The Big Book

of online education

for academics
and other teaching
professionals

Gdańsk 2024

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About the E-Tech *project*

The global digital education market is growing at an incredible rate. It enters rapidly not only into homes, businesses and corporations but also into academia, which has to compete with commercial forms of education. The fast adoption of online learning has been greatly helped by the pandemic and enforced social distance. In addition, today's generation of students, especially at technical universities, is increasingly demanding with regard to teaching materials: they expect dynamism, a digital approach and very good visual quality. All of this means that higher ed teachers (with special focus on STEM) need to acquire new skills very quickly. Among the most important competencies are: methodical, design and technical skills to be able to design online education and create e-learning courses at a high quality.

Help is at hand from researchers at the Gdańsk University of Technology who, in collaboration with the Austrian University of Applied Sciences FH JOANNEUM Gesellschaft mbH in Graz and the Italian Universita Politecnica delle Marche in Ancona, and with support from SEA – the Polish Academic E-learning Association, have set out to develop practical materials and multimedia resources to help teachers across Europe design engaging online education for their students. You can find a full list of great experts who contributed to creating this book at the end of this publication.

E-TECH, or Comprehensive Project for Distance Teaching Skills and Multimedia Resources for Technical Universities in Europe (2020-1-PL01-KA226-HE-096375) is a project founded by the Erasmus+ Strategic Partnership programme

Funded by the European Union Humanitarian Aid

Many thanks to all those who contributed to this publication.

Photo: Joanna Szakoła

Whether we like it or not, the future belongs to hybrid education. Teaching STEM online causes many problems and challenges. We asked a group of experienced academic teachers to share their ways of doing this effectively. I believe such knowledge is invaluable. I recommend reading our book to anyone with a big heart for students and education.

Marek Chodnicki, PhD – E-Tech Project Manager

Writing a friendly book that is full of practical advice, examples and tips is not easy at all. We have tried very hard to ensure that every teacher will find something of value in our publication and will feel inspired to try out new teaching methods. I hope we managed to do it well! Enjoy your reading and good luck!

Alina Guzik, MSc – E-Tech Product Manager

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95% of students said they would recommend online education to others.

Source: bestcolleges.com

81% of students believe that e-learning has helped them get better grades.

Source: Statista

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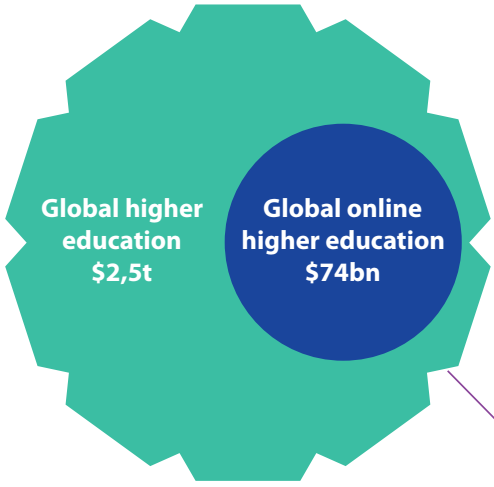
Let's get to know some foundations

Online education in HigherEd

Marek Chodnicki, Alina Guzik

MOST WIEDZY

According to a report by HolonIQ global EdTech (digital education) expenditure **reached approximately $300bn** and the growth is expected to continue. Even at this level, digital spending will only represent 5.5% of the total market. The scope of this market includes a wide range of EdTech products and services, including learning management systems, video conferencing tools, e-learning content creation tools, online collaboration tools, gamification platforms, adaptive learning tools and many more. Digital education also enters the post-secondary education sector. This indicates the market's potential to expand and highlights increased investment in technology-enabled learning solutions and digital content.



Global higher education market in 2025
[Source: HolonIQ report]

What are the most important factors influencing the growth of online education?

Generation Z and Alpha needs

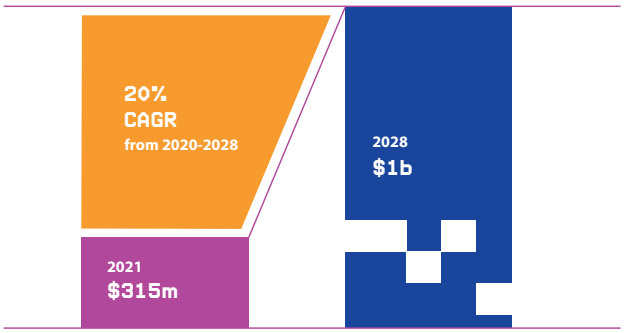
The rise of the young generation has ushered in a remarkable era for the EdTech market. These cohorts, being digital natives, are positioned as the most adept and connected generation in human history. The younger generation craves independence, including the freedom to choose where and when they study. This leads to the development of e-learning educational products and online tools. Consequently, utilizing the internet and smartphones for education is not just an option for them but a necessity taken for granted. Individuals born after 2000 are currently becoming the primary consumers of institutional education and they naturally emerge to be the driving force behind the commercial market for lifelong learning solutions in the near future. Their preferences and demands will shape the landscape of educational technology, paving the way for further advancements and innovation in this field.

Exponential growth of technology

It is evident that technology influences various aspects of our lives, and education is no exception. The advent of highly advanced technologies, such as artificial intelligence, blockchain, the Internet of Things and augmented reality, is reshaping the landscape of learning solutions, consequently transforming the market and higher education as a whole. These groundbreaking inventions are rapidly altering the economy and the world around us. One notable impact of these technological advancements is the potential for reducing the cost of producing digital solutions in education. As technology becomes more accessible and efficient, the production and distribution of edu resources and platforms become more affordable. This, in turn, can lead to an increased availability and accessibility of learning solutions to a wider audience.

Changes in the labor market

The labour market has always exerted a strong influence on changes in education. The demand from employers stimulates the development of vocational training and prompts higher education institutions to launch new study programs. Changes in educational systems require significant costs and their implementation occurs through evolution rather than revolution. This means that those who can quickly adapt to the changing educational landscape emerge victorious. This is one of the reasons why we are witnessing the flourishing of informal education, including online training, e-learning courses and digital boot camps, which enable individuals to quickly acquire new attractive and lucrative professions.



Global e-learning market growth
[Source: Global Market Insights report]

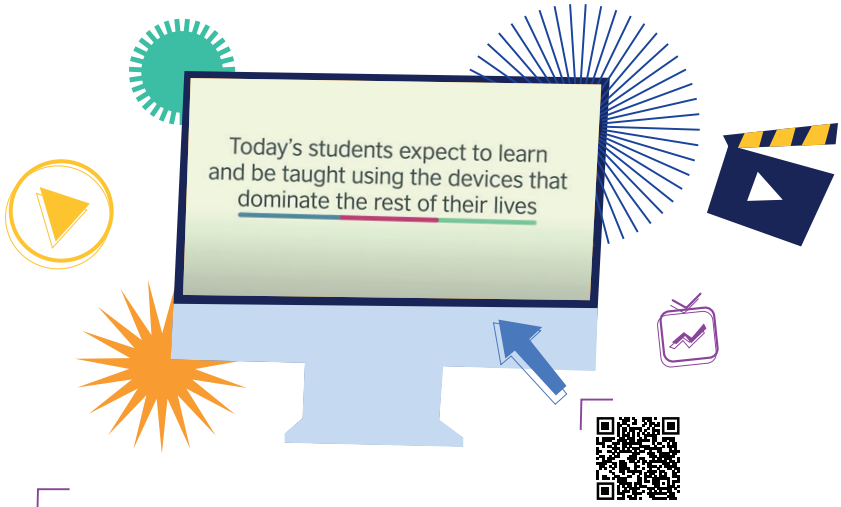
Demand for commercial education

Alternative forms of education in the form of e-learning courses are becoming increasingly popular. Class Central reports that the number of participants in Massive Open Online Courses (MOOCs) exceeded 180 million students in 2020. Online learning is also seen as beneficial by students themselves, with up to 7 in 10 students believing that online education is as good or better than face-to-face learning. Teaching staff also have no doubts about the development of e-learning in schools. Up to three-quarters of teachers say that within a maximum of 10 years, classic textbooks will be replaced by digital educational content. It is therefore not surprising that digital education is also rapidly entering the field of higher education. According to the popular Polish search engine **otouczelnie.pl**, there are currently as many as 857 university courses offered online in Poland.

Black swans

The growth of online education is also influenced by unforeseen and significant events known as black swans, which cannot be accurately predicted in advance. These include pivotal occurrences such as Black Monday on the New York Stock Exchange, the Internet bubble crisis in 2000, the World Trade Center attack and the emergence of the SARS-CoV-2 virus leading to the global pandemic. The last one had the most profound impact on the development of digital education, surpassing any previous catalysts in the history of civilization and permanently propelling remote learning into widespread adoption worldwide.

How is online learning changing higher education?



How is online learning changing higher education?
[Source: British Council, www.youtube.com/@britishcouncil]

Advantages of online education

Online education has gained popularity in higher education for several reasons. Some key factors contributing to its rise are listed below.

Flexibility

Online education offers flexibility to learn at your own pace and on your own schedule. It eliminates the need for students to commute to a physical campus and allows them to access course materials and lectures from any location with an internet connection. This flexibility is particularly appealing to working professionals or individuals with family responsibilities, who may find it difficult to attend traditional classes.

Accessibility

Online education has made higher education more accessible to a wider range of individuals. It has broken down geographical barriers, allowing students from different locations and even different countries to enroll in courses and programs offered by institutions which may have been inaccessible to them before. Additionally, online learning has also made education more accessible for individuals with physical disabilities or other limitations that may prevent them from attending traditional on-campus classes.

Diverse course offer

Online education has expanded the range of courses and programs available to students. It allows institutions to offer a wider variety of subjects and disciplines, including niche or specialized courses that may not be feasible to offer in a traditional class-

room setting due to limited demand or resources. This enables students to pursue their specific interests and career goals more easily.

Technology advancements

Advancements in technology have significantly enhanced the quality of online education. Virtual learning environments, multimedia resources, interactive simulations and collaboration tools have made online courses more engaging and interactive. Additionally, the use of artificial intelligence and machine learning algorithms can personalize learning experiences, providing customized content and adaptive assessments tailored to the needs of individual students.

Cost-effectiveness

Online education can be more cost-effective for students and institutions alike. Students can save on such expenses as commuting, accommodation and textbooks, while institutions can save on infrastructure costs associated with maintaining physical campuses. Online education also allows institutions to reach a larger audience, potentially increasing enrollment and revenue.

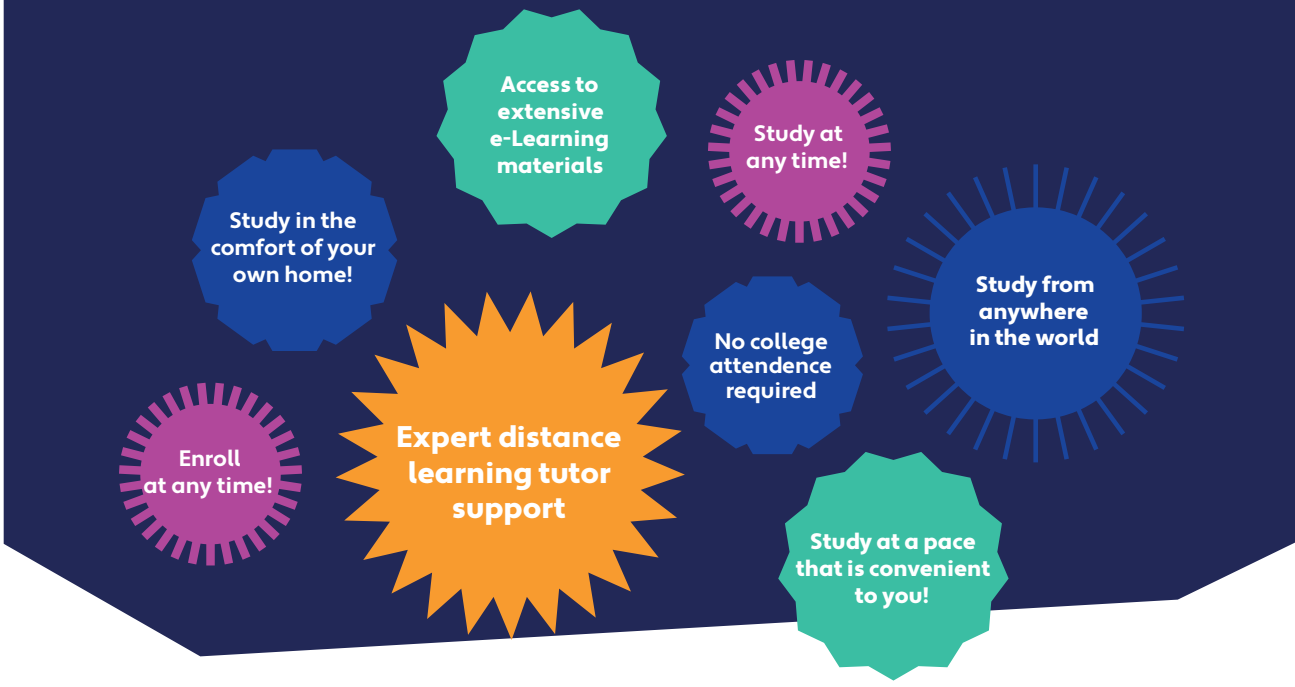
Lifelong learning

Online education has facilitated lifelong learning by providing opportunities for individuals to acquire new knowledge and skills throughout their lives. Professionals can engage in online courses and programs to upgrade their skills or pursue advanced degrees while continuing to work. This flexibility has become essential in a rapidly evolving job market that requires continuous learning and adaptability.

Personalized learning experience

Online education often incorporates adaptive learning technologies and personalized learning platforms that can cater for individual student needs. These technologies use data and analytics to adapt the learning experience, providing targeted resources and feedback based on a student's progress and learning style.

While online education has its advantages, it's important to note that it may not be suitable for all learners and all learning styles. Some disciplines, such as those requiring hands-on lab-oratory work or in-person interaction, may still rely heavily on traditional classroom settings. That is why providing blended learning – an approach that combines traditional face-to-face instruction with online learning activities – is so important. It integrates both in-person classroom interactions and digital resources to create a cohesive learning experience. One thing is certain – the popularity of online education in higher education continues to grow, and institutions are finding innovative ways to leverage technology to enhance student learning experiences.



Disadvantages of online education

While online teaching in higher ed has gained popularity and offers several benefits, it also entails certain disadvantages. Some of them are listed below:

Time-consuming production

The preparation of e-learning courses, digital learning resources and activities is very time-consuming and requires the cooperation of professionals, such as graphic designers and multimedia developers. However, having such content saves a lot of time and makes teaching much more effective in the long run.

Limited social interaction

One of the key drawbacks of online education is the lack of face-to-face interaction with instructors and fellow students. Traditional education settings provide opportunities for networking, building relationships and engaging in collaborative learning, which may be limited in an online environment.

Reduced personal attention

In an online setting, it can be challenging for instructors to provide individual attention to each student. Students may face difficulties in getting immediate clarifications or personalized feedback, which can hinder their learning experiences. Online

education often involves asynchronous communication, which can lead to delays in receiving responses to inquiries and hinder the learning process.

Potential for decreased motivation and discipline

Online education requires students to be self-motivated and disciplined as they have more flexibility and independence in managing their time. However, some students may struggle with staying motivated and disciplined without the structure and accountability of a physical classroom. Also, cheating in exams is much easier in that mode.

Technical issues

Access to reliable internet connection, suitable devices and necessary software can be challenging for some students. Technical issues such as connectivity problems or software glitches can disrupt the learning process and create frustration.

Limited hands-on experience

Some subjects and disciplines require hands-on training or practical experience, which may be problematic to replicate in an online environment. Fields like lab sciences, fine arts, and certain vocational courses may suffer from limitations in providing hands-on training and experience.

Potential for reduced networking opportunities

Networking is a significant aspect of higher education, allowing students to connect with peers, professors, and professionals in their field. Online education may limit opportunities for networking and establishing relationships that could be beneficial for future career prospects.

Key terms

Iwona Mokwa-Tarnowska

MOST WIEDZY

The term 'e-learning', which nowadays is used synonymously with 'online learning', 'web-based training', 'web-based-learning', 'web-facilitated learning' and 'Internet-based learning', became popular in the early 2000s. In the broadest sense, it refers to any instruction delivered over the Internet to support individual performance and development.

It encompasses the provision of learning opportunities in a variety of formats through various forms of electronic media. Thus, it includes the delivery of information via information and communication technologies, the creation of interactive materials using Internet tools, and the facilitation of courses with various forms of support from educators and peers. Its focus is on education rather than technology, which keeps changing and developing.

E-learning courses are demanding on the part of both teachers and their students as they require a lot of effort and motivation, which is an essential element of success.

Distance learning or distance education

Distance learning basically refers to text-based and correspondence-based learning and courses, and it may incorporate elements of e-learning as technology-mediated instruction has gained popularity in recent years. Hence, it involves the delivery of educational materials using both print and electronic media.

Blended learning

The term 'blended learning' refers to a combination of web-supported educational material and traditional in-class learning to achieve an optimum training programme for a specific audience. It allows a two-mode experience which involves the coexistence of conventional face-to-face teaching methods and e-learning in a single course. It entails a wide range of Internet technologies that are integrated with traditional forms of teaching to provide engaging learning opportunities.

In blended learning, e-learning and traditional education are interdependent. An e-learning component is used to wrap around traditional activities or e-learning is wrapped around conventional teaching.

A new blend is a whole, in which the individual parts are not as distinguishable as they once were.

Blended learning gives a chance to extend the educational process beyond the traditional classroom, offering students additional learning opportunities. It is not about supplementing traditional face-to-face sessions with as many e-learning technologies as possible, nor is it about delivery channels. It consists in blending classroom activities with new tools for pedagogic gain.

Web-enhanced learning

Web-enhanced learning refers to studying in a traditional classroom setting with access to online resources and activities that supplement in-class instruction. Online interactions complement traditional ones. They neither replace traditional class time nor constitute a separate delivery mode. Onsite classes are enriched via digital components, e.g., forum discussions, online quizzes, online peer review, and resources available through online platforms.

Hybrid learning

Hybrid learning refers to a teaching model which allows simultaneous online and traditional instruction. It bridges the physical classroom and the virtual one. Remote students join on campus student cohorts to share learning experiences in real time. They can participate both in the classroom and in web-based learning activities. For such a combination of face-to-face and online modalities to be possible, a learning/teaching space has to be equipped with desktop computers or laptops, monitors, visualizers, audio tracking cameras and microphones to allow for interaction between and among all the students and the teacher.

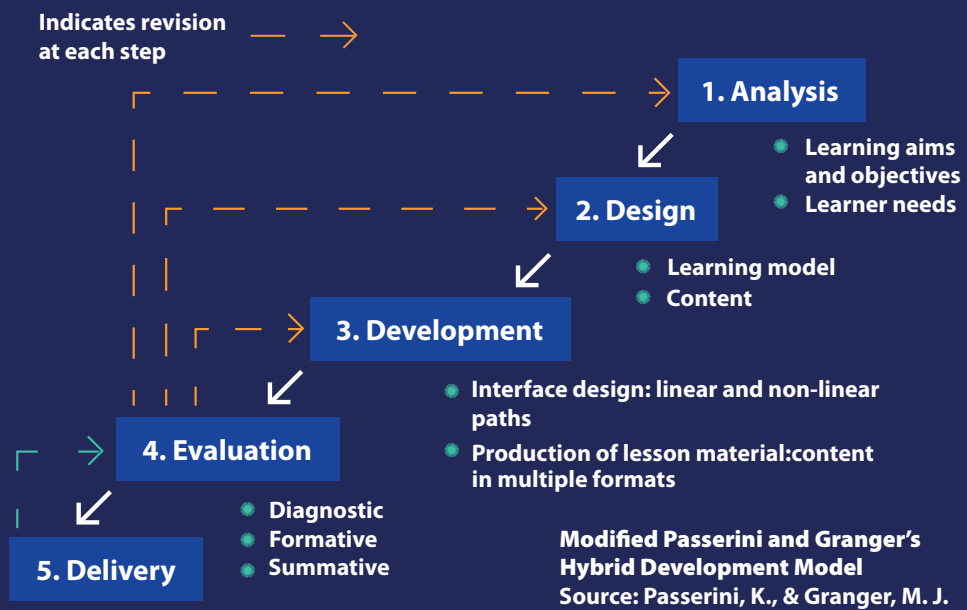
Blends of methods, approaches and technologies

Academics, lecturers, tutors and course developers who want to incorporate technologies into the learning process have a number of options to choose from. Universities and higher-education institutions offer educational programmes that range from tutor-led or self-paced courses developed in an e-learning environment to face-to-face meetings supplemented with various Internet tools. Which of them educators choose to create a successful learning experience should depend on the intended outcome, the needs of the students, and their learning practices. E-learning technologies can be used to support students' in-class and post-class activities, to assess their mid- and end-of-semester assignments as well as monitor and evaluate their overall progress.

Prospective and present undergraduate students have been developing their learning habits around various technologies since they experienced their first classroom setting. Thus, university educators who want to offer novelty, innovation, uniqueness, and originality, and who aim to satisfy their students' needs, should incorporate a variety of tools into the education process.

Instructional design

A constructivist model of instructional design for e-learning, blended learning and web-enhanced programmes shows how each phase can be redesigned based on the feedback generated from evaluation procedures and support analyses. A modification process, with revisions at each stage, actively carried out during the course, aims to satisfy students' needs and achieve the best learning outcomes.



Modified Passerini and Granger's Hybrid Development Model
Source: Passerini, K., & Granger, M. J. (2000, 9)

A well-designed e-learning course or e-learning component:

- has a logical structure and is easy to navigate;
- is visually appealing;
- does not rely heavily on multimedia;
- stresses cooperation and promotes collaboration;
- is structured around active learning techniques;
- has well-defined support structures;
- respects diverse learning habits;
- offers a personalized learning experience as it includes non-linear paths to cater for individual learning needs;
- provides summative and formative assessment;
- has been created by trained staff in the areas of online pedagogy and Internet technology.

Online teaching in STEM

Wiktor Sieklicki, Marek Chodnicki

MOST WIEDZY

Subjects referred to as STEM (Science, Technology, Engineering, Mathematics) constitute an important part of the curriculum at technical universities. They cover the fields of science and technology such as mathematics, physics, chemistry, computer science, engineering, robotics, mechatronics, electronics, mechanics, etc. Within these subjects, classes are conducted to develop analytical skills, creativity, and problem-solving abilities related to real-world technological and scientific challenges.

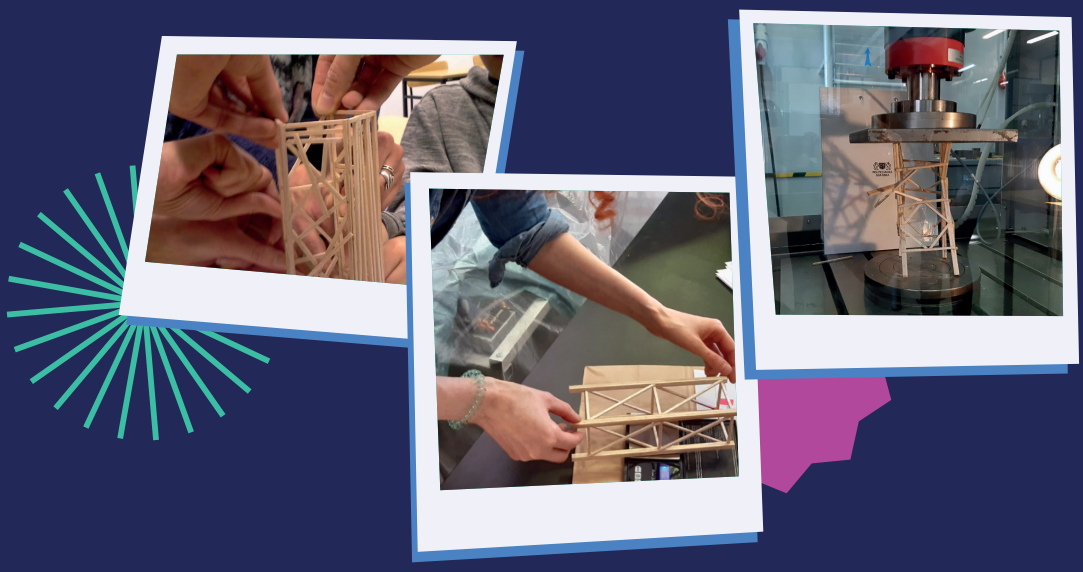
In the context of conducting STEM classes online, several benefits and challenges shall be addressed. Online learning allows for temporal and spatial flexibility, granting students access to educational materials and resources anytime and anywhere. Additionally, online tools may enrich the students' experience through interactive simulations, virtual laboratories, and platforms for collaborative projects. Do these benefits outweigh the challenges students and teachers are facing?

Challenges

Conducting STEM classes online presents significant difficulties. The lack of physical interaction with objects and devices discussed in class poses a considerable limitation on practical experimentation and hands-on learning. Manipulating physical objects, touching machines, feeling their vibrations or weight are crucial elements for understanding and learning in STEM fields.

Therefore, it may be beneficial to be aware of problems that can be encountered and the solutions that may enhance knowledge transfer and skill development for students. Below, several examples that highlight potential difficulties in conducting STEM classes are presented. Furthermore, some tools that can support distance learning in STEM subjects and enhance the effectiveness of these classes are also provided.

Teaching STEM classes online presents numerous challenges, particularly the lack of students' direct access to objects used in experiments. This refers to both the machine that is used as well as the material that is being machined, investigated, etc. In the case of material processing laboratories, welding, or machine part manufacturing, students taught online have a limited possibility to touch and manipulate the produced parts or compare them with technical drawings. Additionally, physical sensations such as machine vibrations, specimen temperature, friction force cannot be conveyed during online classes. This hinders students' ability to comprehend various aspects of technological processes and prevents them from developing a deeper understanding of the subject matter. Unfortunately, even the Finite Element Method (FEM), a simulation which provides a visual insight into the displacements and stress of the specimen while under tensile tests, might not be sufficient for students to understand the process. Touching, rubbing, and loading the specimen with students' own hands provides much more information to an inquisitive student and, most of all, the information obtained in this way is easier to remember and recall.



Balsa wood structures built by students during a traditional class are then tested with loading equipment.

Some alternative educational strategies might enrich students with at least some of the necessary information, skills and knowledge in an online learning environment. One approach is to utilize virtual models, animations, and simulations, which can partially replace physical objects and processes. Through these tools, students can virtually manipulate objects, observe their behaviour, and experiment in a safe and controlled environment. For example, virtual laboratories can allow students to simulate strength tests, observe the working path of a machine or test control algorithms of robots. The downside is that it requires significant upfront effort from the teacher to prepare materials and assessment methods.

Try these tools

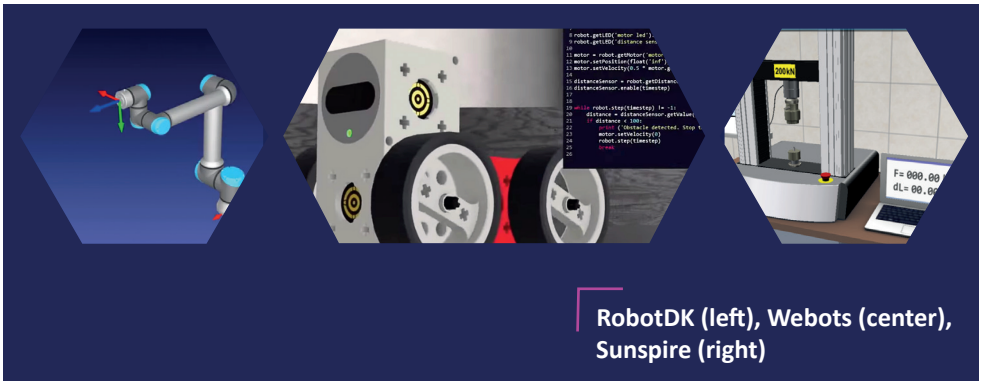
Webots: It is a computer application available at www.cyberbotics.com that provides a programming environment for modeling, programming, and simulating robots. It offers access to numerous pre-built robot designs, guidelines, and facilitates communication among individuals involved in robotics. Webots operates under open-source principles.

RobotBenchmark: The website (www.robotbenchmark.net) enables learning based on programming pre-built robots as well as building your own. It allows verifying

control algorithms and learning about existing ones. It also operates under open--source principles.

RobotDK: It is a computer and browser application available at www.robodk.com Users can simulate their own manipulator or use a rich library of existing manipulators for programming and operation. The free version offers limited functionality.

RoboAnalyzer: It is a simple computer application accessible at www.roboanalyzer.com that allows modeling manipulators and analyzing their kinematics and dynamics. RoboAnalyzer operates under open-source principles.



RobotDK (left), Webots (center), Sunspire (right)

SunSpire: The software (accessible at www.sunspire.site) is a very complex, 3D virtual environment for various tests and experiments. It is adequate for tensile tests, material machining simulation (CNC as well as manual), hydromechanics, mechanics, etc.

Another group of software for simulation is intended for use with more general objects

Simulink: It is a computer application integrated into Matlab software, available at www.mathworks.com. It is a powerful tool for simulating control systems. The software has a large user forum that provides numerous examples, tips, and support. Simulink is paid software with a limited trial version.

MapleSim: It is a computer application integrated into Maple software, available at www.maplesoft.com. MapleSim allows the simulation of mechanical, electrical, thermal, hydraulic systems, both simple (e.g., levers, lumped-parameter systems) and complex (e.g., vehicles, robots, manipulators). The website provides guidelines and tutorials. MapleSim is paid software with a limited trial version.

Automation Studio: It is a computer application available at www.famictech.com/en/Products/Automation-Studio/Educational-Edition"www.famictech.com/en/Products/Automation-Studio/Educational-Edition for simulating electrical, hydraulic systems, PLC programming, creating digital twins and I/O communication with external devices like Arduino.

B&R: The website (www.br-automation.com/en/academy/classroom-training/) offers modules for Automation Studio, MapleSim, Simulink, and other applications, as well as guides and ready-to-use learning materials. Users pay to access the content.
LTSpice, EE-sim: The software, provided by Analog Devices and available at www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html, is for simulating electrical and electronic circuits. This is paid software with limited trial versions.

Another useful strategy for online classes is to utilize LMS that allow collaborative work and problem-solving in groups. This enables students to connect remotely and explore scientific concepts, collaborate on projects, analyze data and exchange ideas. Such interactive educational tools facilitate active engagement and the development of teamwork skills, which are essential in today's STEM work environments. General communication tools are presented in further chapters of this book, but for STEM it is very beneficial to utilize tools like **Asana**, **Trello**, or **GitHub**. These tools also have another functionality that is very beneficial for online learning. They enable monitoring students' work progress and assessing their work in real-time. With access to online tools, teachers can quickly check assignments, provide feedback and deliver grades. This allows for ongoing communication and evaluation of students' progress, which is crucial for their development and understanding of the material.

Providing students with appropriate instructional materials is also crucial when physical objects are inaccessible. Instructors must provide detailed images, models, and descriptions that help students understand and visualize the presented concepts. Since the students' interactions with the lecturer and the opportunities to ask questions are limited, educational materials should be self-explanatory to provide support and clarification on various stages of learning. This requires significant effort from educators to prepare teaching materials.

In conclusion, teaching STEM classes without access to physical objects poses many challenges. However, by employing virtual models, interactive platforms, detailed instructions and regular interaction with teachers, effective solutions can be found. Effective project management and group work within STEM subjects are essential. Course modules and project management tools allow for better organization of student work, progress tracking, and efficient collaboration within groups. Hence, it is worthwhile to invest in tools that facilitate coordination and monitoring of projects, ensuring transparency and fair assessment of students' work.

A general conclusion is that high quality online teaching in STEM classes requires strong general support for the educators. The amount of work needed to prepare proper assessment methods, self-explanatory materials and interactive content is enormous; especially if we assume that academics should be involved not only in the teaching process, but should also provide their students with specific support.

Teaching mathematics online

Anita Dąbrowicz-Tlałka

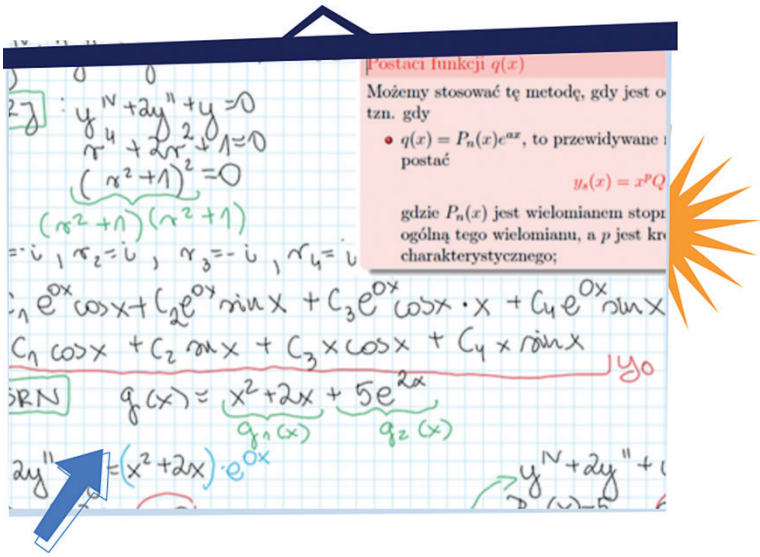
MOST WIEDZY

Synchronous online classes

The teaching of mathematics in engineering studies should focus on the development of analytical skills, i.e. the ability to formulate arguments logically and to apply critical and logical thinking when solving technical problems. Mathematics is to become a student's language for describing processes using symbols and formulas in an accurate and consistent way.

It is important to note that written communication with students using mathematical symbols and formulas can be a serious problem in synchronous online mathematics classes. While the teacher possesses a tablet, allowing them to jot down any sequence of logical transformations, some students may face difficulties presenting their solutions in writing when prompted to do so. For instance, the keyboard lacks essential symbols like integrals or series notations.

However, it is important to remember that, regardless of the size of the student group participating in a synchronous class, the computer screen used for presenting an analysed problem is often a smaller space than the blackboard/whiteboard surface and notations must be legible. In mathematics, reading the index or floor element of a formula properly can be crucial. Additionally, it is important to note that when using written slides and changing them quickly, some may go unnoticed by students when we display the next one. What is more, elements of a previously carried out analysis of a mathematical problem may not be immediately remembered by learners and their subsequent use can be quite a hindrance to understanding the topic.



Some difficulties are relatively easy to overcome. It is necessary, for example, to:

- adapt the pace of work to the group's abilities and make records of the whole activity or its particularly relevant extracts available to the students (bearing in mind the need to ensure the protection of personal data in the recordings made available);
- ensure that you can communicate with class participants so that they can let you know if they are keeping up with the progress of the problem (in this case, voice communication is valuable, as we are not always able to follow the chat in parallel to the class);
- prepare a packet of the necessary information and display it in a selected part of the screen in parallel to the records (these can be, for example, formulas prepared in advance or whole slides with theoretical issues);
- introduce follow-up questions to show whether students are actively participating in the class (e.g., a quick poll on which method to choose in the next step of solving a problem, a quick test indicating which answer should be correct at a given step of solving a problem);
- ask questions frequently and encourage students to answer them, remembering to praise active participants, direct those who find it difficult to understand to the right track and not to stigmatize incorrect answers (gathering information about the reasons for incorrect reasoning can prove valuable to us);
- display visualizations of the solved tasks in parallel with the calculations, enabling students to focus on both the executed transformations and any potential geometric interpretations. Additionally, they can observe how these concepts translate into practical applications.

It is worth noting that presenting pre-solved tasks during synchronous classes could hinder students' ability to follow the problem-solving process, leading them to feel less motivated to actively engage with the instructor in finding the correct solution. The teacher's real-time recording of the successive stages of problem analysis offers an opportunity for increased engagement among class participants. It allows them to collectively explore various reasoning methods, correct mistakes, and witness the creative and dynamic nature of mathematical problem-solving.

The problem of communicating with the language of symbols and mathematical formulae during synchronous classes is much more difficult to resolve. Using a virtual whiteboard obviously seems a basic and foremost solution. It can be integrated into a synchronous communication platform (e.g. Click Meeting, MS Teams) or be used as a stand-alone tool (e.g. Miro, Limnu). The best solution is when students have graphic tablets (the price of such tablets is currently low) or mobile devices allowing handwriting that can work with the system used to conduct the class. Then, with the proper quality of internet connection, online classes fully resemble traditional ones.

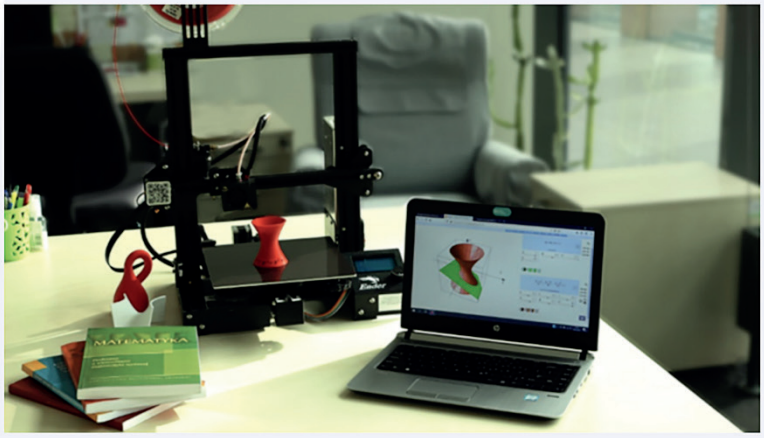


Photo: Łukasz Stępniak

An alternative approach to communicate using the language of mathematics is to utilize software designed for engineering calculations. Then, students can present the solved mathematics problem by sharing their computer screen. However, it should be remembered that the aim of teaching mathematics at a university level is also to shape attitudes related to the quality of calculations performed with the use of computer tools and to ensure that the solutions obtained are as reliable as possible.

Nowadays, we have a great variety of software for performing calculations and analyzing problems – from simple calculators to artificial intelligence. Criticism and attention to reliability when solving tasks are increasingly important. It is important to motivate students to use software that instills a high level of confidence in the reliability of calculations and to teach them to use it correctly. For example – MATLAB, Maxima, Maple, WolframAlpha – are excellent tools for solving tasks (also at the symbolic level) and performing visualizations. Nevertheless, it is essential to remember that using such software necessitates students being prepared to work within the environment of the particular software.

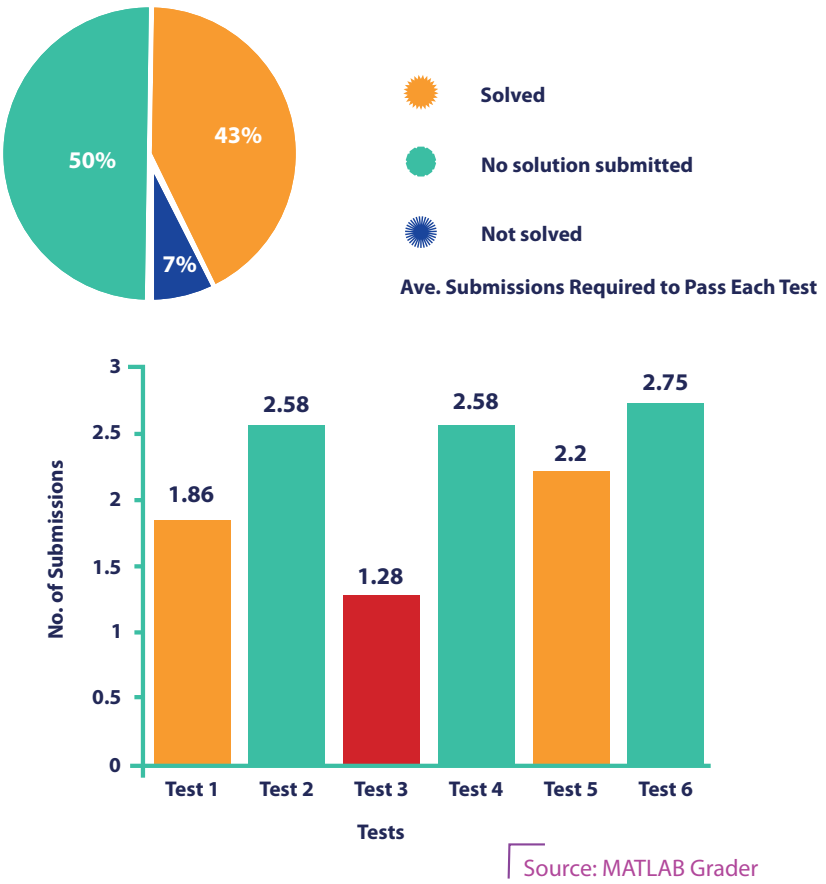
Asynchronous online classes

In the case of asynchronous online mathematics classes, we have a wide range of possibilities for introducing different forms of student engagement and assessment.

We should start by choosing a suitable platform for our mathematics course or its parts, which students will use remotely.

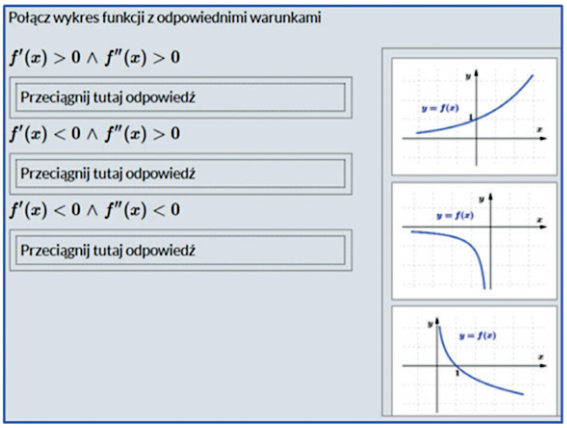
This could be, for example, a university or school educational platform such as Moodle or Blackboard or Microsoft365.

Certainly, integrating software such as MATLAB Grader into the platform will facilitate the generation of problem sets that students cannot readily copy from online sources. The idea is not merely to employ this type of tool for student assessment but also to aid them in creatively attaining learning outcomes. Furthermore, it is possible to provide students with immediate feedback that goes beyond basic error messages. This means that students can get guidance and attempt to solve a problem before seeking individual assistance. What's more – the resources can be copied and re-shared with different parameters.



Source: MATLAB Grader

In general, the platform's functionalities allow for the sharing of mathematics tests (self-checking), as well as uploading and grading solutions to open tasks or team work.



Gdańsk Tech Mathematics Center resources

There are also many possibilities in terms of the way of presenting theory and providing visualizations of the discussed topics. These can be text-based resources such as PDF files, videos posted e.g. on the university's YouTube channel, visualizations and interactive simulations made e.g. with GeoGebra.

It is an excellent idea to involve students in the creation of resources that will form the reviewed knowledge database for their peers. Presenting the reviewed resources, e.g. on the university's YouTube channel accuracy of transformations and the quality of the presented content. This allows educators to gain a better understanding of the difficulties students have in understanding mathematics and to learn about which methods of delivery are clear to them.

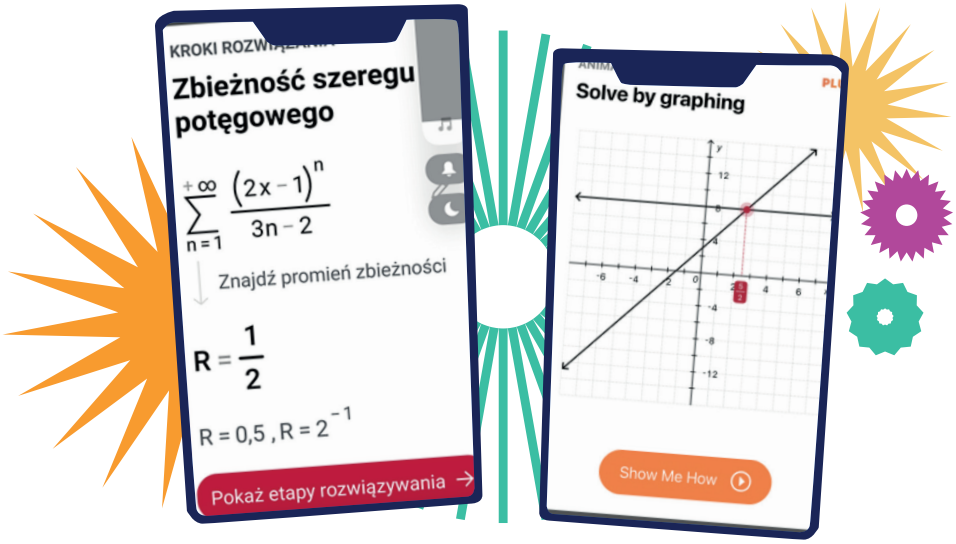


Photo of student task list solved using the Photomath app

The most challenging aspect of conducting mathematics classes lies in designing tasks that prevent learners from relying on pre-made solutions or solver apps such as Photomath.

Implementing a focus on independent work and the requirement to demonstrate the ability to analyse problems and select appropriate computational methods can be very challenging. Generative tasks must not be limited, for example, to changing the coefficients in the equation being solved, but must concern the problem-solving stage. That is to say, a methodology for creating mathematics tasks, which centers on innovatively formulating problems using software and artificial intelligence, while also preventing automatic answer copying without problem analysis, stands as one of the most vital elements in conducting remote mathematics classes.

Active learning in practice

**Alina Guzik, Katarzyna Kubiszewska,
Aneta Sobiechowska-Ziegert**

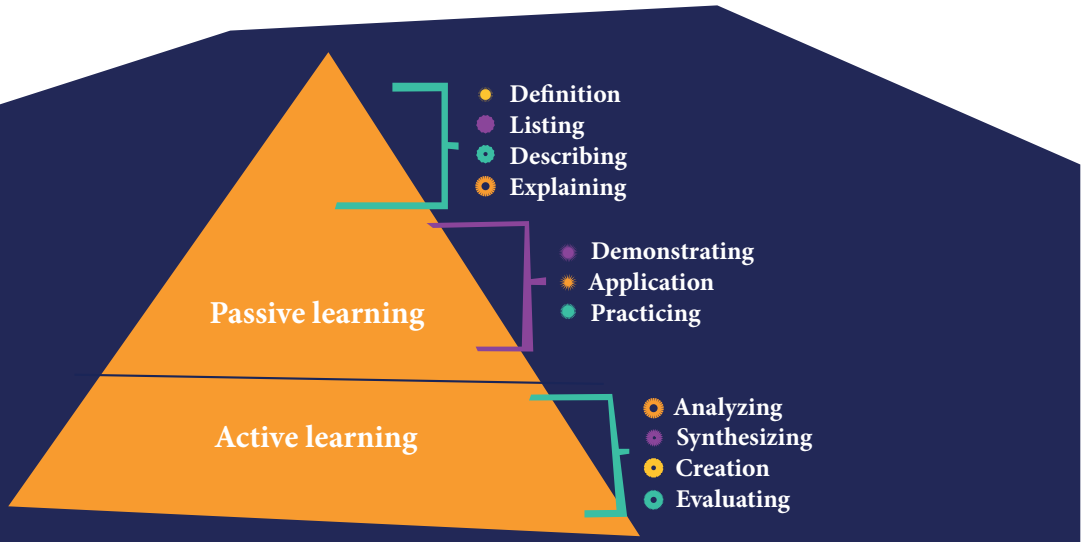
MOST WIEDZY

Active learning in a nutshell

Citizens of the modern world are confronted with more than 100 billion bits of new information every second of their lives. They are bombarded with information not only during everyday conversations and activities, but also from computer screens and phones that are always at hand. If the mind assimilated all the data it is receiving, it would immediately start to emit large quantities of black smoke like an old diesel engine forced to run at an excessive speed.

Have you ever felt a real overload of information? Maybe you didn't even realize that this was the real cause of fatigue, headaches, discouragement and general overwhelming. However, human brains have learnt to defend themselves against this serious danger by ignoring most messages and focusing their attention on those they deem important. How do they make this difficult choice? Our nervous systems create memory traces that only deepen in specific situations and through sensations related to perception, experience or action. For this reason, we mainly remember information that:

- stimulated us emotionally,
- we quickly recognise as very useful,
- is repeated many times,
- can be easily linked to existing knowledge in the mind (i.e. our mental model),
- we have deeply processed, e.g. by making an analysis, synthesis or creation.



Let us note that a traditional academic lecture is often instructivist in nature and lasts from sixty up to ninety minutes, during which the active party is primarily the teacher. They have worked on the content and present it before their students using emotional effort. For this reason, they always have a different perception of the passing of time and the level of attractiveness of the topic discussed. In this set-up, the audience, whether they want it or not, adopt a passive attitude and focus on listening, which is a very exhausting task in the long run. As a result, the thoughts of those in the room unwittingly begin to wander in search of topics that are closer, more exciting or do not require intensive concentration, which they no longer have the energy for. And they are really not to be blamed for this.

Fortunately, the rescue comes in the form of active learning methods. They motivate students to put effort into processing key knowledge, making it meaningful and thus transferring it to long-term memory by creating new memory traces. They can be successfully applied in various teaching situations. Below are some examples and suggestions:

During the lectures

Real-time quizzes

Tools that will help to engage students simply and quickly are online apps like Mentimeter or Kahoot (and many similar ones collected in this list). These allow students to take quick quizzes on their smartphones. "For each lecture in the Corporate Finance subject, I prepared a so-called pre-quiz and post-quiz posted on the GUT e-learning platform. These were short tests (with 5 questions) given at the beginning of the lecture and at the end. The pre-quiz introduced the students to the topic, while the post-quiz allowed for an in-depth reflection on the lecture. The post-quizzes were kept open for another two weeks so that those wishing to do so could attempt them again. Each student was informed of the number of correct answers, but did not know which question they had answered correctly. To do this, they had to search for accurate information on their own in their notes and the opportunity to attempt the quiz multiple times gave them a chance to improve." – Katarzyna Kubiszewska professor from the Gdańsk Tech Department of Finance, Faculty of Management and Economics.

Engagement quizzes can be used not only to test knowledge, but also to obtain feedback from students, e.g. on their expectations regarding the scope of the lecture or the level of attractiveness of the classes. They also have an additional advantage. Not all students are ready to speak in public, and these tools allow them to remain anonymous and ask questions in a safe manner.

Quick summaries

To keep students engaged, it is a good idea to ask them for a short, creative summary after each part of the lecture. A provocative photo or a non-obvious quote can be a starting point for a discussion. Each lecture participant can note down their suggestion in the form of a sketchnote, i.e. a note in graphic form with textual elements or a mind map. 'In order to make this task go smoothly, you can divide the student cohort into several groups and give them some time for discussion. This makes the participants more willing to share their thoughts in the forum. It can be seen especially in the lower semesters, when students need more support from their peers. With me, this method works well in lectures on e.g. the Basics of Economic Forecasting in the Economic Analysis,' explains Aneta Sobiechowska-Ziegert, professor at Gdańsk Tech Department of Statistics and Econometrics.

Groupwork

Method 635

The 635 method or its various modifications works well in the case of groupwork. It involves dividing the students into 6 teams. Each team has to write down a minimum of 3 conclusions from the lecture, but they only have 5 minutes to complete the task. The list is then passed on to the next team, which adds their next 3 points. In this task, the students are encouraged to make an increasing effort each time to recall the content discussed and this stimulates them to remember more. The technique can be used to summarize the lecture or to revise the content of a previous one. The time to write down conclusions can be shortened, e.g. to 1–2 minutes, so that the task can be completed in 10 minutes.

Virtual whiteboard

When working in laboratory classes, it is interesting to use virtual whiteboards, e.g. such as Padlet, Miro or Jamboard, on which students post the tasks they have worked on together. The members of each group, after receiving a link to the board, can post content on the board in the form of text, images, files, e.g. spreadsheets, videos or

other media. For the work to be effective each team should be composed of 3-4 people maximum. Once all the groups have posted their content, each group discusses their solution and the facilitator sums up the topic, posts comments on the board and awards points. "The advantage of online whiteboards is that everything happens in real time. The teacher can see which group is actively working. The students, on the other hand, can see the other groups' responses, which can inspire them, but also introduces an element of competition, especially when the teams have their own names and identify themselves with an invented logo. I used Padlet for the subject of Economic Forecasting," says professor Aneta Sobiechowska-Ziegert.

Working with a virtual whiteboard can also be used as a tool for students to create revision materials before an exam. Resources such as short tests, crosswords, links to interesting sites are shared so that everyone can use them. It is also an interesting idea to create interactive presentations together using the Genially tool.

Pairwork

Think-Pair-Share (TPS)

A Think-Pair-Share activity works quite well in pairs. When given a task, students have some time to think about it individually, then they share ideas on how to solve it and work in pairs. In the next step, they join a new team and discuss their previous ideas. This activity has many advantages. Apart from increasing students' engagement and motivation to learn, it also allows them to reflect and think creatively. It also enables them to develop their communication and teamwork skills. This tool can be successfully used during laboratory classes in e.g. quantitative subjects such as Econometrics or Forecasting and Simulation, when the teacher wants to check their students' understanding of a certain theory.

Snowball

The snowball method is a combination of pairwork and groupwork. It is also known as tier discussion or pyramid discussion. It involves moving from independent work, through pairwork to discussion in an increasing group of students. Initially, a student seeks an answer to a question posed by the lecturer individually. Then the participants discuss their thoughts in pairs, trying to find common ground and creatively develop a joint answer to the question asked. In subsequent stages, twos are matched in fours, fours in eights and so on. Each time an agreed-upon opinion is found, it leads to a joint answer to the initial question posed at the beginning of the activity.

Individual work

Flashcards

Many students find it difficult to revise material before a test or exam. They read endlessly through the same material under the illusion that they have covered it. A more effective solution is to use methods and techniques which allow them to revise issues at random and discuss the content in their own words. To do this, students can prepare their own flashcards, i.e. cards where the name of an issue or important concept is written on one side and its definition, functions, features etc. on the other one. The flashcards can be prepared classically on paper or using applications such as Quizlet.

Mind maps

So-called mind maps can help students to structure their knowledge. This tool is used to present information, knowledge, concepts in a structured and graphical form. It is important to use associations when working and to link individual elements with arrows. By using not only words and symbols, but also colours and drawings, the right cerebral hemisphere which is responsible for imagination, rhythm and spatial perception is activated and the two hemispheres work synergistically together. This kind of representation of issues facilitates a global view of a topic. A mind map can be prepared on a piece of paper or using online creators such as Coggle, Canva or Miro.

Child's test

A method that works well for students' self-study is the so-called 'child's test'. Students have to present a difficult issue in the simplest possible way, as if they wanted to explain the issue to the youngest. 'I gave homework to my Master's students attending International Finance, which involved describing the principles of a selected derivative financial instrument so that my then 9-year-old daughter would understand it. The task turned out not to be as simple as many people initially thought. The students had to be very creative to explain, for example, what derivatives are and how they work,' explains professor Katarzyna Kubiszewska.

Harvesting

Harvesting is a tool that enables a user not only to revise the knowledge they have developed. It is a very valuable way to improve reflective thinking. It involves students answering three questions:

- what they have learned;
- what comes out of it, i.e. why is it important;
- what now, i.e. how to apply it or do it differently.

After the activity, students reflect on what they have understood and assimilated, what needs further development and how the new information can be applied in

the future. Harvesting increases awareness of one's own learning process and the effectiveness of learning.

It pays off

Active processing of information has great power. It helps with learning and makes long classes more interesting and less tiring. Sometimes we think that our students learn best when they are just listening to a lecture with concentration and if they are distracted, it is due to low motivation or laziness. This is not always the case. Natural learning processes and our ability to concentrate require variety, engaging multiple senses, excitement and active work. The effort put into designing tasks that motivate us to analyze and synthesize, to present content in our own words or to develop creative interpretations always more than pays off. As Benjamin Franklin probably would say, 'Tell me, I forget. Teach me and I may remember. Involve me and I will learn.'

Dear students, you'd better get a good night's sleep or your neurons will be training for the next lecture like a marathon runner before the Olympics.

Download poster for your students to help them to understand the idea of active learning

Learning management system

Magdalena Roszak, Anna Ren-Kurc

MOST WIEDZY

LCMS (LMS)

The Learning Content Management System (LCMS) is a software application designed to facilitate the creation, management, and distribution of digital learning content. The term is often used synonymously with the Learning Management System (LMS). Data processing is carried out on a central server machine (a university's IT infrastructure), usually together with a database support system. The user runs selected processes on the server from any computer using a web browser application. The application requires registration in the account database and login data. The end of the working time segment (session) is automatically determined by the inactivity of the logged-in account or on request.

There are a large number of applications available under an open source license. The database stores all information about the operation of the application on the level of a given account. It also stores educational material grouped into units called courses, which can be equivalent to subjects.

What is LMS [Learning Management System]?
[Source: iSpring, www.youtube.com/@iSpringPro]

E-learning course

LCMS enables organizing work and resources into units called courses – a configurable interface for accessing educational materials and communication. Students find the course they want to access in the course index provided on the platform and, if their accounts are in the index of authorized users, they gain access to the course

materials. Traditional divisions into years of study and groups can be applied. Enrolling a student in a group can be done in several ways. Students can be enrolled in a course **by a teacher**, they can enroll **themselves** or it is possible to **import** student data from other files or other systems.

Components of an e-learning course

Educational materials are: lecture materials, multimedia materials, graphic or quantitative process simulations, animations that are substantively appropriate simplifications of the processes.

Evaluation, i.e. the evaluation of student knowledge and necessarily the evaluation of the educational process (questionnaire).

Electronic forms of contact between the teacher and the students.

LCMS enables **building** and **distribution of course material**, including **sharing** various types of **resources and engaging** students in **versatile activities**.

Online tutors can redevelop **learning materials** within their course, i.e. edit those made available and publish new ones. Nowadays, the majority of such materials contain **multimedia and interactive components**.

Communication in LCMS

Student-teacher communication is a key issue, especially when classes are conducted only remotely, i.e. there are no on-site meetings. Asynchronous methods of communication are very valuable. Participants can post questions in a forum available in LCMS, and these questions will be answered within a specified time frame. The teacher can address sets of questions, particularly if they are repeated or similar. All communication within the course can either be visible to members of the particular group or kept private between the student in question and the teacher. LCMS also allows for good contact via email.

Areas of special importance

- Organization and management of learning groups
- Organization of knowledge evaluation
- One-on-one communication, as well as communication with a learning group

This issue is particularly important at non-technical faculties, e.g. at medical universities or humanities, where ICT competencies of teaching staff would be often neglected and marginalized.

Costs

Implementation of multimedia and interactivity may require a lot of effort and expenses. The costs of preparing such an e-learning course are distributed across a few years' period of utilization. The costs of course preparation should be divided by the number of classes held across an approximately 5-year period.

Assessment of knowledge and skills

LCMSs offer a set of tools for building closed-ended and open-ended tests. They often support various interoperability standards, and the IMS Question and Test Interoperability (QTI) specification developed by the IMS Global Learning Consortium is one of them. QTI defines a standardized format for presenting questions and tests, allowing them to be exchanged, imported, and used across various e-learning and assessment platforms seamlessly. Assessment results should be archived automatically, and their basic statistical analysis should immediately rate students' achievements.

Archiving Resources

Archiving assessment results in LCMS involves automatic gathering of data from activities completed by learners (tests, tasks, etc.), which are saved in folders according to group allocation. Results are usually structured in directories, which can be easily reached through selecting a given group of students. It is possible to create various reports, summaries and statistics.

Learning materials

Learning materials are more and more frequently available in multimedia format: audio, video and animation files. Users may lack sufficient knowledge about how to use multimedia. That is why, it is important to publish precise information about hardware and software requirements in the course (necessary device drivers, codecs, players), operating instructions, and information on how to seek assistance.

Challenges

Trouble-free operation of LCMS is a key issue in implementing online education in an educational institution. This requires an IT infrastructure:

- an operating system on a virtual or real machine with sufficiently large operating memory and disk space/disk array;
- preferably RAID storage to guarantee a copy of the data and thus its security;
- database server software installations or access to a separate instance of a production server, as LCMS often requires a separate configuration;

- installation of web application server software (commonly known as a web server) or access to a separate instance, with support for the programming technology in which the LCMS was created (usually PHP or JAVA);
- an installation version of the LCMS and the scripts that set up the application database with the appropriate structure.

The educational institution's IT department provides and supervises IT infrastructure in real time. It is important to have immediate contact with the designated administrator in case of unforeseen situations or failures. The IT department should offer lecturers assistance in converting learning materials from editable to publishable versions. Often, this comes down to pointing to an option in the menu of the application in which the materials were edited, and sometimes more significant intervention in the publication process. Educating lecturers can be crucial in solving many problems.

Solutions

When planning the implementation of LCMS, it is worth examining the following issues in detail:

- what are the hardware requirements (memory, disk space, processor) for the chosen application;
- whether the IT department will ensure that the requirements are met within the existing IT infrastructure;
- whether it is possible to supplement the IT infrastructure with the elements required for the installation of the portal and the effective operation of this application.

The IT department can help identify the most necessary needs, which allows for better budget management. Each LCMS is fully equipped to handle the e-learning process 24/7. Using it is beneficial for students and teachers. Success is guaranteed by an extensive IT infrastructure with staff possessing the appropriate ICT skills to implement and develop e-learning. The first prerequisite allows for full control over the trouble-free operation of the LCMS, as well as secure electronic communication. All messages, including email, should remain on the servers that are part of the educational institution's IT infrastructure to guarantee data protection and copyright. The second condition has a huge impact on the creation of learning resources for e-learning courses.

What to choose?

Today's LCMSs have similar functionalities but they can also differ in several aspects. Enhancements to the LCMS can be costly and not always easy to obtain. Every year, LCMS rankings are produced. There are new products and new ratings (portal rankings).

It is also worth paying attention to the programming technologies used to build the LCMS. Scripting technologies are easy to install and, unfortunately, also prone to hacking attacks and leaks of educational materials, which can discourage lecturers from creating them. Moreover, it is worth checking which applications for editing educational materials lecturers prefer. They usually have access to MS Office-type packages free of charge or licensed by educational institutions, which are equipped with features for publishing edited documents.

Teaching scenarios

Case 1

Conservative Dentistry and Endodontics

– online classes based on clinical cases Technologies used:

- sOLAT, an open-source learning platform used by **Poznań University of Medical Sciences** to support online classes;
- **MS Teams, a communication platform** for synchronous communication, i.e. in real time;
- web 2.0 tools.

The components of the e-learning course were as follows:

- forum and notifications for asynchronous communication – sending organizational messages, including current work schedules, conditions for passing, etc.;
- educational materials included seminar presentations for revisions and additional materials, i.e. instructional videos or guide-lines needed for the subject matter;
- project task (open-end questions) – students developed tasks related to endodontic clinical cases, teachers assessed them by sending individual comments to the work done (feedback was important);
- practice test for a self-check in diagnostics/therapy, with true/false questions (closed end questions);
- ask a teacher – an interface for quick individual student-teacher-contact.

Case 2

Medical Microbiology

Educators form a two-person team that collaboratively creates multimedia lectures, complementing each other in both the preparation of the lecture content and during the recording process. Each person supplements the statements of the other, providing a comprehensive understanding of the topic. The microbiology lectures are an exchange of questions and answers based on clinical cases and the expertise of a doctor with many years of experience and a biologist with extensive experience in the field of microbiology.

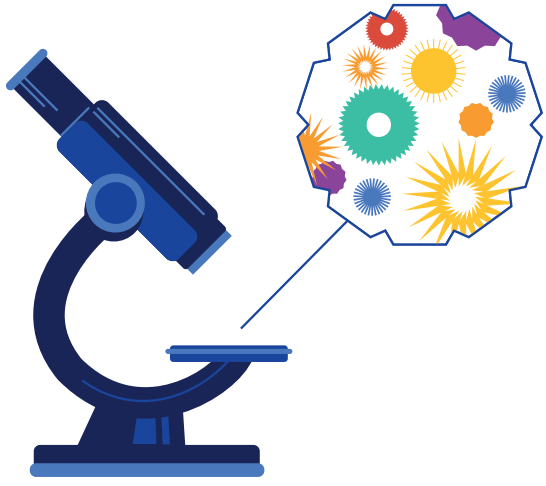
The aim was to develop the habit of listening in future doctors, but also to make them aware of the importance of asking the right questions in order to make the correct diagnosis and implement the appropriate treatment. As in the American series 'Doctor House', the inquisitiveness of the protagonist, complemented by the knowledge of his assistants, makes it possible to solve the most complicated medical mysteries. In this way, the microbiology teachers engage students, increase their involvement and, at the same time, build on the students' existing knowledge from previous classes.

Case 3

First aid course

An important element of this e-learning course is revision. Students pursue individually questions related to the subject matter, which allows them to assess their knowledge levels continuously.

In the First aid course, assessment is embedded in two ways:



Tests and Assignments

- Practice tests at the end of each seminar, containing multiple choice questions randomly drawn from a large database for each student, with both the order of questions and answer options randomized
- Questions in the form of assignments for selected topics

Self-assessment questions included in lecture or seminar content

- The same question for each student, correct answer allows moving on to the next section/part in the resource

Each approach has its merits; their impact on the effectiveness of student learning will be verified by the evaluation of knowledge and the teaching process.

Case 4

Technologies used:

- Moodle-based LCMS called IRDIM implemented at Siedlce University of Natural Sciences and Humanities, Poland
- Google Meet for synchronous meetings

Lecturers are responsible for authoring the educational materials. Students interactively test their knowledge by solving cascade tasks about, e.g. how to operate virtual medical devices.

Event scenarios enable the development of decision-making, analytical and critical-thinking skills. Various selected medical procedures are exemplified, such as auscultation of heart tones, locating chest compressions of a newborn, and performing triage in mass events. Prior to the examination session, students have the opportunity for self-assessment by solving time-limited interactive tests.

Platforms worth knowing

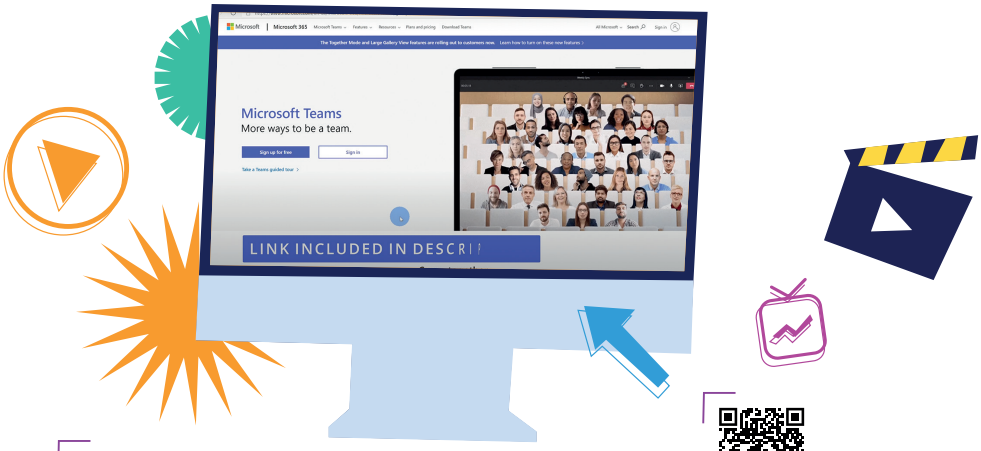
David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

MOST WIEDZY

1. Let's get to know some foundations

Nowadays it is not so difficult to find good online learning platforms that are very well-equipped. The following two are the most important ones that everyone should know well.

Microsoft Teams



Microsoft Teams Tutorial in 10 min
[Source: Kevin Stratvert, www.youtube.com/@KevinStratvert]

Why is it worth the effort?

This platform was created to facilitate online communication. Microsoft Teams, unlike other communication platforms, adds many other features to the basic call service.

Users can:

- upload files, also heavy ones (every participant can do it);
- use the platform as a storage space;
- chat with other participants;
- record the lessons;
- download the lessons;
- share the screen (every participant can do it), to show slides, websites or to write on the screen using e.g. Microsoft Whiteboard to write notes;
- plan a lesson in the calendar shared with others.

Other important features

- There are very few limitations to the number of participants (1000 participants) of a virtual meeting or the number of groups, called "teams", in which a user can participate (1000).

- In MS Teams you can create a lot of different "Teams" and each one will work separately from the others.
- Within each Team, many channels can be created and dedicated to different activities.
- Channels can be private (accessible only to specific person of the Team) or Standard (accessible to all team members).
- Each course can have its group, led by a professor who manages it according to his preferences.

What are the challenges?

- Maximizing the utilization of the tool and its functionalities.
- Capturing the audience's attention and keeping them engaged throughout the call.

What are the solutions?

- Space out moments of explanation and moments of coworking between and among the students with little brainstorming, quick summaries made by them, and questions to/from them.
- Fluent and smooth handling of the software.

Moodle

2022 Moodle LMS video
[Source: Moodle, www.youtube.com/@moodle]

Why is it worth the effort?

Moodle is a learning management system (LCMS). It enables creating a virtual classroom in which two user-roles are configured: the teacher and the learner.

Important features

- Every learner has a customized user's page on which they can find the courses they are enrolled on.
- Editing teachers can manage all their courses by uploading educational material and information they want to share with their students.
- Non-editing teachers have the ability to teach in the course and grade students, but they are not permitted to modify activities and resources.
- Editing teachers and course managers can import course content from one course to another.

The main advantages of Moodle are:

- it has a large storage capacity;
- various tools enable providing resources with contact details of the teacher/teachers, course program, preliminary knowledge, task descriptions, timetables, etc.;
- students can upload their assignments within a specified time frame.

What are the challenges?

Moodle is an open-source application that integrates with various other applications, provides assignment and grading services, and is relatively easy to use. The challenge in managing such a powerful tool is the time needed to try out all its functionalities and organize resources and activities in a coherent whole within the course.

What are the solutions?

Moodle provides valuable tips and tricks on how to develop effective e-courses successfully.

Developing digital resources

Alina Guzik

MOST WIEDZY

Copyright issues

Copyright rules for using resources in education can vary depending on the country and specific circumstances. However, here are some general principles and considerations to keep in mind:

Jonathan Strickland

looks at the complicated issues of copyright and fair use

David Deal

talks about intellectual property as a attorney

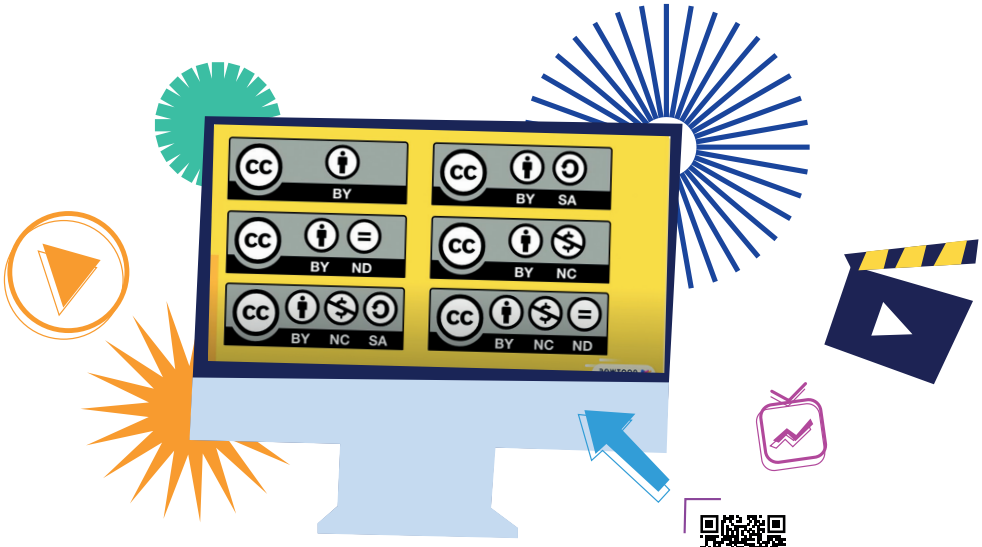
Fair Use/Fair Dealing – Many countries have provisions for fair use (in the United States) or fair dealing (in other countries) that allow limited use of copyrighted materials for educational purposes without permission from the copyright owner. Fair use/fair dealing typically considers factors such as the purpose and character of the use, the nature of the copyrighted work, the amount used, and the effect on the potential market.

Educational Exceptions – Some countries have specific exceptions in their copyright laws that allow for the use of copyrighted materials for educational purposes. These exceptions may specify conditions such as the type of work, the educational setting, and the nature of the use. Check your local law and what it states in that matter.

Public Domain – Works in the public domain are not subject to copyright restrictions. These can include works whose copyright has expired, works explicitly dedicated to the public domain, or works created by the government.

Creative Commons Licenses – Creative Commons licenses provide a standardized way for creators to grant permissions for others to use their works. Some Creative Commons licenses allow for the free use of works for educational purposes, subject to certain conditions specified by the license.

License	Type of use	Symbols
Attribution (BY)	You must credit the creator, the title and the license the work is under.	CC BY
Non Commercial (NC)	The work cannot be used for commercial purposes.	CC BY NC
No Derivatives (ND)	The work can only be used exactly how it is. The work cannot be adapted of modified in any way.	CC BY ND
Share Alike (SA)	Any new material produced using the work must be made available under the same license as the original work	CC BY SA
Public Domain CC0	The copyright holder has volountarily waived their rights and the work can be freely used.	PUBLIC DOMAIN
Public Domain	The copyright of the work has expired and it is free of known copyright restrictions	PUBLIC DOMAIN



What are Creative Commons Licenses?
[Source: U of G Library, www.youtube.com/@UoGLibrary]

Licensing and Permissions: When using copyrighted materials beyond the scope of fair use/fair dealing or other exceptions, it is generally necessary to obtain permission from the copyright owner. This may involve contacting the copyright holder directly or licensing the use of the material through collective licensing organizations or digital repositories.

Good copyright practices

It is important to note that copyright laws can be complex and the application of these rules can vary. It is recommended that you consult the copyright laws and regulations specific to the jurisdiction of a given country or seek legal advice to ensure compliance when using resources for educational purposes. Certain materials are often only available in the form of secondary sources. To avoid potential legal issues related to copyright infringement, educational institutions, professors, and teachers should consider the following guidelines:

- **share website links** instead of downloading and distributing the actual material. By sharing links, the original authors receive proper credit for their publicly shared works. It is important to ensure that the linked material is lawful and does not involve pirated content, such as free scanned copies of paid books found on unauthorized websites. Additionally, the material should have been made publicly available or permitted for public sharing by the original author;
- schools and universities can **acquire software licenses** through their institutional credentials, enabling students to access and use authorized materials available on such platforms for their studies;
- encourage the **use of open-access platforms** that provide free access to educational materials. These platforms allow unrestricted use of uploaded materials as long as they are used solely for educational purposes;
- **seek permission** from the original copyright holder to use their work for teaching and educational purposes;
- **educate students** about copyright laws and the potential legal consequences of unauthorized sharing of copyrighted material. Discourage them from further sharing copyrighted content without permission;
- encourage teachers to develop and share original content that can be easily distributed to students without infringing someone else's copyright.

By following these guidelines, educational institutions and educators can promote responsible and legal use of resources while respecting copyright laws and protecting the rights of content creators.

Who do you need in your team?

Teachers are used to being on their own when preparing teaching materials, but to develop professional digital multimedia and interactive resources as well as e-learning courses, we need a team of professionals with different expertise and background. The specific roles and team composition may vary depending on the scope and complexity of the project, but here are some key roles involved in the process.

Teachers/tutors are experts in the subject matter. They offer the essential knowledge, content, and expertise to ensure alignment with learning goals and accuracy in the e-course materials.

Content writers are responsible for creating clear, concise, and engaging content for the e-learning course. They adapt the subject matter provided by the teacher into instructional content that aligns with the learning objectives.

Instructional Designers or E-learning Designers are responsible for designing the overall structure and flow of the digital content. They analyze learning objectives, create instructional strategies, and design engaging and effective learning experiences.

Multimedia Developers are specialists skilled in creating and implementing various multimedia elements into the e-learning course. They may design and develop simple graphics, animations, videos, and interactive elements to enhance the learning experience.

Graphic Designers create visual elements, including layouts, images, icons and branding elements to enhance the visual appeal and aesthetics of the e-learning course.

Programmers develop and maintain various software applications, tools, and platforms used in educational institutions. Their primary focus is on designing and implementing software solutions, such as interactive simulations, gamification systems and educational games.

The Platform Administrator/LCMS administrator manages the technical aspects of the e-learning course, including setting up the course on the platform, configuring user access, managing assessments, and tracking learner progress.

Quality Assurance (QA) Testers are responsible for testing the usability of the e-learning course. They identify and report any bugs, errors, or issues to ensure the course functions smoothly for learners.

The Project Manager oversees the entire development process, coordinates the activities of the team members, ensures timely delivery, and manages any potential risks or challenges throughout the course development lifecycle.

1. Let's get to know some foundations

Collaboration and effective communication among team members are crucial for successful e-learning course development. Depending on the project requirements and available resources, some team members may take on multiple roles or additional specialized roles may be involved, such as instructional designers or audio/video specialists.

2

Let's build student engagement

Teacher-student relationship

Barbara Purandare, Aleksandra Wiśniewska

MOST WIEDZY

"Education is always about relationships. Great teachers are not just instructors and test administrators: They are mentors, coaches, motivators, and lifelong sources of inspiration to their students."

Ken Robinson

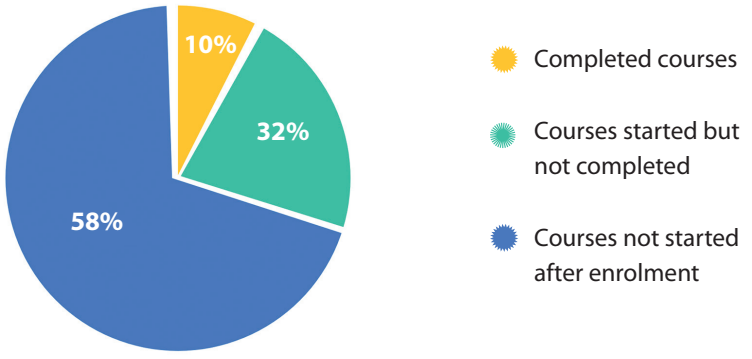
Tips for How to Build Relationships with Students

[Source: McGraw Hill PreK-12, www.youtube.com/@McGrawHillEducationSchool]

The role of relationships in teaching has not always been appreciated, and although the ancient models that are the prototypes of modern education were based on the teacher-student relationship, today the value of connections in formal education is sometimes underestimated. Building relationships in the learning process is not easy, it requires commitment and personalized approach, but given the benefits, it is worth the effort. E-learning presents teachers with additional challenges, and the relationship between students and teachers can often get lost amidst screens filled with slides and turned-off computer cameras. However, interpersonal bonds are essential for building student engagement.

Research indicates that only 32% of people enrolled for a non-compulsory online training actually begin the course while only 10% complete it.

Non-compulsory online training enrolment



Source: Tauber (2013) and Hill (2013)

During online courses, it is essential to cultivate and maintain a positive relationship among participants as it benefits both parties. It increases the level of engagement and efficiency of the course. Learning is a cognitive-affective process which means that with all and any activity undertaken, the human brain activates the motivating system every time. Our motivation level increases when our activities are recognized and appreciated by others. Alternatively, if there is a likelihood of experiencing isolation and lack of acceptance, the motivation for action decreases.

Why is it worth trying?

Without a positive student-teacher relationship, there is a probability of various negative outcomes.

- Higher probability of dropping out of the course
- Lowered or non-existent motivation of the students
- Lowered work efficiency
- Feeling of isolation in the students
- Online loneliness syndrom
- Increased susceptibility to possible technical difficulties affecting the student's mood
- Increased level of stress in the students
- Difficulties in communicating problems by the participants

A positive student-teacher relationship leads to various positive out-comes.

- More efficient performance.
- Participants feeling safe.
- Increased awareness of the learning process and educational path.

- A sense of being part of a community.
- Feeling the sense of belonging with the teacher/tutor and the group.

What are the challenges?

- Challenges in building relationships without direct contact
- Strategies to encourage and maintain motivation
- Establishing a strong bond between teachers/tutors and their students
- Addressing individual factors that may be difficult to specify and average

What are the solutions?

Establish clear communication channels

Use a reliable online platform to communicate with your students. This could include email, messaging apps, video conferencing tools, or a learning management system (LCMS). Ensure students know how to reach you and encourage them to ask questions or seek help when needed.

Personalize interactions

Get to know your students as individuals. Learn their names, interests, and background. Find ways to incorporate this information into your interactions with them. Personalized feedback and recognition can go a long way in building rapport and making students feel valued.

Use multimedia and interactive tools

Keep your online lessons engaging and interactive. Incorporate multimedia elements like videos, interactive quizzes, and virtual simulations. These tools can help capture students' attention and create a more immersive learning experience.

Provide feedback

Regularly provide feedback on students' assignments, discussions, and progress. Be specific and highlight areas of improvement along with positive feedback. Timely feedback shows students that you are interested in their learning and helps them stay motivated.

Encourage collaboration and peer interaction

Foster a sense of community among students by providing opportunities for collaboration and peer interaction. Assign group projects or discussions where students can work together and learn from one another. Use breakout rooms during video conferencing.

2. Let's build student engagement

Important factors affecting the relationship building with course participants include:

- the subject and frequency of interaction;
- clear message formulation, including appropriate structure and functionality;
- guidelines on how to work on the course;
- methods for verifying expected effects;
- a timeline for subsequent tasks and stages of work.

Properly constructed relationships offer essential benefits, such as engaging participants and maintaining a desired level of engagement. It is crucial to attract participants to the course content and then enrourage them to finish the course.

The essence of a message to course participants includes:

- speaking personally;
- keeping frequent communication;
- welcoming the participants;
- using 'reminders' of the subsequent stages;
- congratulating on completion of a given stage and encouraging them to participate in the next one (e.g., informing participants about what is coming next and the knowledge and benefits they can obtain);
- inviting the participants to use periodically appearing materials or extra tasks (recommend books based on your students' interests – ask at first and make notes, surprise them!).

Efective communication involves:

- working in small sub-teams;
- arranging a Mentimeter-type session or a subject-related online game or quiz;
- creating a discussion forum for teachers/tutors and students to ask questions, initiate discussions, and upload resources and links to interesting content;
- designing essay/report tasks to receive feedback from students Providing personalized feedback.

Motivating students to engage in learning entails:

- allowing time for the teacher/tutor to get acquainted with their students;
- introducing question-to-the-teacher sessions;
- maintaining good communication between the teacher/tutor and their students;
- providing prompt feedback;
- showing positive emotions in formative feedback;
- building dynamics by introducing surprise-effect tasks.

Teaching scenarios

Scenarios on how to decrease the level of stress associated with a test/ exam or obtaining credits for the course. Good practice and tools:

To familiarize course participants with the necessity of obtaining a credit, the teacher/tutor can apply various methods and tools, depending on the selected course crediting method;

If a course is accredited based on the average mark of interim projects or tasks associated with subsequent parts of the course content, it is essential to support students through regular feedback, group discussions on common problems and doubts, and individual meetings using available tools such as Clickmeeting, MS Teams, and Zoom;

If the course concludes with a project assessed by other participants and/or a presentation and discussion, it is vital to establish clear rules for awarding marks, including the assessed elements, the method of elaborating the results, guidelines for the presentation, and a list of possible questions. The most commonly used tools for this purpose are a workshop (Moodle tool), a webinar, or a combination of both;

If credits are to be awarded on the basis of a test or an exam, it is worth providing a list of sample questions and problems, revision materials for specific chunks of the content (e.g. in the form of quizzes) or sample tasks with solution patterns and a step-by-step description of the task solving process;

It is good practice to conduct a mock exam during a webinar. This allows for dispelling doubts faced by the participants and identifying possible technical problems, which often contributes to increased stress levels. Additionally, students can test sending the answers in the appropriate form and timeframe.

Scenarios on what to do and how to do it to create a good atmosphere in the group starting a course.

Good practice and tools

Introduce yourself and your experience in the course subject matter. Be concise and use links to your publications, activities, and web-pages. Also, share your interests and hobbies to show your human side. You can record a short video, organize a webinar, or prepare a Q&A list and a short welcome video to do so.

Ask the participants to introduce themselves and organise a webinar-party. During the event, the participants can answer short questions regarding their own interests and hobbies (e.g., using Mentimeter), and they can also describe themselves in any manner they choose (e.g., using Canvas, nicks, avatars, 'words of wisdom', etc.).

Ask the participants to fill in a short questionnaire about the relationships during the course and their expectations.

2. Let's build student engagement

Explain the rules/methods of navigating through the course. Even if you have prepared an appropriate 'self-study introductory course,' presenting the above-mentioned rules personally and enriching them with nonverbal messages will motivate and engage the participants.

Tell your students why it is worth participating in the course. You can present the reasons personally and publish the list of the most important benefits of the course, e.g. skills and knowledge.

Explain the rules for assessing the work progress during the course and the conditions for obtaining credits. Publish these rules in a written form.

You can prepare a recording of a mini-lecture on self-motivation and consistency in achieving the course aims and objectives.

Propose the timeline of the course (especially in the case of asynchronous courses), including contact options (accessibility dates, methods of communication, addresses and links), as well as planned interaction between the participants (joint workshops, webinars and other events).

Provide a proposed method for resolving conflicts (optional, subject to discussion).

Each of the above points can be covered during a Q&A session, which can be held during a webinar. The Q&A session can be open or anonymous, using communicators, nicks, avatars, and other tools.

Tools and Activities for Engagement

- Forum with a question to start a discussion
- Group chat, using e.g. Messenger or WhatsApp
- Drawings to introduce participants, easy to prepare using tools like Canva
- Questions to create a positive atmosphere, e.g.
- How do you feel today?
- Comment encouragement activities, e.g. What do you want to add or say?
- Tools like OneNote, Quizlet, Mentimeter, Linoit for quizzes and surveys
- Flip enabling the teacher/tutor to record a question and students to record their answers
- Google Slides for presentations
- Padlet for posting notes and collaboration
- Tools like Mindmup for mind maps
- Socrative for quizzes and quick question polls
- Symbaloo for creating a database and organizing all your bookmarks
- Blogger for sharing text, photos and video; formative assessment and feedback

Tips & Tricks

Course Overview | Adobe Teaching Online Masterclass
[Source: Adobe for Education, www.youtube.com/@AdobeForEducation]

How to Make Connections With Your Students | Tools to Build Relationships With Students Online
[Source: Mr. Cook's Corner, www.youtube.com/@MrCooksCorner]

Online team work

Alina Guzik

MOST WIEDZY

Why is it worth trying?

The ability to cooperate and think creatively is one of the most desirable skills in the modern world. These skills are crucial both in professional and scientific work. Different thinking styles of people in a team, a mixture of experience, knowledge from various fields, as well as different views on the same issues increase the chances for innovation and good quality of the developed solutions. Combined efforts ensure better results. Unfortunately, many students still have not been taught how to cooperate with others and how to use the methods and techniques of creative thinking in practice. They also pose an emotional challenge as a result of Western culture which promotes individualistic behavior. That is why it is so important to find ways to introduce tasks based on cooperation and creative thinking in the course of traditional and online learning at a higher educational stage.

What are the challenges?

- Students are often not taught how to cooperate with others, this causes conflicts and ineffectiveness.
- The use of an unchecked tool can cause organizational chaos.
- Poorly conducted teamwork may result in unequal workload of specific team members.
- Online teamwork requires dividing into groups and preparing a working environment for each team member (e.g. separate rooms, links, boards). This can be a laborious process.
- Some teachers may think that teamwork will decrease the amount of material covered in class.

What are the solutions?

- Try using the online collaboration tool you have chosen in practice with your colleagues before introducing it.
- Successful student online collaborative projects should be short-term – last no more than two or three weeks).
- Students appreciate clear requirements for collaborative work.
- From discussion threads to breakout groups, make sure students know exactly what they are supposed to be doing together.

Teaching scenarios

- **Collaborative research online project** refers to a research initiative or a study that involves collaboration among multiple researchers or teams, conducted

primarily or entirely online. Participants communicate, share data, analyze findings, and co-author papers through various online collaboration tools and platforms;

- **Discussion seminars in breakout rooms** can be created using a conference tool, allowing students to work in small groups. Students come together to talk about a particular topic and contribute their perspectives to the discussions, expanding their understanding. The purpose of such seminars is to develop autonomous learners. By sharing each other's views, students also learn to listen to others well and respect different opinions that are put forward. It is a great exercise for instilling mutual respect among your students;
- **Online consensus** can be achieved by assigning students to groups and having them review their answers with each other. Each group has to submit one quiz answer;
- **The online jigsaw method** enables the teacher/tutor to divide the educational material among the members of the jigsaw groups. These group members then join expert groups, where they collaborate with others who have the same material. Each expert studies their assigned material and then the expert group members return to their jigsaw groups to teach the material to their peers. At the end everyone takes an individual quiz to check learning effects.

Using the Jigsaw method online
[Source: Teach Smart With Fay, www.youtube.com/@TeachSmartWithFay]

Mini case study

Teacher: Professor Karol Flisikowski, Gdańsk University of Technology

Subject: Data Analysis – team project

Used tools: Git, GitHub

Students tasks: „I divide my students into groups and they work on professional EDA - Exploratory Data Analysis, which is a crucial step in the data science process. It involves the visual and statistical examination of a dataset to better understand its characteristics, patterns, and relationships."

Good advice: Use a version control system that developers use all over the world. Git helps students working as a team to track different versions of their code and collaborate.

Try these tools

Google Workspace provides a suite of productivity tools like Google Docs, Sheets, Slides, and Drive for real-time collaboration, file sharing, and project management.

Miro is an online collaborative whiteboard platform that allows teams to brainstorm, visualize ideas, and work together in real time.

Trello is a visual project management tool that uses boards, lists, and cards to help teams organize and prioritize tasks.

Slack is a team communication and collaboration platform that facilitates group messaging, file sharing, and integrations with various other tools.

Online group work: tips & tools to make it work
[Source: Instructional Media Design, www.youtube.com/@MediaLearningDesign]

- Choose tools that you have checked in practice yourself.
- Ensure the students have a clear purpose, and both staff and students have the same understanding of what the group project needs to accomplish.
- Establish learning objectives early.
- Make the assessment criteria explicit.
- Allow adequate time for preparation and communication.
- Divide the work evenly among your students.
- Ensure group size is appropriate to allow for full participation of all members.
- Clear instructions encourage collaboration.
- Build in opportunities to see the projects at various stages of completion.
- As an teacher, facilitate and actively participate in group activities.

Assessment methods

Peer assessment

Group members evaluate the contributions of their peers within the team. This can be done through self-assessment and/or peer evaluation forms. Peer assessment encourages accountability and helps identify disparities in individual effort.

Group presentation

The group submits a collective presentation or report detailing their findings, process, and outcomes. This allows the instructor to assess the overall group work and the ability of the group's members to synthesize and present information effectively.

Individual reflections

Each group member writes a reflective piece on their experience within the group, highlighting their contributions, challenges faced, and lessons learned. This enables individual self-assessment and self-awareness.

Contribution logs or journals

Group members keep individual logs or journals documenting their contributions, completed tasks, and time spent on the project. This provides insight into individual efforts and time management.

Online discussion participation

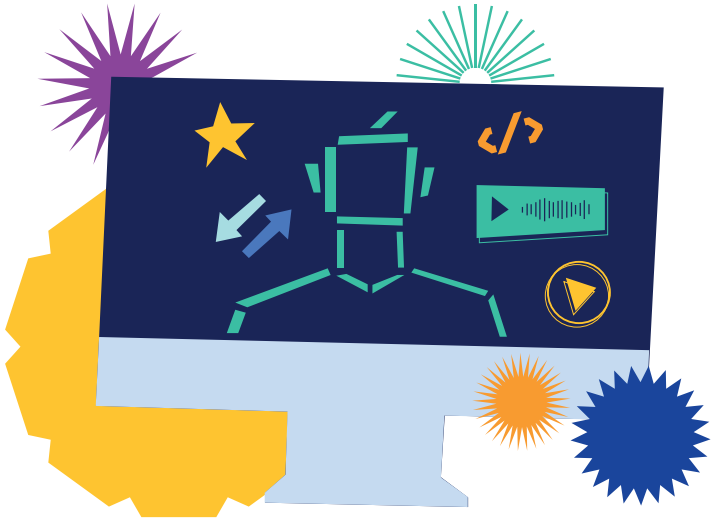
Teachers/tutors can assess individual participation in online discussions related to the group project. This could be conducted through discussion forums or real-time collaboration tools.

Formative assessment

Teachers/tutors should provide ongoing feedback throughout the group project to guide students and ensure they stay on track.

Final group evaluation meeting

Teachers/tutors conduct a virtual meeting with the group to discuss their experiences, challenges and the overall functioning of the group. This gives the educator additional insights into the group dynamics.



Online creative work

Anna Dembicka

MOST WIEDZY

Why is it worth trying?

Nowadays, it is essential to prepare students to be independent individuals capable of creatively solving problems. This approach is entirely different from the previous practice of educating future employees who were primarily trained for repetitive tasks. Transversal skills used in various situations, roles and industries, the possession of which should characterize Industry 4.0 employees, include:

- effective collaboration, also in a virtual team, in an international environment;
- interpersonal skills, including leadership, communication, persuading others to their point of view, motivating team members;
- processing and analysis of large amounts of data from multiple sources;
- assessing the relevance and credibility of information;
- access to information, including using electronic media and big data tools.

These skills should be the starting point for designing creative academic teaching.

What are the challenges?

A prerequisite task before initiating activities generating creativity of students consists in creating an educational framework that rewards: freedom of expression, freedom to experiment, eliminating stereotypes, acceptance of emerging opportunities and ideas, unconventional thinking, flexibility of thinking, tendency to risk, ability to cope with stress, team cooperation, open communication and kindness, giving awards – motivation, courage, positive thinking, cognitive curiosity, perseverance and spontaneity.

Lecturers are often unable to identify the real teaching goal and instead focus only on the immediate actions or results of the teaching process, without much reflection on the question 'why?'. The use of creative methods – in order to strengthen their effectiveness – should be preceded by the use of analytical methods. One such method can be Dan Roam's 6×6 Rule. This method facilitates the improvement of the learning context by revealing the functional and emotional expectations of the student, the implementation of which contributes to increasing the sense of security, commitment and creative action. 6×6 Rule takes into account the following interacting elements:

Who? Students and lecturers get to know each other as much as possible, e.g. by introducing all participants at the beginning of the course, saying a few words about themselves. Obstacle – stress and fear of negative opinions.

How many? There are some important factors to consider: the size of the group and duration of the class, as concentration tends to decrease over time. Obstacle – chaos, fatigue.

Where? Where do participants of the online course meet? It is worth asking about the quality of the Internet connection and any elements distracting students. Obstacle – the need to take certain actions.

When? The time frame is important, i.e. when exactly the classes take place – time of day, day of the week and taking into account internal communication barriers such as feeling unwell, hunger and fatigue. Obstacle – working when productivity is low.

How? What is the agenda of the meeting and what can be changed to improve it? Obstacle – routine, time pressure, feeling of low influence on decision making.

Why? It is essential to draw conclusions after the meeting and prepare an evaluation summary. Obstacle – no incentive for discussion and group problem solving.

What are the solutions?

In order to nurture students' creativity, the lecturer does not have to be an innovator. It is enough that they have a passion for learning and are open to new ideas.

Developing the potential of teaching staff

Developing the potential of teaching staff requires the involvement of lecturers in the process of self-improvement. Constant self-development is valuable when based on regular formative self-assessment that involves evaluating results to make changes during the ongoing educational process, as well as summative self-assessment after the end of the educational process. These assessments help in better planning and implementing similar future activities. **IMPROVING THE TEACHING PROCESS**

In most cases, students need support to filter out the 'information noise' and meaningfully integrate the relevant 'signals'. Modern lecturers more and more often become coaches, supporting learners in their independent search for solutions to problems. **ACADEMIC TUTORING**

Try these tools

Microsoft Whiteboard facilitates visual thinking, enabling users to take creative notes, create mind maps, and engage in graphic facilitation through pictorial presentations of content.

The Noun Project helps create personalized notes and facilitates problem solving.

MURAL offers a variety of templates designed for teamwork to tackle specific problems, which positively impacts the engagement of team members.

Welcome to the new Mural product experience
[Source: Mural, www.youtube.com/@MuralTV]

ChatGPT is an advanced artificial intelligence tool – a language model that provides information and engages in conversations. By providing quick answers in real time, it can help generate educational materials and assess students' work, allowing you to save time that can be spent on developing new resources and activities.

Tips & Tricks

The level of boredom and satisfaction affects the results achieved by students, and emotional states with higher levels of excitement better support cognitive processes (an active attitude to classes is more beneficial than a passive one). Therefore, it is advisable not to start a meeting with a lecture. Instead, consider using an icebreaker such as giving a short talk, sharing something funny, or asking for reflections on the previous lecture or exercises. This approach will help prolong participants' interest and keep them engaged. **ATTRACT STUDENT'S ATTENTION**

Emotions related to achievement have a large impact on the level of student engagement in both traditional learning and e-learning. The highest level of motivation can occur only in the case of fully determined goals and tasks perceived as difficult, but at the same time feasible and remaining within the limits of the student's cognitive skills. **TASKS THAT ARE DIFFICULT BUT CAN BE COMPLETED**

Virtual characters in the e-education environment use the so-called persona effect. The presence of animated or static avatars creates the impression of another person's presence, positively affecting engagement in the interaction or motivation to continue the course. Virtual mentors are also often equipped with the ability to rec-

ognize and respond to the student's emotional states. **INTELLIGENT EDUCATIONAL SYSTEMS**

Involving students in the process of creating an educational game engages their senses and requires them to demonstrate creativity, imagination, and knowledge of a given area. **STRENGTHENING STUDENT ENGAGEMENT**

Ask students to identify three areas (issues, situations, or events) that stood out to them after each activity. This could include things that caught their attention, generated enthusiasm, provided new knowledge, or enabled them to solve a problem. By doing so, you can monitor classes more effectively, understand the real expectations of students (not just those specified by the lecturer), and find the most appropriate solutions. **REGULAR EVALUATION OF THE QUALITY**

10 rules for effective brainstorm

- Encourage wild ideas.
- Allow everybody to speak freely.
- Defer judgment.
- Go for quantity not quality of ideas.
- Be visual.
- Build on the ideas of others.
- Stay focused on the topic.
- Keep one conversation at a time.
- Mix individual and group work.
- Allow for reflection time.

Methods in practice

Creative discussion

Directing the discussion towards fostering creativity stimulates the divergent thinking of its participants, which includes fluency (the ability to generate many ideas in response to an open problem), flexibility (the ability to generate ideas from different categories), and originality of thinking (the ability to come up with non-stereotypical ideas that are still sensible and rational, especially in the case of practical problems). Creative discussion draws from already possessed knowledge and contributes through the exchange of views to shaping a better understanding of the world.

Meeting with a specialist

The opportunity for students to participate in meetings with practitioners in a given field enriches their educational experience, e.g. by showing how the acquired knowledge can be translated into real activities.

What is a Learning Experience Designer?
[Source: LSU online, www.youtube.com/@LSUOnline]

Learning experience design (LXD)

Educational experiences arise under the influence of:

a) sensory stimuli (sensory experiences);
b) emotions (emotional experiences);
c) activities related to reflection, stimulating imagination and creative thinking (intellectual experiences);
d) activities performed by the user (behavioral experiences);
e) contact with other users or a group of users (relational experiences).

The learning experience of a student includes not only the results obtained by the student, but also all activities that the student does (e.g. watching a movie, taking a quiz, asking for help from an automated tutor, discussing online courses). The emotions that shape positive educational experiences include: offering novelty, positive surprise, learning and being entertained at the same time, arousing interest, showing new solutions, adding energy, work comfort, freedom of interaction.

Mini case study

Creative discussion combined with a co-creation workshop

This semester, during my classes on Marketing and Logistics Management in Transport, students were supposed to prepare questions for the final exam of younger students studying the subject Basics of Logistics Management in Transport. This was done to refresh their knowledge in the field of logistics and increase their involve-

ment through this co-creation workshop. The students initially worked in groups of 3–5 people. Each team, based on the lecture materials, chose 15 questions that, in their opinion, best tested the knowledge of the subject. After a debate, representatives from each team selected the final 20 questions.

Assessment methods

- **Rubrics** outline specific criteria for assessing creative work. They can evaluate elements such as originality, creativity, technical skill (if applicable), adherence to guidelines, and overall impact.
- **Peer Review** enables students to provide feedback and evaluate each other's creative work. This can be done through online discussion forums or peer assessment tools.
- **Self-Assessment** encourages students to critically reflect on their own creative work. They can write self-assessment statements explaining their intentions, choices, and what they believe are the strengths and areas for improvement in their work.
- **Online Portfolio** or Showcase allows students to display their creative work. This makes it easily accessible for both peers and the instructor to review and evaluate.
- **Creative Process Documentation** encourages students to document their creative process through written explanations, sketches or drafts. This provides insights into how they developed their ideas and executed their work.
- **Public Engagement** or Feedback (e.g., blogs, social media platforms) can lead to assessment provided by a broader audience.

Storytelling

Alina Guzik, Katarzyna Kubiszewska, Paweł Ziemiański

MOST WIEDZY

2. Let's build student engagement

Since the dawn of time, people have used stories to invoke emotions, entertain and teach. It is not without reason that our prehistoric ancestors gathered around the fire in crowds and then told fascinating tales about wild animals, love, dangerous neighbors and severe punishments for bad deeds. These stories had useful functions: they warned, showed the right way and provoked reflection. They also aroused strong emotions, which made them memorable quickly and for a very long time. They were one of the first tools of education. Storytelling can be an interesting diversion for students, especially if we need to introduce difficult topics in class. Stories allow you to understand the practical application of the discussed mechanisms, theories or procedures. They can be implemented as individual examples or conducted as one extended story throughout the semester or year. The most influential people in this world already know about the extraordinary power of storytelling. The best teachers use it too. Thus, this is nothing new because storytelling has always been present in education. Today, it is high time we restored it to its former glory and rightfully elevated it to a top position in the ranking of the most effective teaching methods.

How to tell stories that stay in the listeners' memory forever?

Telling good stories is an art but also largely a craft that can be learned by acquiring knowledge and practice. Most successful stories have several universal characteristics.

Clear structure

It will come as no surprise that a good story must have a clear, meticulously thought-out structure, and the storyteller must be very well prepared. It is essential to rehearse and perfect the story in practice. It is possible that our speeches will be smooth and catchy only after several solidly executed rehearsals.

Credibility

Persuasive stories are believable, that is, they happen in a coherent world that has been created through details. However, there must not be too many of them otherwise we will discourage and bore our listeners at the outset.

Metaphors and comparisons

Nothing works on the imagination like accurate metaphors. Thanks to them, it is easier for the listeners to understand the theory and translate it into something they have already seen and experienced. Moreover, unconventional and amusing comparisons stay in our minds for a very long time.

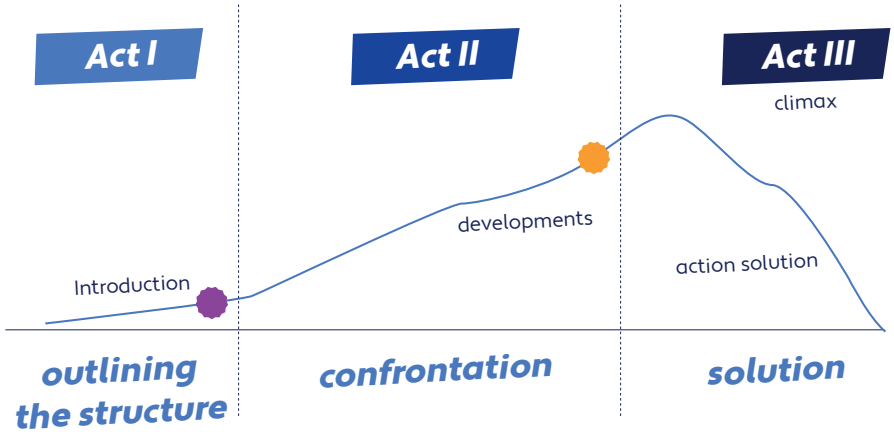
Surprise

If we want to ensure that the audience's hearts skip a beat, it is necessary to plan several elements of surprise and twists. Unexpected events, strange behavior of characters or a change in the course of events for better or worse are just a few examples of this procedure.

Conflict

Screenwriters from major companies such as Disney and Pixar know that a memorable story should touch deep emotions and must contain conflict. Preferably an internal one concerning the main character.

Struggling with oneself, overcoming weaknesses or fighting against fate that forces one to take on an unwanted challenge is a simple recipe for a successful story.



The breaking point

Every conflict and growing emotion must reach its climax. It's where all the introduced plots and dilemmas converge, and it's where the resolution of all the action so far takes place.

Punch line

A good story ends on a strong note. It does not matter if it is something wise, philosophical, practical or funny. It is important that it motivates thought and active action.

Examples of storytelling in academic teaching

Telling well-constructed stories is successfully used at all educational stages. Teachers in higher education are also eager to use it, especially when they are tasked with introducing key, necessary content to be remembered. Below are some examples of how storytelling can be used in practice.

An unconventional introduction to the world of finance

Prof. Katarzyna Kubiszewska from Gdańsk University of Technology uses storytelling, among other things, in the subject Fundamentals of Finance. She introduces a story in the first class and expands on it in each subsequent class throughout the semester. The protagonists of the lectures are two families: the Jetsons and the Petersons. One is employed full-time by a corporation, and the other is self-employed. Students discuss the various problems, noting the differences, but also the similarities in the importance of finance and financial markets for households and businesses.

Each lecture is preceded by a question on the impact of various financial issues such as inflation, interest rates and budget deficits on both families. Students in pairs

or small teams reflect on the answer, which they later discuss in the forum. Results of evaluation surveys indicate that students find it much easier to reflect from the perspective of a particular family than to think abstractly from the point of view of a company or households in general.

True stories about air traffic safety

Storytelling is also employed in the Air Traffic Safety subject at another Polish technical university, where students discuss the causes and consequences of past real-life events.

They learn about these events through emotional stories narrated by the teacher during lectures. Through them, students get involved and take on the role of aircraft accident investigators, and conduct their own investigations into the causes of disasters. Each of the 15 classes in the semester is devoted to a different procedure that didn't work and led to a real-life mishap. At the beginning of the class, students

learn about the chronological course of events in a particular case. They also become familiar with the often tragic consequences. This stage can be further illustrated with video footage. Next, students work in groups to identify potential causes, gather evidence to support their thesis, and prepare a list of questions. The purpose of these questions is to obtain the information necessary to discover the truth.

Living stories in managerial education

The storytelling method can be successfully used in the education of managers. Some of the world's leading business schools (e.g. Harvard Business School in the USA or Ivey Business School in Canada) are so-called "case schools."

Students at various education levels, including executive level, participate in the learning process by solving case studies, which involve real stories from various companies. Their protagonist is often a manager, known by a name, who has to make an important decision concerning strategy, a marketing campaign, company development or finding a way to motivate employees. Such a structure follows the classic recipe for a successful story: there are obstacles in the life of the main character that stand between him and the desired goal.

We also successfully use storytelling in our MBA studies at Gdańsk University of Technology. In classes on communication in business, we talk about how stories serve people to structure the reality encountered in their organizations. And also about the possibilities of using a narrative as a tool for communicating values and exerting influence. A short story with a clear message can be a very good reinforcement of arguments and statistics. – argues **Prof. Paweł Ziemiański** of the Department of Entrepreneurship at the Faculty of Management and Economics at Gdańsk University of Technology.

Is it worth using stories in education?

Storytelling can be an interesting diversification for students, especially if there is a need to introduce difficult issues in class. Stories allow students to understand the practical application of the mechanisms, theories or procedures discussed. They can be implemented as single examples or run as one extended story throughout the semester or year.

Now, we turn to listening to your fascinating stories, which provide thrills and educational value in the background.

The magical science of storytelling
[Source: TEDx Talks, www.youtube.com/@TEDx]

Game based learning

**Karolina Szczeszek, Anna Smelkowska,
Agnieszka Karbownik, Magdalena Roszak**

MOST WIEDZY

Why is it worth trying?

Game-based learning (GBL) refers to the use of board games, computer games, console games, simulation games and others in education. With the growing adoption of modern methods and technologies in education, computer games designed to foster competence in various professional fields are gaining significance. Learners, through participation in games, can develop competencies desirable on the labor market, such as critical thinking, creativity, communication, teamwork, problem solving, reflexivity, independent decision-making, and responsibility for their choices.

Examples of types of multimedia games used in education:

Scenario-based learning (SBL) is based on alternative paths, i.e. scenarios, during which learners make various decisions that affect the further development of the game scenario. When the player makes a wrong decision, the game does not end, the player continues the game learning the consequences of their previous choices. The player has the opportunity to return to the stage in which they made a mistake in order to be able to make a different decision.

A role-playing game allows learners to assume professional roles, providing them with the opportunity to simulate situations related to the performance of a specific profession. The game includes elements of surprise, hints for when a mistake is made, which encourage further analysis of the situation, as well as feedback for both wrong and right answers.

Educational games are based on the implementation of a scenario, the goal of which is for the learner to complete a clearly defined task. The game has different levels of progress, i.e. different stages. The game helps teachers to introduce and consolidate learning material, and learners to remember important content.

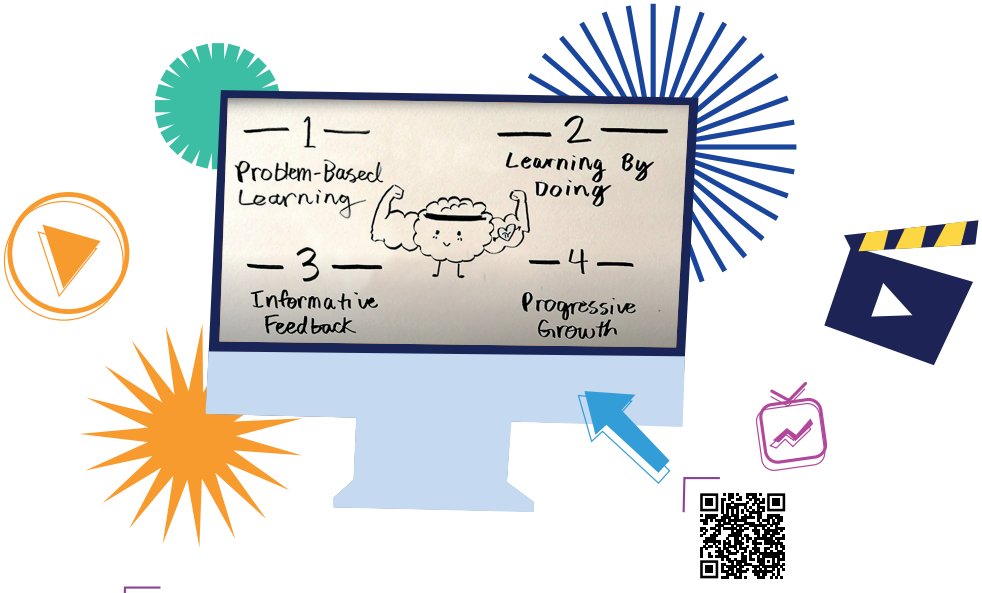
Learners using games in education have the opportunity to:

- work at their own pace;
- learn through play;
- develop critical thinking;
- make decisions independently;
- solve problems in relation to typical, real-life situations;
- take responsibility for their decisions;
- learn at any place and time;
- increase self-confidence;
- feel satisfied with the goals achieved;
- act within established rules;
- increase commitment and motivation to learn;

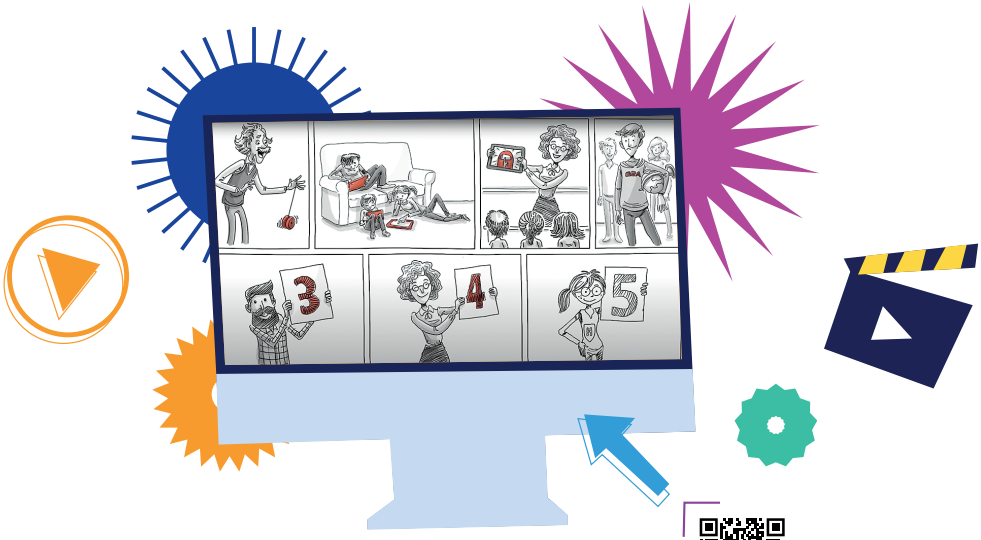
- learn from mistakes in a safe, controlled environment;
- develop skills to deal with professional problems;
- receive feedback on their own learning progress;
- become familiar with new topics and consolidate their knowledge.

Teachers using games in teaching can:

- effectively validate the teaching-learning process;
- create game scenarios tailored to the educational needs of learners, developing specific competencies;
- decide on the scope and level of difficulty of tasks and the complexity of situations faced by the player;
- support and give guidance to learners as they progress;
- provide feedback to the learner on the degree of mastery of the material;
- receive immediate, detailed and accurate results;
- use the game to make their lessons more interesting;
- provide opportunities for learners to learn in a well-defined, controlled and safe environment.



Using Game-based Learning in the Classroom to Develop Productive Struggle
[Source: MIND Education, www.youtube.com/@MIND_Education]



Video games in education
[Source: Sprouts, www.youtube.com/@sprouts]

What are the challenges?

- Learners may find it difficult to solve tasks or make decisions in situations that require creativity and reflexivity.
- The game's design may prioritize achieving success in the shortest amount of time to earn a reward, rather than encouraging players to make a variety of complex choices.
- The game may not be engaging enough, too simple or too complex.
- The game may be too unrealistic when it does not relate to real-life situations, so it may have low educational value.
- The technical/aesthetic level of game preparation is not satisfactory.
- participants may have too little information on how to navigate the game, what the rules are, or what they should do to correct a mistake, improve the score and complete the game.
- Working with multimedia games requires preparing a working environment for each player, e.g. software, hardware, which can be labor-intensive and expensive.
- Some teachers may feel that learning with games is ineffective.
- Designing games and incorporating them effectively into the educational process require teachers to possess specialized skills.

- Improperly designed games may result in failure to achieve learning outcomes.
- The cost of developing certain types of games can be very high.
- Teachers need to cooperate with many specialists during the development of the game, such as graphic designers and programmers.

What are the solutions?

- Create a game scenario based on realistic situations that learners will encounter in the future.
- Establish clear objectives of the game and the rules that apply. Make sure learners are familiar with the rules before they start the game.
- Adjust the level of difficulty of the game to the learners' abilities and knowledge.
- Allow the game to be played anywhere and at any time.
- Provide learners with the opportunity to play the game multiple times.
- Allow learners to interrupt and resume the game at their convenience.
- Ensure the interactivity of the game, allowing learners to influence the choice of different paths of action.
- Design the structure and navigation of the game in a clear way to facilitate learners' independent work to the highest extent possible.
- Ensure that the level of learner motivation is increased by creating realistic characters and storylines in the game scenario.
- Place high demands on the learners in terms of the knowledge and skills achieved while going through the levels of the game.
- Test the knowledge and skills gained in the game through other activities, such as discussions and class activities.
- Provide teachers with support in the technical, graphic, IT, and educational aspects for the proper planning and implementation of the game in the teaching-learning process.

Teaching scenarios

The role-playing game 'Working in a General Pharmacy' is designed for individuals training to become pharmacy technicians. The multimedia material allows students to become familiar with the basic activities performed in a pharmacy, such as receiving goods and controlling inventory, arranging drugs in the pharmacy, filling prescriptions, and selling medicinal products in a public pharmacy.

After familiarizing learners with the role-playing game, you can ask them to develop: an infographic, a mind map, a graph, a diagram on a selected issue presented in the

game. You can divide the group into smaller teams, whose task will be to prepare questions for the other teams on the content of the game. The game can also be a starting point for an in-depth discussion on the selected issue. The teacher or a designated person writes down the answers, creating a diagram on the board.

The SBL game 'Manual Lymphatic Drainage of the Upper Limb' is intended for people training to become a masseur technician. The multimedia material allows students to get acquainted with the work of a masseur technician with a patient after mastectomy, who requires lymphatic drainage for the upper limb.

You can ask learners to work in small groups of a few people to develop: a diagram, infographics, a mind map on a selected topic related to the game. Learners take turns answering questions about the topics covered in the game. Based on the game, learners can create their own case studies to be analyzed together with the teacher.

The educational game 'From drug to result' is designed for students studying to become pharmacy technicians. The purpose of the game is to develop knowledge and skills in basic analyses of medicinal products and medical devices.

The game consists of three levels. To complete the game, students must pass and successfully complete all three stages. After introducing this educational game, teachers can ask learners to collaborate to develop: a task, a quiz or a case report thematically related to the issues covered in the game. One by one, learners answer questions about the content presented in the game. The game can serve as a starting point for practical laboratory exercises.

Here are some examples of situations where game scenarios can add significant value to the learning process:

Learner motivation is low

A well-designed scenario, through an interestingly told story and elements that stimulate intrinsic motivation, allows satisfying learners' curiosity and their desire to succeed in acquiring new knowledge and skills. However, success must be achievable, and the challenge posed should be within reach.

Basic content is monotonous or complex

If learners find it difficult to understand why they are learning the content presented in the game, it is advisable to start the game with a story illustrating the importance of the topic. When learning, it is easier to remember an interesting story related to life than dry facts.

The topic covered is difficult, sensitive or touchy

To assimilate such a topic, learners should be able to approach a particular stage in the game as many times as they need. Scenarios should have branching paths with

many possible choices, enabling learners to understand the consequences of their decisions.

There is no single right answer

It is advisable to build scenarios with branching paths with multiple correct answers to allow learning more about the subsequent paths of the scenario. In this way, learners are able to familiarize themselves with the consequences of their choices and make further decisions in a situation that is ambiguous, non-dimensional and more complex.

Try these tools!

EdApp is a game-based learning platform, it has a group of instructional designers to support the creation of game-based courses.

Resimion is a simulation platform that allows you to create game scenarios, quizzes and interactive tasks.

VirtualPT Clinician is an application for creating virtual patient cases. It is also possible to use ready-made cases created by other authors or their modifications.

DxR Nursing SELECT is dedicated to creating cases for training in the nursing profession.

Gametize is an educational platform that allows you to use games and real-world challenges for training in various professions.

Centrical is an application for creating game-based materials, designing competitions and preparing content for e-learning courses.

Hoopla allows you to use digital educational games to create a competitive environment and motivate sales teams to increase efficiency.

Raptivity is an interactive tool for creating games and educational materials.

Tips and tricks

- Pay attention to learning needs. Start by defining learning objectives/learning outcomes tailored to the target group.
- Pay attention to the content of the game: clear description of the rules and conditions for winning (users should know when they will win), different stages/levels, different roles that participants can take, clearly defined goal(s), elements of reward, feedback, elements of surprise, obstacles that players will encounter on the way to achieving a goal.
- Create opportunities for participants to compare their scores with the score calculated by the computer, to redo the task and to receive formative feedback.

2. Let's build student engagement

- Plan game scenarios that allow for interactivity – this allows users to make decisions and learn by experiencing consequences. Define the active role of the learner – the learner makes decisions, sets the direction, pace of learning himself, and actually decides the scope of learning.
- Pay attention to context. Embed the game in situations that are familiar to learners, related to real social or professional problems.
- Build appropriate tension and motivation. A well-constructed scenario, realistic characters, an appropriate storyline will strengthen commitment to action.
- Ensure safe conditions. Failures incurred in the game are not harmful in any way. Immediate feedback allows you to take quick corrective action, allowing you to change your decision and choose the correct path to solve the problem.
- Appropriately present the problem/task to be solved. Think about what could be the starting point of your scenario. i.e. an interesting situation or event requiring a decision.
- Identify decision points. Explain the problem situation, identify key decision moments. Identify typical mistakes people make. Include feedback and reflection points to highlight the significance of various aspects in the game.
- Plan learning by doing. Games help learners dive straight into practice by implementing the most important information, allowing them to decide when and how to access it.
- Allow participants to learn from mistakes. Reflection on mistakes allows learning through failure. Repeatedly going through a given path before achieving success allows for a better understanding and remembrance of the situation, enabling making the right decision in the future.
- Allow participants to experience learning through play. This increases motivation to learn, resulting in better assimilation of knowledge and faster application in practice.

Assessment methods

- Tests and quizzes
- Graph/schema tasks
- Formative feedback showing the strengths and weaknesses of the decision made, encouraging further learning
- Points or rewards to progress to the next level of the game or complete it successfully

Gamification

Alina Guzik

MOST WIEDZY

Why is it worth trying?

If we were to acquire knowledge only through practice, there would not be enough time in life to learn what the modern world expects of us. The learning process sometimes requires long hours spent over books, and sometimes it is really difficult and tedious. It also requires effort, but that's even a good thing because our brains remember information better when we put in a little effort to process it. When learning becomes monotonous, gamification can provide assistance. Its effectiveness is not magic but the action of a chemical compound called dopamine, which plays an important role in our reward system and cognitive processes such as attention, memory and problem solving. What does this mean in practice? When we complete a task, have success, eat a tasty meal or even when we see a new Facebook notification on our phone screen, it is dopamine that is released in our body causing us to have a better mood, extra energy and motivation to act. Is this something our students might sometimes need?

A crucial point to remember is that gamification is not the ultimate solution to all problems; its effectiveness relies on the proper functioning of other key elements in the learning process, such as clear and accessible content, and a positive classroom atmosphere.

How to design gamification?

Step one: learning outcomes

The first step in designing gamification is to analyze learning outcomes. Our motivational support system should be focused on what is most important – the knowledge and skills we want our students to acquire. All the tasks and rewards we will design should aim at making participants process the information important in the subject.

Step two: what can be won?

In the next step, we create proposals for tasks that we will reward. Depending on what background story we propose and how our gamification system is structured, we will award points, coins or something to symbolize them. Let's remember that free choice has a formidable to arouse motivation, so it's a good idea to develop an excess of challenges so that students can choose the closest to their preferences. Let's not shy away from suggesting creative tasks, such as creating your own video presentations, podcasts, infographics or mind maps. Tasks where you can let your imagination run wild for many people are inspiring in themselves.

What can you win? Ideally, the grand prize in the game is something of real value to the students: a guaranteed passing grade, an extra credit or an exemption from completing a tedious report. Don't worry, all these benefits will be well-earned, as those who score a lot of points in the game also engage in a lot of substantive work during the game. Is it possible to lose? Although competition, or the "when I win, you lose" model, can be an effective motivator, the best gamification does not rely solely on it. Instead, it assumes that every participant, without exception, can score the maximum number of points and get a prize. It is also worth considering additional tasks for those who have surpassed the ceiling and wish to continue playing, even after winning all possible prizes. Such situations, to great surprise, happen quite often.

Step three: the storyline

The most crucial element of gamification is the storyline. It should fit the preferences of the audience but, most importantly, the teacher. Why is it so important? It is the lecturer who introduces the students to the story that is the background for the tasks performed. If they do it with heart and full conviction, the effect will be as expected – the participants will get caught up in the adventure, missions, earning points,

or other artifacts. Tedious tasks will be more readily completed and the eagerness to learn will be consistently warmed.

What kind of storyline can be proposed? In fact, anything is allowed. At the Faculty of Management and Economics, students in a gamified MBA program called 'Project Impact' complete development challenges and thus collect points. If they collect enough of them they will adopt an orangutan at the local zoological garden. Students enrolled on the Fundamentals of Economic Forecasting course taught by prof. Aneta Sobiechowska-Ziegert from Gdańsk University of Technology earned points to reach the next level of advancement. Participants of the Finance subject, taught by prof. Katarzyna Kubiszewska, completed tasks, exchanged them for money and ration cards to furnish their virtual single-room apartment from the communist era. In addition to earning various trophies, students who have successfully completed the gamified course in Technical English called 'MyICM – My Interstellar Mission', developed by Dr. Iwona Mokwa-Tarnowska, become the governors of the colony they have helped build.

When introducing the plot, be cautious about infantilism. The proposed story can be realistic, fantastic, or even out of this world, but it should not be overly childish. Students may quickly feel disconnected if they find themselves in a fairy tale that doesn't resonate with them. Remember one thing: in order to keep the fire in the fireplace burning, you need to add wood to it. Similarly, the teacher/tutor should fuel the story throughout the gamification, e.g. refer to it during their classes if it is part of a blended learning programme. The good news is that students who get involved in the adventure will come up with their own amazing ideas, and the whole story will take on a life of its own.

Step four: clear rules

It is very important that students are given clear rules of the game at the outset, information about the scoring system, a clear list of tasks to be completed and all the necessary instructions. It is also useful to have an encouraging and nicely graphically framed description of the plot because the success of our project largely depends on it. Do not forget to write that participation in the game is voluntary, and if someone does not want to participate in the game, then they can complete traditional tasks and earn the usual grades. In games only participation based on free will really makes sense. Also take care of a place where students can keep track of the points earned. In the basic version, a shared spreadsheet, such as the one available online at Google Workspace, will suffice for this purpose.

Is gamification for everyone?

Gamification aims to help build motivation, but like any activity, it may not be suitable for everyone. Not all students will want to participate in it, so launching it should be a joint decision between the teacher and students. What's more, if the lecturer is not comfortable with introducing participants to role-playing with a twist or still doesn't see its added value, then they should not be forced to implement it. There are other methods and techniques worth considering. The truth is that gamification works when the teacher conducts it with full commitment and a genuine desire to engage. Do you feel it's not for you? It's worth giving gamification a chance and checking it out for yourself. To your great surprise, you may find that it is something you have been trying to find for a long time.

The Power of Gamification in Education
[Source: TEDx Talks, www.youtube.com/@TEDx]

Social media learning

David Scaradozzi, Laura Screpanti, Benedetta Castagna
Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

MOST WIEDZY

Why is it worth trying?

Learning has always been considered a social activity, where students interact with teachers and classmates to acquire new knowledge. Thanks to new technologies, a new type of **digital dialogue** is now emerging, focused on learning also through social networks. Social media can complement the learning process, which is essential in an information-sharing society.

Today, we refer to open learning as an inclusive and integrative training approach that involves the use of digital content, promoting self-learning through exchanging, comparing, and acquiring new knowledge.

The use of social media has many advantages for teachers:

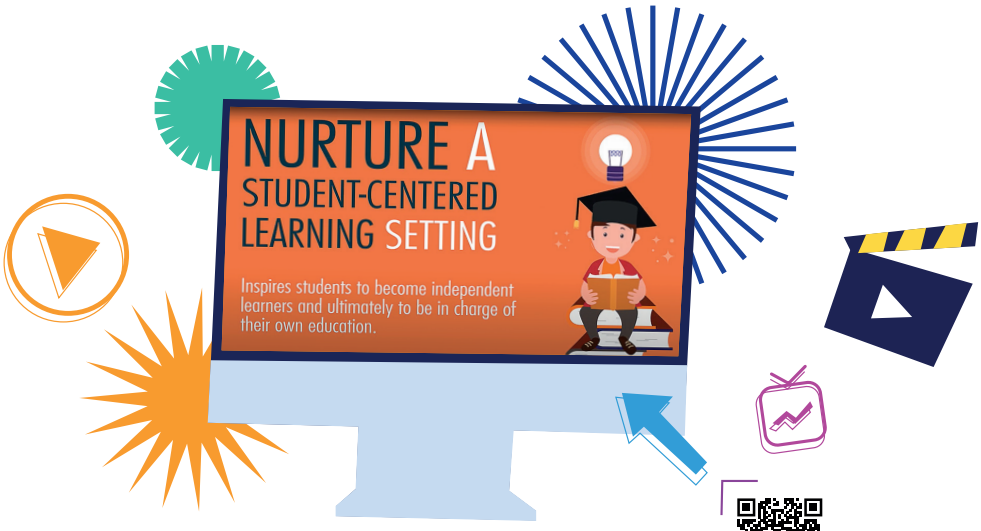
- It is a familiar and friendly environment for students.
- Students use it freely, daily, and with ease.
- It facilitates an effective way of communication.
- Social media allow combining text, images, videos, and/or audios.
- It allow you to create dedicated channels and different accounts.
- It makes assignments captivating and exciting.
- It offers both students and teachers the possibility to engage in scientific dissemination.
- It is easily accessible anywhere and requires little time.

Social media use algorithms to provide users with a personalized experience, offering content similar to what they have already viewed, thereby expanding and enhancing their knowledge and information on topics of interest.

What are the challenges?

The main challenge you may encounter when entering the world of social networks is the need to devote time to get accustomed to the platform you decide to use. Apart from that, you also need:

- video editing and video-making skills;
- to take it seriously;
- not to get distracted while using it;
- to provide clear explanations;
- to create content of sufficient duration.



SOCIAL MEDIA Enhancing Student's Academic Performance
[Source: Ma. Israelle S. Lopez, www.youtube.com/@MaIsraelleSLopez]

What are the solutions?

The constant use of social networks in your free time is certainly a solution! This way, you can directly get ideas from the most relevant influencers in your area of interest.

Social media can actually be divided into two main groups:

- for contents creation and spreading knowledge;
- for management and assigning tasks.

The first group includes Instagram, Facebook, TikTok, YouTube and Twitch.

Their power lies in their widespread diffusion and popularity, allowing users to focus on the content without spending time and energy understanding how to use them, both for students and teachers.

Moreover, these social media platforms offer a vast collection of videos and content, as many users have already created and shared various materials.

The second group consists of social media platforms that enable efficient and clear transmission of assignments, potentially enriched with examples or schemes to guide the development of tasks. Furthermore, they facilitate the exchange of opinions between teachers and students, as well as among group participants, during their collaborative work. In this sense, useful social media platforms include Slack and Discord, as well as other platforms that allow the exchange of messages within a community and the sharing of documents.

The characteristics of social media can be summarized with 5 words starting with the letter 'C':

Teaching Scenarios

Let's now provide some examples of teaching scenarios.

Regarding an assignment, such as research or a study, teachers can specify that the contents produced by students must be uploaded to one of the main social networks as proof of their understanding of the topic. To promote this activity, a specific channel could be created to avoid using the students' personal accounts;

In the case of YouTube, a private playlist can collect videos from teachers and also contributions from students, giving different formats and specificities depending on who created it. The content could have the form of a scientific dissemination pill or tutorial. From the point of view of the teacher, this practice can also constitute a precious resource to teach and explain concepts to the students in a captivating way. For example, a single physical phenomenon can be presented in a video, as well as the main ground rules about a scientific field;

The contents can take on different forms, such as schemes, diagrams, videos, collections of pictures, polls representing a concealed form of testing, or even an alternative way to understand the prevailing thinking among the students;

The material can be collected in a playlist on YouTube or in a specific account, e.g. on Instagram, Facebook, TikTok, to create an organized bank of contents.

Mini case study

Any YouTube channel dedicated to dissemination can be taken as an example of good practice, including scientific communication. In this context, interesting channels are Vsauce, Code.org and Mashup Math. The first one is dedicated to curiosities,

aiming to engage in science education; the second one is for computer science education, and the third one focuses on the dreaded math.

When discussing Instagram, we can mention the following profiles that offer a variety of content:

@nasa for resources related to science and space;

@noaafisheries for ocean lovers;

@homeworkhelpglobal for study tips, guidance, and inspirational quotes for learners; and

@tech for all things related to STEM.

Moreover, we can also mention some **TikTok** interesting accounts:

@mathswithmisschang, run by a math teacher from London;

@iteachalgebra, managed by an algebra teacher;

@mrs.b.tv, belonging to a science teacher;

@stevespangler, hosted by a well-known television host and a STEM teacher.

Try these tools

Let's now briefly describe the main social media useful in e-learning.

YouTube is the second most visited website in the world, just after Google. Here it is possible to see video clips, trailers, short films, news, live streaming, slideshows and other content such as educational videos and more, with users who can interact by voting, commenting and book-marking the video. It is possible to create a channel for your subject, your class or institution. It is possible to integrate the platform into teaching, involving students, their ideas and their creativity.

Instagram mainly allows you to take photos, shoot videos, apply filters and share them. An Instagram account can be used to share reworked school content, study topics, and current affairs, all by utilizing the tools available on this social network.

Facebook is less frequently used by the new generation of students than TikTok, but it is still worth mentioning. Here, it is possible to create a private group accessible only to the students who require access. Within the group, both the teacher/tutor and the students can share content through posts, including videos, pictures, and even long captions.

TikTok is the newest and most widespread social network among the new generation. This platform has now amplified and diversified its content by including educational videos alongside the entertaining ones. Therefore, with a certain amount of creativity, you can create your own content for this platform or take advantage of content provided by other 'TikTokers' who address topics of interest similar to those you desire.

Slack is a messaging app that offers a channel-based, organized space for collaboration. In channels, it becomes easier to communicate with students, allowing you to chat, send audio and video clips, or join a meeting in real-time to resolve any doubts promptly.

Discord is an instant messaging and digital distribution platform created for communication between gamers. It provides what you need through:

- servers are private spaces that can only be accessed by invitation. In other words, a server can be your class;
- channels are part of servers, where you can interact with students. Text channels allow for messaging and file transfers, while voice channels enable live class sessions;
- moderator Bots are usually installed inside servers or channels and can save you time by automating repetitive tasks or comments, such as welcoming new members or reminding everyone of the rules.

Twitch is a platform useful for streaming, where many users overlay their audio and/or video streams to capture their narrations and reactions. It also features a live text chat stream, allowing them and their viewers to interact and react in real time. You can create your own channel in the category you prefer, where you can meet with students and share any information. It can show slides, videos, text or a virtual blackboard. You can also add a video of yourself and enable live chat. This way, you can create a virtual classroom with the appeal and user experience that young people love, while having the opportunity to combine informal learning with tailor-made learning. Moreover, it archives your stream sessions, allowing viewers to watch them later. Additionally, you can directly upload the video to YouTube.

In conclusion, bringing teaching to social media has never been easier than in this historic period, so why not give it a try?

Methods in practice

Let's show now how to structure a social account for a course using these simple steps:

Video based learning

Collaborate with the students to determine the appropriate social network and account name.

Upload videos covering the topics addressed in the course, including:

- a summary of the previous lecture;
- an introduction to the upcoming lecture;
- a complete lecture, featuring in-depth analysis or content integration.

2. Let's build student engagement

The initial video for the channel/account could be a comprehensive course presentation, including an index of the content. As for the main social networks, here's a suggestion:

- use YouTube as a tool for sharing the entire course with its presentations, even if only in private mode (ensuring that only those with the link can view the video);
- use Instagram and TikTok to share short clips and curiosities on specific topics, engaging students and staying up-to-date with the times.

Flipped classroom

You can also use videos If you have decided to implement the 'Flipped Classroom' approach. It may be interesting to divide the class into groups and assign each group a different video to work on.

Finally, for subjects that require a laboratory that cannot be accessed online, video tutorials are a valid substitute. In this case, the selection of videos by teachers is essential to ensure the quality of teaching and learning.

Tips & Tricks

First and foremost, it is essential to understand that the primary difference between various social networks lies in the duration of the content:

- on Instagram and TikTok the ideal time is 30–45 seconds, and up to 1 minute (mini pills);
- for Facebook we recommend preparing videos that are about 3 minutes long, even if the platform allows uploading videos up to 4 hours;
- for YouTube, we recommend up to 10-minute videos, but with a verified account (verified through a text message or an automated voice call), it is possible to upload even much longer videos.

The most crucial advice is to immediately capture the audience's attention by expressing the aim of the video/pill in the first 5 seconds. This will prevent the students from being tempted to "scroll" to see other people's content.

Another helpful tip is to use relevant hashtags to link your video, effectively indicating the theme associated with it.

You can also find other tips here.

- Collect videos, images, and data during laboratory and manual activities in order to reuse them later.
- Find good videos on the internet.
- Be precise and focused on a specific topic or aspect in each video.
- Use good quality infrastructure and recording equipment.
- Invite students to react and contribute with personal impressions.
- Make questions to engage and promote discussion and participation.

Assessment methods

The use of social media can serve as a means to monitor and assess students' progress by having them create various types of content. Examples of such content include summary videos on specific study topics, complete posts or stories, photos combined with known captions, or captions written in reference to provided photos by the teacher.

Assessment will be based on the multimedia content produced and its corresponding value.

Attention must also be given to assessing the students' learning progress based on their content and delivery. Assessment should not be focused on graphics and video quality; rather, it should aim to minimize the gap between students' video-making skills. A helpful suggestion is to encourage the use of the same video tools and support whenever possible to ensure a similar level of competence.

Project based learning

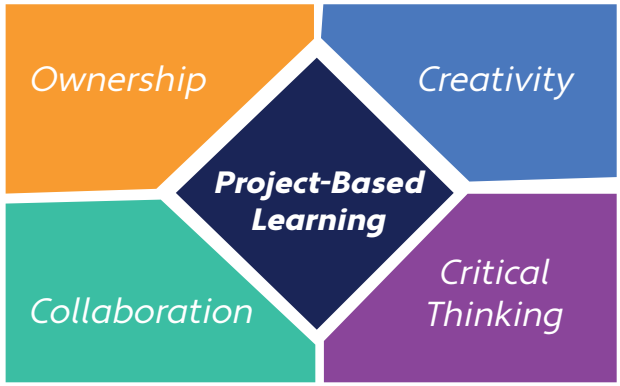
David Scaradozzi, Laura Screpanti, Benedetta Castagna,
Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

MOST WIEDZY

Why is it worth the effort?

Project-Based Learning (PBL) has advantages. In fact, it allows:

- emphasizing teamwork;
- supporting the development of critical thinking;
- facilitating deep and long-term learning;
- infusing self-confidence;
- increasing involvement;
- improving decision-making and technological skills;
- facilitating multidisciplinary learning.



What are the challenges?

The common way of delivering lectures often leaves students detached from the concepts and notions presented by the teacher. Many students get bored quickly, and some only pay attention out of obligation. All this happens because students have the impression that the activities they do and what they are listening to are useless.

New teaching methods should aim to counteract this dynamics and emphasize the relevance and usefulness of the information transmitted. The challenge is mainly to make the students interested in what they have been asked to do.

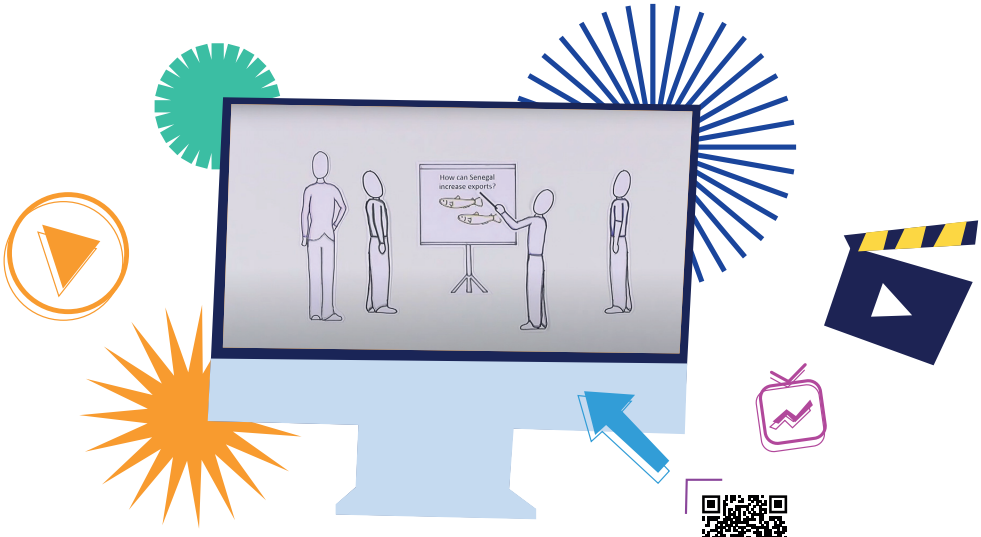
What are the solutions?

Project Based Learning tries to meet these needs by increasing student motivation when engaging them in a meaningful activity. Project-Based Learning provides a context for learning, making it more relevant and useful to students, as it simulates real-world tasks.

2. Let's build student engagement

This teaching and learning model gives students a new perspective on what learning means and involves them in a practical context. Now, students can experience a sense of responsibility and relevance in their work, two aspects that contribute to increased motivation.

By engaging in projects, students feel more motivated and satisfied as they can directly experience the results of their group effort. Besides, by working as a team, they develop many soft skills that will prove to be very useful for them.



Project Based Learning: Explained
[Source: PBLWorks, www.youtube.com/@BIEPBL]

Teaching Scenarios

This teaching method can be used in many ways and contexts in an online environment.

- Teaching of a technical subject at any level, including university. Use of a communication platform (e.g. MS Teams) to create multiple channels for distinct threads of discussion:
  - one channel for general announcements and plenary lessons;
  - as many channels as there are virtual groups;
  - one channel for frequently asked questions (FAQs).
- Additionally, the chosen platform can be used as an integrated, centralized place to share files and collaborate online, thereby increasing the effectiveness of online PBL.
- Real technical problems can be addressed by students using knowledge acquired in previous courses and reviewed at the beginning of the current course or through video pills shared by teachers. When solving a problem, students recall useful theoretical notions and develop hard skills.

Moreover, by applying their skills and knowledge to real-life scenarios, students develop competence and significantly increase the probability of retaining what they learn.

Mini case study

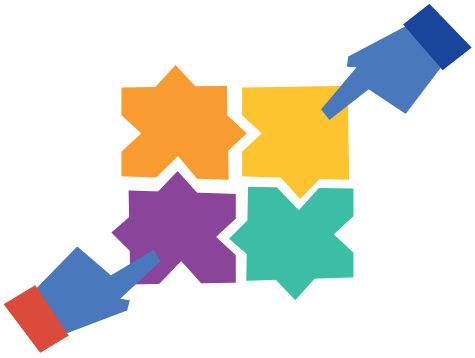
In the Laboratory of Mechatronics at Università Politecnica delle Marche (UNIVPM) students are usually divided into groups. Each group is asked to provide a solution to a problem or to work on a product in a real case scenario. Each member of the group is responsible for a certain aspect: technical documentation, software development, hardware development, research and management. At the beginning of the classes, students are introduced to various tools for managing and evaluating their projects, including verification and validation methods, Factory Acceptance Tests **(FATs)**, **Key Performance Indicators (KPIs) and Technology Readiness Level**.

Each task is linked to a real usage scenario (e.g., building a prototype of a stereo-camera, designing a user Interface to monitor water quality; testing the validity of a theoretical model, etc.). Each group chooses the challenge they want to tackle and prepares the Gantt Chart of the development process. The time given to develop the result is the duration of the semester.

Throughout the semester every group must submit written reports/presentations every two weeks, which are then evaluated and provided with feedback by the teachers and a commission of experts. At the end of the semester, groups showcase their results and promote the solution they have invented.

2. Let's build student engagement

Assessment is based on the timeliness of activities, correct use of achievement indexes in the final report, operationalization of the results, innovation, and effectiveness of the final presentation.



All these concepts are adaptable to e-learning courses by using the right tools and platforms. Even during the pandemic it was possible to maintain this work structure by using the following tools:

- Microsoft Teams for synchronous live lessons during the first phase and group assignments;
- Moodle for reference lessons available for consultation in an asynchronous mode;
- MATLAB for model development or LabVIEW for design;
- GitHub to create open-source projects and repositories.

Tips & Tricks

- Set intermediate deadlines between the beginning and the end of the project to allow teachers/tutors to monitor the progress of their students' work.
- In relation to the intermediate deadlines, it is advisable to have the students give a small presentation to adjust the focus if necessary.
- It is advisable to integrate feedback (even using anonymous surveys) into the activity to understand if it is perceived as pleasant.
- Another useful tip is to connect GitHub with a messaging system to encourage students to create open-source projects and repositories.

Assessment methods

The assessment of projects mainly depends on the successful completion of all the tasks related to the assigned project. However, if the project has not been completed within the deadline, the evaluation should also consider the students' commitment

and the various difficulties and gaps they may have encountered at the beginning of the project.

Another important factor to consider is the assessment of the students' improvement in practical skills and their level of understanding of the tasks to be performed. Some students may have started from a scratch, having never carried out a project of that type, while others may already possess the necessary skills, possibly due to personal interest.

Using MS Teams is helpful in assessing the students' engagement throughout the project development period. For instance, you can evaluate the number of messages exchanged or the amount of data used for file sharing.

Personalisation

David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

MOST WIEDZY

Why is it worth the effort?

Psychologists, educators, and pedagogists agree that people have different ways of learning, which depend on their mindsets. Empirical studies have demonstrated that different types of learning attitudes are related to the processes and preferences that learners adopt to achieve their goals. For example, learners can prefer theoretical knowledge over empirical knowledge or vice-versa. In the first case, learners like studying a solution to a given problem and then applying it; in the second case, they tend to approach a given problem using the "trial and error" method.

When it comes to online education, teachers should compensate for its shortcomings, such as the lack of a student-teacher relationship facilitated by eye contact and potential distractions caused by the home environment. In online learning, we can use personalization to tailor the educational path to the needs of individual learners. Introducing personalization allows students to get personalized feedback about their learning and teachers can rely on an automated system that collects evidence of students' learning to support their assessment.

What Is Personalized Learning?

[Source: EDUCAUSE, www.youtube.com/@educause]

What are the challenges?

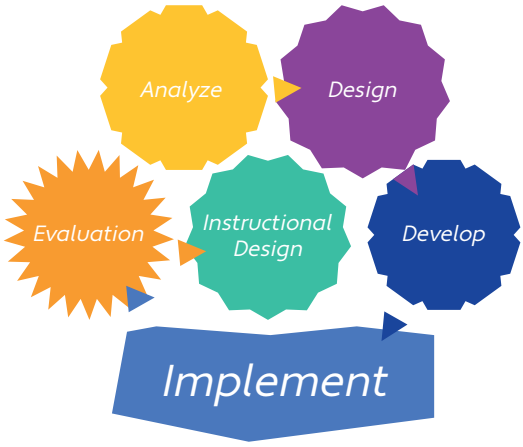
Providing individualized support poses unique challenges because it requires an intelligent tutoring system (ITS's), which can model and adapt to student behaviors, skills, and mental states, often not as structured and well-defined as those involved in traditional problem-solving.

2. Let's build student engagement

Moreover, while ITS's are commonly designed to enhance student learning, they are not typically designed to meet the needs of teachers who use them in their classrooms. In fact, ITSs generate a wealth of analytics about student learning and behavior, opening a rich design space for real-time teacher support tools such as dashboards. While real-time dash-boards for teachers have become popular with many learning technologies, we are not aware of projects that have designed dashboards for ITSs based on a comprehensive investigation of teachers' needs. So, the adoption of ITSs in real classes still poses challenges. While the benefits for learners are clear, the way teachers should use ITSs depends on their vision and willingness.

Instructional Design is of utmost importance as it aims to systematically design, develop, and deliver instructional materials to facilitate knowledge acquisition. The process involves determining the needs of learners and defining the aims of instruction, among other aspects.

There are many instructional design models, and some of them are based on the ADDIE model, which has five phases: Analysis, Design, Development, Implementation, and Evaluation.



What are the solutions?

As information and communication technology access expands in the developing world, learning technologies play a growing role in enhancing and supplementing strained educational systems.

An intelligent tutoring system (ITS) replaces a human tutor with a machine and, in most cases, it's an intelligent computer-based trainer. A learning situation always involves three different components: the topic, the tutor, and the learner. An ITS focuses on three aspects:

- Knowledge about a domain (usually an expert model about a topic)
- Knowledge about the learner (learning mind processes)
- Pedagogy (knowledge of teaching strategies)

These three components are connected and exchange information during a learning activity in the following way:

- the expert model should be able to solve the problems the tutoring module submits to the students;
- the tutor module controls the interaction with the student, based on its teaching knowledge and comparisons between the student model and the domain knowledge;
- the student model reflects what the machine can infer about the student's cognitive state.

An ITS can also be integrated into a Learning Management System (LMS), such as Moodle. An example of ITS is analysed in the paper titled 'Intelligent Tutor System for Learning Object Oriented Programming' (Torres & Sentí, 2017).

An ITS can integrate three complementary basic aspects:

- pedagogical models,
- mathematics,
- instructional designer skills.

Tips & Tricks

Usually, additional extensions and functionalities are integrated into the platform used to facilitate the ITS, offering a variety of tools and plugins, such as different types of quizzes, exams, assignments, etc. The type of support students receive during a task plays a significant role in their learning process. **Hints** (level-specific or

task-general) or distractions (information not relevant to the task, a joke or fun fact) can help students stay focused, motivated, and entertained.

Methods in practice

Practically, the steps to ensure the ITS works well are as follows:

- developing content to deliver to students;
- integrating the ITS with the learning management system (LMS);
- enrolling students and solving problems.

We also recommend watching this video, in which a professor from the **University of Memphis** joins a podcast to discuss the student benefits of intelligent tutoring systems.

Intelligent Tutoring Systems (ITS) at University of Memphis
[Source: Helix Education, www.youtube.com/@helixeducation1653]

Mini case study

During the pandemic, some **UnivPM** professors handled remote learning using different tools. Let's showcase the good practices they followed. Prof. D. Scaradozzi in **Laboratory of Mechatronics and Modeling and Identification of Dynamic Processes** and prof. L. Screpanti in **Manufacturing Models and Optimization** experimented with the use of Moodle and some add-ons available on the platform to personalize feedback and automate assessments.

Moodle offers a variety of tools to create different activities and resources. To create interactive and personalized content teachers can use the 'Lesson' activity, which enables teachers to deliver content and/or practice activities in interesting and flexible ways.

- Teachers can use the lesson to create a linear set of content pages or instructional activities that offer a variety of paths or options for learners. In either case, teachers can choose to increase engagement and ensure understanding by including a variety of questions, such as multiple choice, matching and short answers.
- Depending on the student's choice of answer and how the teacher develops the lesson, students may progress to the next page, be taken back to a previous page or be redirected down a different path entirely.
- A lesson may be graded, with the grade recorded in the gradebook.
- Lessons may be used for self-directed learning of a new topic, for scenarios or simulations/decision-making exercises, or for differentiated revision, with different sets of revision questions depending upon answers given to initial questions.

In addition to adaptive learning with mostly theoretical concepts, the classes also included coding assignments to learn **MatLAB** and **Python**.

- Assignments could be submitted either individually or working in groups, depending on the kind of activity and the student's personal choice.
- To gather preferences, teachers inserted the "Group Choice" module, which allows students to enrol themselves in a group within a course.
- Students can view the members of each group before making a selection and, if the teacher allows for it, change their selected group until the deadline. More than one group may be chosen if necessary.

The 'workshop' activity enables the collection, review and peer assessment of students' work. After students have submitted files, they are assessed by their peers using a multi-criteria assessment form defined by the teacher.

- Students were given the opportunity to assess one or more of their peers' submissions.
- Students obtained two grades in the workshop activity: a grade for their submission and a grade for their assessment of their peers' submissions. Both grades are recorded in the gradebook that automatically collects all the grades from students or groups.
- The last tool used to improve students' involvement in hands-on laboratories was MatLAB. It can be presented to students both during live sessions or by inviting them to follow the Onramp activities and then submit the certificate to the LMS systems.

2. Let's build student engagement

There is also an interesting tool – MATLAB® Grader™ – which is a browser-based authoring environment for creating and sharing MATLAB coding problems and assessments.

> Please note: At UNIVPM the integration of an LMS, such as Moodle, Canvas, or another platform, into learning design requires academics to have an Academic Teaching License, Campus-Wide License, or Community and Technical College License.

Try these tools

There is not much ready-to-use software available. Several ITS systems were built using expert system technology. Below are a few links to commercial adaptive learning technology that can be used to build adaptive environments:

- Knewton
- Domoscio
- Woonoz
- Lalilo

Furthermore, there are dozens of examples of Intelligent Tutoring Systems. Here are a few of them: Mathia, ASSISTment, Alta, Toppr and Area9Lyceum.

Online assessment

Iwona Mokwa-Tarnowska

MOST WIEDZY

Why is it worth the effort?

Online methods and tools can help make assessment objective, thorough and balanced as well as student-friendly and supportive. Assessments conducted in an online environment may prove more effective and informative for both educators and students compared to traditional on-campus paper-based tests and examinations.

Being assessed at all the stages of an online course, students get gradually accustomed to assessment practice, whose supportive nature helps speed up the learning process. Technology used for delivering formative feedback and evaluating student progress in a summative way can enhance the quality of the learning process. It is not worth experimenting with e-assessment if tutor marking, because of its value and quality, cannot be replaced with computer-based assessment.

What are the challenges?

- In which subject areas can you apply online assessment and where should it not replace traditional evaluation methods?
- How can you ensure the secure administration of online exams?
- How can you prevent cheating?
- How can you help students achieve the intended learning out-comes?

What are the solutions?

You should:

- use different assessment methods, traditional and online ones;
- use formative and summative assessment relevant to your discipline and context;
- not overuse summative assessment in the form of quizzes and tests;
- decide what learning outcomes you can assess using e-assessment;
- decide which tools used to support assessment you feel comfortable with;

- develop online exams with questions which check understanding;
- not create questions that only test how well students can remember information;
- construct open-book tests that target your students' analytical and critical thinking skills;
- maximise use of authentic application activities;
- use plagiarism detection tools to check every tutor-marked submission.

Assessment types

To assess their students, online tutors can use a variety of methods and tools, which range from traditional or technology-supported ones to fully automated **computer-based assessment**, that is **e-assessment**.

Whatever the mode is, assessment delivered online can be formative or summative.

Formative assessment provides learners with feedback on their progress. Thus, it enriches their understanding of the subject matter and shows them how well they have been able to meet course aims and objectives. It is frequently referred to as '**assessment for learning**'. It should be delivered throughout the whole course. The focus on its developmental role and positive language is what makes it student-centered and student-friendly.

Summative assessment, described as 'assessment of learning', can be carried out at the end of each activity/module/course to show students how well they have developed new knowledge and/or skills – so it is evaluative. It provides the tutor and course participants with an insight into which issues are more difficult, and which need further explaining, analysing or refining – thus it is also diagnostic. Summative assessment done at the end of each online module shows which students may continue working, which students have to retake the end-of-the-module test, and which students need further practice or assistance to proceed to the next step.

2. Let's build student engagement

E-assessment is delivered in the form of different online quizzes with close-ended questions, i.e. questions with a fixed set of predetermined responses:

- **a multiple-choice** test with randomised question selection, with single answer and multiple answer questions;
- a test with **numerical questions**, simply with a box for entering a value, with or without an accepted error, and multiple-choice;
- a test in which students **select missing words** or phrases and drag and drop them into text;
- a test with a background image on which students **drop markers**, text and images onto selected areas or predefined boxes;
- **matching test questions**, where students pair items (symbols, words, phrases, pictures) shown on the left to items (symbols, words, phrases, pictures) on the right;
- a test with **short answer** questions that require simple answers, a word or phrase in each gap;
- **true/false** questions;
- **crosswords**.

E-assessment can also involve open-ended questions, which allow students to provide extensive answers as they are not limited to predefined answer options. The tool used to create these types of questions is called '**Essay**,' where students can enter their multi-word answers, which then require manual grading.

Teaching scenarios

Web-technology-supported teaching involves various assessment methods and techniques.

- **E-portfolios** can be used for assessing analytical and critical thinking skills and presenting the knowledge students have gained, skills they have acquired and self-reflection abilities they have developed.
- **Case studies** can be used for assessing problem solving skills in a specific environment.
- **Posters** summarising facts and data can help assess the ability to recall information, and use analytical and critical thinking skills. Infographics can be helpful in assessing knowledge and understanding as well as analytical and critical thinking skills.
- **Long tutor-marked assignments** such as essays and reports with criteria defined and explained can be used for both formative and summative assessments.
- **Projects** can provide formative assessment.

- **Educational online quizzes** with unlimited attempts can give formative or summative assessment or both.
- **Educational online quizzes** with one attempt allowed and correct answers shown after the attempt, with formative or summative assessment or both, can help students progress.
- **Educational online quizzes** with two attempts allowed and correct answers shown after the second attempt (grade for a higher score or better answer), with additional formative assessment can stimulate involvement.
- **Online tests** with questions presented to students in a random order and the answer options shuffled, with one question per page and no going back to a previous question can prevent cheating.

Good practice

Create an online test with close-ended questions if you want to test students' ability to recall information.

Create an online test with close-ended questions but only if you can formulate the answer options which are not rewritten phrases from your presentations, hand-outs or the textbook your students used to understand the subject matter. Your students should choose/enter the correct answer option after applying critical thinking.

Include educational quizzes with an unlimited number of attempts for practicing – do not penalise students for wrong answers.

Show correct answers in online tests, students will not make progress if they cannot see what they have done wrongly and what answers are correct.

Do not set the time limit in educational quizzes.

Add formative feedback in educational quizzes and online tests.

Create short quizzes with 10–15 questions – they are more student-friendly, thus more student-centered. Include several short quizzes instead of one long practice test in the educational material – very long quizzes can have a demotivating effect.

Build short matching test questions with well-thought-out lists of questions and answers, in which each entry on the left matches only one entry on the right. You can give additional answers on the right as distractors.

Try these tools

Free tools for formative and summative e-assessment

- Moodle quizzes
- Free Online Surveys
- ClassFlow
- iSpring Free

- Kahoot!
- Mentimeter
- Nearpod Silver Edition
- Quizizz
- Quizlet
- Poll Everywhere
- Socrative
- Survey Monkey

Methods in practice

Tutor-marked assignments submitted online can include formative and summative assessment. Formative feedback:

- can be emailed to students in writing alongside a transcript of results;
- can be recorded in audio or video format and then uploaded to the course website;
- can be provided during synchronous meetings;
- can be entered in an appropriate section while setting up an online activity;
- can include not only text but also pictures, sound, or other media;
- may have the form of emoticons, pictures, animations, comments, remarks, suggestions, advice, requests, reflection points, analysis and descriptive evaluation.

Formative assessment must be delivered in positive language, because then it is proactive, encouraging, and helpful.

Summative assessment is recorded as scores or grades, and it typically impacts the overall subject grade and academic achievement. Examples of summative and formative assessments include:

- exams,
- mid-semester tests,
- final projects,
- research papers,
- reports,
- infographics,
- posters,
- presentations.

Tips & Tricks

- Use **positive language**, easy to understand and straightforward, in your formative feedback.
- Give your students **extensive practice** before each test or exam.
- Use a wide range of assessment **methods** if you want to enhance student learning but do not assess every online activity – student engagement matters.
- Use a **rubric**, where you present the criteria that you use to evaluate an activity, give the rating scale and describe performance for each criterion. It helps students understand course requirements and motivates them to perform better.
- On-demand **formative testing** can quickly identify problem areas.
- E-assessment can track down students whose performance exceeds expectations, and those who are lagging behind. As a result, the tutor can immediately provide the weak with **additional tasks** and support, and the most brilliant with more challenging tasks and more difficult problems.
- E-assessment can offer a better testing environment for students with **physical disabilities**, who may feel more comfortable sitting an exam delivered in an easy to use electronic format.
- Staff and students need to be trained in how to approach **computer-based tests**. Money has to be invested in applying the best possible software to guarantee the quality of assessment procedures.

Peer and self-assessment

Iwona Mokwa-Tarnowska

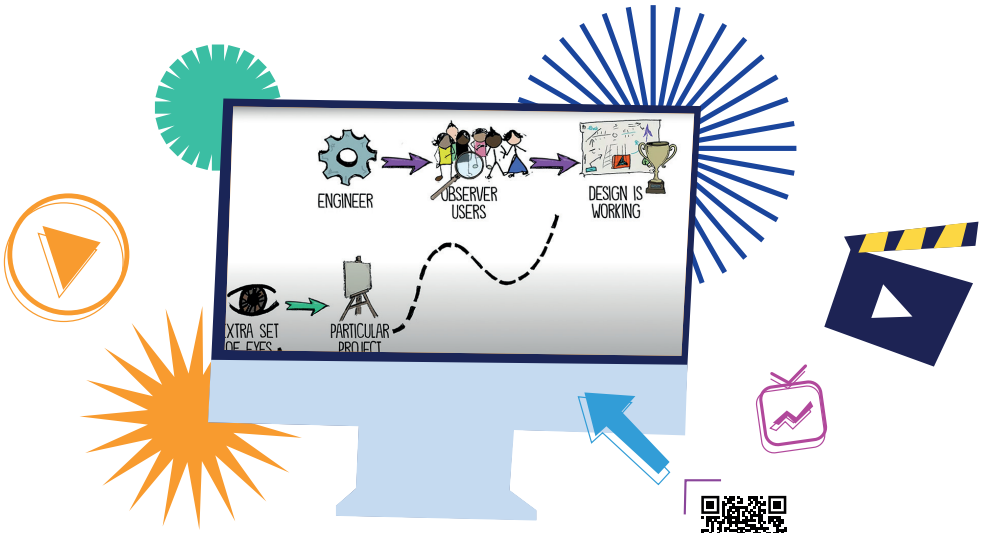
MOST WIEDZY

Why is it worth the effort?

Peer assessment and self-assessment are important aspects of 'assessment for learning'.

- They help **engage students** in learning.
- They improve **reflective**, **critical** and **analytical thinking** skills.
- They build an awareness of learning, which results in students becoming more autonomous learners.

Incorporating peer assessment and self-assessment is a move towards student-centered learning and teaching. Peer assessment teaches students how to make academic judgements. It encourages students to learn more intensely because assessing a task requires a deeper understanding of the subject matter. Students learn from identifying and articulating problem areas and positive things in a peer's work and from incorporating the feedback they have received into their own work. Self-assessment helps students reflect on their efforts, shows if they have improved their skills and builds new knowledge.



Empowering Students to Own the Assessment Process
[Source: John Spencer, www.youtube.com/@spencereducation]

What are the challenges?

- Can students assess their and others' work in an **objective** way?
- Can they give appropriate negative and positive **feedback**?
- Are students likely to recognize the benefits of **involving** them in the assessment process?

2. Let's build student engagement

- Is formal education only about learning from **experts**?
- Is it time–consuming to develop an effective assessment that **involves** students?

What are the solutions?

You should:

- Write clear assessment criteria;
- Use a rubric, which teaches students how to understand what constitutes a well-written piece of work;
- Allow for both quantitative and qualitative feedback;
- Define the rules of conduct, which minimises the possibility of unfair assessment;
- Provide a model answer or analyse example answers to teach students how to approach a task they will need to assess;
- Give yourself the right to modify student-allocated marks if they do not meet the predefined criteria;
- Use double blind peer review, in which the identity of both the author and the reviewer is not disclosed;
- Treat both peer and self-assessment as learning exercises that help your students to become life-long learners;
- Not treat peer assessment as peer grading;
- Allow yourself some time to develop effective assessment strategies that involve students.

Teaching scenarios

- Group projects with self-assessment and peer assessment to determine the amount of work done by each group member;
- Peer-assessed reports to help students understand and master report writing style;
- Peer-assessed research papers to introduce students to good practice in technical writing and academia;
- Reflection logs that show students what they have done – which can serve as revision notes but which can also be used in calculating their final grades;
- Self-assessment quizzes with close-ended questions, with formative feedback for incorrect, partly correct and correct answers.

Example peer assessment task set up using the Moodle workshop tool

"This week you are doing a peer review. Please assess your friends' reports, give a score and a comment. Do not use negative language, be positive, identify all strengths and weaknesses. Instructions to do so are provided in the review phase of the workshop, so you will know what to do. The system will allocate submissions randomly. The author's and the reviewer's identity will not be disclosed. You have to review 3 reports. Be honest in your work. You receive two grades in this activity and both of these grades appear in the gradebook: a grade for your submission (i.e., how good your submitted work is)and a grade for your assessment (i.e., how well you assessed your peers). I will also send you my feedback."

Good practice

- Prepare a short set of criteria explained in a rubric, according to which students will assess each other's work.
- Explain the criteria in detail to ensure consistency between different reviewers.
- Use explicit instruction, it will help students formulate feedback. Encourage students to provide formative feedback that will help their peers to make adjustments and modifications.
- Combine your feedback with peer assessment – your assessment will provide additional support.
- Introduce peer assessment prior to the submission of the final version of the task which will be graded by you.
- Inform your students that you will delete irrelevant comments.
- Suggest taking notes and explain to your students that their notes will show how they reflected on their own performance.

Try these tools

Moodle workshop for peer assessment and optional self-assessment

CLAS (Collaborative Learning Annotation System)

ComPAIR

peerScholar

Methods in practice

Formative feedback should appear in peer assessment, summative feedback is not necessary. Scores and grades limit the amount of information and may be awarded subjectively, without proper effort on the part of the reviewer. Formative assessment better justifies the reasoning behind the feedback provided.

Peer assessment does not equal peer grading. It shows student engagement but it cannot result in the tutor being replaced by their students. Peer assessment should not focus only on what requires improvement, but also on what is done well – identifying strengths is as important as showing weaknesses.

Self-assessment can be used to set learning goals and help students to self-direct the learning process. If students regularly self-assess their activity, they will understand that this assessment strategy will help them build their knowledge and skills. Educators can encourage them to do so by incorporating self-assessment questions (SAQs), reflection points or short reflection tasks into the educational material. Activities with no straightforward answers encourage students to reflect upon what they have learnt. They motivate them to rethink some ideas or redefine their knowledge. Their level of difficulty has to be adequate to the learners' competence level. Situations in an online resource in which SAQs and reflection activities are worth inserting into include: recalling, constructing, calculating, analysing, applying, designing and evaluating. SAQs are usually short questions, marked by clickable icons, to which the course management system provides answers, which are hidden but available if students want to see them.

Reflection points are short questions or suggestions that guide students to consider specific aspects after interacting with certain parts of the educational material. No straightforward answers are provided on the course pages, as they aim to stimulate learners to search for precise answers, targeting important or difficult issues and helping to develop core competencies. On the other hand, reflection tasks are longer assignments that are useful for higher-level students. They can lead to the creation of an e-portfolio.

SAQs and reflection activities can test if objectives are being met, so they help students achieve the intended learning outcomes. Educational quizzes with an unlimited number of attempts or with correct answers displayed after the first attempt help students self-assess their progress.

Apps and tools collection

David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

MOST WIEDZY

Why is it worth the effort?

Using the right apps and tools is very important to keep your students attentive and engaged. Some of them can also be useful for obtaining honest and anonymous opinions from students. Educational apps can provide interactive and engaging content, making learning more enjoyable and effective. They often use multimedia elements like videos, animations, and quizzes to present information in a dynamic way.

Why are the challenges?

The main challenges are, therefore, to:

- make your lessons more interactive;
- get feedback about student engagement.

What are the solutions?

Take advantage of the tools available to get more attention and student involvement.

Teaching scenarios

1. Basic tools for online collaboration

Some apps and tools can be used for **asynchronous** or **synchronous** collaboration.

Synchronous
communication

Asynchronous
communication

The first group for asynchronous collaboration includes tools like:

- OneDrive
- Dropbox
- SharePoint
- Google Drive

The second group for synchronous collaboration includes for example:

- Microsoft Office online package (Word, PowerPoint, Excel);
- Google Workspace (Docs, Slides and Sheets)

2. Other active learning apps

Kahoot, Mentimeter and Socrative are just some of the tools used to carry out polls and surveys. The use of these tools can constitute a way to test the attention of the audience or to track the real-time understanding of your students.

- For example, you can send unannounced questions in the app throughout the whole lecture which students must answer so that you can see who is not listening.
- Also, you can read answers and have a more frequent response about student understanding.

The tools allow you to run quick polls to detect how much students learned during the preceding lecture, during the last 10 minutes of the current lecture or regularly during the classes. Then, through the resulting graphs showing answers, it is possible to take hold of the general learning trend, to know the topic that was most difficult for the students. Now you know more about your students' understanding the subject matter, and you can plan the next lecture or take some provisions to improve your teaching method and get the best from your students.

Through the apps, the teacher has the possibility to do the brainstorming or quick polls at the beginning of the lecture to figure out the learning level or what they have to repeat.

- For example, before starting a lecture, you can conduct a poll to assess what students remember about some fundamental topics that are essential for understanding the upcoming lecture.
- Based on the survey results, you may need to do a quick review of certain concepts.

The use of apps and tools can also make the decision making process faster.

We all know that many students are a bit shy and tend not to expose themselves to express their opinions. Even in a simple moment like when it comes to expressing a preference, they might hesitate.

Some tools can reduce time and make some activities more efficient.

3. Content editing tools

Canva, Genially, Miro, Thinglink can be used to create presentations, but not only.

- They offer a custom environment to stimulate team work and collaboration.
- Students can jointly define schemes or diagrams intuitively and simply.
- They can also use the tool simultaneously and reach a common decision.

- They are useful for brainstorming, reviews, summaries, and every activity developed collaboratively.
- These apps make teamwork easier and with a Project Based Learning (PBL) situation, they can provide what you specifically need.

Welcome to Canva for Education
[Source: Canva, www.youtube.com/@canva]

Try these tools

Kahoot! is a game-based learning tool, useful for educational purposes. Its interactive quizzes, called 'Kahoots', can be created by the user, who can set up multiple-choice options. Kahoot! can be accessed through a browser or its app.

Mentimeter is used to create interactive presentations easily and instantly add questions, polls, slides, pictures and more. The audience participates via smartphones and all answers are shown in real-time. Finally, you can export and share the results to analyze them.

Socrative is an educational app, free for students, that facilitates transforming every lecture into a two-way exchange, providing the teacher with immediate insights into their teaching.

Canva is a platform that allows creating and customizing the graphics of any type in a simple and intuitive way, making it particularly useful, especially for those who do not have particular graphic skills.

Genial.ly is a web-based platform that enables the creation of various types of quizzes through a simple and intuitive interface. Some quizzes can be presented in the form of a game to generate more interest for students.

Mirò is a fully online interactive whiteboard on which entire teams can work simultaneously. This software helps users all over the world to be productive and collaborate remotely.

Thinglink is an interactive multimedia platform that allows users to create engaging content by adding multimedia links to photos and videos simply by placing tags on any image or anywhere on the board being created.

Tips & Tricks

- Use platforms designed to make lessons interactive and accessible, with or without a facilitator, to increase student engagement.
- Mix in-class lessons with interactive lessons.
- Incorporate interactive and reflective moments into the teaching process.

Assessment methods

The following tools can be used for assessment for learning or of learning.

Tools like Kahoot!, Mentimeter and Genia.ly enable producing a ranking list of students based on their scores. Obviously, educators may need more than just a ranking to perform thorough assessment.

They can be connected to platforms like Google Forms to collect all the available data and visualise results as a summary.

It is worth remembering that:

- Introducing effective Q&As to assess understanding and identify areas needing repetition can enhance students' learning and increase the lesson's value.
- All these platforms generate real-time statistics of poll answers, enabling educators to better assist students in comprehending challenging concepts.
- Tools like 'Socrative' can be beneficial for engaging students in game design through project-based learning. Students can be asked to invent a game based on the lesson, either individually or in groups, and they can also evaluate each other's contributions.

3

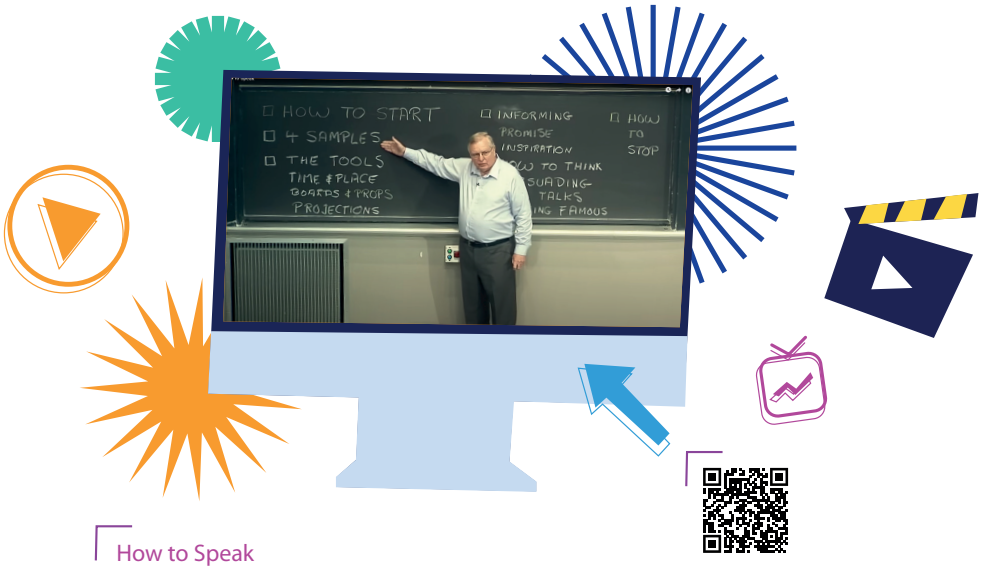
Let's design attractive content

Online lectures

Mariusz Deja, Iwona Mokwa-Tarnowska

MOST WIEDZY

Lectures and presentations can be more understandable and clear for listeners if they are conducted in accordance with certain guidelines and rules. **Professor Patrick Winston** delivered a talk at MIT during the Independent Activities Period, titled 'How to Speak,' in which he provided a collection of excellent rules and examples for effective communication. The universality of his rules lies in the fact that they can be applied in various situations, regardless of the delivery mode and purpose, i.e., traditional and online lectures, job interviews, thesis defenses and oral examinations. Learning a few heuristic rules can definitely improve the speaking skill, which can be critical even with very good substantive content. Professor Patrick Winston led a research group which focused on developing AI systems that have human-like intelligence, including the ability to tell, perceive, and comprehend stories. Perhaps this is the key to why his tips are so accurate and persuasive both for novice speakers and for experienced educators, especially since his rules often deviate from the generally accepted ones. Professor Patrick Winston died on 19 July 2019, but fortunately, we can still listen to his advice thanks to the recording of his talk, which has over 19 million views, along with many interesting and sometimes even touching comments.



How to Speak
[Source: MIT OpenCourseWare, www.youtube.com/@mitocw]

Knowledge and experience with a little talent make the master

Undoubtedly, our knowledge, experience, and inherent talent have a direct impact on the quality of communication, which can be significantly different. However, having only talent without the right amount of knowledge and experience will not allow us to reach a certain level, for example, in sports or science.

How to engage students?

Due to the development and common use of electronic devices in everyday life, we can encourage our students to use laptops and cell phones to take notes. During online courses, a computer enables access to our classroom, but other electronic devices can be distracting as humans have only one 'language processor.' In a traditional classroom, students using electronic devices may distract others, including the teacher. I recommend recording lectures because they are later accessible to people who could not attend them for various reasons and for those who would like to rewatch them.

However, watching or listening to a long recorded lecture can cause the attention of the viewers or listeners to weaken over time. It also happens that students may not access the recording due to the lack of time. If we do not have time to do it soon, most probably we will not have it in the future. Another advantage of having recorded lectures is the possibility to make them available to students when we really can't deliver them, e.g. due to illness or a business trip. Teaching people how to think is the most important thing we do as teachers. To achieve this, you must develop your own personal style for teaching and inspiring students, while also considering the recommendations of others or simply listening to other presentations.

Simple rules of engagement

During online lectures, everyone should use a camera when speaking or when asked a question because it promotes better engagement and fosters a more interactive learning environment.

Jokes at the beginning? Probably not. Starting with information about what new students are going to learn at the end of the meeting is a better solution.

Checking attendance at the beginning of the class, especially if the group is relatively small, allows the teacher to get to know their students by name.

It is worth remembering that the topic the teacher is talking about is new for most of their students, but most probably not for the teacher, as they repeat it every year or even more often. So, the teacher should consider the students' level of understanding and present the material in a clear and engaging manner by giving up-to-date examples and references to real-life situations**.** Quite often, as teachers, we think we've been repeating the theme for many years, and you know what they say – 'students still don't get it, so we have to repeat it again!'

Incorporating interactive activities**,** such as quizzes, polls and surveys, and encouraging discussions enhances student participation and increases engagement during the class.

Using breakout rooms for dividing participants into smaller groups to discuss specific topics, brainstorm ideas, or work on collaborative tasks helps students to engage more actively, exchange diverse perspectives, and foster a sense of teamwork.

It is much more beneficial for students if lectures are divided into meaningful chunks, and each chunk is recorded separately. Breaking down video lectures into shorter segments, of a few minutes' duration, stimulates better focus, aids comprehension, and allows students to review specific topics more efficiently.

By recognizing and prioritizing the following elements in verbal communication, lecturers can enhance their ability to connect and effectively convey ideas to others.

- Clearly expressing ideas and thoughts ensures that the intended message is easily understood by the listeners.
- The tone of voice conveys emotions (e.g., enthusiasm), influencing how the message is received.
- Using emphasis techniques, such as intonation and volume, highlights important information and improves retention.
- Body language, facial expressions, and gestures play a significant role in explaining the spoken message as they complement and reinforce the words.
- Presenting information succinctly and avoiding unnecessary details can keep students focused and prevent misunderstandings.
- Using signposts clarifies the structure and organization of the lecture, making it easier for the audience to comprehend the content and its relationship to the overall topic or subject. Signposts signal shifts in topics, indicate when important information will be presented, and draw attention to key insights. They can also invite audience engagement by prompting questions or encouraging participation at specific points in the lecture.
- Adjusting communication style to suit different audiences and contexts enhances the effectiveness of the lecture.
- Providing and receiving feedback during an online lecture constructively promotes learning.
- Demonstrating respect for others' opinions and viewpoints encourages open dialogue and fosters a positive communication climate.
- Communicating the aim of the lecture and objectives of its parts clearly helps ensure that students know what they should focus on.
- Structuring the content to flow logically, with smooth transitions between ideas, ensures that the audience can follow the lecture effortlessly.
- Utilizing language that captures the audience's attention, such as vivid descriptions, rhetorical devices, or storytelling, can enhance the lecturer's impact.

- Minimizing the use of filler words, such as "um," "uh," "you know", helps maintain professionalism and clarity in the delivery.

Questions checking knowledge development and attention asked during lectures should not be too obvious or too difficult because they may remain unanswered and discourage students from participating. Their role is to:

- foster engagement and active participation among students;
- encourage critical thinking and deeper understanding of the subject matter;
- provide valuable feedback to both the students and the lecturer; help identify areas of confusion or topics that need further clarification;
- enhance the overall learning experience and retention of information;
- create a dynamic and interactive learning environment.

When and where to conduct a lecture?

Timing helps optimize effectiveness, so avoiding starting lectures too early ensures that students are awake and alert, while avoiding starting them too late prevents fatigue. A time like 11 am would be perfect, although scheduling constraints may not always allow it.

The room where the lecture is being held or recorded should be well-lit, and all the electronic equipment and online tools needed for delivering it should be checked beforehand.

What to use to enhance understanding?

Boards, whether traditional or digital, serve as effective tools for conveying information during lecturing. The pace of writing on the board aligns with the speed at which people can absorb ideas. Utilizing a whiteboard is highly effective and should guide students' thinking, helping them better understand the topic. Unfortunately, the board's exceptional virtue is often underestimated and less utilized today, particularly during online classes.

Props appeal to various learning styles, allowing students to see, or interact with objects, which enhances understanding and retention of information. Physical objects or visual aids that educators incorporate into their presentations can:

- make abstract ideas more tangible and create memorable learning experiences;
- help make complex concepts more accessible;
- add an element of surprise and novelty to the lecture, capturing students' attention and making the material more interesting;
- create stronger associations, making it easier for students to recall information later.

Examples of props in lectures

3D models or diagrams can be used to explain intricate structures or processes in science and engineering.

Charts, graphs, and infographics can clarify data and statistics, making them easier to comprehend.

Real-life objects related to the topic, such as artifacts or specimens, can bring science lessons to life.

Lectures in science and engineering benefit from live demonstrations using experiments and apparatus.

Videos and animations allow students to observe real-world scenarios and experiments that might otherwise be challenging to demonstrate.

Virtual reality can transport students to different environments for a more immersive experience.

Slides are better suited for exposing ideas than for teaching them. If there are too many slides, or too many words on a slide, students may feel overwhelmed and find it challenging to stay focused on the presentation. This can lead to information overload, making it difficult for them to absorb and retain the key points being conveyed.

The general rules for using slides in lectures are:

- do not read the text from the slide;
- include pictures to enhance visual understanding;
- keep images simple and clear;
- eliminate clutter to maintain a focused presentation;
- use as little text as possible to avoid overwhelming the audience;
- ensure font size is appropriate and easily readable, especially for larger audiences or in online presentations.

The rules are simple, and applying them reduces the time needed to prepare slides. Getting rid of logos, titles, subtitles and bullets simplifies the slides, making them more informative and inspirational. Since we only have one 'language processor,' we can either use it to read the content or to watch and listen to the lecturer.

The laser pointer crime

When you use a laser pointer, you lose contact with the audience. It is better to use a little arrow on a slide to highlight something.

How to end a lecture?

Ending a lecture effectively is crucial to leave a lasting impression on the audience and reinforce key takeaways. Here are some tips:

- summarize key points covered in the lecture. This helps reinforce the core message and ensures that the audience remembers the most important information;
- remind the students of the lecture's aim and how it aligns with the overall topic or the subject;
- address questions if time allows;
- encourage the students to ask questions or seek clarification on any points that were difficult to understand;
- offer suggestions on additional resources or materials for further learning;
- conclude with an inspiring quote, thought-provoking question, or motivational message. This leaves the students with a sense of enthusiasm;
- encourage your students to provide feedback on the lecture by giving them a short online poll. This helps you improve your teaching and understand the audience's perspective and needs;
- thank the students for their attention and participation. This will create a positive rapport with them;
- express how much you value the time you spent with your students and their contributions.

Mini case study

During this semester's lectures on advanced manufacturing at Gdańsk University of Technology, Professor Deja frequently incorporated current topics often discussed in social media, such as the use of artificial intelligence or additive technologies in space missions, to provide examples. This approach proved to be really inspiring for the students, who became more active and engaged during the classes. It confirmed Professor Patrick Winston's opinion that 'people can be inspired by someone who helped them see a problem in a new way or someone who exhibited passion about what they were doing'.

Webinars

Maja Dragan, Manuel Pichler

3. Let's design attractive content

Webinars in education are online seminars or workshops conducted over the internet. The term '**webinar**' is derived from the combination of '**web**' and '**seminar**'. Webinars are becoming increasingly popular in educational settings due to their convenience and accessibility. They provide an opportunity for educators, experts, or presenters to share knowledge, conduct interactive sessions, and engage with a virtual audience in real-time.

7 Tips for Running a Truly Engaging Webinar
[Source: Slido, www.youtube.com/@Slido]

Why is it worth the effort?

- Webinars are a simple and efficient way to meet online with students.
- They are cost-efficient and flexible in terms of time and location.
- They can be accessed virtually anywhere.
- Webinars are mostly delivered in real-time, but they can also be offered in a recorded version.
- They can be accessed using smartphones, tablets, notebooks, etc.
- Webinars facilitate effective communication with the audience.
- You can insert multimedia formats (videos, presentations, voice recordings, etc.) into them.
- Webinars offer a voice-over feature.
- They include chats for communication.
- The teacher can interact with the audience using various tools.
- The teacher can provide direct feedback.

What are the challenges?

Live Webinars

- Potential overuse of presentations
- Main content-focused, limiting other forms of interaction
- High risk of technical issues, including network problems, microphone and speaker malfunctions, and issues with presentations and multimedia content

Recorded Webinars

- Lack of interaction with participants
- Impersonal nature due to the absence of live engagement

What are the solutions?

- Use different multimedia formats like Prezi presentations, videos, and interviews.
- Check the network and surroundings to ensure sufficient capacity is available.
- If the webinar is recorded, review the video before uploading it to a platform.
- Give the audience the opportunity to chat and interact during live webinars.
- For recorded webinars, create a platform to collect and address questions.
- Use slides to support your content. Listeners should focus on you and not the slides.

Teaching scenarios:

- Teachers can create a presentation with multimedia content and either record the lecture or conduct it in real-time.
- After special chapters, teachers can include a quiz section to re-engage students' concentration. For recorded videos, it could be a good idea to continue with the webinar after students complete the quiz.
- Before the webinar, teachers can prepare assignments or work for the students, and the webinar can serve as a follow-up and discussion session.
- Teachers can design project-based tasks for students to work on after the lessons.

Try these tools

Livestorm
ClickMeeting (not free)
GoToWebinar (not free)
Zoom
Webinar Geek

Mini case study

How to make a webinar

- Choose the webinar topic. Ensure that the topic is both motivating and informative for the audience.
- Define the structure of the webinar. Decide whether it will be a single webinar or part of a webinar series.
- Set the date and time for the webinar.
- Create hashtags for the webinar to engage the audience and generate interest in the topic.
- Send out email invitations to the intended audience; Double-check the registration link to ensure it is working properly.
- Create the content and perform a test run to ensure everything works smoothly.
- Host the webinar as scheduled.

Methods in practice

When to use Webinars?

- Webinars are used in various teaching and training scenarios, such as online lectures, student workshops, guest lectures, expert talks, and supplemental learning.
- There are scenarios for theoretical based content but also for practical training.

Use Webinars to:

- Set up conferences all over the world without traveling.
- Facilitate real-time discussions and exchanges on specific topics.

Tips & Tricks

Hosting a successful educational webinar requires careful planning, engaging content, and effective delivery. Here are some tips.

The starting point is the most powerful moment in a webinar, so increase interest, break the ice, and build tension.
Keep it short and to the point (maximum 30 minutes for the presentation part).
Interact with the audience to refocus their attention on the topic.
Allow the audience to ask questions.
At the end of the webinar, ask for feedback.
After the webinar, send a link to the audience to download the materials used.

Visualize data as much as possible.

Perform an analysis afterward with different questions.

- How many people were registered?
- How many of the registered attendees logged in to the webinar?
- What is the feedback output? What can be improved?

Assessment methods

- Online assessment via Moodle or other tools
- Self-assessment before and after the learning process

Video lectures

Maja Dragan, Manuel Pichler

Why is it worth the effort?

A video lecture is a presentation of educational material on a specific topic in the form of a video. Lecture recordings can fall under several categories, including talking-head videos with a lecturer or instructor speaking to the camera, captures of traditional lectures, slides with voice-overs, demonstration videos, or screencasts. They can also take the form of interactive lectures, in which video, audio, PowerPoint slides, and other features are combined.

Video is one of the most powerful virtual learning media that captures and distributes information while also providing a stimulating learning environment where students can better understand and retain data longer (Fern et al. 2011).

- Videos add life to the e-learning course, making it effective and engaging.
- They increase learner engagement and participation.
- They reduce cognitive overload and maximize retention.
- They provide simpler and practical learning experiences.
- They are a cost-effective training approach.

For students

- Videos serve as learning resources that students can view and refer to whenever they require a refresher.
- Students have the freedom to watch videos at any time and as often as needed. They can pause and rewind sections as required.
- Students become owners of their learning.
- Visuals in videos make the learning experience more interesting.
- Videos are advantageous for visual learners.

- They can showcase real-life examples or case studies.
- Students become more responsible for monitoring their learning progress.
- Videos can be downloaded for offline viewing, ensuring access even without an internet connection.

For teachers

- Teachers can record lectures on topics that remain relatively unchanged over the years.
- They can make recorded lectures available for students to view before coming to class.
- Videos can be used to create a flipped classroom or a blended learning environment.
- They can introduce the theoretical part of a topic, and the practical aspect can take place in face-to-face classroom sessions.

What are the challenges?

- Teachers often have concerns about students' understanding of the lecture when using videos.
- Poor video quality can be a challenge.
- The decision between creating custom videos or using readily available resources from the web can be difficult.
- Students may struggle to become autonomous learners.
- Finding the right video that aligns with the learning aims and objectives can be challenging.

What are the solutions?

- Encourage students to **take notes** and ask questions that arise during the lesson.
- Use **good quality infrastructure**.
- Provide students with access to videos that align with the course content.
- Encourage students to rewatch videos if they don't understand a concept or perform poorly on an assessment.
- Suggest watching videos as a way to prepare for upcoming lessons.

Teaching scenarios

After a video lesson, interactivity can be encouraged through a video conference or in-class discussion.

Synchronous learning/teaching

- After watching a video, ask students to work in breakout rooms and create five questions about the content. These questions should focus on evaluating, analyzing, applying, and understanding the topic, and they will later be answered by their peers.
- After watching a video, students brainstorm on new concepts/ ideas/processes used and note the context.
- After watching the video, students prepare questions related to topics that are still unclear.
- Students write a reflection on the topics or content covered in the video.
- Students apply the newly gained knowledge during the practice phase/ practical lessons.

Try these tools

Video creation tools and applications

Recording a video is the initial step in utilizing video content for both asynchronous and synchronous meetings. This process is relatively straightforward and cost-effective, with numerous tools available that cater to both synchronous and asynchronous video creation and delivery. Many of these tools are free or come at a low cost, often offering special discounts for teachers and students. Several such tools include:

Google Classroom collaborates with Google Drive to host essential classroom elements such as student profiles, assignments, grading and instructional resources like videos. Utilizing Google Classroom, you can create asynchronous videos and host synchronous conferences using Google Meet.

Blackboard is an educational platform designed for students and teachers. Similar to Google Classroom, it allows teachers to create and share files, videos and grades. Students can submit assignments and check their grades. However, unlike Google Classroom, Blackboard does not offer synchronous video hosting integration, which means that any live videos will need to be hosted on a different platform.

Adobe Connect allows teachers and students to access resources similar to those available on Blackboard and Google Classroom, including both synchronous and asynchronous video hosting. Additionally, Adobe Connect provides advanced tracking tools to monitor engagement during class. This tracking data can assist teachers in tailoring lessons to better meet the needs of their students. Moreover, Adobe Connect offers specific resources designed to support students with accessibility needs.

3. Let's design attractive content

Zoom is one of the most popular synchronous video hosting platforms. Teachers can utilize the standard version to host virtual class meetings for free, with a time limit of up to 40 minutes. Additionally, Zoom's paid subscription offers an extended educational package, allowing for longer meetings. Both options enable participants to record meeting videos, which can then be made available for asynchronous learning.

YouTube, owned by Google, stands as the world's largest video-sharing platform. It enables recording and storing of asynchronous videos for later use, along with hosting live videos. However, during live videos, YouTube permits interaction solely through comments. This level of interaction is suitable for demonstrations or lectures where active audience participation isn't a requirement.

For certain tools, such as Blackboard, educator credentials are necessary to create an account. Other platforms like YouTube are free and accessible to the public. If you're considering a paid account to access premium features, be sure to explore available educational discounts.

Record Your Classroom Lectures and Presentations
[Source: Dr. Jacob Goodin, www.youtube.com/@DrJacobGoodin]

6 Free Software for Making Video Lectures

Methods in practice

Videos should be used during lessons in an educational manner and not as a time-filler. To learn how to use videos in online teaching and learning, check out FH JOANNEUM's project CORSHIP – development of micro-credentials. Pestle - CORSHIP.eu

Videos as teaching tools: an educator's guide | Adobe Video

Tips & Tricks

- Keep your video short! Break lessons into segments of about 7–10 minutes.
- Use visuals, images and animations.
- Incorporate guided or embedded questions.
- Assess knowledge through quizzes and self-assessment tasks.
- Leverage pre-existing videos.
- Remain authentic.
- Engage in communication with your audience.
- Conclude the video by posing a question to ensure comprehension of the topic.

Assessment methods

- Embedded questions and quizzes
- Post-video quizzes to assess students' comprehension of the new material
- Utilizing PowerPoint presentations as an assessment method (This method should consider two categories: design and presentation/ speaking skills. It is important to establish rules and assessment criteria in advance, covering aspects such as the design and organization of the PowerPoint presentation, the use of images and tables, as well as speaking and presenting abilities)

Video clips

Jarosław Ziętarski

MOST WIEDZY

Video clips

It's likely that no one would be particularly surprised to learn that teachers should possess a thorough grasp of their subject matter before attempting to impart it to others. Let's take this notion one step further. The pivotal roles of teachers involve not only possessing ample knowledge but also effectively conveying it to others. Both of them should be constantly mastered, which means that teachers should commit themselves to continuous learning. Let's begin by examining the foundation: knowledge.

How to balance theory and practice in education?

Teachers concentrate on developing theoretical knowledge alongside the enhancement of practical skills, aiming for a symbiotic relationship between the two. When it comes to knowledge development, educators must not solely possess the information to convey but also deeply comprehend the subject matter they are teaching. This aspect might not be immediately apparent. Science often simplifies reality, leading to a significant temptation for teachers, especially in higher education, to present ready-made solutions that students would accept without questioning. However, what if these statements contradict students' existing thoughts, knowledge, and experiences?

How to captivate students' attention in the classroom?

When a teacher presents a concept without providing an explanation, it's only natural for students' minds to raise questions. This reaction diverts their attention from the ongoing class, diminishing its effectiveness. It's akin to trying to hold a conversation with a sports fan engrossed in a crucial match on TV; the dialogue won't flow smoothly and might likely become a monologue. This highlights one advantage of traditional classes over online ones. When students enter a physical classroom, their time is dedicated to listening to the teacher, and the environment is conducive to an uninterrupted class. This doesn't imply that online classes are inferior, but rather that the online setting can tempt students to divide their attention between the class and other tasks.

One of the primary objectives of classes is capturing students' attention. This principle extends to both well-prepared materials and effective methods of knowledge dissemination. Employing quality materials is a significant step towards success, yet the art of imparting knowledge encompasses much more. Young students not only grapple with academic challenges but also struggle with various problems associated with transitioning into adulthood. These diverse concerns influence their attention, even within the classroom setting. However, it's not merely the teacher's entrance that can immediately command everyone's focus as they step into the classroom.

Mini case studies

Embracing the might of patience and time

It's essential to remember that classes aren't the sole responsibilities students have on a given day, especially part-time students. Due to this, I implement an approach of deliberate segmentation within my class. If a lecture spans 45 minutes, instead of delivering a single extensive narrative, I break the material into smaller segments and present multiple stories, separated by anecdotes, brief discussions, or a few quiz questions. Irrespective of my choice, I consistently circle back to previously covered topics. Shorter stories help maintain student attention, while quizzes serve to assess learning outcomes. In this context, a smartphone can be a valuable ally.

Utilizing smartphones wisely

I've heard about classes where students are required to turn off their smartphones. However, instead of outright rejecting phones, we can harness their potential. Once, I asked the class leader to discuss a particular issue with the entire group and share their thoughts. At that moment, I noticed everyone checking their phones. Soon after, the class leader informed me that they had already made a decision. While I was speaking, they had already deliberated on a solution using their phones and posted comments in their group discussion forum. This efficient communication system highlights the group members' strong social competence, and it's not something to oppose.

This isn't the only scenario where phones prove useful. Anonymous quizzes after each segment of the class serve as a means for both students and the teacher to receive feedback about the students' comprehension of the material. The results provide insights into the effectiveness of the class. If the entire group performs poorly, it

serves as a significant indicator for the teacher. Something didn't work. The way the class was taught needs improvement. In such instances, the teacher can refine their approach, striving for improvement and imparting knowledge more effectively. In this way, teachers learn how to teach better.

Very often, I ask my students during a lecture if what I have just said was clear. At the beginning, there is usually silence. Silence for me means two possibilities: either "we didn't understand" or "we are afraid to admit that we didn't understand." The second case is worse because it indicates students' discomfort in communicating with the teacher. In such cases, I inform the students that I will explain it using a different example, and at the end, I ask the same question again. I keep explaining until the whole group states: "**We don't need further explanation; we understood the issue now!**" Then I move on to the next topic.

Managerial Accounting in 8 minutes

As time went on, I began to experiment with various teaching methods. I realized that I am a 'visual learner' and require aids like diagrams, charts, and videos to fully grasp the material. Scouring for suitable videos, editing or fast-forwarding through them, and attempting to connect completely different narratives didn't meet my expectations. This prompted me to create and share my own videos on my YouTube channel, FAT CAT Financial Education. If a picture is worth a thousand words, then a video can hold immeasurable value.

I divided the subject of managerial accounting into segments, each forming the basis of approximately 8-minute videos. Shorter clips cater to shorter attention spans, which proves advantageous for individuals who struggle with sustained focus. These videos prioritize key information, minimizing the time required to grasp complex concepts. In my videos, I use visualizations, animations, graphics, and other multimedia elements to enhance the comprehension of intricate processes and abstract

ideas. My aim is to facilitate the understanding of complex topics, make learning more interesting and engaging, practical, and appealing.

Short clips uploaded to platforms like YouTube are readily accessible and can be played on various devices, enabling learning anytime and anywhere. Students can plan their studies better, knowing they only need to watch a couple of 8-minute videos at a time. I have no control over whether my students watch the assigned video in their pajamas, while eating, on a train, or in a bar, nor any influence over the viewer's situation during playback. In those 8 minutes, I aim to explain the concept with a practical example. After each video, I provide a quiz with key questions related to the topic to assess the knowledge students have developed. Viewers can always rewatch the video if they need better comprehension or if certain aspects remain unclear. To address language barriers, I speak English slowly, recognizing that learning in a foreign language can be an obstacle for some students. Proficient English speakers can adjust the video playback speed, alleviating frustration with slower speech. These videos have proven to be one of my most effective teaching aids.

My primary aim is to provide clear explanations. I recognize that videos are just one component of the learning process, which should also encompass reading, practical exercises and discussions.

Continuing the journey: lifelong learning beyond endings

Since becoming a teacher, I've developed empathy and patience towards my students. I recognize the need to capture and maintain their attention. I always analyse the group's grades, aiming for their improvement in the upcoming semester. I've willingly invested additional time and effort to ensure a better grasp of the subjects I teach. My personal challenges with learning have enabled me to better comprehend students' struggles and help them overcome obstacles. Teaching has evolved into both my profession and passion, and I agree with Albert Einstein that 'intellectual growth should commence at birth and cease only at death.' Moreover, I remain committed to lifelong learning – as Steve Jobs famously said, 'there's always one more thing to learn!' Hence, I embrace the prospect of continuous learning with great enthusiasm.

E-quizzes

Maciej Zaremba

Why is it worth the effort?

E-quizzes can be used in daily teaching and learning practice. They can help teachers to assess the knowledge of their students, to consolidate the material and to make their topics more attractive. E-quizzes can also help students prepare for an exam or a test, making them valuable for self-assessment.

E-quizzes are more engaging and effective than paper-based quizzes. They are easy to conduct and evaluate, since some of them have automatic grading embedded. They can contain pictures, videos, charts and multimedia content. Moreover, e-quizzes are easy to modify and share. Opting for this type of assessment can save teacher's time, which can then be allocated to planning lectures or offering feedback to students.

What are the challenges?

The key challenges of e-quizzes are associated with anxiety and difficulties in using the tool. Secondly, especially in the case of quizzes containing video or audio components, they can be too loud and hinder the ability to concentrate on the tasks. Also, some questions may require detailed answers; in such cases, it is essential that students have enough time to complete the tasks.

What are the solutions?

Before students attempt to solve a quiz, make sure to explain all the tasks and ensure that there is enough time allocated to complete them all. Before you publish an e-quiz **test it yourself**, make sure the pictures, graphs, etc., are clearly visible on all devices. If you use video or audio clips in your quiz, also check their quality and sound levels.

Teaching scenarios

- Prepare a presentation/lecture or other materials for students.
- When it is time to assess the students' knowledge gained during the learning activity, provide them with the link to the e-quiz prepared beforehand.
- Explain the nature of the task and go through all the required types of answers.
- Clearly define how much time is allocated to solving the quiz. Instruct students when to begin the quiz.
- If automatic grading scores are not available to them, promptly send them the results.

Mini case study

Case study – dynamic quizzes make classroom learning fun

Try these tools

Google forms is a free tool allowing you to create forms which can be easily converted into tests.

- Various types of questions are supported (multiple choice with a single option, multiple choice with more than one option, short answer, long answer, yes/no, true/false).
- It is possible to mix the order of questions for each user.
- You can also modify colours, fonts, pictures to customize the look of the quiz.
- It is also possible to add video files to your quiz; however, the tool works best with YouTube videos.
- It is also possible to limit the number of attempts.

Google Forms Tutorial
[Source: Kevin Stratvert, www.youtube.com/@KevinStratvert]

Ispring is a free learning authoring tool that allows you to create responsive courses and quizzes in PowerPoint. Download is required. Key features include:

- 3 question types (multiple choice, multiple response and short answer),
- wide customization options; it is possible to add images, audio and videos to your quiz to make it more attractive and captivating,

- flexible scoring; you can assign different point values to each question (for example, assigning more points to complex questions),
- individual feedback,
- limits on number of attempts.

Testportal is a skill and knowledge building platform, there is a free EDU plan available for teachers only. Key features include:

- great charts and graphs,
- time limits per quiz and question,
- randomization,
- flexible scoring,
- multiple question types, possibility to add images, videos and audio files,
- dedicated app for Microsoft Teams,
- cheating prevention.

Jotform is a free online form builder. Key features include:

- it has multiple choice style forms,
- quiz results can be emailed, viewed within the app, or displayed to the user upon test completion,
- it is totally free to use.

Free Online Surveys allows the user to quickly create an online survey/ poll or forms that can easily be converted into quizzes. Key features include:

- easy to create using drag-and-drop builder,
- easy distribution (link, email, QR-code),
- automated scoring,
- theme customization,
- possibility to add images, videos or text fields,
- possibility to create custom messages to quiz-takers based on their scores,
- supports a number of question types: multiple choice, drop-down list, text, comment boxes, dates, picture-choice questions.

Hot Potatoes is a free online tool to create interactive online exercises and quizzes. Key features:

- mixed question types in a single quiz;
- sophisticated scoring (allocated weights for various questions, individual answer settings);
- timer on assessments and exercises.

Methods in practice

How to Create an Online Quiz in Under 10 Minutes
[Source: Interact, www.youtube.com/@tryinteract]

Tips & Tricks

- Create a suitable number of questions. A good quiz should contain 8 to 15 questions.
- Make your quiz visually attractive. Game-like appearance will make your quiz entertaining.
- Ensure there isn't an excessive number of open-ended questions requiring students to type in their answers.
- Pick the right types of questions.
- Make sure you have correct links/QR codes to your quiz.
- Define the objective of the quiz – teaching, evaluating, consolidating, etc.

Assessment methods

Many online quiz builders have automatic grading embedded, while others provide the results/answers in an accessible way, so grading/ evaluation is easy. Results can be presented in formats such as pie charts or graphs.

Presentations

Maja Dragan, Manuel Pichler

In the context of education, presentations can take various forms and serve different purposes. Teachers often use them to deliver content and information to their students during a lesson. Presentations may include slides, multimedia elements, and interactive activities to engage students in the learning process. Sharing presentations in online education can be done through various platforms and methods to ensure easy access for students. You can prepare them using software like Microsoft PowerPoint, Google Slides, Genially, Prezi, or other similar tools. You can share them using cloud storage, a learning management system (LMS), a video conferencing platform or send them via email. If the presentation is intended for a wider audience or public access, you can share the link on social media, educational forums, or websites.

Why is it worth the effort?

- A presentation is a simple and efficient means of conveying information, ideas, and concepts to an audience in a structured and visually engaging manner.
- It can be used virtually anywhere.
- It supports collaborative creation and editing.
- You can choose to create your own design or use existing templates.
- It is reusable for multiple occasions.
- It can be exported to various formats.
- It facilitates effective communication with the audience.
- Multimedia elements such as images, videos, and audio can be easily inserted;
- Voice-over narration is possible.

What are the challenges?

- Presenters often rely excessively on slides.
- Teachers may sometimes overuse presentations.
- Text overload can occur.
- There's a significant risk of technical issues (e.g., compatibility problems or power failures).
- An abundance of features can be overwhelming.
- File sizes frequently make emailing challenging.

What are the solutions?

- Utilize pictures, graphics, and photos in place of excessive text.
- Employ key phrases (or incorporate graphics) and include only essential information to effectively convey the narrative.
- Limit the use of punctuation and avoid using all-capital letters.

3. Let's design attractive content

- Optimize readability by incorporating empty space on each slide.
- Apply contrasting colors for text and background.
- Create straightforward and uncluttered slides.
- Ensure that slides complement your content without becoming a distraction;
- Guide the audience's attention towards you rather than the slides.
- When sharing, consider password-protecting the file or utilizing restricted access settings on the platform.
- Design with purpose.
- Plan the structure.
- Get visuals.
- Avoid overload.
- Be consistent.
- Use templates.

Teaching scenarios

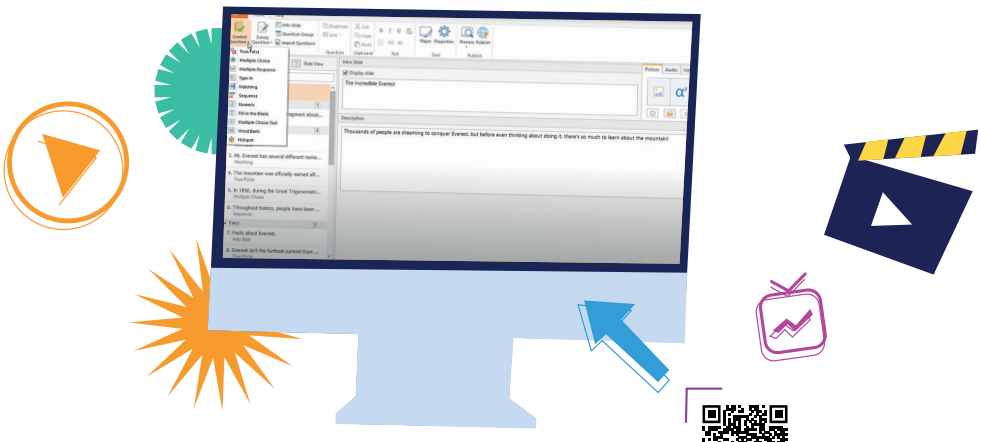
Teachers/lecturers can incorporate question slides into their PowerPoint presentations, making the class more engaging for students.

Teachers can embed interactive polling questions between the slides to create a seamless presentation aligned to the lecture.

Teachers can prepare a pre-reading task as preparation for the topic before the class.

Teachers can prepare project-based tasks for their students after the class.

Mini case study



How to Make a Quiz in PowerPoint
[Source: iSpring, www.youtube.com/@iSpringPro]

Try these tools

Prezi – How to make a Prezi presentation

Genially – Genially for Teachers

Methods in practice

Use presentations to:

- outline your talk without writing on the board;
- present instructions step-by-step without wasting paper;
- present discussion points or questions;
- display a short quiz or a test.

13 Presentation Design Tips to Create an Awesome Slide Deck
[Source: Visme, www.youtube.com/@VismeApp]

Tips & Tricks

- Keep the presentation short and concise.
- Choose the right font (Verdana, Calibri, or Helvetica are safe choices).
- Font size matters (try using a header size of 20pt and footer size of 18pt).
- Pay attention to contrast.
- Relevance and quality are key, so use high-quality images and relevant content.

3. Let's design attractive content

- Combine diagrams, schemes, or screenshots with images.
- Visualize data whenever possible.
- Simplify tables.
- Minimize the variety of transitions – using one type is more effective (less is more!).
- Define colors based on your target audience.

11 Visual Hierarchy Design Principles – Learn How to Improve and Create Beautiful Graphic Designs

[Source: Visme, www.youtube.com/@VismeApp]

Assessment methods

- Embed questions and quizzes using tools like Kahoot, Mentimeter, etc.
- Assign creative work based on the presentation's content.
- Assess knowledge development based on a short presentation, either individually or collaboratively prepared.
- Consider suggesting the use of a presentation for self-assessment on lecture topics.

E-books and interactive books

Maciej Zaremba

MOST WIEDZY

Why is it worth the effort?

E-books, short for electronic books, are digital versions of printed books that are designed to be read on electronic devices, such as e-readers, tablets, computers, and smartphones. It is really hard to believe it, but the first concept of an electronic book reader appeared in Bob Brown's manifesto of 1930 entitled „The Readies". However, the e-book as we recognize it today was born in 1971 and its father was Michael S Hart of Illinois University in Chicago. Nowadays, it is hard to imagine life without e-books, especially if you are an avid reader. Among the biggest advantages of this format we can list: lower costs of production, easier access and archivization, text customization options, to name just a few.

Interactive books are digital books that incorporate multimedia elements, hyperlinks, and interactive features, including quizzes and assessments, to enrich the user's experience. These elements surpass traditional text and static images, enabling engagement with the content in a more dynamic and immersive manner. It is worth considering this form of expressing ideas due to its fundamental advantages, including affordability, accessibility, interactive content that can be easily updated, and, last but not least, comfortable usage.

E-books and interactive books can be used, for example, as resources in e-learning courses as supplementary material, subject tutorials or examination compendiums.

What are the challenges?

Creating an interesting interactive book is not an easy feat, however, it can be done when the author puts in some effort. Some of the challenges are similar to the ones associated with creating (or writing) a regular book.

The biggest challenges include:

- developing an interesting and descriptive title;
- creating captivating content;
- designing a user-friendly layout with clear divisions into chapters and subchapters;
- ensuring an appealing book layout;
- achieving a good balance of content, particularly in relation to regular and interactive elements.

What are the solutions?

Title

- Keep it short and simple. If your title is too long, ambiguous or boisterous, the readers may not want to reach for your book.
- Make sure your title does not contain play on words or jokes – as most people might miss them.
- Aim to satisfy your readers' thirst for knowledge.

Content

- Take some time and write without rushing.
- Do not get entangled in too many details – a certain topic can be your life and soul, but remember that your readers may be new to this topic.
- Do not flood your readers with text – use some pictures, charts, tables, links, exercises and quizzes.
- Proofread, proofread and proofread. Preferably by more than one person.

User-friendly design

- Prepare a nice visual cover.
- Use a table of contents.
- Make sure that the structure of each chapter is the same.
- When you use graphic material, make sure its quality is high and that the content is clearly visible on any device.

Book layout

- Opt for a fixed layout if you want the content and other elements to remain consistent on each page.
- Include vertical and horizontal scroll bars, enabling readers to access all content even when zoomed in.
- If you want your book to be readable on many devices, including e-book readers, tablets or smartphones, reach for a reflowable layout. This layout type, among others, permits readers to adjust font size and type according to their preferences.

Well-balanced content

- Too much of a good thing is a bad thing. Do not use interactive elements excessively.
- Use interactive elements to back up or clarify the topic, do not use them for the sake of having interactive elements.
- Make sure that your links work.
- If you use third party content, make sure you check the copyright before you embed them in your book.

3. Let's design attractive content

Teaching scenarios

Have students read a chapter/chapters from the interactive book. Give them a deadline.

- After the initial task is done, break your group into smaller teams and ask the students to prepare questions or problems connected to the content for other groups. Make sure that the questions are relevant before the groups start asking them.
- Working in groups the students expand on the ideas presented in the materials they read.
- Encourage the students to pinpoint the areas that require further explanations.
- Ask the students to prepare a presentation or write a short paper reflecting upon the content they read.
- Encourage the students to apply the knowledge they gained in practice, e.g. during a laboratory class.

Mini case study

- Virginia Tech Professors Create the World's First Interactive Multimedia Textbook on 5G;
- Piano for All Utilizes Interactive Ebooks for Online Music Teaching.

Try these tools

Canva can be used for creating e-books and interactive books (free license available).

Create An Ebook In Canva (In Just 10 Minutes!)
[Source: Jason Whaling, www.youtube.com/@JasonAWhaling]

Kotobee is an online tool for creating interactive books, exporting them in multiple formats, and securely delivering them to users (with a free license available)

Soundsnap allows the addition of royalty free sound effects and relevant music.

Dreamstime enables utilising royalty-free stock photos.

YouTube and Vimeo can be used for making video clips.

Methods in practice

How to create an e-book for free (step by step)

How to write like the best-selling author of all time

5 Best e-book creators and software to create e-books

Tips & Tricks

- Keep it short and do not deviate from the main topic.
- Do not rush, take your time and give your book care and attention.
- Do not use low-quality material.
- Do not infringe copyrights.
- Support the text with interactive content.
- Do not use vivid colours.
- Keep in mind that your target group may be new to the subject.
- Remember that you are not creating your book for yourself but for a broader audience.
- Find someone or several people to proofread your content before publishing.

Assessment methods

- Online quizzes and test platforms/apps (Kahoot, Moodle, etc)
- Group work, including question and answer sessions, summaries, etc.
- Presentation or a short paper reflecting on the topic

Forums

Maciej Zaremba

MOST WIEDZY

Why is it worth the effort?

Forums or message boards are one of the first things that come to mind when we talk about the Internet. A forum is a great medium where students from all over the world can engage in conversations through posted messages. It builds a sense of virtual community – a group of people who share the same interests and exchange ideas. Forums provide users with the opportunity to ask questions, share ideas, and receive feedback from others. A good forum is like a discussion club; however, you do not have to leave home to participate in the exchange of ideas. Furthermore, a forum is also a treasure trove of knowledge, ideas, non-standard solutions, and lively interaction among people interested in similar topics.

What are the challenges?

The challenges associated with forums can be divided into two basic groups.

Technical challenges include the management and operation of the forum server, the creation of boards, sections, and subsections, maintaining the appearance, and addressing issues such as combating spammers, trolls, and bots.

Substantial challenges are associated with moderating the discussion, ensuring that threads or topics are not duplicated, and maintaining relevance and civility in the posts.

Other challenges include making the forum a living organism, which basically means filling it with users, who will then fill the forum with posts.

What are the solutions?

When you start a forum, make sure you appoint the following.

An administrator is a person that manages the technical details associated with running the site. An admin also appoints or revokes moderators, oversees rule enforcement, and performs data-base operations such as backups.

A moderator is a user who has access to other users' posts and threads, and moderates (or mediates) discussions. The list of the moderator's duties includes keeping the forum clean, answering users' questions, and addressing specific complaints. Moderators can also ban/unban or suspend/unsuspend users who violate the forum rules, and they have the authority to add, edit, or remove posts, threads, and topics. Usually, more than one moderator is needed.

- Before starting a forum, design its tree-like structure, clarify what type of content can go into a specific category.

3. Let's design attractive content

- If you plan to post messages that are not related to one another, use a non-threaded message board. However, if you intend to have message topics with replies to the topic and responses to those replies, you need to opt for a fully-threaded board.
- Also, it is very important to define the rules for joining the forum, user rights and obligations and their privileges.
- Last but not least, it is necessary to ensure that there are some **security measures** applied – you need to prevent forum hacking, spammers, bots, and other threats associated with running a specific website, such as a forum or a message board.

Teaching scenarios

End your lecture, presentation or lesson with a specific problem related to its topic. Invite students to join the forum to share their ideas on solving the problem or to express any questions or doubts they may have. Be sure to specify the time frame for the discussion and actively moderate the conversation. Encourage the students to post the ideas even if they seem to be far-fetched or not advanced enough. Emphasize that this is an online brainstorming session with a specific purpose: to leverage the knowledge they already possess in order to address particular challenges.

You can also use a forum as a platform to pose questions related to the material covered in class. Encourage students to engage in peer-to-peer discussions. However, remember to moderate the thread and intervene if necessary. This approach offers an excellent opportunity to reinforce understanding, identify challenging areas within the material, and provide further elaboration on those topics during subsequent classes.

Mini case study

Types of interaction in Online Discussion Forums:

A Case Study

Try these tools

Forum in Moodle enables students and teachers to share ideas through threaded comments. Posts can contain images and media. Teachers can grade and rate posts, and students may rate each other's contributions too. Moodle allows you to export and download an entire forum, a discussion (thread), or a single post. This feature can be helpful when you want to print students' contributions to a Standard discussion.

How to Create a Discussion Forum in Moodle 4.0

phpBB is a flexible free forum software enabling users to create boards where registered users can post messages. It includes a theme system, has plenty of options for customization of the overall look, users' profiles and posts and offers access to plenty of moderation options.

MyBB is one of the best forum software options, it shares a lot of features with phpBB. MyBB is easy to use and has many plugins and theme systems. The control panel is feature-rich, and its appearance is more modern than that of phpBB. Additionally, MyBB provides gamification and communication plugins to enhance user engagement, incorporates user-reputation systems, and facilitates the use of calendars for scheduling events.

WordPress is one of the most popular content management systems available today. Its wide array of applications includes creating forums; however, you need one of the forum plugins such as Asgaros Forum, wp-Foro Forum or bbPress. It is the best choice if you want to set up a regular website with a forum. WordPress provides access to the largest collection of themes and plugins on the web. It allows you to create almost any type of a website, and provides a wide variety of forum plugins for a highly personalized experience.

Discourse is a free forum software that offers a modern user interface for community discussions. It is mobile-optimized, which means that it can fit various screen sizes, including tablets and smartphones. It also provides login integration with Facebook, Instagram and Twitter. The software offers a number of features as far as members, moderation and community management are concerned. It may take some time to learn all the features, but the end result makes it worth it!

Methods in practice

- Creating and running a discussion forum
- How to be good on an Internet forum
- How to make a forum website using MyBB in just 5 minutes

Forum discussion ideas

Tips & Tricks

- Clearly define the structure of the forum, divide it into topics.
- Ensure user registration is easy.
- Create a set of rules for the forum members.
- Moderate when necessary.
- Regularly monitor the forum to ensure discussions stay on track.
- Focus on content quality and users' engagement.
- Reward active participation.
- Encourage students from different backgrounds to share their perspectives.
- Align forum discussions with your curriculum.
- Adapt your approach as your forum grows.

Assessment methods

Since forums generally serve as venues for exchanging ideas, asking questions, and finding solutions, assessing members' activity is not always easy. You might consider awarding badges, points for being active, or providing marks or extra credits to recognize the best contributors.

Podcasts

Krzysztof Zięba

MOST WIEDZY

Why is it worth the effort?

Humans are listeners. In the past, as distant as the Stone Age, people used to gather around the fire to listen to stories, absorb knowledge and learn new things. Despite all the technological progress, verbal communication is still one of the most important ways of communication. Hence, harnessing our natural predisposition to listen to stories may serve as an effective way of teaching students and presenting knowledge to them. This kind of learning may be perceived as attractive, as it is quite effortless. Listening to podcasts can be easily combined with everyday tasks and duties, such as house chores, driving a car or sports activities.

What are the challenges?

Podcasts are not as engaging as other forms of online learning, as they usually lack the video component. It is well-established knowledge that pictures, graphs, and especially the face of the presenter help keeping attention of viewers and let them stay focused for a longer time. Hence probably the greatest challenge while using podcasts for teaching is to keep the focus of listeners and not to discourage them from further listening.

What are the solutions?

The greatest weakness of podcasts, mentioned above, is paradoxically their greatest strength. They do not require full attention and therefore they allow you to combine listening to them with other activities. Learning while riding a bike or having a running practice? Only podcasts can do that. The goal should be not to capture full attention of listeners, but to keep their focus strong enough to absorb the most important information and carry on listening till the end of the episode.

Teaching scenarios

Podcasts can be used for both synchronous and asynchronous learning, but they are far more suitable to listen to alone. It comes from the fact that the main idea is to allow students to listen to podcasts when it suits them best.

The primary use of podcasts in the learning process is to present students with additional knowledge, putting some ideas, notions and relations in various contexts.

Podcasts can also be used to point to some other areas, not directly addressed in the online course. They are useful as a means to broaden the views of students and to trigger their interest.

Podcasts are a great way to get students acquainted with topics which are unfamiliar to them at the moment. Podcasts may serve as a good introduction to elective courses, as they allow students to learn basic facts and principles, and to decide whether a given student should be interested in course enrollment.

It is a good idea to record a podcast together with an expert in a certain field in the form of an interview or a free conversation.

Last, but certainly not least, podcast may be used as a way of staying in touch with former students as a form of course follow-up. That feature may be used either for building a community around a specific topic or to encourage lifelong learning activities.

Try these tools

Podcasts are relatively easy to create, and sophisticated tools, software and a dedicated recording studio are not necessary. While even a smartphone may be enough to produce a podcast, it is worthwhile to get some basic equipment, though.

As podcasts are all about voice recording, a good microphone is certainly recommended. Your weapon of choice may be Blue Yeti, which is a USB condenser microphone. It allows recording in three most desired patterns: cardioid – if you plan to record your own voice (single actor), bidirectional – if you want to interview a guest (two actors with microphone between them) and omnidirectional – if you want to record not only actors, but the whole background as well. No matter what microphone model you choose, remember that for recording podcasts condenser mics are far better than their dynamic counterparts.

There are countless applications to record and process sound – free and paid ones. One of them, particularly worth trying out is Audacity. It is free of charge, simple in use and offers features that are absolutely sufficient for most podcast creators. It allows you to improve the recorded track by cutting out unnecessary parts and applying additional effects. Three the most important include: normalisation, compres-

sor and noise reduction. Using these can significantly improve the quality of your recording.

Once your podcast is produced, you need to publish it somewhere. Spotify allows you to publish your podcast on four platforms, including obviously Spotify itself. Less obvious, yet still a good place for your podcast can be a YouTube channel or your own website. Podcasts may also be uploaded to e-learning platforms such as Moodle.

Tips & Tricks

How to Start a Podcast on Your Phone
[Source: Pod Sound School, www.youtube.com/@podsoundschool]

Know your audience. Their characteristics will guide you in determining the appropriate language to use-whether formal or informal-and help you decide on the ideal episode length, ranging from just a few minutes to more than 20 minutes. Additionally, understanding your audience will inform the structure of your content.

The recording environment matters. Instead of a recording studio, opt for a cozy space with soft objects like cushions, blankets, and curtains. Avoid hard surfaces that can cause voice reflections, which might make your podcast less appealing.

Having a quality condenser microphone is essential. Try to lower the gain parameter to minimize background noise, unless capturing it is your intention. Lowering the gain will also assist you in maintaining a lower recording level. Excessively high levels can complicate post-production.

Depending on your pronunciation, consider buying a pop filter. They are affordable and help reduce the unwanted effects of explosive consonants, such as 'p,' 't,' 'k,' 'b,' 'd,' and 'g.' If you are skilled enough, you might choose to forgo a pop filter and instead position your microphone slightly to the side of your mouth. If you make a mistake

while recording, tap the microphone. This action will serve as a marker for moments that require your attention during post-production. This approach significantly simplifies the process of identifying sections that need to be edited or deleted.

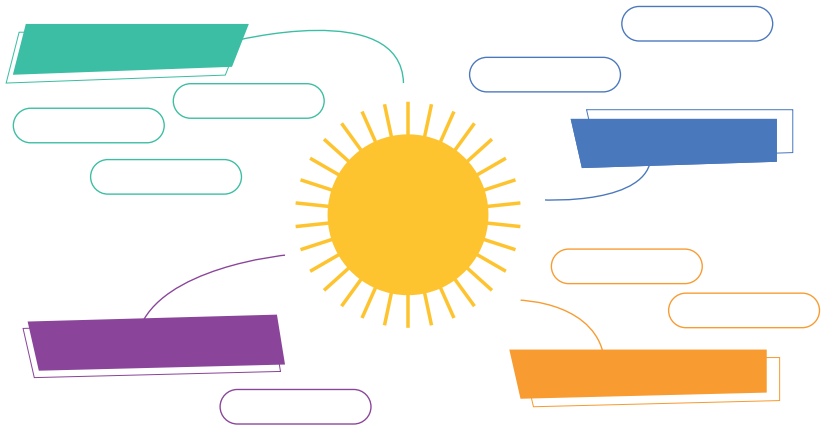
Never read your podcast from notes! It takes a talented actor to make that engaging. We read stories to children to put them to sleep. If you read to your listeners, you might not make them fall asleep, but you will certainly discourage them from listening to you.

Online mind maps

Maciej Zaremba

Why is it worth the effort?

Online mind map is a diagram used to visually organize information, usually in the form of a hierarchy showing relationships among various components of the whole. A mind map is usually created around a single concept, which becomes the central point of the map. From this point other ideas, associations, images branch out, creating a comprehensive mind map. Mind maps are very effective in helping people understand concepts and ideas in science. They also have a positive impact on memory recall. They are more effective than reading text passages, attending lectures or even participating in class discussions.



What are the challenges?

Mind maps are easy to overcomplicate, especially when dealing with a group that enjoys showcasing their knowledge and ideas. Creating mind maps can be time-consuming and demanding in terms of effort. There is a risk of losing information and details when mind mapping.

What are the solutions?

- When you begin to work on your mind map, ensure that your students understand the importance of using keywords instead of full-length phrases.
- If you are worried that mind mapping will take too much time, allocate a specific period (for example 10 or 15 minutes) for creating the mind map.
- If you are afraid that your mind map might overlook important details, try to be concise.
- Make a list of keywords before adding them to the mind map and gradually refine the list until you reach a satisfactory level of details.

Teaching scenarios

Provide your students with a general idea and encourage them to build upon it. Depending on the type of activity, specify the desired end result, so that the students know what they need to achieve. For activities such as mind maps or infographics, you can divide students into groups, with each group addressing a different aspect of the issue. Then, have the groups present their ideas and encourage them to share their opinions about the outcomes.

Mini case study

Case Study on Effective Use of Mind Map in Engineering Education

Try these tools

Coggle allows you to collaborate on note-taking, brainstorming ideas, and even creating project plans. You can add central nodes within a single workspace and establish loops and branches to connect with other mind maps, revealing relationships. You can view the history of the mind map, check who and when edited it and make a copy. It is also possible to gradually reveal the mind map using the presentation mode. Coggle also enables sending messages to team members, leaving notes, and even chat in real time.

GitMind is an online tool used to visualize complex concepts and ideas, create task priority lists, and more. It offers a wide range of classic, colorful, and business-oriented templates. Node shapes, spacing, background colors, line thickness, and border shapes can all be customized. Your mind map can be arranged in different layouts, including logic charts, vertical/horizontal timelines, tree charts, and fishbone diagrams. Maps can be viewed, edited, and exported in outline mode, and they are easy to share using a link.

Mindmeister is an online mind mapping application that allows its users to visualize, share and present their thoughts via the cloud.

Miro Map Maker helps teams generate new ideas, organize information, and visualize how complex concepts connect with one another.

Canva allows you to choose a mind map template from its mind map maker, customize labels, and collaborate with a team to add branches of information to build new concepts. It is possible to create a mind map with online whiteboard tools and elements for free.

Wondershare EdrawMind is a cross-platform mind mapping software with an interface similar to that of MS Office. It allows you to insert relationship lines, callouts, pic-

tures, links, attachments, notes, and tags. The software offers twelve different mind map layouts and a plethora of ready-made templates. You also have the option to automatically create slides by disassembling your mind map into separate branches. Your files can be stored in Edraw cloud storage, ensuring easy access and enabling real-time collaboration. Additionally, the software includes a Gantt Chart mode.

Tips & Tricks

Creating effective online mind maps can greatly enhance your brain-storming, planning, and organization processes. Here are some tips and tricks to make the most out of using online mind mapping tools.

Begin with a central idea or topic in the center of your mind map and branch out from there. Keep your main idea clear and concise. Use keywords and short phrases rather than long sentences. This keeps the mind map concise and easy to understand at a glance.

Utilize colors, icons, and images to visually represent concepts and create a more engaging mind map. This can help differentiate branches and make the map more memorable.

Arrange your ideas hierarchically, with main branches branching into sub-branches. This helps maintain a clear structure and organization.

Some online mind mapping tools offer templates for various purposes such as project planning, decision making, or goal setting. These templates can save you time and provide a structured frame-work.

Many online mind mapping tools allow integration with other productivity tools like task managers, calendars, and note-taking apps. This can help you turn your mind map into actionable steps.

Assessment methods

- Develop a detailed rubric that outlines specific criteria for assessing the mind map. Assign points or levels to each criterion, such as content accuracy, organization, creativity, clarity, etc. This structured approach provides clear expectations and consistency in grading.
- Have students exchange their mind maps and provide feedback to their peers based on predetermined criteria. Peer review promotes collaboration, critical thinking, and the development of communication skills.
- Ask students to evaluate their own mind maps against a provided rubric. This encourages self-reflection, self-awareness, and meta-cognitive skills as they analyze their work objectively.

Infographics and sketchnotes

Maciej Zaremba, Iwona Mokwa-Tarnowska

MOST WIEDZY

Why is it worth the effort?

Infographics are graphic visual representations of information, whose main purpose is to present it clearly and quickly. They can improve cognition by using graphics to improve our visual system's ability to identify patterns and trends. They are easy to create even with the aid of everyday tools such as paper, pencils, markers and rulers.

28 Infographic Examples for Your Inspiration

Sketchnotes are a visual note-taking technique that involves combining words and images to capture and represent information, ideas, or concepts in a visually engaging and organized manner. They are a form of visual communication that leverages doodles, drawings, icons, typography, and other visual elements to enhance the understanding and retention of content. Sketchnotes are often created in real-time during lectures, presentations, meetings, or while consuming any type of educational or informational content.

What are the challenges?

Infographics and sketchnotes require a lot of time to design and produce them. They cannot be used with any topic or any type of content. They can be misinterpreted, especially if there are some flaws in the design. Lastly, the information is limited on space.

What are the solutions?

- The design is crucial. Allocate enough time for designing your infographics and dedicate sufficient time to research.

3. Let's design attractive content

- Do not include too much information, as this would necessitate more extensive research.
- Label your pictures and charts; what may seem to be obvious for you may not necessarily be obvious to your target audience.
- Consult your ideas with others to make sure that they grasp the message you intend to convey.
- To save space, be concise and stick to the point.
- Avoid overwhelming your infographics with information.
- Choose the most relevant and important details.

All of the above mentioned tools aim to achieve similar goals. Provide your students with the general idea and encourage them to expand on it. Depending on the type of activity, specify the end result, so that the students know what they need to achieve. In case of mind maps or infographics, you can divide students into groups and each group can deal with different aspects of the problems. Have students present their ideas, encourage them to share the opinions on the outcomes.

Teaching scenarios

- Select a suitable topic that can be visualized and broken down into key points or concepts. Thoroughly research it before creating your infographic to gather accurate and relevant information. Outline the main points.
- Clearly outline the learning objectives you want to achieve through the infographic. Tailor your approach to your students' needs and the specific learning objectives you want to achieve.
- Choose the type of infographic that best suits your aim and topic.
- Use visual hierarchy to guide the viewer's attention. Important information should stand out, and the flow of information should be logical and easy to understand.
- When designing the infographic, keep the design clean, visually appealing, and organized. Use colors, icons, images, and text boxes to convey information effectively.
- Simplify, summarize, and focus on key points. Avoid overwhelming the infographic with excessive details. Use concise language.
- Add interactive elements such as clickable links or animations to enhance engagement.
- Show the infographic to your students. Discuss the main points, encourage questions, and facilitate a class discussion about the topic.
- Involve students in collaborative work on an infographic. This could include analyzing data, identifying trends, making predictions, or drawing conclusions based on the issues presented in class.

- Assign group projects where students create their own infographics on related topics. This encourages collaboration, creativity, and deeper exploration of the subject matter.
- Assess student understanding by asking them to explain the key points from the infographic. Use quizzes, assignments, or presentations based on the information presented in the infographic.
- Encourage students to provide feedback on the effectiveness of the infographic as a teaching tool.

Try these tools

Canva offers smart filters that allow you to choose the one that best suits your preferences, including style, theme, price, color, and other categories.

Easel.ly is a tool that empowers users to create visually engaging and informative infographics. It offers a comprehensive library of customizable infographic templates. Its drag-and-drop interface simplifies the process of adding and arranging elements such as text, icons, images, charts, and shapes within the infographic canvas. Users can easily customize templates by adjusting colors, fonts, sizes, and layouts to align with their branding or visual preferences, ensuring their infographics stand out. Easel.ly fosters collaborative work by enabling multiple users to contribute to the same infographic project, thereby enhancing team-work and creativity.

Infogram is a powerful data visualization and communication tool that facilitates the creation of captivating and informative visuals. This versatile platform is employed for various purposes, including data-driven infographics, interactive charts and graphs, maps and geographical data, presentations, and reports and dashboards. Its technical features include a drag-and-drop interface, customizable templates, tooltips, animations, and clickable areas within visualizations. Additionally, users can utilize bubble charts, scatter plots, heatmaps, and more to effectively convey complex data relationships.

Piktochart is a versatile visual communication tool that empowers users to craft a diverse array of visual content, including infographics, presentations, posters, and reports. It aids in conveying information concisely and with visual appeal, facilitating audience understanding of crucial points.

Venngage is a user-friendly design platform that empowers educators to create visually compelling content with ease. Whether you're a professional designer or someone new to design, Venngage offers a straightforward and intuitive interface that allows you to craft stunning graphics, infographics, presentations, and more. With a wide range of customizable templates, icons, and images at your fingertips, expressing your ideas creatively is very simple.

Visme offers a variety of infographic categories and provides layouts for presentations, documents, printables, social media, and web graphics, including custom-sized tem-

plates. The free package permits up to five projects, while paid business plans offer distinctive features such as audio recording, a brand kit, folder organization, a slide library, and more.

Methods in practice

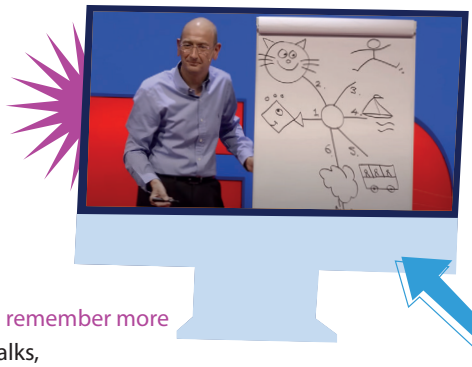
- Infographics and sketchnotes can either be used by teachers as valuable teaching aids during online lectures or e-learning courses or be assigned to students for summarizing class content.
- Students can be assigned a topic to research and then asked to present their findings in the form of an infographic. This encourages them to present information in a visually appealing and organized manner.
- Students can be asked to collect data and use infographics to represent their findings. This is an effective way to teach data visualization and interpretation.
- Academics can elaborate on a topic by having their students compare and contrast subjects, devices, functions, time periods, or any other relevant elements using an infographic.
- Academics can have their students create infographics that provide step-by-step instructions for various tasks. This will help them practice clear and concise communication.
- Educators can use infographics to explore cause-and-effect relationships, demonstrating the consequences of certain actions or events.
- Students can document the process, observations, and outcomes of experiments in an infographic format, which can help them visually organize their findings, present complex data succinctly, and share their results with clarity and creativity.
- Post-infographic activity can involve peer discussions, where students analyze each other's infographics and provide feedback on clarity, design, and content. This encourages critical thinking and fosters collaborative learning.
- For technical language classes, students can create infographics to showcase new vocabulary words, their meanings, and their usage in context.

Infographics in Education: Why and How to Apply (with Examples)

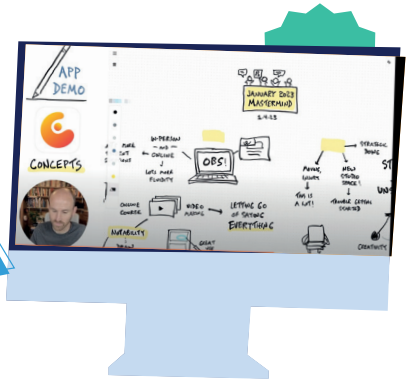
How to make an infographic

Why Use Sketchnotes in the Classroom?

Tips & Tricks



How to draw to remember more
[Source: TEDx Talks,
www.youtube.com/@TEDx]



How I Use Concepts
for Live Sketchnoting
[Source: Verbal to Vis,
www.youtube.com/@verbaltovisual]

Assessment methods.

- Creating infographics and sketchnotes by students can be a form of assessment for a given topic;
- Depending on the assessment, students may need to research, synthesize information, and create content for their infographics. They should be encouraged to use reliable sources and cite their references according to academically accepted styles;
- Academics can evaluate their students' infographics using an assessment rubric. This should provide constructive feedback that highlights strengths and suggests areas for improvement;
- To evaluate students' infographics, academics need to develop a clear assessment rubric that outlines the criteria that will be used. It should include such aspects as content accuracy, visual appeal, creativity, organization, and adherence to guidelines;

3. Let's design attractive content

- In a peer-review phase, students can exchange their infographics with classmates for feedback. This encourages collaboration and provides insights from different perspectives;
- Infographics serve as a versatile medium through which students can showcase their knowledge, making the assessment process engaging and providing an alternative to traditional forms of evaluation.

Video & graphics editing tools

David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

Why is it worth the effort?

Multimedia content in presentations is crucial for engaging the audience and enhancing the appeal of lectures, as long as the quality meets acceptable standards. The impact on students increases with higher quality video and graphic elements.

What are the challenges?

Providing good multimedia content requires addressing several technical aspects:

- audio quality,
- video quality,
- entertainment value,
- smooth transitions,
- highlighting key concepts,
- effective timing.

The challenge lies in being attentive to all these aspects to create valuable content that can truly make a difference in student engagement.

What are the solutions?

Good media content can be developed using one or more of the following methods:

- animated slideshow presentation,
- slideshow presentation and voice-over,
- screen recording with voice-over,
- webcam recording,
- recording a speech with the support of a lightboard,
- merging different video clips together.

When recording a video, always remember that the quality of both the audio and video is crucial for engaging students. Therefore, be sure to utilize high-quality microphones and cameras.

After recording a video and before making it public, remember that the video editing phase is fundamental. A valuable tool for this purpose is Kaltura. Kaltura developed the first open-source video platform for video management, creation, interaction, and collaboration. Kaltura's platform allows you to integrate rich media's advanced and interactive features into any site easily and effectively, including functions like searching, uploading, importing, editing, annotating, remixing, and sharing photographic, video, and sound material. The platform also offers collaboration features that allow groups of users to co-author and access aggregated video services such as video advertising and professional video editing. Kaltura's sources are free and available to web developers both in the form of platform extension development kits and as ready-to-use extension packs or plug-ins for content management software, blogging, and collaboration platforms.

What is Kaltura? Why would I use it?

The Kaltura plugin for Moodle allows everyone to easily record, upload, and publish high-quality videos and audios. Kaltura is a video hosting service that "lives" behind Moodle, through which you can: record your screen and/or webcam, upload videos that you already have and embed videos into Moodle courses.

Try these tools

There are many platforms to edit videos and to design graphic content. The most popular are:

Movavi Movavi Video Editor [Complete Beginners Tutorial]

Adobe Premiere Pro Premiere Pro Tutorial for Beginners 2023 – Everything You NEED to KNOW! (UPDATED)

Davinci Resolve DaVinci Resolve 18 – Full Tutorial for Beginners

Canva How To Use Canva For BEGINNERS! [FULL Canva Tutorial 2023]

Adobe Photoshop

GIMP How to use GIMP – Beginner Tutorial

3. Let's design attractive content

Pixlr Pixlr Photo Editing – Pixlr E Tutorial for Beginners (2023)

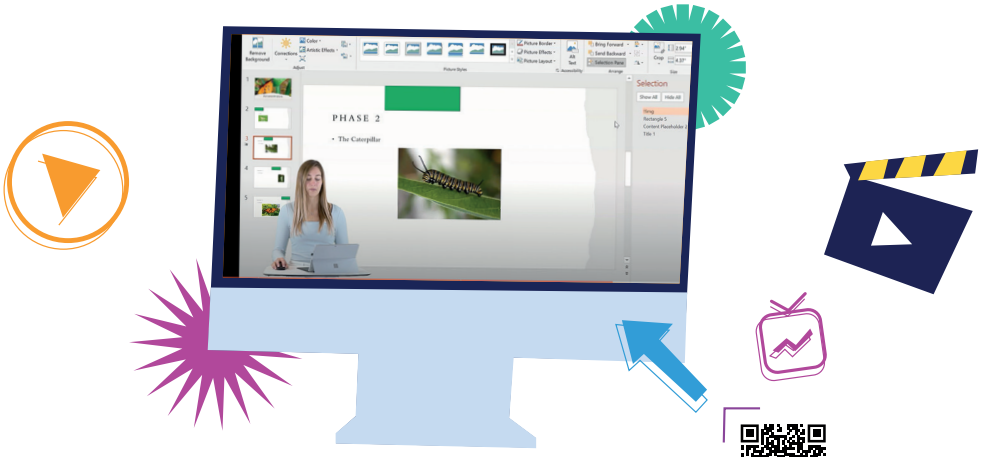
Audacity (audio recording) How to use Audacity to Record & Edit Audio | Beginners Tutorial

Some basic recording options are available in PowerPoint as well.

Tips & tricks

- When you record the lesson, make sure you are in a quiet place.
- Keeping the speaker visible, rather than using a simple voice-over, makes the content more attractive for the audience.

The following video shows an example made with PowerPoint's Morph transition. This tool can easily make your presentation more attractive.



How to Use the Morph & Enhanced Morph Transition in PowerPoint
[Source: ClassPoint, www.youtube.com/@ClassPoint]

4

Let's look into the future

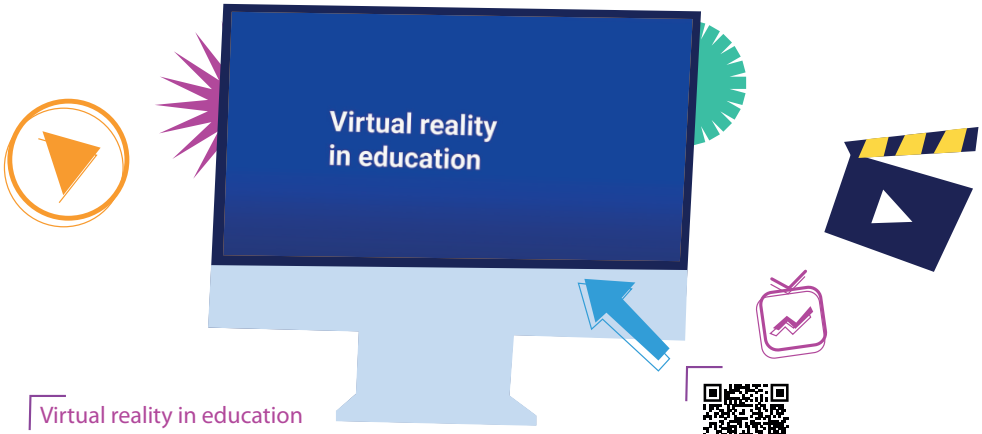
XR technologies

Alina Guzik, Beata Krawczyk-Bryłka,
Marek Chodnicki

MOST WIEDZY

Why is it worth the effort?

Over the past few years, the world has become almost obsessed with XR technology. One can no longer search in vain for articles on future trends without at least a brief mention of it. At the biggest fairs in the EdTech industry, such as Bett UK or Frankfurter Buchmesse, booths adorned with electronic glasses and huge screens displaying magnificent digital universes reign supreme.



Virtual reality in education
[Source: Wydział Zarządzania i Ekonomii Politechnika Gdańska, www.youtube.com/@wzie_pg]

Many experts, including academics, are placing a lot of hope in it. Are they right to do so? It's worth examining the terms related to XR technology. There are many of these terms; below, we present the most important ones:

Virtual Reality (VR)

It is a three-dimensional image created by a computer. It can represent elements of both the real and fictional worlds (e.g., in computer games).

Augmented Reality (AR)

It involves placing digital content onto a live background, such as 3D graphics superimposed on an image captured by a camera. Examples include interior furniture design applications, where you can select a piece of furniture from a company's catalogue and position it within a photo of a room to visualize how it will appear.

Mixed Reality (MR)

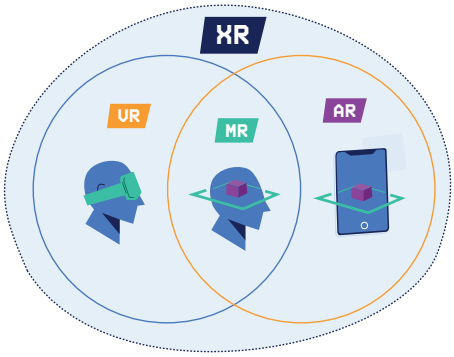
It is a form of augmented reality, but more advanced. It enables interaction with the real world. It uses a system of cameras and sensors that scan the environment and create a 3-dimensional model of the space onto which virtual content can be placed.

Extended Reality (XR) – XR Technology

XR is a fusion of all existing technologies: VR, AR, MR, and the real world into a single experience. It allows users to create new forms of reality by integrating digital objects with the real ones and real objects into the digital ones.

Metaverse

It is an alternative version of reality or a virtual universe in which digital representations of people – avatars – interact with each other. It is intended to encompass various aspects of life, including work, family, travel, and everything else.



What are the opportunities and benefits in applying augmented and virtual reality to education? There are quite a few. XR technology:

- makes it possible to present things, situations and phenomena that are difficult to access and sometimes dangerous to demonstrate in a lecture hall (e.g. an explosion-threatening chemical experiment),
- sparks students' interest (until it becomes boring); by engaging the sense of touch, movement, and visualization, helps enhance memorization (as opposed to learning methods solely based on listening or reading),
- facilitates contextual learning (e.g. enabling students to walk through streets in ancient Greece),
- enables the digital analysis of data related to user behavior and progress,
- allows for greater interaction among students who are far from each other, e.g. in remote learning settings,
- provides an opportunity to reduce costs (e.g. by simulating the use of specialized space equipment).

Methods in practice

Let's take a look at some examples that demonstrate how augmented and virtual reality are making a strong and resilient entry into the world of education.

Medicine and social welfare

Augmented reality has been spectacularly successful in medical education. Working with a hologram – a patient with a specific condition – is excellent training for students to learn how to implement medical procedures and respond to unexpected incidents. Virtual simulations of complex surgeries or mass disasters, in which future doctors op-

erate thanks to special goggles and virtual hand controllers, are solutions that are used successfully in Polish medical academies. AR opens up new possibilities in the training of caregivers of the elderly or patients with dysfunctions. The applications allow one to enter the reality of the wards and experience their perception of the world and such treatment develops sensitivity and helps to consolidate correct therapeutic responses.

Psychology

In the training of psychologists, experiments implemented in virtual reality, illustrating the behavior of people in various situations, are an important development. The use of this technology in the treatment of disorders, such as anxiety and phobias, is already highly developed. Applications for desensitization, i.e., gradual exposure to a threatening stimulus (e.g., in the treatment of fear of heights, social anxiety) are known, which allow modeling the patient's behavior under controlled and safe conditions. Access to such approaches can be an excellent re-source for learning about dysfunction and possible therapies.

Criminalistics

Another example involves the utilization of virtual crime scene inspections as a component of a forensic science program. This virtual, yet highly realistic, approach includes the collection of physical evidence, material analysis, and psychological preparation for real investigative scenarios. These are the primary objectives of such educational applications.

Architecture

Augmented reality laboratories are also a space for training architects. Thanks to them, future designers can get more closely acquainted with the construction of historical and modern buildings, access to which is limited (for example, due to distance). Being able to observe buildings from different perspectives and at different levels of detail is an important learning experience. Creating virtual simulations allows testing multiple solutions already at the idea stage, develops spatial imagination and results in a better understanding of architectural designs.

Engineering

The relatively low cost of experimentation and confusion in virtual reality makes it eagerly used in engineering education. Learning about, designing and testing automated production lines using robotic work is a challenge taken up by university students, but also by employees who are being prepared for a specific professional environment. This makes it possible to learn about complex technical systems, complicated machinery and design processes precisely thanks to XR technology. This reduces preparation time and the risk of accidents.

Military

Security is an argument for the use of virtual reality also in military schools. Simulators that visualise the conditions of warfare (terrain, site infrastructure) serve to de-

velop tactical and topographical orientation competences, while the visualisation of episodes shapes the ability to plan combat and supervise its execution.

Physical education and sport

In the preparation of physical education academy students, the use of augmented reality technology in the mental training of athletes is discussed. It supports the improvement of motor skills, learning about new sports facilities and psychological preparation for competition. Its advantage is the adaptation of application indicators to the biophysical conditions of the trainee with the possibility of insight into the biological functions accompanying the motor task.

Business

Let's not forget the education of business students. XR technologies are widely used in the development of entrepreneurial and managerial competences. They make it possible to simulate any business and economic processes taking place under different economic conditions. This creates an excellent environment for decision-making training. The aforementioned simulations are also an important element of didactic games, where students can take on different roles (e.g. marketing employee, HR department, production manager) to take on challenges concerning logistics, people management, marketing strategy or sales. According to the PwC report, the use of XR in teaching soft skills has tangible results: employees learn faster, are more focused, are more emotional about the training content and are more likely to transfer the skills they have learnt to work.

The use of XR technology also has its dark side.

- Buying equipment for every student is still a huge cost in our world.
- Producing 3D digital content is still a job for those with a very fat wallet.
- Developing worthwhile usage scenarios that really carry educational value is a difficult challenge.

- There is a lack of teaching aids for teachers.
- Some users of XR solutions complain of dizziness and other symptoms of motion sickness and this can lead to exclusion.

Try these tools

Virtual Reality Training Solutions (VRTS)

Unity Real-Time Development Platform

CoSpaces Edu

Avantis World

3spin Learning

PIXO VR

Mini case study

CNC Machine training with Virtual Reality

Beware of the Robot: A Highly Interactive and Immersive Virtual Reality Training Application in Robotic Manufacturing Systems

The application of virtual reality training for anastomosis during robot-assisted radical prostatectomy

What does the future hold for XR in education?

Augmented and virtual reality in education can be used in many good and clever ways but the truth is that they have still not been implemented on a large scale. As you can easily guess the main reason for their slow adoption is money. XR is currently a very strong trend and is at the top of its media career which means that, according to the Gartner Hype Cycle trend popularity model, it will soon enter the Valley of Disillusionment Phase. What will happen next? Either it will become widespread like the smartphone we carry in our pockets every day or it will remain an exclusive curiosity for the chosen few. Time will tell.

Cyber-physical laboratories

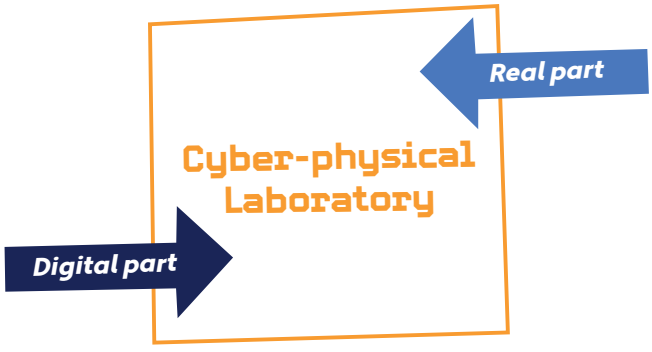
David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

Why is it worth the effort?

The idea of introducing cyber-physical laboratories, either as an alternative to traditional lessons or as a supplementary component, represents an innovative approach that can enhance the classroom experience, making it more engaging and inspiring for both teachers and students.

What are the challenges?

The main challenges lie in the very essence of the term 'cyber-physical', which involves the integration of the 'cyber', i.e. the digital component, with the 'physical' component composed of real devices.



Furthermore, the possibility of conducting laboratory activities not only in person but also remotely is a significant challenge that must be taken into consideration.

What are the solutions?

The future of laboratories has to be seen as a cyber-physical system where learners must have both real, physical robots and the ability to recreate the robots they have in the lab, synthetically and digitally. In order to do this, software is needed that allows for Engineering Design, i.e. for modelling and control algorithms, and that allows operating with both physical and cyber systems.

The main tool for this is Matlab, a programming platform designed for engineers and scientists, featuring its own block diagram environment for Model-Based Design, called Simulink. Alternatively, LabVIEW, a system-design platform and development environment for a visual programming language by National Instruments, could be utilized. More-over, one of the many modern programming languages could be also considered, such as Python and C#.

4. Let's look into the future

Below you can observe, for example, the Simulink library browser, with its elementary blocks to be used in a project, and the workspace, where the project can be built by interconnecting the blocks.

Library Browser
[Source: MathWorks, https://www.mathworks.com/]

At this point, if the real laboratory is available, microcontrollers must be chosen so that they have the ability to run software such as:

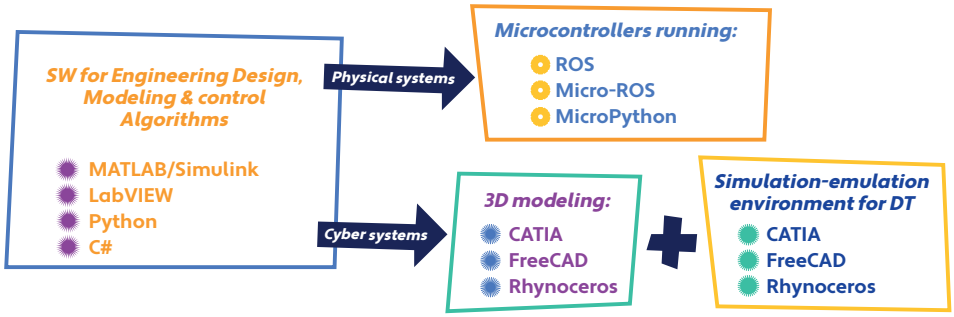
ROS (Robot Operating System), a set of software libraries and tools to build robot applications,

Micro-ROS, a robotic framework targeting embedded and deep-embedded robot components with constrained computational resources,

MicroPython, an implementation of the Python 3 programming language, optimised to run on microcontrollers and in constrained environments.

At the same time, an infrastructure is also needed to mechanically copy the mechatronic device for its 3D modelling, such as CATIA, FreeCAD, Rhinoceros, etc.

In addition, a simulation-emulation environment is needed to create the Digital Twin (DT): you can consider Unity or an environment specific for the engineering domain (UWSim, UW Morse, UUV, etc.). At this stage, you could choose either one from the engineering domain or otherwise, you should choose a differential equation solver that gives the physical answer in the synthetic system, (e.g. AGX for Unity). In conclusion, a summary scheme is presented:



Teaching scenarios

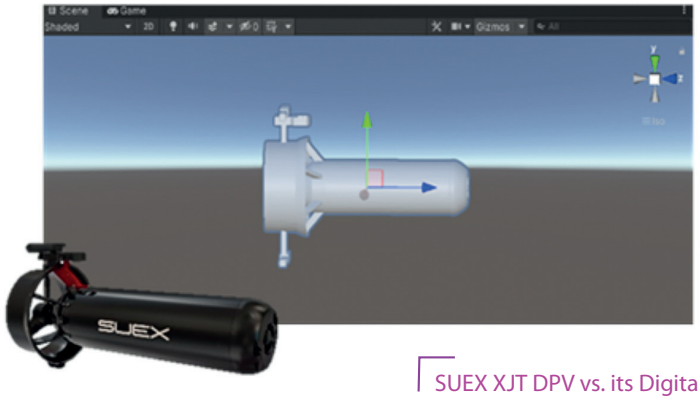
Once the project to be carried out through a cyber-physical laboratory has been decided and established, it is recommended that teachers also introduce the following concepts:

- KPIs: Key Performance Indicators,
- TCs: Test Cases,
- TPs: Test Procedures,
- TRL: Technology Readiness Level,
- V&V (Verification and Validation) Model.

All those concepts can then be adapted by the team of students to carry out their work, for example by having them create a V&V model associated with TCs and TPs, also used to evaluate the TRL of their project/ product.

Mini case study

The presented case study is taken from the work carried out by a group of the "**Laboratorio di Meccatronica**" course, held by professor Scaradozzi at Università Politecnica delle Marche during the pandemic.

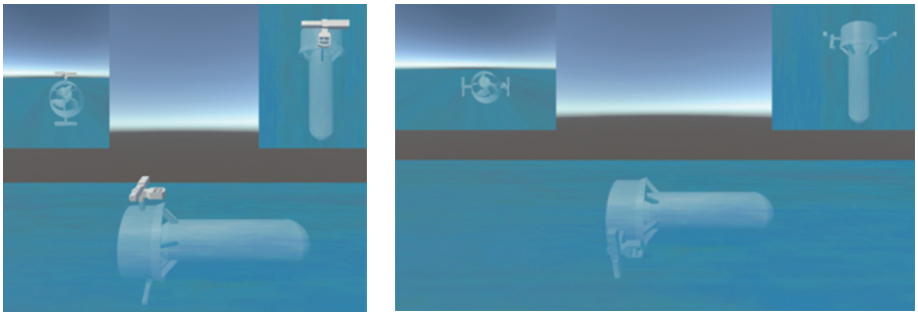


SUEX XJT DPV vs. its Digital Twin

4. Let's look into the future

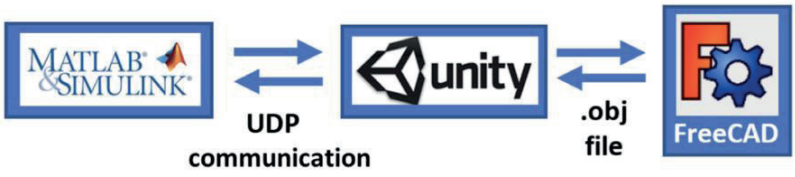
The aim of this group was to create the digital twin of an underwater scooter, whose acronym is DPV, that means Diver Propulsion Vehicle. The DPV in detail is the SUEX XJT.

In the following two figures, two screenshots are presented, showing the initial position of the DPV and the position it reaches in the water, when still, after a series of oscillations.



Unity app before simulation vs. Unity app showing the DPV rotation when at rest

For the execution of the project, various software was used that must interact with each other by exchanging information in real time. Below is a diagram to illustrate how the different software is connected to better understand the use of the technologies used for the development of the Digital Twin.



In this chain **MATLAB/Simulink** was used for the implementation of the physical and mathematical model, and then for the user interface (not shown in this e-book). They are interconnected with **Unity3d graphic solver** through the **UDP connection**. The 3D CAD of the DPV device is exported from FreeCad and imported into Unity for a graphic display.

For further information you can also consult the paper by Bartolucci, Ciuccoli, Prendi, Screpanti and Scaradozzi (2022).

Try these tools

Matlab & Simulink Remember to ask whether your institution already has a university or corporate license – if so, you may get it for free.
CATIA

FreeCAD

Unity

Assessment methods

As in project-based learning, also in this case the assessment of the work mainly depends on the successful completion of all the tasks related to the assigned project.

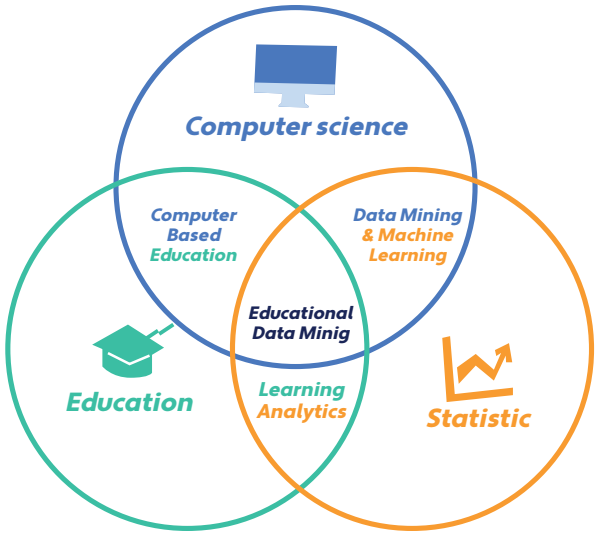
In general, the assessment can be based on the timeliness of activities, operativity of the results, innovation, and effectiveness of the final presentation. Also, the correct use of the indexes of achievement (KPIs, TCs, TPs) has to be considered.

Future assessments: the digital twin of the class

David Scaradozzi, Laura Screpanti, Benedetta Castagna, Veronica Bartolucci, Mattia Francavilla, Nicolò Ciuccoli

Why is it worth the effort?

Educational Data Mining (EDM) and Learning Analytics (LA) are emerging disciplines that exploit the wide availability of educational data within the online learning environment. Recommender systems, Intelligent Tutoring Systems and serious games build upon these disciplines to provide users of e-Learning systems with personalised learning and feedback.



Online laboratories involving tangible instruments in a remote room still cannot exploit such revolution and the subsequent potential benefits. Anyway, integrating physical environments (e.g. laboratory materials) with virtual ones (e.g. virtual materials) is worthwhile to discover how students learn during a hands-on session carried out within a remote laboratory experience and to provide personalised feedback. In this regard, an interesting work is presented in the article by Scaradozzi, Cesaretti, Screpanti and Mangina (2021).

What are the challenges?

- connecting the physical world and the virtual world is not an easy task. In most cases a dedicated digital infrastructure should support the tasks of data collection, data analysis, and data visualization. Such a system is not yet commercially available and the associated costs could be not irrelevant;
- the barriers to the creation of a system that highlights the learning pattern of a student also include the lack of available educational resources and indicators to represent the learning gain of students. This feature hinders the application of personalised learning tools to the application of online learning environments supporting remote laboratories.

What are the solutions?

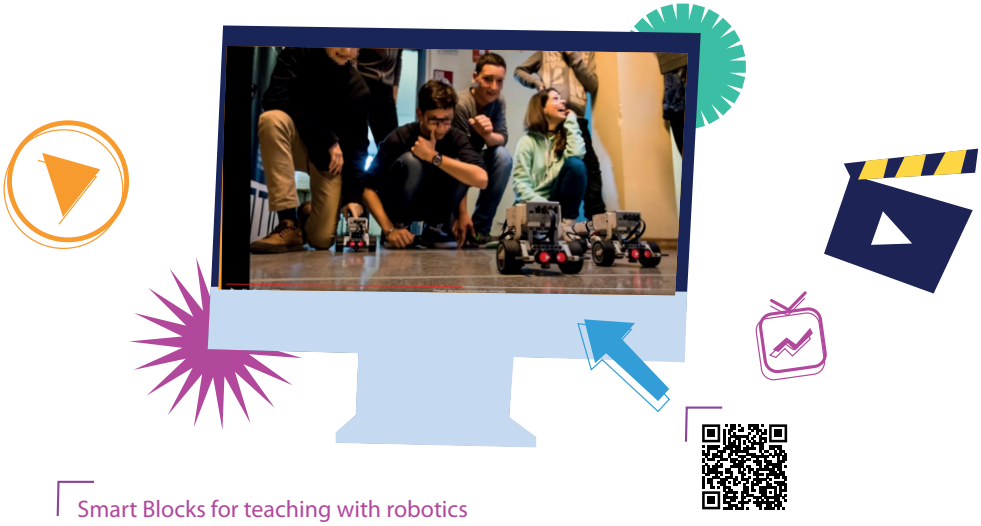
Available prototypes of such a system are presented in the paper by Screpanti, Scaradozzi, Gulesin and Ciuccoli entitled 'Control Engineering and Robotics since Primary School: an Infrastructure for creating the Digital Twin model of the Learning Class'.

The proposed system aims at supporting teachers when providing feedback to students during an educational robotics activity. This process represents a Cyber-Physical Human System (CPHS), where the physical robots designed by students, humans (teachers and learners), and cybertechnologies are interconnected to accomplish a goal which is learning. The entire infrastructure could be seamlessly deployed into the learning environment, supporting the feedback process starting from the deployment of a (quasi) real-time intelligent collection system.

Teaching scenarios

During an Educational Robotics activity students assemble and program a robot so that it can accomplish a given task. An interesting work is presented in the paper by Scaradozzi Cesaretti, Screpanti and Mangina entitled 'Identification of the Students Learning Process During Education Robotics Activities' (2020).

Thanks to the approach proposed in this document, the toolkit could extend its capabilities to perform an evaluation of students' learning.

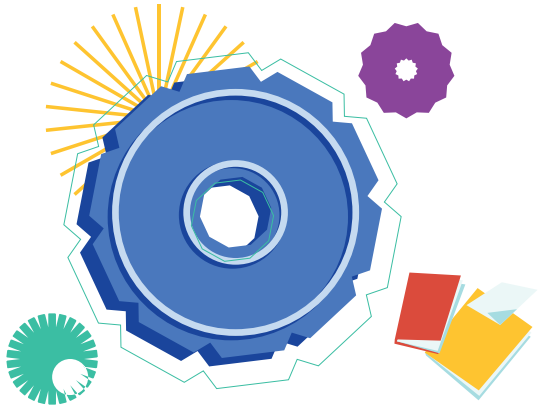


Smart Blocks for teaching with robotics
[Source: Netval, www.youtube.com/@netval5648]

A scenario involves the self-paced learning of a learner in an online learning environment during a tech activity about robotics. Assembling the dedicated hardware and software, the learner progresses toward the achievement thanks to the suggestion that the automated feedback system can provide.

Another scenario could involve the remote monitoring of a student (or a team of students) during a robotics' laboratory. The remote tutor can provide support to each student in the lab thanks to a learning dashboard that shows relevant indicators for each learner and provide the 'learner's status' that warns the tutor about students at risk of failure.

Please note that the infrastructure must store data in a remote data-base, process it using ML algorithms, and then use the collected information to tune a model of the learner and send the forecast of results back to the teachers' dashboard. Thus, teachers can have a model of the students in the classroom while learning and the resulting **Digital Twin** can support teachers' decision about the adequate feedback to give to students or assist teachers while scoring assignments.



An important final observation is that when students interact with the mechatronic elements, they do not notice or care about the evaluation process, and in this way their typical anxiety connected with the assessme0nt is reduced, leading them to give their best without pressure.

Assessment methods

When assessing a robotics laboratory in a structured learning environment like an e-learning platform some of the classical evaluation methods involve either the administration of a final test, or the teacher's evaluation of a presentation written by students, or simply the evaluation of the achievement of the given task. However, traditional assessment can be complemented by future assessments relying on EDM and LA techniques or even automated thanks to their modeling and profiling activity.

Artificial intelligence in education

Alina Guzik, Karol Flisikowski

MOST WIEDZY

'It will either be the best thing that has happened to us or it will be the worst. If we're not careful, it could be the last thing for us' – famed astrophysicist Stephen Hawking once said of artificial intelligence. Why does its development give people goosebumps, trembling hands and accelerated heartbeats? We are quietly afraid of a robot revolt and that they will take over the world and turn us into slaves. We also fear that they will take away our jobs and that the world of emotions will be irrevocably forgotten. It sounds like the script for a good horror film, doesn't it?

Special task assistant

Anything can happen, nothing is a foregone conclusion. However, let's now look at the future through rose-tinted glasses and discuss how AI can help teachers in their work.

Natural language processing

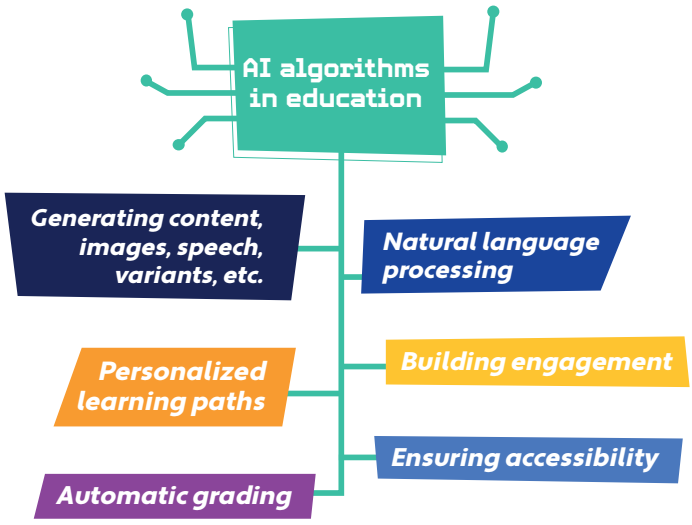
AI-powered natural language processing tools that allow conversations to be conducted with a chatbot are becoming increasingly popular. They help answer questions and construct solutions to complex tasks, such as composing essays and code. AI can also support teaching in the classroom. For example, the deployment of virtual assistants using advanced natural language processing (NLIP) techniques to converse with students is becoming increasingly popular. Chatbots**,** for example, answer introductory questions related to a topic in preparation for an in-depth conversation with a live teacher.

Image recognition

Applications based on image and character recognition are sometimes used in classes (e.g. applications that identify mathematical equations from notebook images, scan text and create automatically generated infographics). 'Our students from courses such as Computer Science, Data Engineering and the postgraduate course Artificial Intelligence and Business Process Automation in Technical Perspective are already working with large data sets, building their own AI engineering solutions using machine learning, deep learning and image recognition algorithms' – says Prof. Karol Flisikowski from the Department of Statistics and Econometrics at the Faculty of Management and Economics, Gdańsk University of Technology.

Document processing

AI-enabled document processing has been in use for several years now and has successfully automated the entire information processing cycle. Nowadays, language recognition and analysis models are entering a higher and higher level. Intelligent tools have already been developed at many universities to answer student queries related to courses, examinations, the organisation of deaneries, recruitment processes or administrative systems.



Generating new options

An interesting application of chatbots is also the creation of contrasting examples to present students with different solutions to a given problem (e.g. with different initial assumptions). The mathematics teacher can thus offer to generate multiple ways of correct solution. It is also possible to generate, for example, different writing styles for the same text.

Personalisation of the learning process

Every student has different strengths and weaknesses and also progresses at their own individual pace. AI-based software can learn fromexamples and diagrams and provide personalised learning paths, e.g. in the form of tasks with the right level of difficulty, given at the right time and in the best context. AI is also an opportunity for the development of e-learning courses. In the case of MOOCs (massive open online courses), developers employed by well-known companies such as Coursera, Udemy or EDx have long been introducing intelligent systems for user selection of content, code interpreters, knowledge testing programmes and automatic feedback. On platforms such as Moodle (on which GUT's and many other universities' across the world e-learning systems are based), these types of solutions are still being planned, but we can already use external solutions and 'plug' them into our e-courses today with a little effort.

Generating engagement

Artificial intelligence can also enrich our classes by improving their quality by engaging students. An example of this is the use of intelligently created virtual reality along with different scenarios of the course of events (medical procedures, engineering ap-

plications, etc.). These types of resources enhance textbook material and help to conduct classes that are interesting and full of practical examples. AI is also being used to build gamified learning environments, identifying student interests and offering an extra shot of endorphins through a well-tailored challenge and reward system.

Supporting people with disabilities

AI also increases the accessibility of our classes for students with hearing or visual impairments, or those who do not speak the language of the lecture well. Tools such as audio transcriptions have recently become available on, for example, the MS Teams platform. The technology can also be used by students to take notes (speech-to-text conversion, OCR – handwriting recognition), or to take written exams.

Improving evaluation

AI algorithms can be used in the process of automatically testing student's' knowledge. Such assessments require a combination of image recognition, text and deep learning-based models (contextual text analysis, NLP language models) to capture test information, understand it and give an appropriate grade. More recently, the GUT's e-learning platform has introduced offline test functionality, whereby a teacher can construct a test based on their database of questions, administer it in the classroom and then scan the students' answers. Then, the system will recognise, analyse and grade the test itself and enter it into the e-course gradebook. Such evaluation methods can save lecturers time and reduce errors. AI can also understand answers in the case of open-ended questions such as essays and grade them. Admittedly, this type of functionality is only in the development phase, but mass deployment is already being announced on several MOOC platforms. The same solutions are currently being used to detect plagiarism and, through the development of text analysis techniques, they are becoming increasingly powerful.

Teaching support

AI can detect a high number of wrong answers and suggest questions to teachers that, for example, mislead students. It can also suggest what type of content is most effective and correct the teaching strategy based on the data and its own predictions.

Tools worth considering

- Response generation: ChatGPT (the world's most famous AI chatbot), Ivy (chatbot for higher education, handles millions of student queries)
- Image generation: DALLE2 (advanced AI algorithm), NighCafe Presentation generation: Curipod (query-based lesson creation)
- SlidesAI
- Text-based quiz generator: Yippity

4. Let's look into the future

- Text generation: Smodin, Eskritor
- Note and transcription generation: Otter (real-time transcription of group conversation), Cloud Speech-to-Text
- Video lecture generator: Synthesia (creates virtual actors)
- 3D model generator: Sloyd
- Intelligent translation and editing: DeepL, Grammarly

Summary

Let's take off our rose-tinted glasses for a moment. ChatGPT has so far passed his professional exams in law, management and medicine, and successfully interviewed for and got a job at Google. Cheating has never been so easy. Modern chatbots are already very efficient at processing text and answer students' questions in less than two seconds. They can be used to solve their assignments, create handouts, articles, essays or code by copying other people's work without leaving a trace. Language models that rely on large data sets also tend to produce misinformation in a convincing way. They can return inaccuracies, including fabricated quotes, statistics and facts. It is easy to make the output sound 'smarter' or 'dumber' making plagiarism even more difficult to detect.

As of today, it is very difficult to distinguish between human-written content and AI-generated content, and the saddest part is that all those who use borrowed intelligence in excess deprive themselves of the opportunity to learn and grow. As a result, life gets easier but wisdom seems to be in short supply.

For those who are still a little worried about the threat posed by the expansion of artificial intelligence, the words of the columnist Jak Meth will come in handy, 'ChatGPT is really good at writing things that are good. At the same time, it's really bad at writing things that are great.' We, the community of Gdańsk University of Technology, explorers, inventors and creators of exceptional things, can rest easy. Yet.

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Assistant professor at the Faculty of Management and Economics of the Gdańsk University of Technology. His research interests concern entrepreneurship, entrepreneurial intentions, and the regulating role of convictions about possessed competencies in different domains. He also conducted research regarding psychological aspects of exercising power in organizations. In teaching, he is interested in developing and using case studies. He finished the training on case teaching and writing at Western University in Ontario, Canada and received a Paul R. Lawrence scholarship awarded by the North American Case Research Association.

Krzysztof Zięba

University professor, passionate about teaching others economics. Works as a professor for the Department of Entrepreneurship and Business Law at the Faculty of Management and Economics of Gdańsk University of Technology. Occasionally TV expert on economic topics. He has participated in many scientific projects, including Pomorskie Obserwatorium Gospodarcze. Successfully runs a YouTube channel and Spotify podcast series "Off My Desk".

Jarosław Ziętarski

A manager with over 12 years of experience both in the SME sector as well as international corporations. He is a PhD in economics with comprehensive expert knowledge in the field of business management.

Since 2015, a lecturer at the Faculty of Management and Economics at the Gdańsk University of Technology. He has his own educational channel on YouTube: FAT CAT Financial Education. He is the co-author of the corporate finance handbook.

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Apps and tools collection

Canva	https://www.canva.com/pl_pl/, www.youtube.com/@canva
Dropbox	https://www.dropbox.com/pl/
Genial.ly	https://genially.com/higher-education/
Google Drive	https://drive.google.com/drive/my-drive
Google Workspace (Docs, Slides and Sheets)	https://workspace.google.com/intl/pl/
Kahoot!	https://kahoot.com/
Mentimeter	https://www.mentimeter.com/
Microsoft Office (OneDrive, SharePoint)	https://www.office.com/
Miro	https://miro.com/pl/product-overview/
Socrative	https://www.socrative.com/
Thinglink	https://www.thinglink.com/

Artificial intelligence in education

Asana	https://asana.com/
ChatGPT	https://openai.com/chatgpt/
Cloud Speech-to-Text	https://cloud.google.com/speech-to-text
Curipod	https://curipod.com/
DALLE2	https://openai.com/index/dall-e-2/
DeepL	https://www.deepl.com/pl/translator
Eskritor	https://eskritor.com/pl/
Grammarly	https://www.grammarly.com/
NighCafe Presentation	https://creator.nightcafe.studio/
Otter	https://otter.ai/
SlidesAI	https://www.slidesai.io/pl
Sloyd	https://www.sloyd.ai/
Smodin	https://smodin.io/pl
Synthesia	https://www.synthesia.io/
Yippity	https://yippity.io/

E-books and interactive books, podcasts

Audacity	https://www.audacityteam.org/
Canva	https://www.canva.com/pl_pl/, www.youtube.com/@canva
Dreamstime	https://pl.dreamstime.com/

Kotobee	https://www.kotobee.com/
Moodle	https://www.youtube.com/@moodle, https://moodle.org/
Soundsnap	https://www.soundsnap.com/
Spotify	https://open.spotify.com/
Vimeo	https://vimeo.com/

Forums

Discourse	https://www.discourse.org/
Forum in Moodle	https://docs.moodle.org/404/en/Forum_activity
MyBB	https://mybb.com/
phpBB	https://www.phpbb.pl/
WordPress	https://pl.wordpress.org/

Game based learning

Centrical	https://centrical.com/
DxR Nursing SELECT	https://dxrgroup.com/healthcare-education-products/dxr-nursing-select/
EdApp	https://training.safetyculture.com/
Gametize	https://corp.gametize.com/
Hoopla	https://www.hoopladigital.com/
Raptivity	https://www.raptivity.com/
Resimion	https://resimion.com/
VirtualPT Clinician	https://dxrgroup.com/healthcare-education-products/virtualpt-clinician/

Online assessment

ClassFlow	https://classflow.com/
Free Online Surveys	https://freeonlinesurveys.com/
iSpring	https://www.ispringsolutions.com/ispring-free, www.youtube.com/@iSpringPro
Kahoot!	https://kahoot.com/
Mentimeter	https://www.mentimeter.com/
Moodle quizzes	https://docs.moodle.org/404/en/Building_Quiz
Nearpod Silver Edition	https://nearpod.com/pricing
Poll Everywhere	https://www.polleverywhere.com/
Quizizz	https://quizizz.com/?lng=pl
Quizlet	https://quizlet.com/pl
Socrative	https://www.socrative.com/
Survey Monkey	https://www.surveymonkey.com/

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Online creative work

ChatGPT	https://openai.com/chatgpt/
Microsoft Whiteboard	https://www.microsoft.com/pl-pl/microsoft-365/microsoft-whiteboard/digital-whiteboard-app
MURAL	https://www.mural.co/, www.youtube.com/@MuralTV
The Noun Project	https://thenounproject.com/

Online mind maps, infographics and sketch notes

Canva	https://www.canva.com/pl_pl/, www.youtube.com/@canva
Coggle	https://coggle.it/
Easel.ly	https://easel.ly/
GitMind	https://gitmind.com/
Infogram	https://infogram.com/
Mindmeister	https://www.mindmeister.com/
Miro Map Maker	https://miro.com/pl/concept-map/
Piktochart	https://piktochart.com/home/?nab=1
Venngage	https://venngage.com/
Visme	www.youtube.com/@VismeApp
Wondershare EdrawMind	https://edrawmind.wondershare.com/

Online teaching in STEM and mathematics

Automation Studio	www.famictech.com/en/Products/Automation-Studio
B&R Industrial Automation GmbH	www.br-automation.com/en/academy/classroom-learning/
Code.org	https://code.org/
GeoGebra	https://www.geogebra.org/
LTSpice, EE-sim	www.analog.com/en/design-center.html
MapleSim	www.maplesoft.com
Mashup Math	https://www.mashupmath.com/
MathWorks	https://www.mathworks.com/
MatLAB	https://www.mathworks.com/products/matlab.html
MATLAB® Grader™	https://grader.mathworks.com/
Maxima	https://maxima.sourceforge.io/
Microsoft Power	https://www.microsoft.com/pl-pl/power-platform
Photomath	https://photomath.com/
Python	https://www.python.org/
RoboAnalyzer	www.roboanalyzer
RobotBenchmark	www.robotbenchmark.net
RobotDK	www.robodk.com
ROS (Robot Operating System)	https://www.ros.org/

Simulink	https://www.mathworks.com/products/simulink.html
SunSpire	www.sunspire.site
Webots	www.cyberbotics.com
WolframAlpha	https://www.wolframalpha.com/

Online team work

Google Workspace	https://workspace.google.com/intl/pl/
Miro	https://miro.com/pl/product-overview/
Slack	https://slack.com/
Trello	https://trello.com/

Peer and self-assessment

CLAS (Collaborative Learning Annotation System)	https://clas.ubc.ca/
ComPAIR	https://www.compair.com/pl-pl/
Moodle	https://www.youtube.com/@moodle, https://moodle.org/
peerScholar	https://www.peerscholar.com/

Personalisation

Alta	https://www.adaltatutoring.com/
Area9Lyceum	https://area9lyceum.com/
ASSISTment	https://new.assistments.org/
Domoscio	https://domoscio.com/en/
Knewton	https://support.knewton.com/s/
Lalilo	https://lalilo.com/
Mathia	https://www.carnegielearning.com/solutions/math/mathia/
Toppr	https://www.toppr.com/guides/
Woonoz	https://www.woonoz.com/en/

Project based learning

GitHub	https://github.com/
MatLAB	https://www.mathworks.com/products/matlab.html
Microsoft Teams	https://www.microsoft.com/pl-pl/microsoft-teams/group-chat-software
Moodle	https://www.youtube.com/@moodle, https://moodle.org/

Social media learning

Discord	https://discord.com/
Slack	https://slack.com/
Twitch	https://www.twitch.tv/

Facebook, Instagram, TikTok, YouTube

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Teacher – student relationship

Blogger	https://www.blogger.com/about/?bpli=1
Canva	www.youtube.com/@canva
Flip	https://info.flip.com/en-us.html
Google Slides	https://workspace.google.com/intl/pl/products/slides/
Learning Management System (LMS)	https://www.techtarget.com/searchcio/definition/learning-management-system
Linoit	https://en.linoit.com/
Mentimeter	https://www.mentimeter.com/
Messenger	https://www.messenger.com/
Mindmup	https://www.mindmup.com/
OneNote	https://www.onenote.com/?public=1&wdorigin=ondcauth2&wdorigin=ondc
Padlet	https://padlet.com/
Panopto	https://www.panopto.com/
Quizlet	https://quizlet.com/pl
Socrative	https://www.socrative.com/
Symbaloo	https://www.symbaloo.com/home/mix/13ePBdQhSP
WhatsApp	https://www.whatsapp.com/?lang=pl_PL

Video & graphics editing tools

Adobe Photoshop	https://www.adobe.com/pl/products/photoshop.html
Adobe Premiere Pro	https://www.adobe.com/pl/products/premiere.html
Audacity	https://www.audacityteam.org/
Canva	www.youtube.com/@canva
Davinci Resolve	https://www.blackmagicdesign.com/pl/products/davinciresolve
GIMP	https://www.gimp.org/
Kaltura	https://corp.kaltura.com/
Movavi	https://www.movavi.com/
Pixlr	https://pixlr.com/pl/

Video lectures, e-quizzes, presentations

Adobe Connect	https://www.adobe.com/products/adobeconnect.html
Adobe for Education	www.youtube.com/@AdobeForEducation
Apowersoft	https://www.apowersoft.com/free-online-screen-recorder
Blackboard	https://www.blackboard.com/
Free Online Surveys	https://freeonlinesurveys.com/
Genial.ly	https://genially.com/higher-education/
Google Classroom	https://classroom.google.com/
Google Forms	https://www.google.pl/intl/pl/forms/about/

Google Slides	https://workspace.google.com/intl/pl/products/slides/
Hot Potatoes	https://hotpot.uvic.ca/
iSpring	https://www.ispringsolutions.com/ispring-free, www.youtube.com/@iSpringPro
Jotform	https://www.jotform.com/pl/
Loom	https://www.loom.com/
Microsoft Whiteboard	https://www.microsoft.com/pl-pl/microsoft-365/microsoft-whiteboard/digital-whiteboard-app
Microsoft PowerPoint	https://www.microsoft.com/pl-pl/microsoft-365/powerpoint
Prezi	https://prezi.com/
Screencast-O-Matic	https://screenpal.com/
Testportal	https://www.testportal.net/
Verbal to Visual	https://verbaltovisual.com/, www.youtube.com/@verbaltovisual
Vsauce	https://www.vsauce.com/#/, https://www.youtube.com/VSAUCE
Zoom	https://zoom.us/pl

Webinars

ClickMeeting (not free)	https://knowledge.clickmeeting.com/knowledge-base/first-steps/free-trial/
GoToWebinar (not free)	https://support.goto.com/webinar/help/how-much-does-goto-webinar-cost
Livestorm	https://livestorm.co/
Microsoft Teams	https://www.microsoft.com/pl-pl/microsoft-teams/group-chat-software
Panopto	https://www.panopto.com/
Webinar Geek	https://www.webinargeek.com/
Zoom	https://zoom.us/pl

XR technologies, cyber-physical laboratories

3spin Learning	https://www.3spin-learning.com/en/
Avantis World	https://www.avantisworld.com/
CATIA	https://www.3ds.com/products/catia
CoSpaces Edu	https://www.cospaces.io/
FreeCAD	https://www.freecad.org/
LabVIEW	https://www.ni.com/en/shop/labview.html
MatLAB	https://www.mathworks.com/products/matlab.html
MicroPython	https://micropython.org/
Micro-ROS	https://micro.ros.org/
PIXO VR	https://pixovr.com/
Rhinoceros	https://www.rhino3d.com/

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ROS (Robot Operating System)	https://www.ros.org/
Simulink	https://www.mathworks.com/products/simulink.html
Unity Real-Time Development Platform	https://unity.com/
Virtual Reality Training Solutions (VRTS)	https://vrts.ca/

Other useful websites, channels and tools

British Council	https://www.britishcouncil.org/, www.youtube.com/@britishcouncil
MIT OpenCourseWare	www.youtube.com/@mitocw
TEDx Talks	www.youtube.com/@TEDx
U of G Library	www.youtube.com/@UoGLibrary
ClassPoint	www.youtube.com/@ClassPoint
Dr. Jacob Goodin	www.youtube.com/@DrJacobGoodin
Helix Education	www.youtube.com/@helixeducation1653
Instructional Media Design	www.youtube.com/@MediaLearningDesign
Interact	www.youtube.com/@tryinteract
Jason Whaling	www.youtube.com/@JasonAWhaling
John Spencer	www.youtube.com/@spencereducation
Kevin Stratvert	www.youtube.com/@KevinStratvert
LSU online	www.youtube.com/@LSUOnline
Ma. Israelle S. Lopez	www.youtube.com/@MaIsraelleSLopez
McGraw Hill PreK-12	www.youtube.com/@McGrawHillEducationSchool
MIND Education	www.youtube.com/@MIND_Education
Mr. Cook's Corner	www.youtube.com/@MrCooksCorner
Netval	www.youtube.com/@netval5648
Pod Sound School	www.youtube.com/@podsoundschool
Project Based Learning Works	www.youtube.com/@BIEPBL
Slido	www.youtube.com/@Slido
Sprouts	www.youtube.com/@sprouts
Teach Smart With Fay	www.youtube.com/@TeachSmartWithFay

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