachers of other specialties.

Finally, there was a statistically significant positive correlation between the attitude towards the use of digital technology in teaching with the University's support for the use of digital technologies and the personal use of digital technology.

## 4. Conclusions

The self-assessed level of digital competence of tutors of the Ionian University and the University of Patras was investigated regarding the use of digital technologies in student education, according to the European Framework for Digital Educators' Competence (DigCompEdu). The analysis of the data shows that the respondents are at the Independent level (B1) in all dimensions of digital competence.

In alignment with the general characteristics of level B1, teachers experiment with digital technologies in different contexts for different purposes by integrating them into many of their practices. They use them creatively to enhance various aspects of their professional practice and are willing to expand the scope of their practices (DigComp, 2022).

However, they are still working to understand the tools that work best in different situations and adapt digital technologies to pedagogical strategies and methods. They may need more time for reflection, experimentation, collaborative encouragement and knowledge sharing to move to the next stage of Expert (B2) (Redecker & Punie, 2017).

The self-estimated level of digital proficiency was also examined by Dias-Trindade et al. (2020) on 118 Portuguese University professors of various faculties with the same research tool (DigCompEdu). They also found that the level of digital proficiency of university teachers is at a moderate level, a finding confirmed by some more relevant studies (Balyk & Shmyger, 2018; Benali et al., 2018; Guillén & Mayorga, 2020; Montoro et al., 2015; Romero-Rodríguez et al., 2019). When interpreting these finding, it is important to remember that diverse cultural groups may have different orientations towards digital skills as well as that the Western oriented digital literacy environments and relevant skills exclude the access of non-western people and cultures (Palaiologou, 2007). This creates a need for interculturally-aware development of digital skills (Lee et al., 2023). It is also worth mentioning that the self-assessed level of digital competence of tutors differs from the level of direct self-assessment of their existing digital competence. The self-assessed level of digital competence,

according to the survey's CheckIn tool, is lower (B1, Independent) than what they directly stated about the level of their existing digital competence (C1, Experienced).

The overestimation of digital competences and the discrepancy demonstrated could be attributed to confusion between digital competence based on the domains, as defined by DigCompEdu, and the direct assessment of their personal digital competence, which is related to the use of internet and digital technologies. This finding is in alignment with those found in other similar studies (Balyk & Shmyger, 2018; Dias-Trindade et al., 2020). Such differences in perspective raise the need for nuanced understandings of the teachers' experiences, as these can help avoid unhelpful deficit perspectives (Montero-Sieburth, 2023).

Regarding the attitude of the tutors towards the use of digital technology in the education of students, the results showed that it was positive or very positive (93.4%). This is particularly important because the simple acquisition of new technology does not necessarily lead to its effective use while teaching and learning (Polly et al., 2010; Vongkulluksn et al., 2020). Teachers' positive attitude and willingness to use new tools and technologies enhances the assimilation of digital skills and the successful integration of digital technology practices into their teaching (Chen, 2010; Nikou, 2019).

The correlation of the respondents' level of digital proficiency with their years of teaching experience did not show a statistically significant difference. On the contrary, the results of other researchers (Benali et al., 2018; Ghomi & Redecker, 2019) show that the years of teaching experience affect the level of self-assessed digital proficiency of the respondents positively.

The fact that teachers use digital technology more after the Covid-19 pandemic could be attributed to the fact that the pandemic forced Universities to apply distance education, whereas face-to-face teaching and traditional sitting exams were replaced by online courses, video tutorials and online exams. Thus, faculty members got more familiarized with new online teaching methods, practices, and the use of online technology in their daily work (Johnson et al., 2020; Marioni; Van't Land & Jensen, 2020).

Regarding the role of the University in the use and support of the respondents' digital technologies, the majority consider that the University promotes the integration of digital technologies in teaching, provides the necessary technical support, provides students with access to digital devices, ensures the connection of the department on the internet in a reliable and fast way, the connection of their personal space or elsewhere on the internet for distance teaching in a reliable and fast way, has the necessary equipment and software for distance teaching and provides interactive whiteboards, projectors or similar means of presentation in the classrooms they teach. To a lesser extent, they consider that the University supports them in the development of their digital competence or that it does not support them to the extent it should. This finding is consistent with the view that trainers/teachers usually learn in a self-taught manner and when they need help they turn to internet resources or consult their colleagues (Montoro et al., 2015; Podorova et al., 2019).

The fact that the majority of respondents consider it easy to work with technical equipment and use internet extensively and effectively, is positive. Besides, according to Marcelo and Yot-Dominiguez (2019), the increased use of digital tools affects the sense of competence which in turn enhances the increased use of digital tools.

This study, through its findings, hopes to contribute to a further understanding of tertiary education reality and highlight the possibilities and needs of university operation in the new complicated digital environments. It could also contribute to the development of a fruitful dialogue, reflection and operate as a stimulus not only for the orientation of the university transformation but also for further successful action and initiatives in this field.

However, it is inevitable for almost every study to come up against limitations and shortcomings, no matter how organized or well-prepared it may be (Hammersley & Traianou, 2012). This particular research is no exception. The main limitation of the research is that the results are not generalizable for the whole population. Finally, regarding future exploration, this study could constitute a starting point for further relevant studies that may examine the issue more deeply.

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