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HI-TEACH:
A NEW TRAINER TEACHING FRAMEWORK IN THE POST-COVID ERA

ERASMUS+ KEY ACTION 2 - STRATEGIC PARTNERSHIP IN THE FIELD OF HIGHER EDUCATION
CODE N. 2020-1-IT02-KA226-HE-095528

HI-HANDBOOK:
METHODOLOGICAL COMPENDIUM FOR SMART E-LEARNING

INTRODUCTION TO HI-TEACH HANDBOOK

The Hi-Teach handbook is the **methodological compendium** to all learning units and contents of the Hi-Teach project - a new trainer framework to support high education teachers in strengthening their digital skills and teaching approach in the post-covid era. Within the project, the Hi-Teach platform provides the most up-to-date methodologies and tools on smart e-learning and e-teaching - including video pills, teaching and learning methods and strategies, as well as further information materials – while the Hi-teach handbook, serves as theoretical and practical compendium and is organized in four thematic chapters. Each chapter is organized into three parts: definition and theory on the main topic, application and case studies on the most important methodologies, list of useful tools and further information materials

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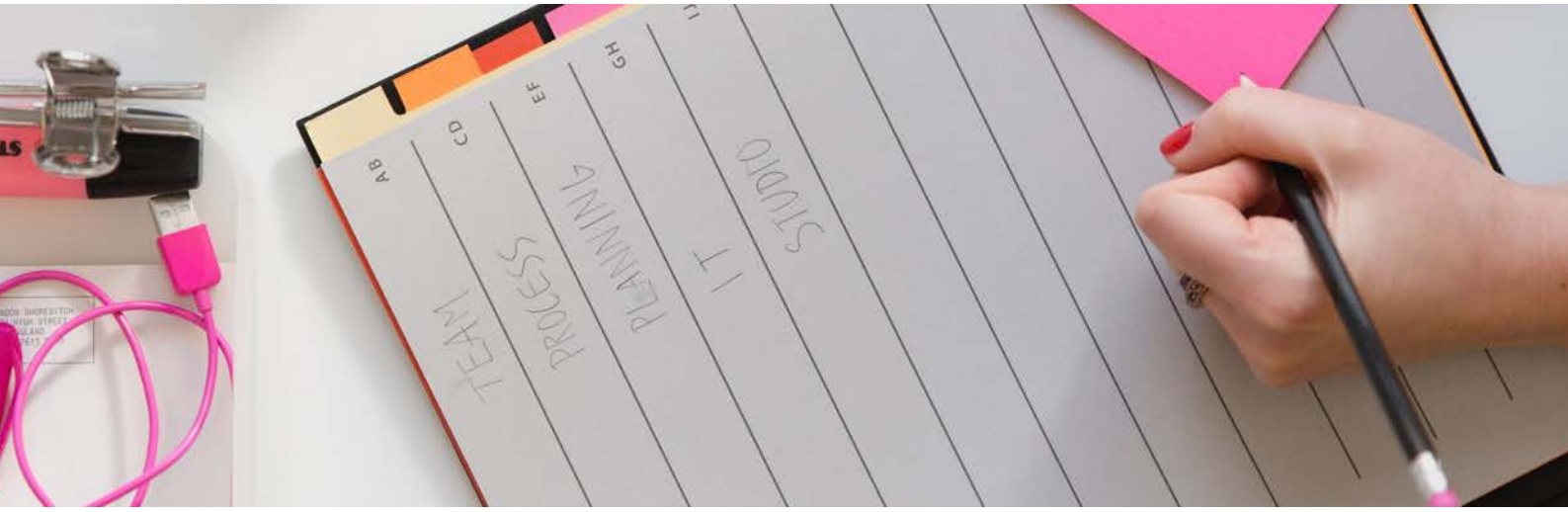
THE CHAPTERS



Chapter 1 is about instructional design: In this chapter you will learn about: ‘what is the instructional design’; ‘what are the most common models of instructional design’; ‘how to plan, develop, evaluate, and manage the instructional process of learning’; ‘how to create experiences that facilitate learning in an efficient, effective, and engaging way’; ‘the main tools to support instructional design".

GO TO CHAPTER 1

Chapter 2 is about game-based learning: In this chapter you will learn about: ‘what are the concepts of edutainment, game-based learning and gamification’; ‘what are the main theories connected to game-based learning and gamification’; ‘the game mechanics’; ‘the main models for designing games; tools and practical examples of gamification’.

GO TO CHAPTER 2

THE CHAPTERS

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Chapter 3 is about movie education. In this chapter you will learn about: 'what is movie education'; 'how to run short movie laboratories'; 'how audio-visual production works'; 'how to enable students gain hard skills (a deeper understanding and knowledge of contents)'; 'how to enable students gain both hard skills and soft skills; tools and practical examples of movie education'.

GO TO CHAPTER 3

Chapter 4 is about the new frontiers of education. In this chapter you will learn about: 'what are immersive technologies applied to education'; 'what is Virtual Reality (VR)'; 'what is Augmented Reality (AR)'; 'how to use VR, AR and digital learning material in new and innovative ways'.

GO TO CHAPTER 4

We wish you a fruitful reading and use of the Hi-teach handbook.

KEYWORDS

Instructional design, models of instruction design, learning design considerations, learning designers' competences, tools for instructional design.

In this chapter you will learn about:
What is the Instructional Design

- What are the most common models of Instructional Design
- How to plan, develop, evaluate, and manage the instructional process of learning;
- How to create experiences that facilitate learning in an efficient, effective, and engaging way.
- Tools to support Instructional Design

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ABSTRACT

Instructional design can be defined as a systematic approach to effectively **plan, develop, evaluate**, and manage the instructional process based on knowledge and experience of learning and teaching theories to improve the quality of instruction and ensure the effectiveness and persistence of learning. It also includes **information technology, human-computer interaction, human performance techniques and systems analysis** methods and it can be applied to both physical and virtual education, including online courses. The goal of instructional design is to help educators create experiences that facilitate learning in an **efficient, effective, and engaging way**.

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ABSTRACT

Instructional designers have skills and knowledge in different disciplines and are responsible for executing and coordinating planned tasks using learning and teaching principles to develop an instructional design. Teachers at any level of education serve as instructional designers for their learning activities, lessons, modules, courses based on principles of instructional/learning design. Educational scientists and psychologists have developed several instructional design models since 1950 (**Bloom's Taxonomy, Gagné's 9 Events of Instruction, ADDIE, Successive Approximation Model (SAM), Merrill's First Principles of Instruction, Action Mapping, Dick and Carey Model, Kemp Design Model, AGILE and Rapid Prototyping, 70-20-10 Model**). For instructional designers in higher education the careful alignment among the **learning objectives**, **instructional content**, and **assessments** in any course design and delivery method is of great importance. The instructional design models help them ensure this alignment in the creation of the instructional resources based on learning design considerations for an enhanced student learning experience.

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ABSTRACT

Several tools have been developed to assist teachers in planning **learning outcomes, activities, assessment, and other aspects of learning**. Instructional/Learning design authoring tools have the goal to facilitate the **sharing, adaptation, and reuse of teachers' pedagogical ideas**, and they are also useful as tools for **reflection** on practice. Different tools may employ different representations and operate at different levels of degree of detail.

Academics should be more open in how they produce and share knowledge, in how they teach and assess students. Higher education institutions should shift their practices towards **open educational practices**. Learning research at all levels can support and guide educational policy and practice. A list of useful links can be found in this chapter of the handbook and can support and guide teachers through instructional design studies, tools and practices.

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1. WHAT IS INSTRUCTIONAL DESIGN?

Nowadays, in all levels of education and in higher education as well, the focus of curriculum design has shifted from instruction to productive learning (Debattista, 2018). At the same time, the availability of interactive technologies allows education at all levels to move from textbooks to more experiential learning models (Hussin, Bunyarit & Hussein, 2009)while ubiquitous learning tools enable new learning experiences, providing seamless usability at any time and place. They also facilitate easy interaction between independent resources and digital learning resources, while providing personalized learning (Aljawarneh, 2020). Effective planning is a prerequisite for effective teaching and learning as it is a systematic process for designing materials by any teacher who is able to apply effectively in practice principles of teaching and learning (Gagne, Wager, Golas & Keller, 2005).

The term instructional design can be defined as a **systematic approach to effectively plan, develop, evaluate, and manage the instructional process based on knowledge and experience of learning and teaching theories to improve the quality of instruction and ensure the effectiveness and persistence of learning**. Nowadays, it goes further and includes information technology, human-computer interaction, human performance techniques and systems analysis methods (Baturay, 2008). It can be applied to both physical and virtual education, including online courses. The goal of instructional design is **to help educators create experiences that facilitate learning in an efficient, effective, and engaging way**.

1. WHAT IS INSTRUCTIONAL DESIGN?

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Instructional designers are considered individuals with multiple skills and knowledge in different disciplines who are responsible for executing and coordinating planned tasks. Instructional designers and instructional developers use learning and teaching principles to develop their instructional design (Chen, (2014). Teachers at any level of education serve as instructional designers for their learning activities, lessons, modules, courses. According to Mayer (2005), instructional designers should answer three basic questions:

1. Where are we going? (what is the goal of the course, module, lesson, learning activity?)
2. How do we get there? (what are the teaching strategies and instructional resources?)
3. How do we know when we get there? (What should our test include? How do we evaluate and revise our teaching materials?)

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1. WHAT IS INSTRUCTIONAL DESIGN?

According to Bound & Chia (2020) there are six (6) principles of instructional/learning design:

1. AUTHENTICITY: Use of real-world work practices and settings. Embodies complexity of work and enables engagement.
2. ALIGNMENT: Design that involves every aspect of learning so that all work together.
3. HOLISTIC: Integrates knowing, doing, thinking, and feeling. Integrates theory and practice, technical and generic, learning to learn. Appeals to multiple senses.
4. FEEDBACK: *Involves*

- giving and receiving feedback from multiple sources
- opportunities for learners to act on their feedback

5. JUDGEMENT:

- Enables learners to make judgments about their own and others' performance
- Involves making and evaluation ethical judgements

6. FUTURE-ORIENTATION: *Involves*

- Learning to learn
- Deep understanding
- Consideration of multiple perspectives
- Inquiry

2. MODELS OF INSTRUCTIONAL DESIGN

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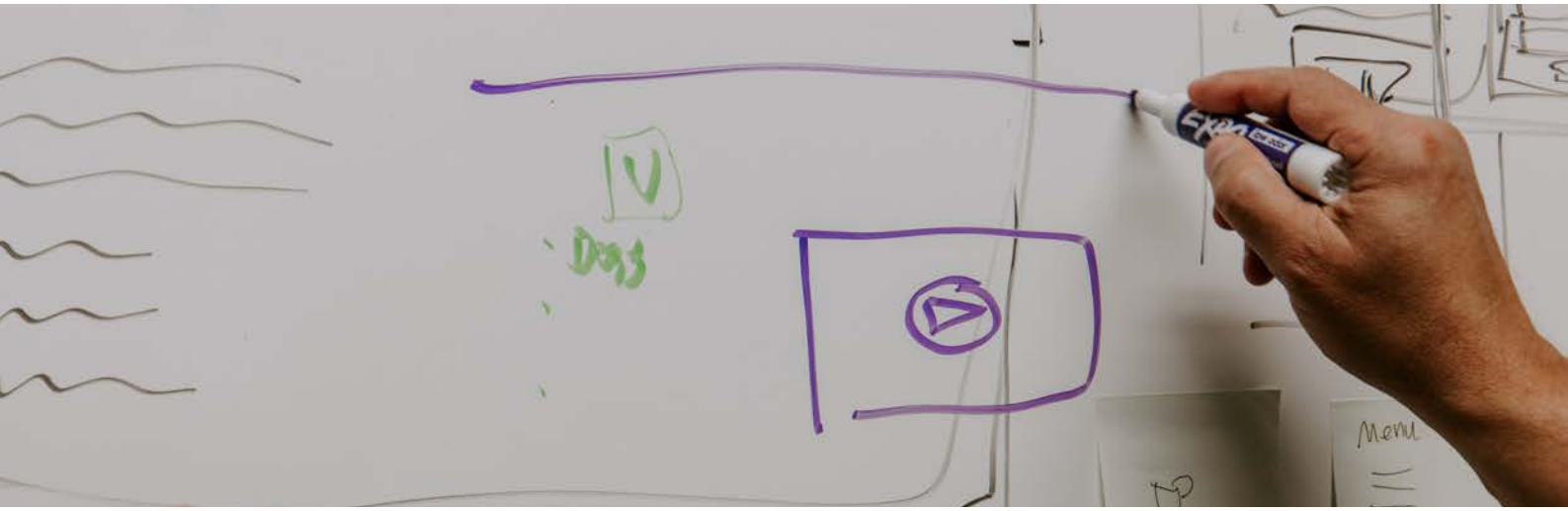

Educational scientists and psychologists have developed several **instructional design models** since 1950. Each model includes a set of guidelines that organize creating educational experiences into a streamlined and scalable process based on best practices arose by research. The 10 most popular models are:

1. *Bloom's Taxonomy*
2. *Gagné's 9 Events of Instruction*
3. *ADDIE*
4. *Successive Approximation Model (SAM)*
5. *Merrill's First Principles of Instruction*
6. *Action Mapping*
7. *Dick and Carey Model*
8. *Kemp Design Model*
9. *AGILE and Rapid Prototyping*
10. *70-20-10 Model*

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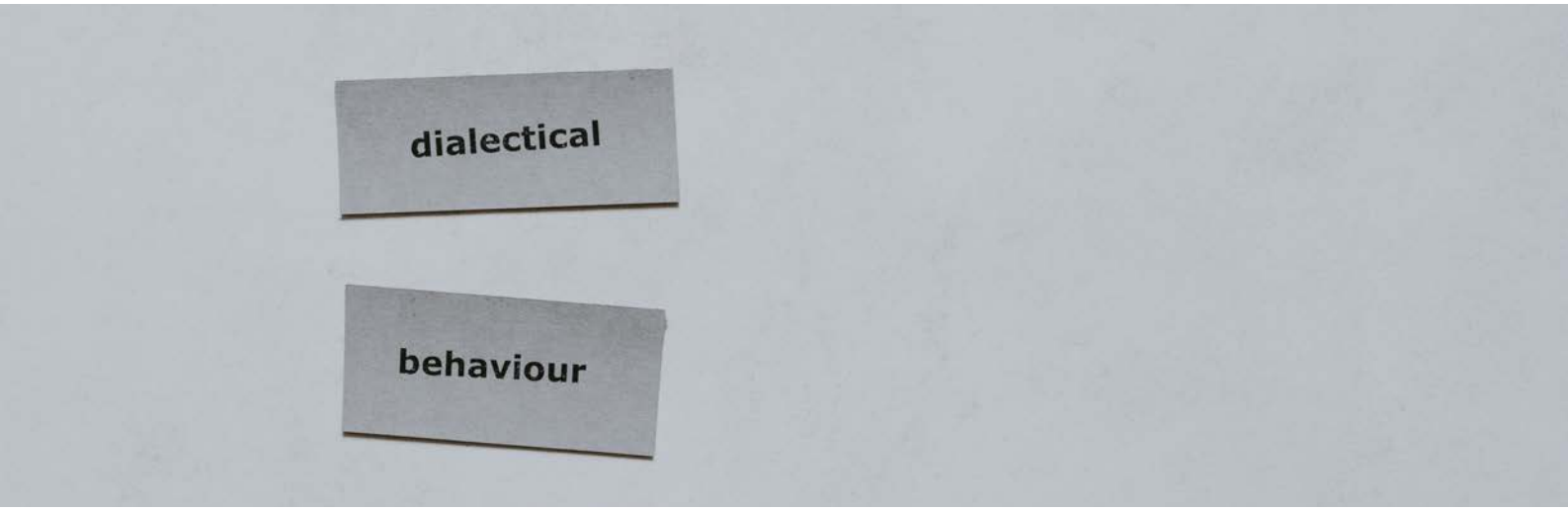
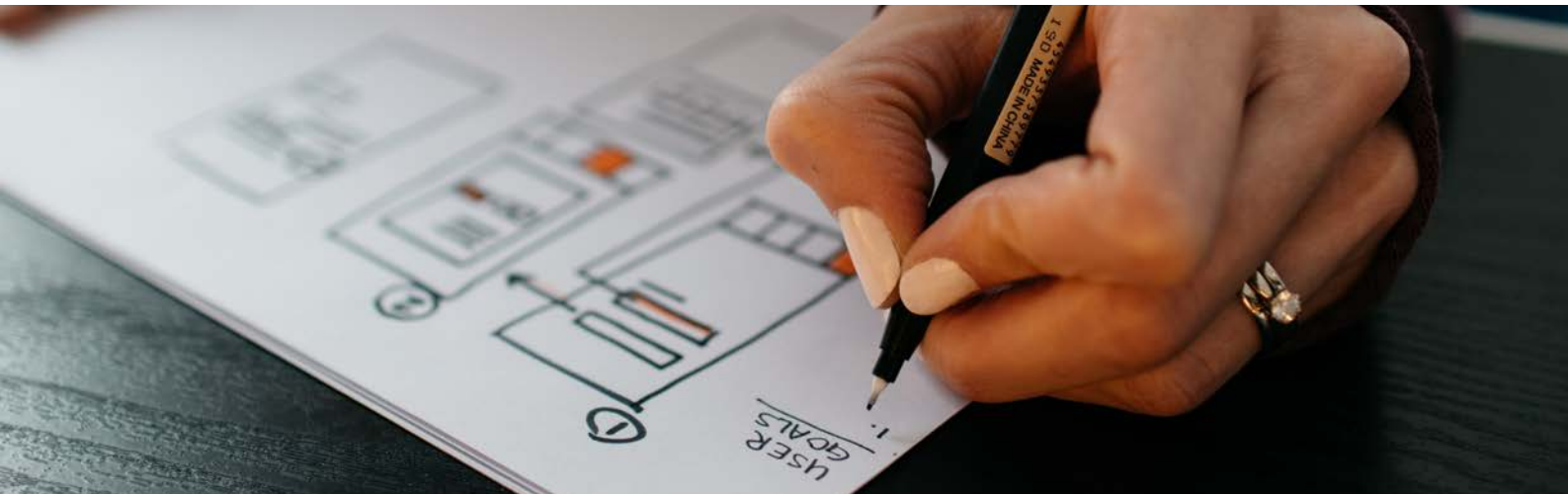
2.1 BLOOM'S TAXONOMY



Bloom's Taxonomy (Anderson & Krathwohl, D. R. (2001), revised in 2001 by Anderson and Krathwohl (Krathwohl, 2002)., defines six levels of cognitive learning (cognitive domain) starting with the simplest and moving up through the levels to the deepest learning. As an instructional design framework, Bloom's Taxonomy supportslearners not only to remember and understand new information, but to be able to apply it, analyze it, evaluate its impact, and to solve problems by creating solutions that would not have been possible without the new knowledge. The six levels of cognitive learning are: **creating, evaluating, analyzing, applying, understanding, remembering**.



2.2 GAGNÉ'S 9 EVENTS OF INSTRUCTION

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Robert Gagne's Nine Events of Instruction (Gagné,1985; Gagné, Wager, Golas, & Keller, 2005) are based on the behaviorist approach to learning. Gagne identified the mental conditions for learning in adults and created Nine Events of Instruction to confront the conditions of learning. The Nine Events of Instruction are:

1. **Gain the student's attention**. Emotional stimulus is the first step in laying the foundation for learning retention. This can be done by telling a story or asking a thought-provoking question.
2. **Inform students of the objectives**. Establishes expectations for the course and criteria for measuring success or failure.
3. **Stimulate recall of prior learning**. Leverages existing knowledge as a scaffold to incorporate new knowledge.
4. **Present the content**. Use strategies to present the content of the lesson content to provide more effective instruction. Organize and group content in meaningful ways, and provide explanations.
5. **Provide learner guidance**. Supplement the content with case studies, activities, discussion questions and other instructional support materials.
6. **Elicit performance**. Challenge learner's activities that recall, utilize, and evaluate knowledge.
7. **Provide feedback.** Use immediate feedback to reinforce knowledge.
8. **Assess performance**. Test learner knowledge against established criteria.
9. **Enhance retention and transfer**. Help learners retain new knowledge by providing them opportunities to connect concepts to real-world applications.

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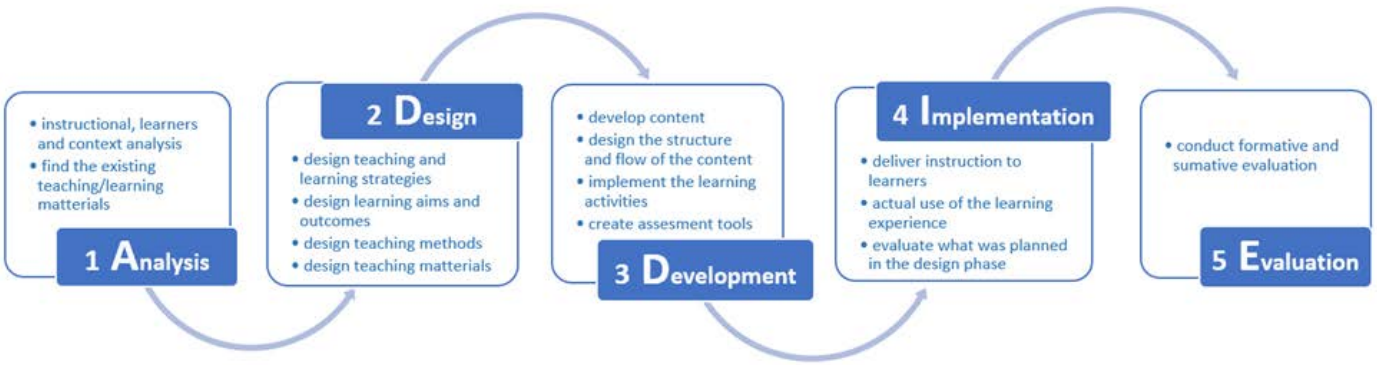
2.3 ADDIE MODEL

Although different design models are available, they all include the following key stages of learning and teaching design: **Analysis, Design, Development, Implementation, and Evaluation** - ADDIE model (Picture 1). The main task of the HEI teacher is therefore to:

- Identify learning outcomes.
- Design teaching strategies based on the learning outcomes.
- Evaluate student progress in terms of the achievement of learning outcomes.

However, higher education activities in planning educational experiences or designing educational research should be guided and supported by the science of learning and instruction (Khalil & Elkhider, 2016).



Picture 1. ADDIE model phases and the steps during each phase (source: Khalil & Elkhider, 2016)

2.3 ADDIE MODEL

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Analysis. In the first phase teachers need to carry out instructional and learner analysis to identify subordinate skills, entry behaviors, entry knowledge and experiences and characteristics of the target learners. Analysis will help teachers determine the aims, it presents an important factor in choosing the instructional strategies later on, enabling teachers to properly address a variety of concepts. It is also important to consider the fact that students are already adults, so the principles of adult learning theory, which describe many parameters of adult learners that inform the design of instruction for successful learning outcomes should be taken into consideration.

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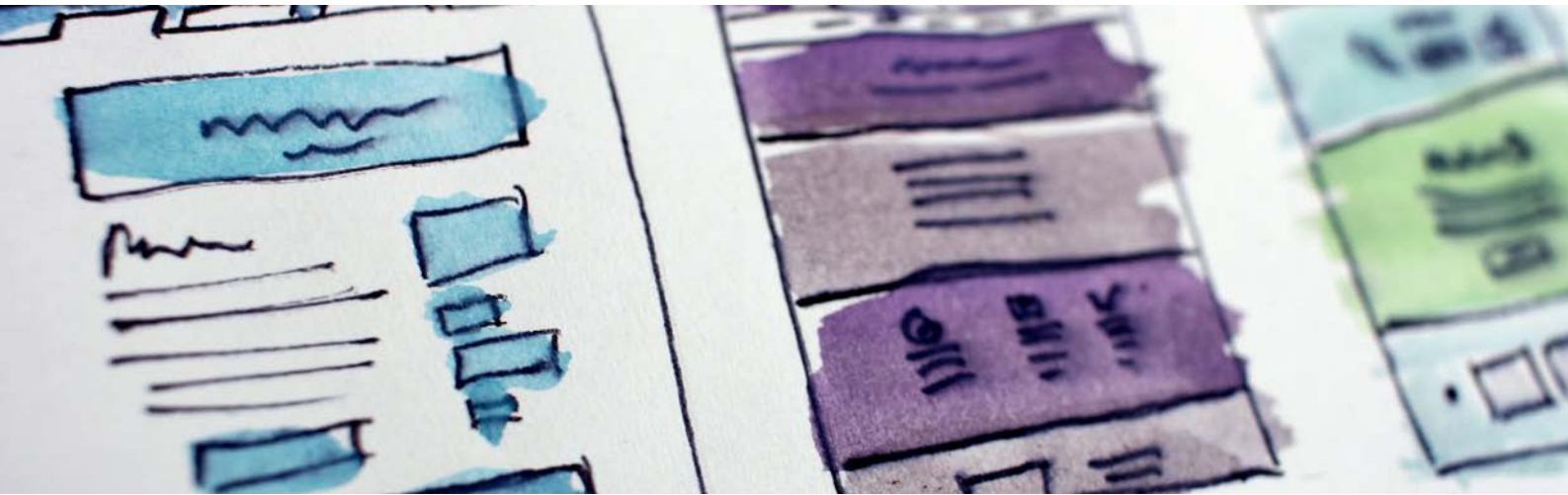
2.3 ADDIE MODEL

Design phase. When teachers start to think as instructional designers, they will be able to deal with learning as an interactive process. A crucial part of the learning process is creating specific and detailed learning aims and learning outcomes so that teachers can determine how they will design and implement the process of learning as well as how they will evaluate and assess the instruction and the learners' success. The design phase should be systematic and specific. *Learning outcomes* are the set of information, knowledge, understanding, skills, competencies, behaviors, values, attitudes a learner has acquired after the completion of a learning process. *Bloom's Taxonomy* can be used for identifying learning outcomes using measurable verbs (e.g. '*define*', '*explain*', '*list*'") and avoiding non-behavioral verbs (e.g. '*understand*', '*know*', '*grasp*'). There is a dynamic relation between Learning activities, learning outcomes and assessment.

Development phase. In this phase, it is important to create and develop content that is targeted to the students and desired level of learning. In the development phase, teachers design the structure and flow of the content as well as the type of media that will be used to deliver the content and implement the learning activities. Teachers can modify existing resource materials to align with the objectives of the learning activities or can develop new materials. In this phase, it is important to refer to the principles of multimedia design and cognitive load theory guidelines to create one's own instructional materials.



2.3 ADDIE MODEL

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Implementation phase. The implementation phase represents the actual use of the learning experience. Teachers verify that learners have acquired the proper prerequisites and received orientation and training on the hardware and software to be used during the delivery of instruction and that they have access to all supporting materials. Teachers also need to check the learning environment, equipment, and technology. This phase provides an opportunity to evaluate what was planned during the design phase and to make sure everything performs as predicted.

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2.3 ADDIE MODEL

Evaluation phase. Evaluation can take place at any stage of the instructional design process. *Formative evaluation* is conducted during the design and development phases to improve instruction and learning materials and to make sure they are aligned with the learning goal and objectives. Teachers can try out newly developed instructional materials with a small group of students and record their performance and feedback. Student feedback on the clarity, accuracy, sequence, and difficulty level will be corrected before the actual delivery of instruction to the entire class. A l*arge-scale formative evaluation* is usually conducted by the office of assessment and evaluation, which collects data on students' performance and perceptions toward specific courses or modules. *Summative evaluation* is conducted at the end of the instruction to ensure that learners achieved the learning outcomes and that the course achieved its objectives. It is important when assessing students' performance to clearly understand the difference between formative assessment, which is *assessment for learning* and summative assessment, which is *assessment of learning*.

2.3 ADDIE MODEL

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A good practice example.

Checklist for designing a flipped classroom model using ADDIE MODEL.

Analysis

- Course content is appropriate for the flipped model.
- Students understand the new model logistics (grades, participation, assessment, and technology).
- The learning environment is conducive to the flipped model.
- Course aims and learning outcomes are clearly defined.

Design

- Pedagogy-based teaching methods are selected to interactively engage learners.
- Content for out-of-class learning is selected based on the learning aims and learning outcomes.
- Assessment tools are selected to measure both in-class and out-of-class learning.
- Lectures are highly structured and planned.

Development

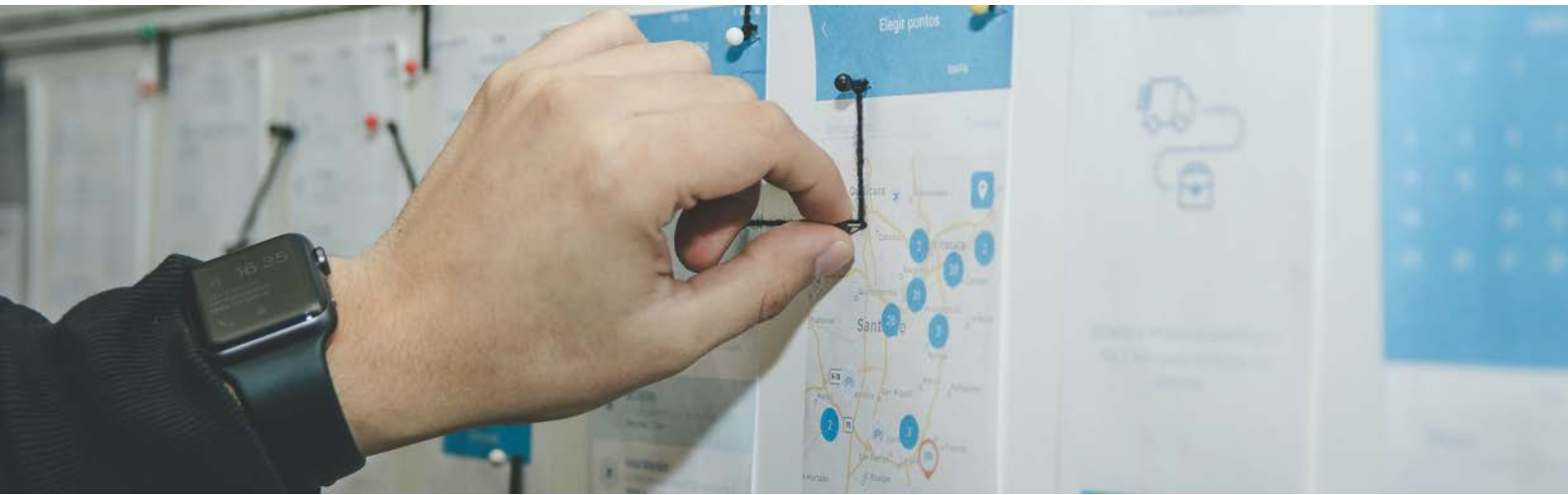
- Out-of-class content is developed based on instructional design principles.
- In-class activities are directly relevant to the out-of-class work and force students to retrieve, apply, and extend the content studied.
- Course offers multiple opportunities for students to interact with content and for the instructor to provide feedback on the learner's performance.

Implementation

- Course aims and expectations on attendance and grades are clearly communicated to students.
- Students clearly know where to find and when to submit course activities, assignments, and homework.
- The instructional setting is conducive to learning.
- Needed technology and equipment are available.

Evaluation

- The course clearly assesses learning outcomes and learner's experience in the flipped classroom.
- Formative and summative evaluations are conducted throughout the course delivery.
- Higher Education Institute (HEI) plans to use learners' feedback in an ongoing evaluation to improve the course.



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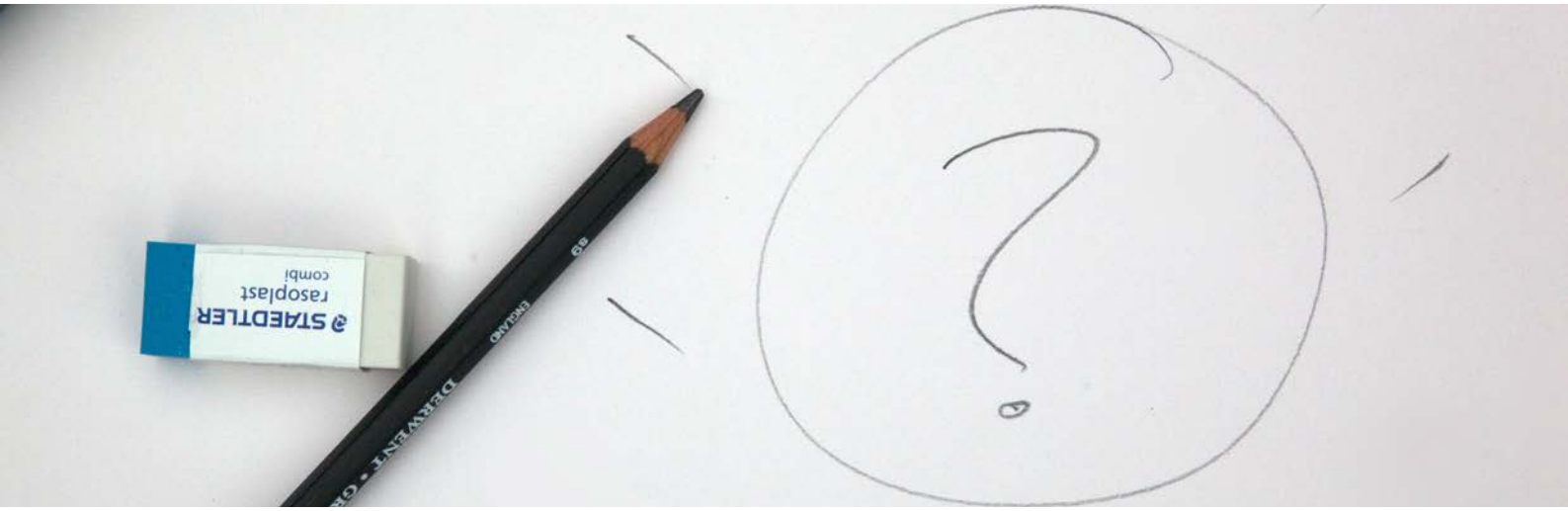
2.4 SUCCESSIVE APPROXIMATION MODEL (SAM)



This theory was designed by the behavior science professionals at Allen Interactions as an alternative to ADDIE. Similar to ADDIE, SAM (Allen & Sites, 2012). is an iterative, agile approach to instructional design. The steps laid out in the SAM model can be repeated to create an effective course. SAM and ADDIE both include analysis as an important step to continuously refining the teaching program. Within the SAM framework, two models exist: SAM1 and SAM2.

SAM1 is best suited for small teams and projects. It's a simplified version of ADDIE that only consists of three (3) (repeating) steps:

1. *Evaluate*
2. *Design*
3. *Develop*

SAM2 is best suited for larger teams and projects. It breaks down the instructional design process into 3 phases:

- *Preparation* (background work)
- *Iterative Design* (Prototype, Evaluate, Design - repeat)
- *Iterative Development* (Implement, Evaluate, Develop - repeat)

The phases align with a project timeline.

2.5 MERRILL'S FIRST PRINCIPLES OF INSTRUCTION

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David Merrill's 2002 *First Principles of Instruction* (Merrill, 2002). framework integrates five (5) principles of learning:

1. **Task-centered principle**: Learning starts with a real-world task or problem the learners can relate to.
2. **Activation principle**: Activating the learner's existing knowledge base helps them connect previous knowledge with the new knowledge.
3. **Demonstration principle**: A course should present the knowledge in multiple ways so that it leverages different regions of the brain, and increases knowledge retention.
4. **Application principle**: Learners must apply new information on their own and learn from their mistakes.
5. **Integration principle**: Help to integrate the knowledge into the learner's world through discussion, reflection, and/or presentation of new knowledge.

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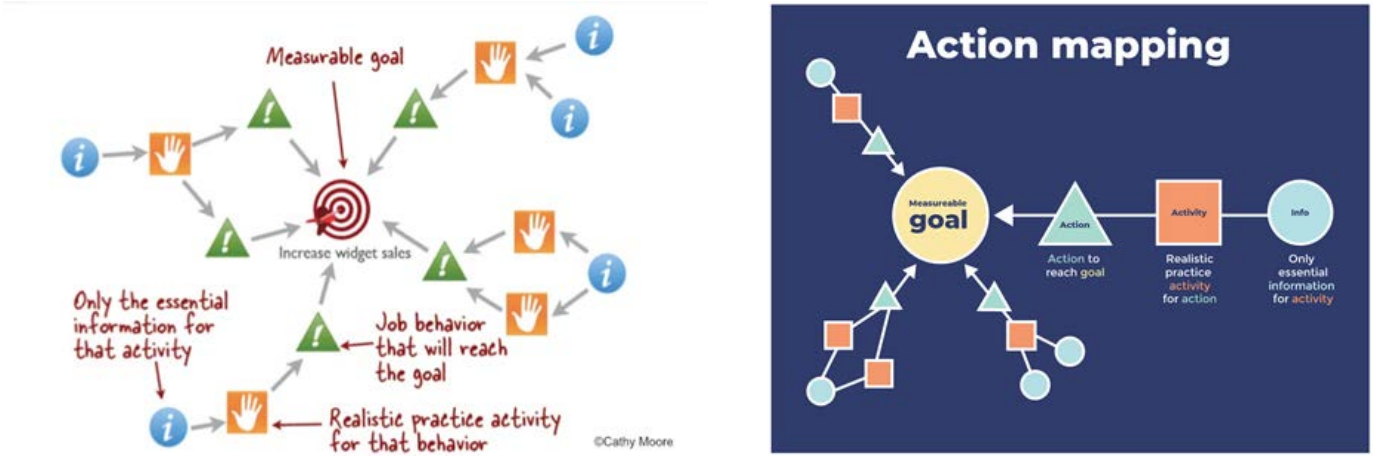
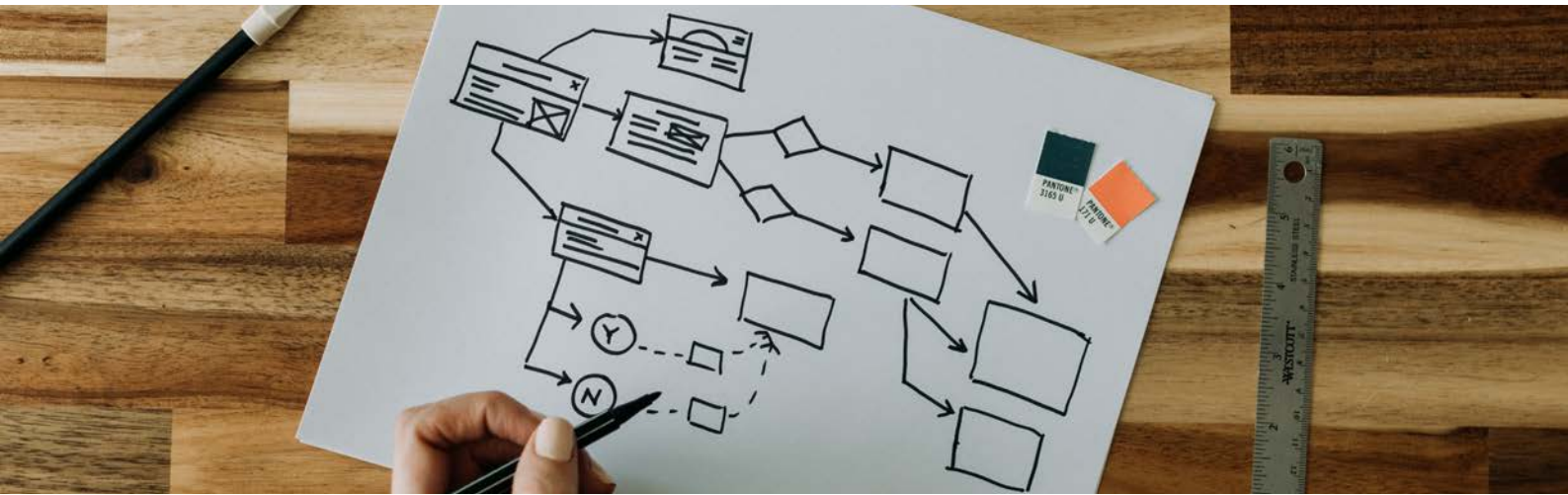
2.6 ACTION MAPPING

Action Mapping (Matsui, 1997). is a visual approach to instructional design developed by American training designer Cathy Moore. The model was created to address the challenges of designing practical business training. It consists of four (4) essential building blocks:

- **A measurable business goal** at the center of the training curriculum
- **A series of actions** required to reach the goal
- **Practice activities** designed to teach students how to perform the actions
- **Information** essential to carry out the activities



Picture 2. ADDIE model phases and the steps during each phase (*source*: https://blog.cathy-moore.com/, https://www.gerardfriel.com/instructional-design/action-mapping/)



2.7 DICK AND CAREY MODEL

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This instructional design framework, also known as the Systems Approach Model, was developed by Walter Dick and Lou Carey in 1978 (Dick, Carey & Carey, 2005). The Model assumes that all elements of the learning experience form an interrelated system that defines the outcome of training. These elements include:

- The instructor
- Students
- Instructional materials and activities
- The teaching techniques
- The learning environment

In this model, the training design process consists of ten (10) steps:

1. **Identifying the goals and objectives of the training**. Teacher figures out the instructional goals and what is expected from students to learn after completing the course based on the aims of the course and the students' needs.
2. **Instructional analysis**. Teacher determines how familiar his/her students already are with the subject of the course.
3. **Analysis of the learners and contexts**. This concerns activities and research to better understand students' needs, goals, and motivations.
4. **Defining performance objectives**. Teacher organizes how he/she will assess students' progress.
5. **Developing tools of assessment**. e.g., quizzes and exercises.

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2.7 DICK AND CAREY MODEL

6.**Developing an instructional strategy**. Teacher defines how he/she will deliver the course.
7.**Developing instructional materials**, e.g., a presentation or other visuals that will be used during lessons.
8.**Formative evaluation**. Teacher collects feedback about the lesson or the course.
9.**Revisions**. If formative evaluation reveals areas for improvement, teachers should make the necessary changes/modifications.
10.**Summative evaluation**. Teacher evaluates the effectiveness of the lesson or course. That can be done by testing students on their gained knowledge or skills, running satisfaction surveys, etc.

Steps 2 through 9 should be repeated until the teacher reaches an optimal, ready-to-launch version of the course.

2.8 KEMP DESIGN MODEL

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Also referred to as the Morrison, Ross, and Kemp model, this framework was developed by American instructional design researcher Jerrald Kemp (Kemp, 1985). The model names nine (9) key elements of instructional design:

1. Specifying the goals of the instructional program
2. Researching learners
3. Identifying content relevant to the subject matter of instruction and analyzing tasks and exercises that will support the stated goals and purposes
4. Making the instructional objectives known to the learners
5. Sequencing instructional content within each class for logical learning
6. Designing an instructional strategy that will help students master the objectives
7. Planning the contents of instruction (lectures, presentations) and delivery
8. Developing evaluation instruments (e.g., tests and quizzes)
9. Picking resources and activities to support learning

While this model appears similar to the Dick and Carey model, the sequence of steps is represented as a circle rather than a line.

The Agile methodology (Adnan & Ritzhaupt, 2018) was adapted as an instructional design model by instructional design strategist Conrad Gottfredson. The Agile framework has five (5) key elements:

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2.9 AGILE AND RAPID PROTOTYPING

- **Align**. Analyze the needs for the course. Discuss and agree on goals and objectives with the team.
- **Get set**. Gather the knowledge and resources necessary to build the training program. Plan the project timeline and assign tasks.
- **Iterate and Implement**. Create a prototype of the course. Revise existing prototypes.
- **Leverage**. Make optimal use of project resources, including people, technology, and data.
- **Evaluate**. Design an assessment strategy and apply it to each prototype produced.

Rapid Prototyping aligns the Agile framework with the three (3) essential steps of the course design process: design, development, and evaluation. Course builders produce course prototypes, then, stakeholders (including educators, designers, developers) evaluate each prototype and create revised iterations until they reach a desired outcome. This means three (3) repeatable steps to designing a learning program:

1. Prototyping
2. Reviewing
3. Refining

2.10 THE 70-20-10 MODEL

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The 70-20-10 model (Johnson, Blackman & Buick, 2018) in learning and development was created by McCall, Lombardo, and Morrison at the Center for Creative Leadership. It identifies three ways in which people learn and assigns weight to each of them. According to the model:

- 70% of knowledge comes from **experience, experiment and reflection**.
- 20% of knowledge comes from **working with others**.
- 10% of knowledge comes from **formal, planned learning**.

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3. TEACHERS IN HEI AS INSTRUCTIONAL DESIGNERS

There are hundreds of instructional design models and processes defined and described in the academic research literature. Teachers as instructional designers in higher education need to be aware of these models and processes and know when to use a model or process that is appropriate for their current instructional design project. Prior research has shown that professional instructional designers utilize many different instructional design models (e.g., *Dick and Carey or backwards design*), but often describe the phases of the ADDIE model (*Analysis, Design, Development, Implementation, and Evaluation*).

For instructional designers in higher education the careful alignment among the *learning objectives*, *instructional content*, and *assessments* in any course design and delivery method is of great importance. The instructional design models help them ensure this alignment in the creation of the instructional resources.

3. TEACHERS IN HEI AS INSTRUCTIONAL DESIGNERS

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The competencies of instructional design professionals working in institutions of higher education below are not mutually exclusive and are not meant to document the only competencies for these professionals (Stefaniak, Conklin, Oyarzun & Reese, 2021):

1. Strong Communication and Soft Skills
2. Deep knowledge of Instructional Design Models and Processes
3. Deep knowledge of Learning Theories and Instructional Strategies
4. Expertise in integration Technologies in Instructional Designer Practice
5. Skills from Project Management field (*schedule management*, *scope management*, *human resources management*, *budget management*, *stakeholder management*, and *quality management*)
6. Deep knowledge Formative and Summative Evaluation procedures and tools
7. Skills for Faculty Professional Development and Support
8. Skills for Change Management and Leadership (*The ability to implement, manage, and lead change*)

Learning design considerations for an enhanced student learning experience are presented below (Reyna, 2022) :

- Communication, interpersonal skills, and collaboration
- Apply co-design approaches
- Apply learning theories

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3. TEACHERS IN HEI AS INSTRUCTIONAL DESIGNERS

- Use adult learning principles
- Apply cognitive load theory
- Apply multimedia learning principles when creating online content
- Consider how students self-regulate and are motivated
- Formulate realistic learning objectives and align them with assessments and learning tasks
- Apply digital media principles for content creation
- Use evidence-based ‘flipped’ learning
- Design authentic assessments
- Apply principles of inclusive education
- Embed cultural safety practices
- Apply evaluation and research approaches to improve student learning experiences

4. TOOLS TO SUPPORT INSTRUCTIONAL DESIGN

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Nowadays, Information and Communication Technologies (ICT) pervade every aspect of education, supporting the preparation of teaching and learning activities -'*the process of Instructional design*'- is of increasingly important. A number of tools have been developed to assist teachers at all levels of education in planning *learning outcomes*, *activities*, *assessment*, and *other aspects of learning*, both *inside* and *outside the classroom*. Instructional/Learning design authoring tools generally have the goal to facilitate the *sharing*, *adaptation*, and *reuse of teachers' pedagogical ideas*, and they are also useful as tools for reflection on practice. Different tools may employ different representations and operate at different levels of degree of detail (*from capturing the essence of a design to aiding in its semi-automated development*).

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4. TOOLS TO SUPPORT INSTRUCTIONAL DESIGN

There are several tools for Instructional/Learning design. The most popular ones are:

- **LAMS** (Learning Activity Management System): facilitates the micro-level planning and automation of the learning activities.
- **Learning Designer**: facilitates design work at the macro level, aiding the design of whole learning sessions and modules, and supporting more strategic pedagogical thinking.
- **OpenGLM**: an authoring toolkit to provide comprehensive graphical support for the design of units of learning.
- **CADMOS**: a graphical tool based on the 'separation of concerns' principle.
- **ScenEdit**: an intention-oriented tool for designing learning scenarios with an emphasis on the orchestration of interactional situations.

These different tools support different visual representations to abstract the elements of a design such as *learning activities* and *resources*, to be easily defined and manipulated.

5. OPEN EDUCATION AND INNOVATIVE LEARNING ENVIRONMENTS

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The definition of open education in the OpenEdu Framework is: “Open education is a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects the two” (OpenEdu Framework, JRC 2016:10).

Open education concerns practices that can lead higher education to be more inclusive, in line with societal changes, innovative, making effective use of teaching and educational resources, research and students’ services. These practices are referred to as ‘open educational practices’ and can lead to more inclusive education systems. Each individual academic can be more open in how they produce and share knowledge, in how they teach and assess students, and in collaborating with others.

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5. OPEN EDUCATION AND INNOVATIVE LEARNING ENVIRONMENTS

Higher education institutions should shift their practices towards open educational practices and academics can start changing the landscape of higher education by prompting changes in their own institutions (dos Santos, 2019).

Learning research should support and guide educational policy and practice. According to OECD (Organisation for Economic Co-operation and Development), the Principles of Learning to design effective and innovative learning environments are (OECD, 2017):

- *The learning environment recognises the learners as its core participants, encourages their active engagement and develops an understanding of their own activity as learners.*
- *The learning environment is founded on the social nature of learning and actively encourages well-organised co-operative learning.*
- *The learning professionals within the learning environment are highly attuned to the learners' motivations and the key role of emotions in achievement*
- *The learning environment is acutely sensitive to the individual differences among the learners in it, including their prior knowledge.*
- *The learning environment devises programmes that demand hard work and challenge from all without excessive overload.*
- *The learning environment operates with clarity of expectations and deploys assessment strategies consistent with these expectations; there is strong emphasis on formative feedback to support learning.*
- *The learning environment strongly promotes "horizontal connectedness" across areas of knowledge and subjects as well as to the community and the wider world.*

1. LEARNING DESIGNER

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Learning Designer (learningdesigner.org) is an open-access software application and a community knowledge building tool. It was created by a team led by Diana Laurillard at the University College London (UCL) Knowledge Lab as part of the Leaning Design Support Environment project (LDSE, https://www.ucl.ac.uk/learning-designer/) and can be integrated in other learning platforms such as LAMS and Moodle (Bower, Craft, Laurillard & Masterman, 2011; Prieto, et al.,2013).

The products of Learning Designer are **Learning Designs** containing formal learning concepts (e.g. *Bloom's taxonomy of learning outcomes and a typology of forms of learning*), underpinned by semantic technologies. Users can design a module (i.e. a *sequence of sessions*), or a session (i.e. *a sequence of teaching and learning activities-TLAs*), or just a teaching and learning activity (*TLA*). Each module, session or learning activity consists of components such as *aims, learning outcomes, teaching methods, assessment, learning approach, duration, resources*, etc. Teachers can retrieve templates and approaches from different learning designs that are related with specific educational contexts and use them for their own designs. The tool is linked to an extensive help system with a glossary of pedagogical concepts and support for selecting learning tools (Prieto, et al.,2013; Laurillard et al., 2013; Zalavra & Papanikolaou, 2019).

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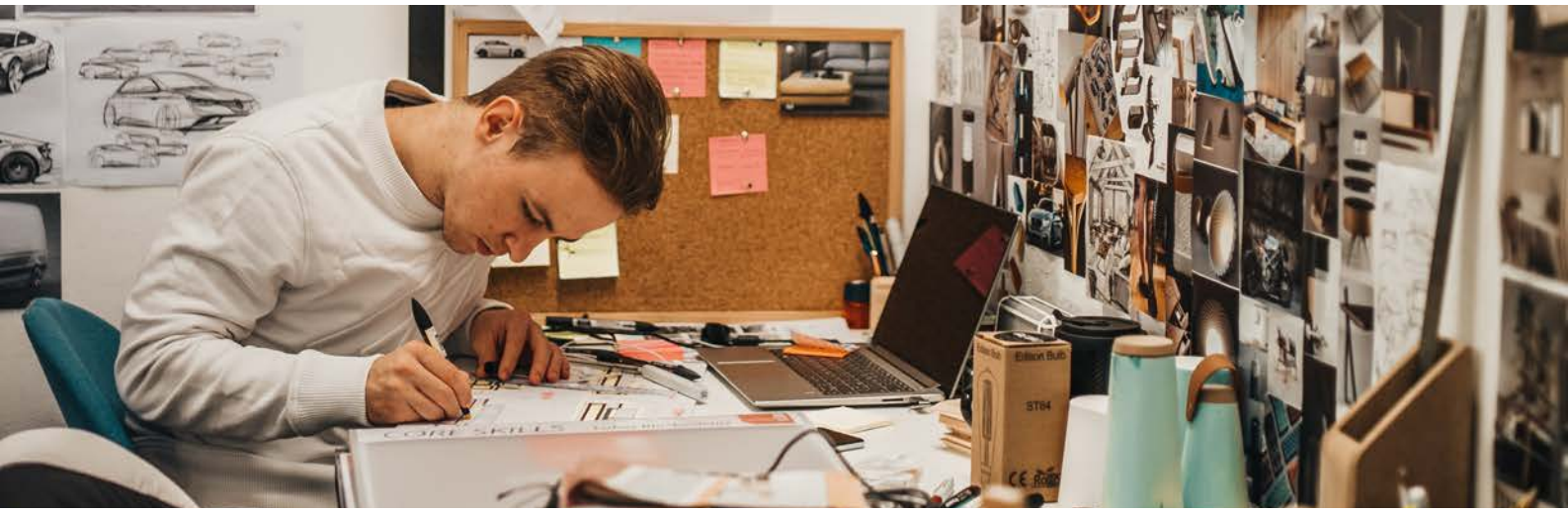
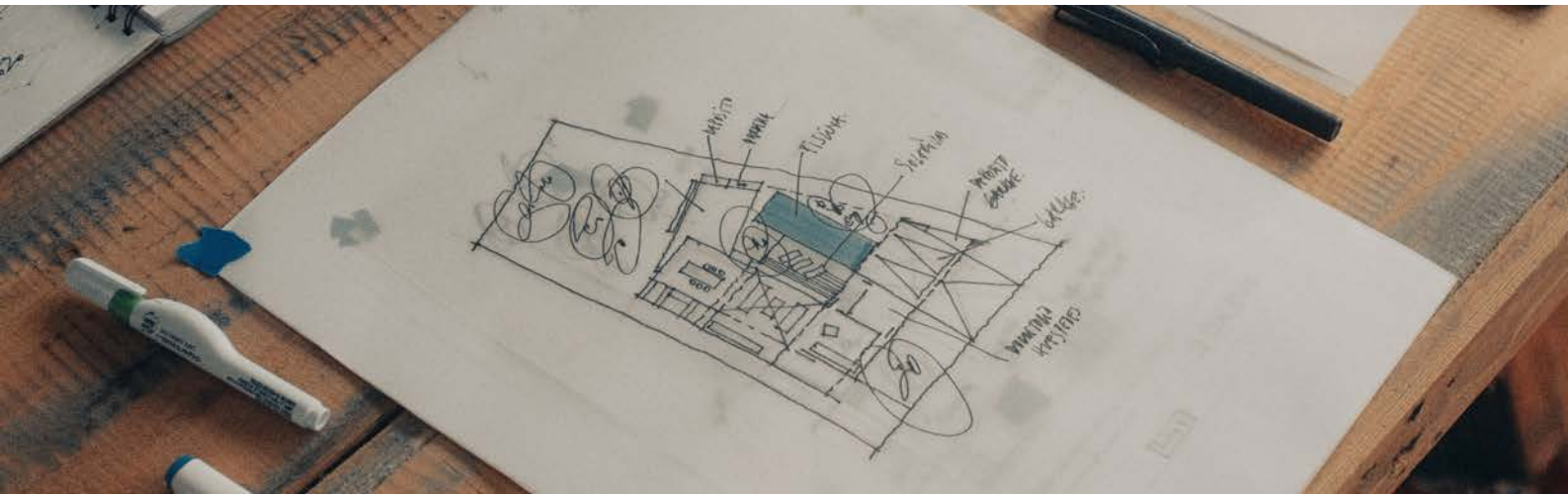
1. LEARNING DESIGNER



For each TLA teachers can adjust default settings according to factors, such as *teaching approach* and *class size*. They can specify activity details, such as *duration* and *group size* (for small-group activities) and keep general notes about what the students will do. TLA has two main properties that users can edit:

- Nature of the learning experience: *personalized* (i.e., unique to each student), *social* (e.g., a small group activity), or *one-size-fits-all* (e.g., a lecture).
- Proportions of different forms of learning (*cognitive activities*) that the TLA supports: *acquisition, inquiry, discussion, practice, and production*.

Pedagogic principles and concepts are introduced to users during the construction of a sequence of sessions or learning activities for a session. Learning Designer is based on the *Conversational Framework*. This Framework unites the *didactic, experiential, constructivist*, and *collaborative theories* of learning in *interaction cycles of continuous exchange between learners-teachers and learners-peers*.



1. LEARNING DESIGNER

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These cycles are *acquisition* (i.e. read/watch/listen), 2) *inquiry* (i.e. investigation), 3) *practice*, 4) *production*, 5) *discussion* and 6) *collaboration*. They connect *theoretical* and *practical* levels of learning, describing how students are familiarized with concepts through their experiences (Zhang & Laurillard, 2015).
Learning Designer provides teachers an intelligent inferencing engine that assists them in *creating, modifying, representing, finding, sharing*, and *reusing* learning experiences for their students.

Learning Activity Management System (LAMS, https://www.lamsfoundation.org/) is an open-source tool that provides an authoring interface for creating, planning, managing, delivering, orchestrating, visualizing and sharing/reusing structured flows of content and collaborative tasks (called 'sequences'). It is developed and managed by LAMS Foundation Ltd, LAMS International Pty Ltd and Macquarie E-learning Center Of Excellence (MELCOE), Macquarie University. LAMS can operate as a standalone e-learning system or in combination with other learning management systems (LMS) or Virtual Learning Environments (VLE), such as Moodle, Sakai, LRN, WebCT and BlackBoard (Philip & Dalziel, 2004; Alexander, 2008).

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2. LEARNING ACTIVITY MANAGEMENT SYSTEM (LAMS)

LAMS includes environments for user administration, *student run-time delivery of sequences, teacher run-time monitoring of student sequences and teacher authoring/adaptation of sequences*. LAMS gives emphasis on collaborative and group processes reinforcing the social and cognitive interaction between the users. Activities can include a range of *individual tasks, small group work and whole class activities centered around both collaboration and content*. Learning sequences can be modified to be used in different contexts (Dalziel, 2003). The drag and drop authoring environment and the presentation of activities in a flow chart provides a visual representation of the learning design's components. Activity tools (*chat, forum, questions and answers (Q&A), voting, resources*) can be dragged from one frame to another. Users can also create links between activities with arrows. Collaborative tasks and content are presented with a structured flow.

2. LEARNING ACTIVITY MANAGEMENT SYSTEM (LAMS)

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When the sequence is saved it can be run by a designated group of students from a learner area. Sequences can be linear or contain multiple paths for students to follow according to the design set by the teacher (Dalziel, 2007).

LAMS can support various pedagogical approaches, *such as inquiry-based learning, problem-based learning, game-based learning, and collaborative learning*. Teachers *can guide, monitor, and reflect students' progress in synchronous and asynchronous individual and group activity*. They can adapt learning sequences and create opportunities for collaboration according to *students' prior knowledge*, *interests and preferable learning activities* by using suitable grouping and *branching*.

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2. LEARNING ACTIVITY MANAGEMENT SYSTEM (LAMS)

Students can visualize their progress. A record of all activities is kept allowing students and teachers to watch how they are progressing (Kordaki, 2011; Karga & Satratzemi, 2018). Using the tools of LAMS a community of practice for learning experiences can be created. In such a community social construction of knowledge is achieved. Furthermore, shared practice gives the opportunity for the generation of community artifacts. Such artifacts in higher education could include embedding graduate attributes in assessment strategies, tutorial procedures, language support activities for international students (McDonald & Star, 2006).

3. SLIDEWIKI

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SlideWiki is a Web application facilitating collaboration around educational content (https://kmi.open.ac.uk/projects/name/slidewiki). With SlideWiki users can create and collaborate on slides and arrange slides in presentations. Presentations can be organized hierarchically, to structure them reasonably according to their content. Currently large-scale collaboration (*crowd-sourcing*) around educational content is supported only in a very limited way. *Slides, presentations, diagrams, assessment tests etc. are mainly created by tutors, teachers, lecturers and professors* individually or in very small groups. The resulting content can be shared online (e.g. *using Slideshare, OpenStudy, Google Docs*). Using the SlideWiki platform, potentially large communities of teachers, lecturers, academics are empowered to create educational content in a collaborative way. Teachers at any level of education can focus on creating educational content in their area of expertise and still this content can be easily integrated with other content, re-structured and re-purposed. A particular aspect, which is facilitated by SlideWiki is multi-linguality as, it is easy to semi-automatically translate content and to keep track of changes in various multilingual versions of the same content object (Khalili, de Graaf & Klaas, 2018).

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3. SLIDEWIKI

SlideWiki focuses on crowd-sourced *authoring, translation support and enrichment of educational content* with self-assessment questions. Features included are: WYSIWYG slide authoring, Logical slide and deck representation, LaTeX/MathML integration, Multilingual decks / semi-automatic translation in 50+ languages, PowerPoint/HTML import, Source code highlighting within slides, Dynamic CSS themability and transitions, Social networking activities, Full revisioning and branching of slides and decks, E-Learning with self-assessment questionnaires, Source, citation and attribution tracking, Synchronization and remote control of presentations.

3. SLIDEWIKI

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SlideWiki allows to collaboratively create comprehensive OCW (curricula, slide presentations, self-assessment tests, illustrations etc.) online in a crowdsourcing manner, to semi-automatically translate this content into more than 50 different languages and to improve the translations in a collaborative manner and to support engagement and social networking of educators and learners around that content. It can support secondary education, vocational and professional training, higher education and community-driven open-education. A particular focus of the technology development is the suitability for academics, teachers, and learners with disabilities (Mikroyannidis, A. (2018); Mikroyannidis et al, 2018; Mirette et al., 2018).

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3. SLIDEWIKI

An example.

'Ethics and Technology': A course as trial of SlideWiki at University of Patras.

The trial implemented by Computers and Educational Technology Lab (CETL), University of Patras, was based on a monthly on-line course with the theme of *Ethics and Technology* using the SlideWiki platform as the main learning and collaboration space. The course was addressed to future and in-service teachers of primary and secondary education. A total of 175 trainees participated in the trial. The trainees were allocated in seven (7) groups according to their status and specialty *(university students, postgraduate students, in-service teachers, studying Humanities or ICT*). Five (5) trainers developed educational material and were supporting the trainees' learning paths and activities during the course. According to the learning scenario, trainees had to study and interact with the educational material that had been organized in four (4) decks, one deck per week. The content of each deck focused on: *Ethics and Technology, Internet and Intellectual Property, Data security on the Internet, Privacy and protection on the Internet respectively.*

University of Patras conducted a trial with two phases. Participants, trainers, and trainees, worked collaboratively to create educational material as SlideWiki Decks and to participate in learning activities, respectively in order to discuss topics about Ethics and Technology. The goal of the trial was to evaluate specific functionalities of SlideWiki supporting authoring, reusing of open educational resources as well as community collaboration in a real higher education setting. Five (5) trainers were supporting their learning paths and activities during the course and the trainees' efforts answering their questions and comments mainly via the SlideWiki platform and via emails as well. They were intervening with instructional comments any time it was necessary. The trial was conducted in two phases: The 1st phase was conducted during July 2018 and 145 trainees participated (*university students, postgraduate students, in-service teachers, studying Humanities or ICT*). The 2nd phase was conducted during October 20018 and 30 trainees participated (in-service teachers). The trial was based on three (3) stages: a. *Educational material production*, b. *Implementation of the Learning Scenario*, and c. *Analysis of the trial data*.

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3. SLIDEWIKI

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The Educational material organized in four (4) decks) and produced on the platform collaboratively by the members of Academic Staff involved in the Trial. They used all the services of the SlideWiki platform to produce and manage the material and discuss during the production. Additional material in the format of pdf files and URLs was used under the tag 'Sources' for each deck and it was also collaboratively by the members of Academic Staff involved in the Trial. The 4 decks are: '*Ethics and Technology*', '*Internet and literary property*', '*Data security on the Internet*', '*Privacy and protection on the internet*'. A fifth deck was created during the last week of the course in order for the trainees to discuss on four (4) questions expressing their thoughts about their experience with the SlideWiki platform and the content they studied as well. During the learning process trainees had to collaboratively create one deck per group on the topic '*Web security protocols*'. In this way a total of seven (7) decks were created by the trainees. According to the learning scenario, trainees had to study and interact with the Educational material that had been organized in four (4) decks, one deck per week. Every week trainees had to (a) *study the content of the slides of the deck*, (b) *study additional material unloaded under the tag sources*, (c) *add their comments to contribute to a discussion about the main idea of the content using the comments tool*, (d) *add their comments to ask questions or/and express their difficulties with the platform*, (e) *self-evaluate themselves answering the questions under the tag questions.* During the 3rd week they asked to collaboratively create one deck per group with the theme *Web security protocols*. They had to use the main services of the platform to *create, edit and manage the slides* and the *comments to discuss* among them during this collaborative activity. In the last week trainees had to discuss four (4) questions expressing their thoughts about their experience with the SlideWiki platform and the content they studied as well, working with the fifth deck. The trainers and almost all trainees supported that the most important positive characteristic of the platform is the access to open educational resources by ensuring appropriate Intellectual Property under Creative Commons. As very important reported the ability to copy and re-use educational material respecting the rights of the creator referring to him/her. They supported that the platform enables the creation, organization, and storage of material in an easy, flexible and interactive way.

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4. FLIPBOARD

Flipboard, is a social-network aggregation software that can be used in teaching any subject in post-secondary education institutions. Among many uses (keeping up on current issues, collecting useful materials related to a project, as a resource guide on a single topic, for curating relevant reading materials, etc.) Flipboard can be helpful when encouraging students to read, summarize and speak (F2F or on-line) about what their teacher considers important for the development of different skills[1].

On the application website (flipboard.com) a visitor who is signed in can see Cover stories, which represents the highlights from everything one follows. The second item on the menu is Following where one can see individual magazines one follows. The last item on the menu is Explore, which brings into view all magazines curated on Flipboard by all users arranged in several sections (New & Noteworthy, By Our Readers, News, Business, Tech & Science, Sports, Photos & Design, -etc.).

[1] https://about.flipboard.com/tutorials

4. FLIPBOARD

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Possible uses of Flipboard in education:

1. keeping up on the current events
2. creating a class syllabus
3. creating a class-project magazine
4. creating a resource guide on a single topic
5. curating relevant reading materials
6. collaboration by inviting other educators to collaborate on a magazine

Flipboard can be used for raising awareness on:

- language awareness (LA): the explicit knowledge about language with the emphasis on language learning and teaching as well as language use (ALA, 2012)
- brain awareness (BA): awareness of the progress and benefits of brain research
- learning myths: misconceptions about learning styles, left/right brain hypothesis, male/female brain, 10 % brain usage etc.
- effective learning/e-learning

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5. MOODLE

One of the most effective platforms that can be of significant help in planning and managing teaching and student's learning is the very well known freely available learning management system **Moodle** which is 'designed to provide teachers with *personalized learning environments'* (Moodle website 2022). The platform allows the teacher to divide the content of the course into logical units that best fit his/her planned process of teaching. It may be divided into time units (weeks) or topic units (according to the *content of the course*). Each unit may contain resources that can be put into separate folders and different kinds of activities. Teachers can prepare their own learning material, also interactive content in many diverse forms, which support student's active learning and collaboration. Different tools allow teachers to get immediate feedback from students and there are enough possibilities to provide feedback according to students' answers. It is also a powerful tool to assess students' knowledge[1].

[1] ttps://docs.moodle.org/400/en/About_Moodle

USEFUL LINKS

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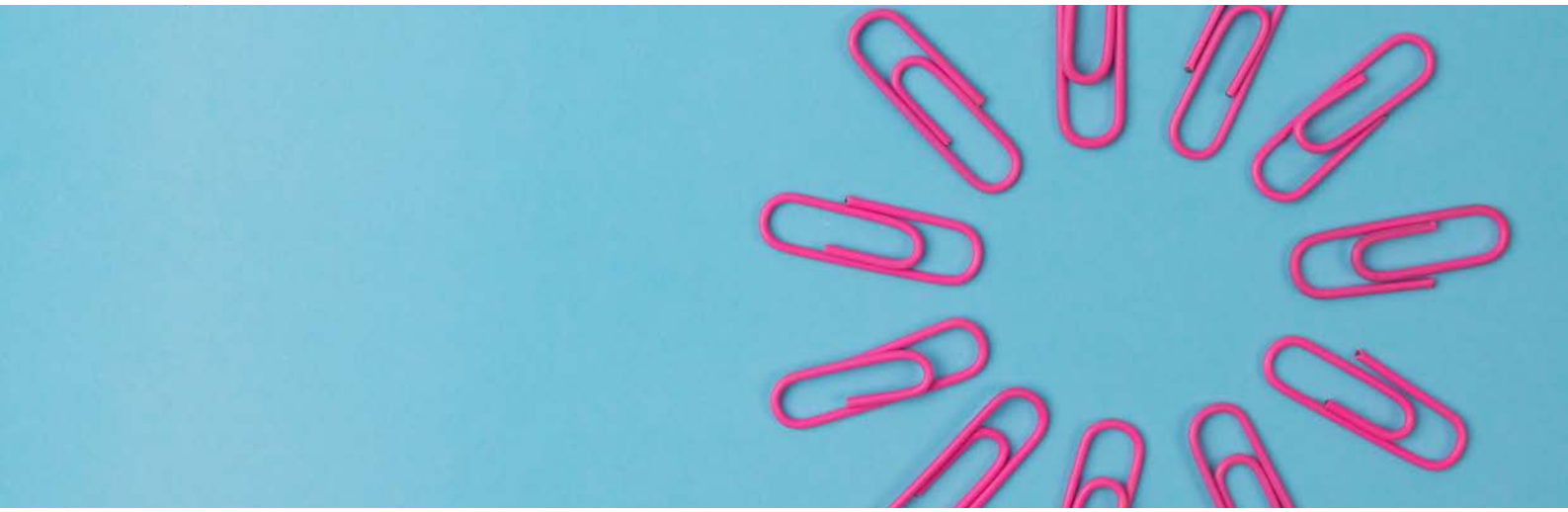

The ADDIE Model of Instructional Design (video)

https://www.youtube.com/watch?v=vSLv2KDYz9A

Learning Designer

https://www.youtube.com/watch?v=765RMSOJErM

ABC workshop to Learning Designer

https://pt.slideshare.net/EileenK01/m25-presentation?fbclid=IwAR2-qAhZQ6ocSjuTCuSw4bnPc6PgKjzhLXL4cpeQFoobXl_JZK0sBpBF42w

The Learning Designer and the International Learning Designs Challenge

https://www.youtube.com/watch?v=cXXa1sA3TAQ

This video presents how to adapt a learning design in the Learning Designer tool

LAMS

https://lamslearning.medium.com/your-first-lams-learning-design-b9600c3fd72

How to create a LAMS Learning Design

OpenGLM

https://edutechwiki.unige.ch/en/OpenGLM

Description, Features, Installation and Resources for OpenGLM

CADMOS

https://cosylab.gr/index.php/tools/115-cadmos

Description, Features, Download and Resources for CADMOS

ScenEdit

https://www.pconlife.com/viewfileinfo/scenedit-exe/

How to download and Install ScenEdit

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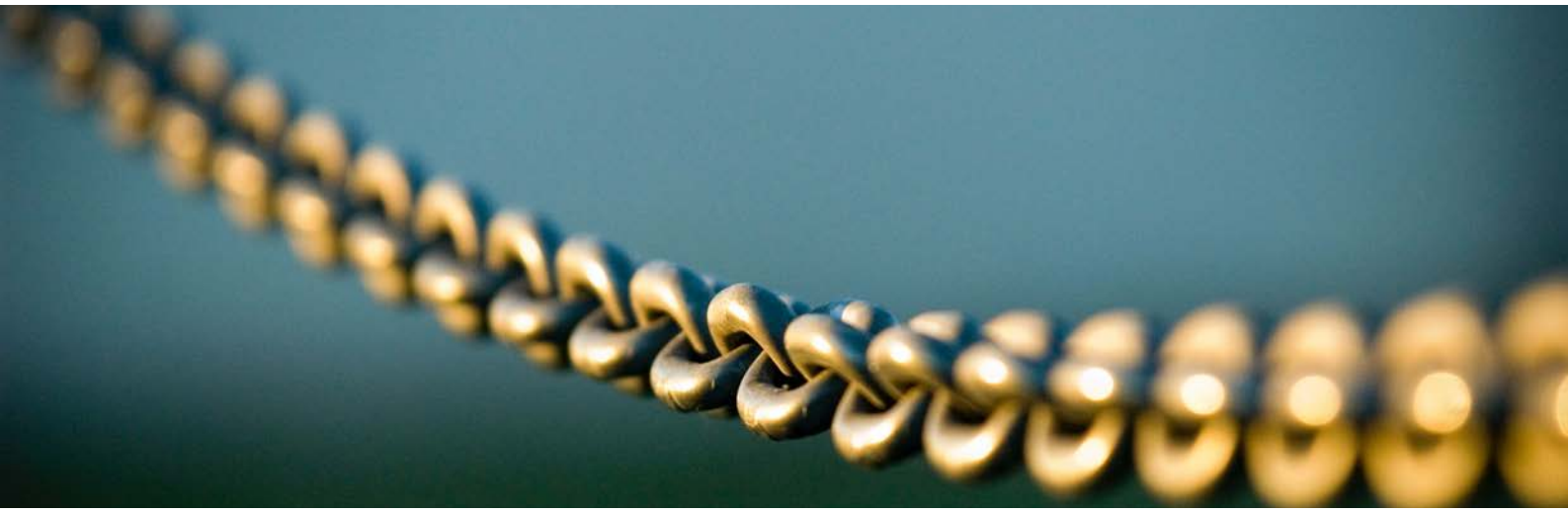
USEFUL LINKS



https://www.researchgate.net/publication/221423733_ScenEdit_A_Goal-Oriented_Tool_to_Design_Learning_Scenarios

Emin, Valérie & Pernin, Jean-Philippe. (2009). ScenEdit: A Goal-Oriented Tool to Design Learning Scenarios. In Conference proceedings '*The 9th IEEE International Conference on Advanced Learning Technologies, ICALT 2009, July 15-17, 2009, Riga, Latvia*' 736-737. 10.1109/ICALT.2009.107.

The paper that presents hee the main functionalities of the environment with an example of use.

http://eductice.ens-lyon.fr/EducTice/recherche/scenario/scenedit/demoScenEditITS

Valérie Emin, Jean-Philippe Pernin, Viviane Guéraud.(2008). ScenEdit: a tool to design pedagogical scenarios. *In Proceedings of the Demonstration Program. ITS2008. Montréal. 23rd -27 th June 2008*.

The paper presents the main functionalities of the environment through an example.

USEFUL LINKS

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SlideWiki

https://slidewiki.github.io/

https://kmi.open.ac.uk/projects/name/slidewiki

Flipboard

https://flipboard.com/@edirrr/teaching-with-brain-in-mind-4lotc0tez

https://about.flipboard.com/tutorials

https://about.flipboard.com/tools

https://about.flipboard.com/help-center

Moodle

https://docs.moodle.org/400/en/About_Moodle

website retrieved on 20th July 2022

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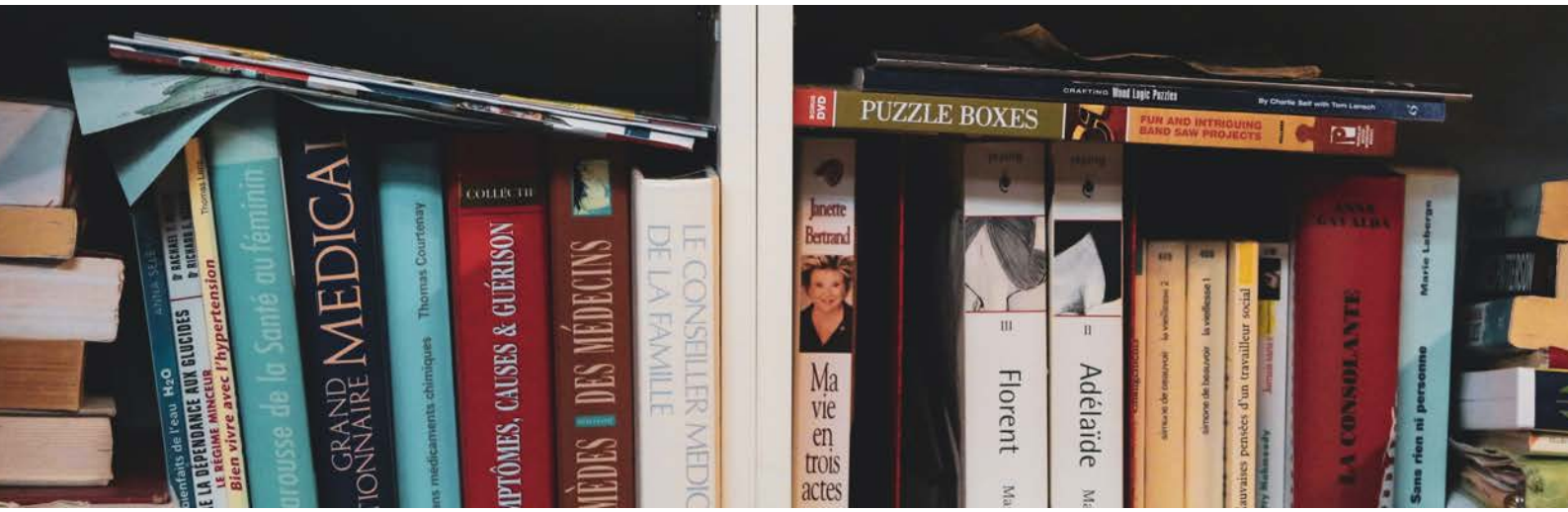

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KEYWORDS

edutainment, game-based learning, gamification, theories of learning, game mechanics

In this chapter you will learn about:

- What are the concepts of edutainment, game-based learning and gamification
- What are the main theories connected to game-based learning and gamification (behaviourism cognitivism and constructivism)
- The game mechanics based on Bloom's taxonomy
- Models for designing games (ADDIE, SADDIE and ELECTRA)
- Tools and practical examples of gamification

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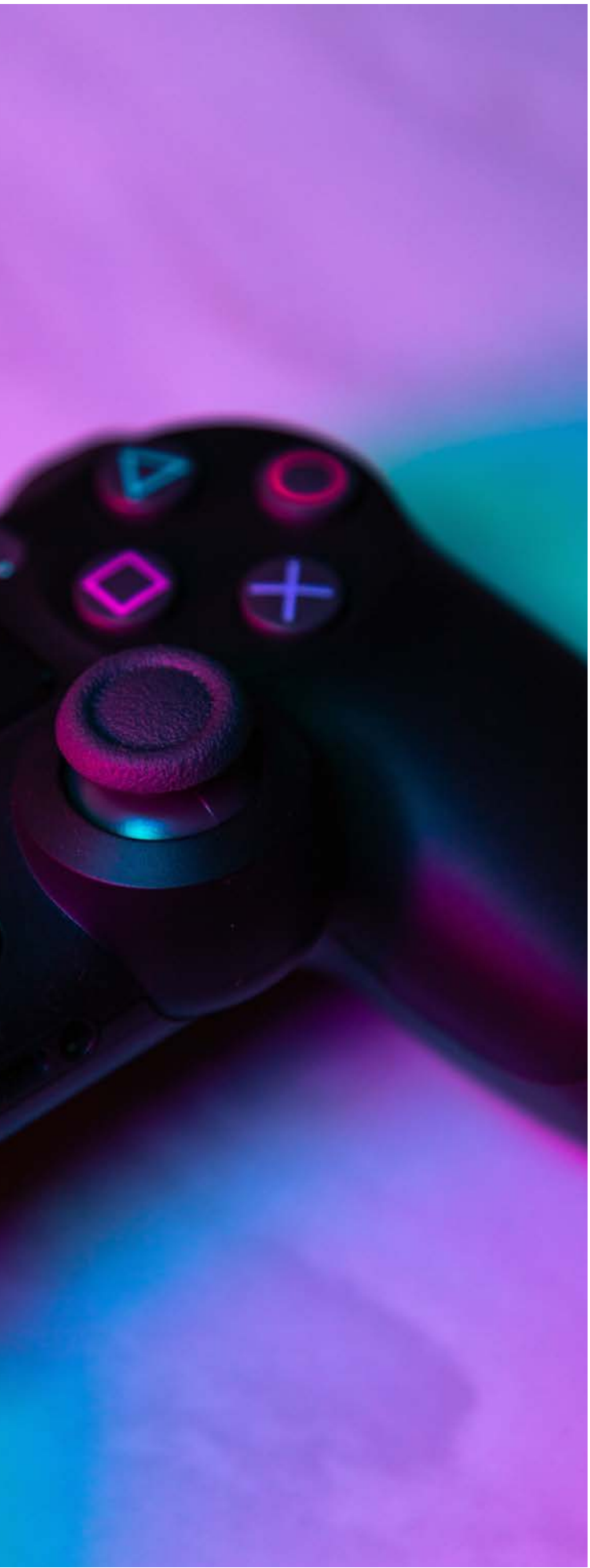

ABSTRACT

Game-based learning is a kind of edutainment that rests upon the idea of using the motivational and immersive potential of conventional video games in the educational context to enhance learning and teaching process. Gamification is slightly different as it advocates the use of game-design elements in non-game contexts. More generally, Edutainment is a combination of entertainment and education. The main purpose of edutainment is to promote student learning through exploration, interactivity, community experience, teamwork, trial and error, and repetition in such a way that students get so lost in the fun that they do not realise they are learning at the same time.

This chapter covers game mechanics used to address different thinking skills based on Bloom's taxonomy, introduces the most commonly used game elements and types of gamification as well as practical examples of gamification in the pedagogical process. Introduction outlines the context of the functioning of generation Z in the social world, especially in relation to the assumptions of the digital nomad theory.

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ABSTRACT

Critical reference has also been made to this theory and its broader relevance to the younger generation and other generations. In the concept of edutainment, game-based learning and gamification, the assumptions characteristic of edutainment are reviewed and the assumptions of game-based learning and gamification are described.

The Game-based learning - theoretical background part examines the concept through the prism of modern learning theories such as behaviourism, cognitivism and constructivism. The issue of Game-based learning in relation to contemporary pedagogical practices is also examined and game mechanics and learning mechanics organised on Bloom's revised taxonomy are discussed. Game-based learning educational models and approaches discuss the assumptions of the ADDIE, SADDIE and ELECTRA models. Examples of the use of these models in educational games are presented together with the advantages and limitations of introducing gamification into the learning process. A list of useful links is also provided to support and guide game-based learning studies and practice.

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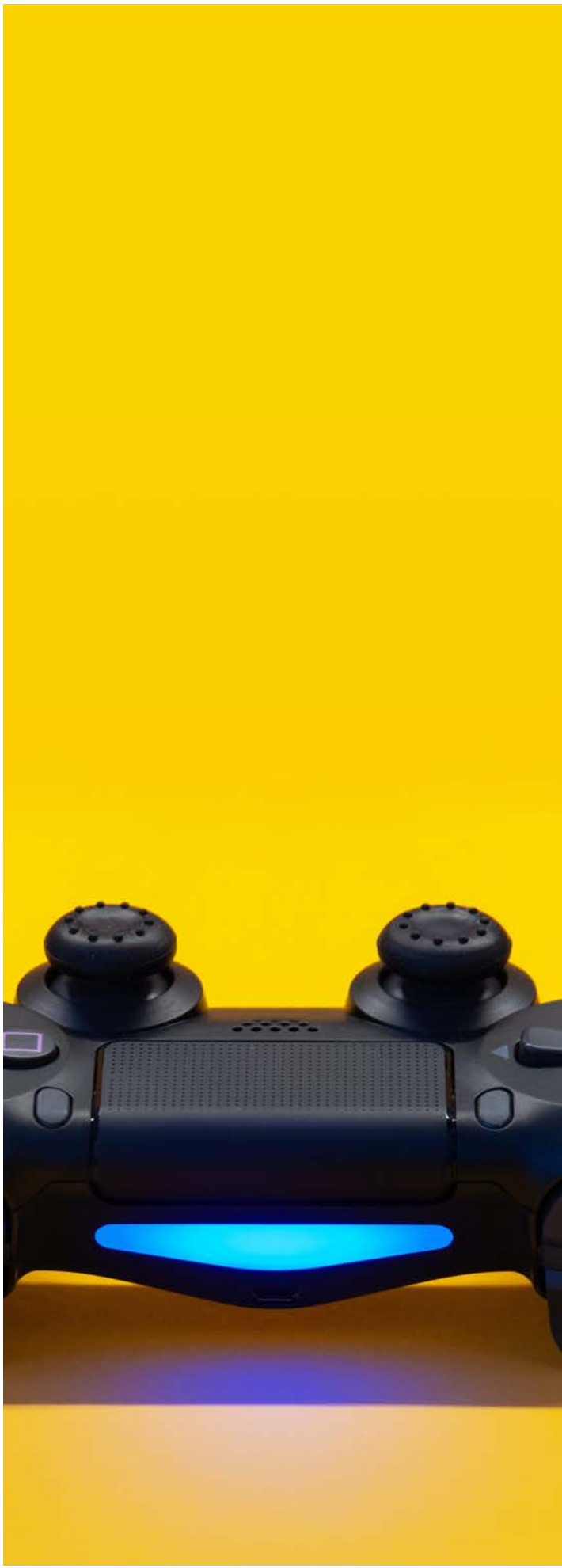

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1. INTRODUCTION

Considering the goals of the handbook (and the project), the perspective of digital nomads' characteristic of Generation Z seems to be the most appropriate. However, the authors focus on selected assumptions of this theory, bearing in mind that the adaptation of the young generation to the use of broadly understood new technologies is not tantamount to the ability to use them creatively. The young generation is, although slightly different than the one that grew up without the support of new technologies from birth, adapted to communing with the digital world; however, similarly to the older generation, it feels lost in it, often adopting a passive, receiving attitude, and focusing on reproducing rather than producing the content presented in it. In conclusion, Generation Z is not as strong a prosumer as the digital nomad theory assumes.

2. WHAT IS EDUTAINMENT, GAME-BASED LEARNING AND GAMIFICATION?

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Edutainment is a combination of entertainment and education. The main purpose of edutainment is to promote student learning through exploration, interactivity, community experience, teamwork, trial and error, and repetition in such a way that students get so lost in the fun that they do not realise they are learning at the same time. Aksakal (2015) points out the following characteristics of edutainment:

- entertainment and interaction, which is thought to be missing in education, attracting learners' attention due to being gamified;
- combining education and entertainment and increasing learners' excitement and enthusiasm to teach them subjects and information that is hard to learn;
- acquiring learning more easily by making the subjects and information that will be taught more enjoyable;
- attracting learners' attention and gaining the permanence of learning by the rousing of learners' feelings;

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2. WHAT IS EDUTAINMENT, GAME-BASED LEARNING AND GAMIFICATION?

- making the internalisation of difficult subjects easy using methods of simulation or graphs and visual methods, like in real life;
- teaching how to use resources and methods regarding the value of life by combining educational aims and measurement;
- teaching how individuals in learning environments apply their own knowledge;
- demonstrating how individuals understand or internalise what they learn;
- used to teach to learners combining what they perceive or evaluating what they learn;
- finally, it provides learners with a good time in the process of creating and experiencing.

Edutainment is an attractive method of teaching, since it encourages personalised learning, enhances creativity and visualisation, transforms a conventional classroom into a smart classroom, improves interactive and collaborative teaching and learning methods, promotes a digital culture and provides technological tools for educators.

Game-based learning is a kind of edutainment that rests upon the idea of using the motivational and immersive potential of conventional video games in the educational context to enhance learning and teaching process (Linek et al., 2009). Gamification is slightly different as it advocates the use of game-design elements in non-game contexts.

3.1 BEHAVIOURISM

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Most games, especially computer games, were more like teaching materials with game elements added in the beginning. The games were based on behaviourist learning theory, where the basic element of the learning process is questions and feedback in the form of a response. In the case of a correct answer, the player receives positive feedback, which can be a happy melody or an animation that stimulates positive emotions in the player, while in the case of a wrong answer, the reverse happens, as the player receives a negative response, e.g. in the form of a sad melody (Rugelj, 2015; Bevčič et al., 2020).

Behavioural games are based on the principle of “drill and practice”, and learning is achieved when the student responds to a stimulus from the environment. The player reacts to the situation in the environment rather than taking an active role in discovering it. According to behaviourist theory, learning is the result of generalisation and the student can apply prior knowledge to a new situation (Ertmer & Newby, 2013; Nemanič et al., 2020). Games characteristic of behaviourism are e.g. various quizzes, practice of basic arithmetic operations, point and click, etc. (Rugelj, 2015; Bevčič et al., 2020).

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3.2 COGNITIVISM

In the 1970s, a shift from behaviourism to cognitivism began, which meant a move from drill-based learning to mental problem-solving and the learning of fundamental concepts that require the student to use logical deduction to acquire new knowledge, to participate actively in the learning process, to understand, to find solutions independently and to apply rules. Cognitive theories equate learning with changes between states of knowledge. They focus on the conceptualisation of learning processes and address the process of students receiving, organising, storing and retrieving information, what students know and how they come to acquire that knowledge. The resemblance with behaviourist theory is reflected in the importance of the role of the environment on learning, where cognitivist theory advocates the role of instructional explanation, demonstration, graphic elements and imagery in guiding students. Students learn new material when they understand how to apply the knowledge in different contexts (Ertmer & Newby, 2013; Nemanič et al., 2020a).

3.3 CONSTRUCTIVISM

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Examples of games based on cognitivist theory are puzzle games, strategy games, tetris, Age of Empires and Professor Layton (Cognitivism and games, 2012; Nemanič et al., 2020a).

A constructivist approach, based on the active role of the student and aiming at higher taxonomic levels of knowledge, is also increasingly emerging in the field of game-based learning. Learning should be problem-based, and the role of the teacher is also important, as he should first select the appropriate games, provide guidance during the gameplay itself, and manage the different responses before or during the game. The teacher also has an important role to play after the game has been played, reflecting on the game and summarising the learning outcomes, which can help the learner to develop appropriate thinking processes (Rugelj, 2015; Bevčič et al., 2020).

Constructivist theory argues that knowledge is constructed by each individual and emphasises the importance of the interaction between the human mind and environmental experience. Students do not transfer knowledge from the outside world, but build their personal interpretations based on experience and interaction (Bednar et al., 1991; Nemanič et al., 2020a).

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3.3 CONSTRUCTIVISM

It is important that learning takes place in real environments and that tasks are related to students' real experiences (Ertmer & Newby, 2013; Nemanič et al., 2020a). Games with a constructivist approach contain all the necessary information, simple elements and data that players can manage. Games such as Black and White, Spore and simulation games such as Age of Empires emphasise constructivist theory by allowing for different open ends to the game, with each end depending on the individual player. Constructivist theory emphasises the construction of mental structures during the learning process itself. The idea is that this happens primarily in development environments such as Kodu for Xbox, Mission Maker and GameStar Mechanic (Constructivism & Games, 2012; Nemanič et al., 2020a).

3.4 GAMES IN PEDAGOGICAL PRACTICE

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Educational games can be used for learning at all levels of education, from kindergarten to higher education. In almost every subject area there is a game, formal or informal, that can be used for learning. At higher levels of education, games are increasingly being used in areas where real-world training is difficult, such as healthcare or the military, but also in communication, negotiation, teamwork and practical training, as serious games allow us to simulate an environment that players can identify with and that is as similar as possible to the real environment (Rugelj, 2015; Bevčič et al., 2020).

Constructivist theory has spread most widely at higher education level. In 1966, Jerome S. Bruner proposed the idea of learning as an active process in which individuals construct their own knowledge about a topic based on past knowledge and experience. Bruner believed that teaching should encourage learning and orient the learner towards structuring knowledge in a way that enables the most effective learning (Bruner, 1966; Bevčič et al., 2020).

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3.5 GAME MECHANICS AND LEARNING MECHANICS ORGANISED ON BLOOM'S REVISED TAXONOMY

When we create games, we want to bring the right amount of fun and learning. This is where teachers tend to struggle, as they find it more difficult to link appropriate game mechanics to different learning strategies. The GAME-ED project (Game-ED project team, 2022) has used a framework (Suttie et al., 2012) to develop a methodology for selecting game mechanics appropriate for the development of creativity, which includes game and learning mechanics organised according to the thinking process stages in Bloom's revised taxonomy.

3.5 GAME MECHANICS AND LEARNING MECHANICS ORGANISED ON BLOOM'S REVISED TAXONOMY

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Game mechanics		Thinking skills	Learning mechanics	
Design/Editing Infinite Game Play Ownership Protégé Effect	Status Strategy/Planning Tiles/Grids	CREATING	Accountability Ownership Planning Responsibility	
Action Points Assessment Collaboration Communal Discovery	Resource Management Game Turns Pareto Optimal Rewards/Penalties Urgent Optimism	EVALUATING	Assessment Collaboration Hypothesis Incentive	Motivation Reflect/Discuss
Feedback Meta-game Realism		ANALYSING	Analyze Experimentation Feedback	Identify Observation Shadowing
Capture/Elimination Competition Cooperation Movement	Progression Selecting/Collecting Simulate/Response Time Pressure	APPLYING	Action/Task Competition Cooperation Demonstration	Imitation Simulation
Appointment Cascading Information	Questions and Answers Role-play Tutorial	UNDERSTANDING	Objectify Participation Questions and Answers	Tutorial
Cut scenes/Story Tokens Virality Behavioural	Pavlovian Interactions Goods/Information Momentum	RETENTION	Discover Explore Generalisation	Guidance Instruction Repetition

Table 1. Relationships between "game" and "pedagogical aspects" of serious games (Suttie et al., 2012)

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3.5 GAME MECHANICS AND LEARNING MECHANICS ORGANISED ON BLOOM'S REVISED TAXONOMY

A very interesting example of defining different learning objectives and appropriate game types and functionalities has been developed by the Uni-Game project (Pivec et al., 2004), where questions such as: which types of games can address specific learning objectives, which functionalities should be included in games to successfully pursue the chosen learning objectives, etc. can be answered.

What we can conclude is that different game mechanics can be used to address different thinking skills in students. Moreover, based on the results of the GAME-ED project research, we can conclude that games usually include game mechanics that promote the development of thinking skills at different levels according to the Revised Bloom's Taxonomy. We need to make sure that our games and the selection of game mechanics are balanced in a way that is sufficiently motivating for players and, of course, not too challenging.

3.5 GAME MECHANICS AND LEARNING MECHANICS ORGANISED ON BLOOM'S REVISED TAXONOMY

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It is therefore essential that when developing our own games, we first think about the learning objectives we want to achieve with the game and support these learning objectives with appropriate game mechanics that will allow students to both learn and have fun while playing.

Adult education is not the subject of this study (and project). However, it is worth emphasising that game-based learning is also used in the labour market, including in recruitment and implementation processes related to taking new professional positions (Senderek et al., 2022). The use of game-based learning is therefore continued after the end of the education process of pupils and students. Another important remark concerns the use of this concept in the social and vocational rehabilitation of people with disabilities (Tlili et al., 2022).

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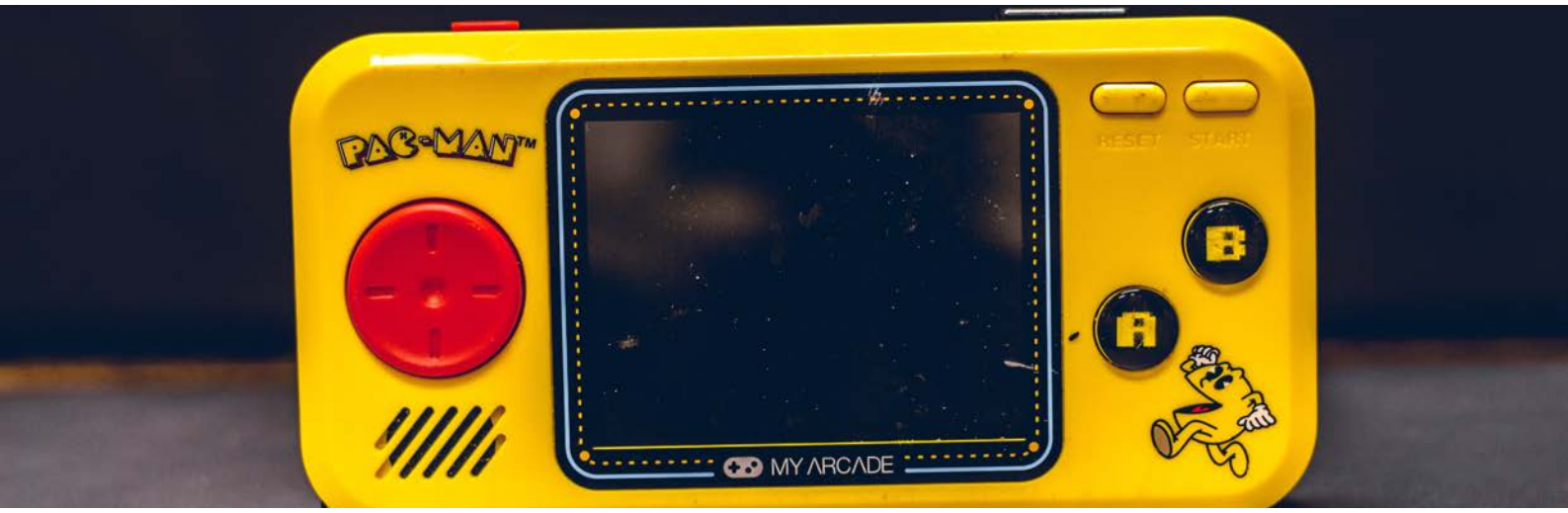
4. GAME-BASED LEARNING EDUCATIONAL MODELS AND APPROACHES



Salen and Zimmerman (2003) defined a game as “a system in which players engage in artificial conflict, defined by rules that result in a quantifiable outcome”. It is not an easy task to design an interesting game that motivates, involves players, and immerses them in fun activities while meeting learning objectives at the same time (Achiruzaman, 2019). The collaboration is required between psycho-pedagogical scientists and industrial game designers (Linek et al., 2009). There are several models that describe the process. Below is a table with some examples of models that are often used when talking about game-based learning.

4. GAME-BASED LEARNING EDUCATIONAL MODELS AND APPROACHES

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Authors	The basic stages/phases of development assumed by the model
ADDIE (Grafinger, 1988; Molenda, 2003; Wang & Hsu, 2008)	Analyse, design, develop, implement, and evaluate
SADDIE (Zapušek & Rugelj, 2013; Zapušek & Rugelj 2021; Rugelj, 2015)	Specification, analysis, design, development, implementation, evaluation
11 main issues (Kapp, 2012)	Learning Goals, Audience, Game Design, Theming and Story, choosing a Game Genre/Type, Playing Games, Wireframing, One-page Design, Paper Prototyping, Storyboard, Design Document
Digital Game-Based Learning-Instructional Design Model (DGBL-ID) (Zin et al., 2009)	Analysis (analysis of requirements and problems, determination of student characteristics, definition of the learning objective, determination of the game idea, definition of the teaching environment through the game), design (lesson design, game design), development (develop lesson plan, develop teaching materials, develop game prototype), quality assurance (check quality of the game, check content of the game, improve quality of the game), implementation and evaluation (introduction, evaluation and modification)
The 5/10 model (Jeuring, Rooij & Pronost, 2013)	Analyze (setting learning goals, analyzing learning material and background, analyzing existing teaching methods, analyzing related learning games), design (designing learning tasks, sequencing task classes, setting performance goals, designing supporting information, designing procedural information, design challenges and levels), develop (create artistic content, program the game, debug), implement (implement in test environment, implement in teaching environment), evaluate (internal tests, public tests, get feedback)

Table 2. Models that are often used when talking about game-based learning.

Looking at the different models, we can quickly see that most of them have similar stages or phases: analysis, design, development, implementation and evaluation. In this section three of them will be presented more in detail.

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4.1 ADDIE MODEL

The ADDIE Model was based on the Five Step Approach ID Model, developed by the U.S. Air Force. It stands for Analyse, Design, Develop, Implement and Evaluate. It is a generic process and instructional design methodology, traditionally used as a guideline to enable designers or developers planning and developing effective education and learning programs (Kurt, 2018; Aldoobie, 2015). The stages in the model are following:

Analyse stage

The Analysis stage is always about setting learning objectives based on the target need analysis. Depending on the level of competencies or skills of the targeted audience, the sophistication of the game must be determined, as well as learning and teaching objectives.

Design stage

In this stage the learning objectives must be operationalised, the content is designed based on planned and possessed resources, available technology, and funds. This phase should be systemic, and specific. Systematic means an orderly method of identifying and assessing the usefulness of the designed strategies aimed at achieving the intended teaching goals, and the specific one determines the attention to every detail of the designed game.

Development stage

In this stage the content is being created that has been designed in the previous phase. Programmers/developers work to integrate technologies, then the product is tested, reviewed, and revised according to the given feedback.

4.1 ADDIE MODEL

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Implementation stage

During this stage a procedure for training the facilitators and learners is developed. The facilitators are trained in terms of learning objectives, methods of delivery of the content, testing procedures. Additional training materials (also for students) are prepared as well. The training for facilitators can reveal additional shortcomings in the game, thus the role of designers in this stage is very important.

Evaluation stage

The evaluation can be formative and summative. The formative evaluation refers to all stages, while summative occurs at the end of the program. The main goal of this stage is to determine whether the learning objectives have been met and what to do to increase the effectiveness of the tool.

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4.2 SADDIE MODEL

The design and development of serious games can also be based on the SADDIE model (Rugelj, 2015), which was developed as an extension of the ADDIE model, one of the most widely used models for educational content development. The SADDIE model includes an additional phase, called Specification, set as the first phase of the model. The main idea of the additional phase is to identify a didactic problem in the learning process that cannot be effectively solved by traditional teaching/learning methods, to identify specific learning objectives and to propose an innovative educational method or game technique that could be used to effectively solve the problem. Game developers document all stages and submit the project documentation together with the game for evaluation at the end of the game creation process.

As a complement to the ADDIE method above, we will look in more detail at the specification phase foreseen by the SADDIE model. Specification is a rather didactic task. At this stage, the authors, based on their experience, identify "weak points" in traditional teaching and learning of the selected topics where they and their students need help. Considering the curriculum, they define the learning outcomes and the didactic method or technique of the game that will serve them in the later stages of the project to design and develop the elements of the game. It is very useful if the authors develop at least a rough idea of the story, which will later be the basis for the script.

4.2 SADDIE MODEL

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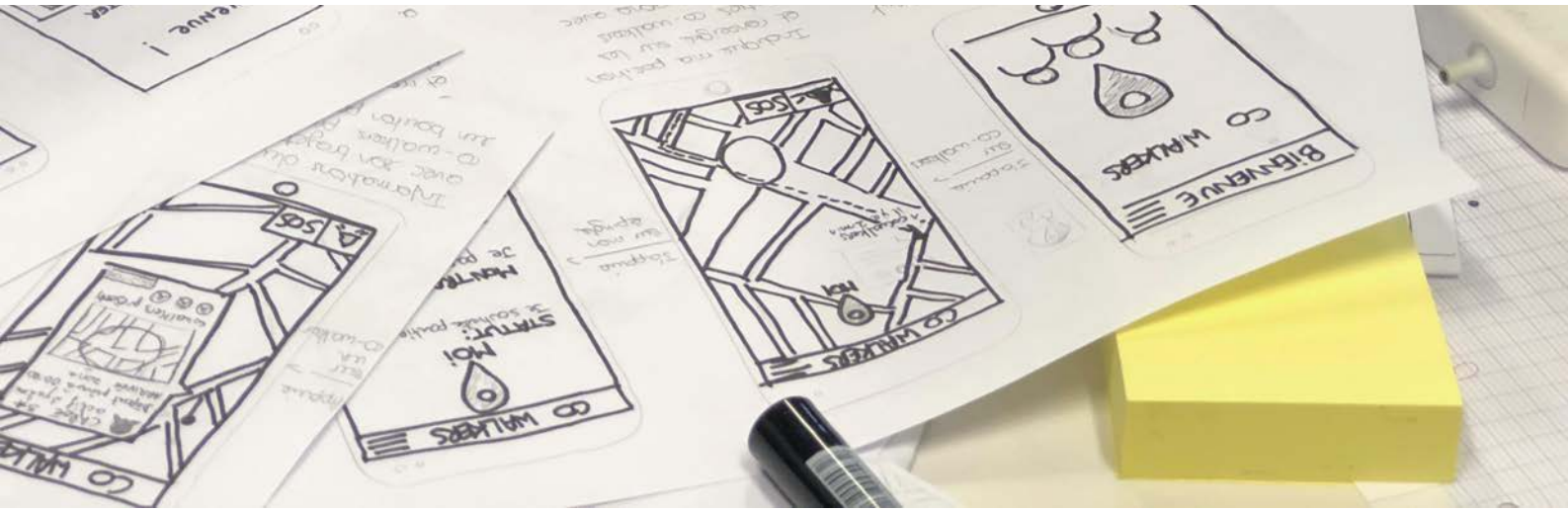

The story defines the time and place of the events, the characters and the various artefacts that appear in the story and the links between them, together with the plot and the challenges that are at the heart of the story. This specification can then be passed on to the team that will develop the game (Rugelj, 2015).

The GAME-IT project (Jedrinovic et al., 2020) has developed a methodology guide for designing games and game scenarios based on the SADDIE model, where each of the phases is further supported by sub-phases to make it as easy as possible to design and build games. The phases as defined in the project are: a) **Specification**: identifying suitable topics; defining learning objectives, teaching method and strategy; formulating the first idea of the story'; b) **Analysis**: collect relevant information; analyse learning objectives and teaching methods'; c) **Design**: selecting the theme, the game universe and the definition of the game plot; definition of the game system, the rules and the choice of game mechanics; developing character profiles and defining non- playable characters; definition of the levels of difficulty; definition of the time frame for a single game; Determining the number of players; Determining accessories and multimedia tools for the game; preparing the core design document; d) **Development**: the production of the game; creation of the game manual; e) **Implementation**: consider how to use games in education; prepare lesson plans for teachers; f) **Evaluation**: beta tests; gamma tests; prepare tips and tricks for troubleshooting.

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4.3 ELEKTRA MODEL

ELEKTRA (Enhanced Learning Experience and Knowledge Transfer) was an EC-project under FP6 on game-based learning. One of the aims of this project was the conceptual design and production of digital learning games. The methodology that has been elaborated builds not only framework for structuring and supporting the interdisciplinary cooperation, but also inherent several interrelated phases and evaluation-cycles that enable continuous improvements and enhancements of the educational game design. The methodology is built on 4Ms: *Macroadaptavity* (M1), *Microadaptavity* (M2), *Metacognition* (M3) and *Motivation* (M4). *Macroadaptavity* refers to the potential pedagogical sequencing of alternative learning situations/scenarios for one specific learning objective. Microadaptavity refers to a specific learner, thorough understanding his/her skills and competencies and potential pedagogical rules determining the required interventions. Metacognition is about cognitive processes at the general level.

4.3 ELEKTRA MODEL

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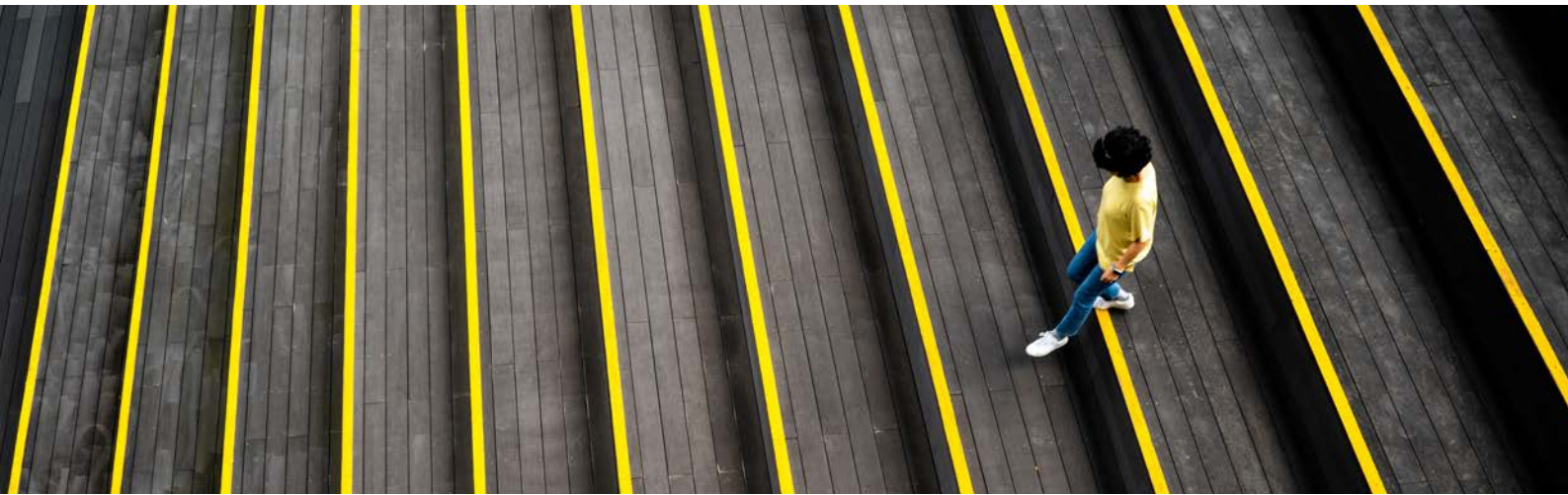
Finally, Motivation refers to different techniques and approaches used for enjoying and learning. The whole process consists of 8 following phases (Linek et al., 2009; Kickmaier-Rust et al., 2006):

- Phase 1: identify instructional goals
- Phase 2: instructional analysis
- Phase 3: analyse learners and context of learning
- Phase 4: write performance objectives and overall structure of the game
- Phase 5: learning game design
- Phase 6: production and development
- Phase 7: evaluation of learning
- Phase 8: revise instruction

Listed phases do not follow linear order but have several interconnections and feedback cycles that enable a close interdisciplinary collaboration between game design, pedagogy, cognitive science and media psychology.



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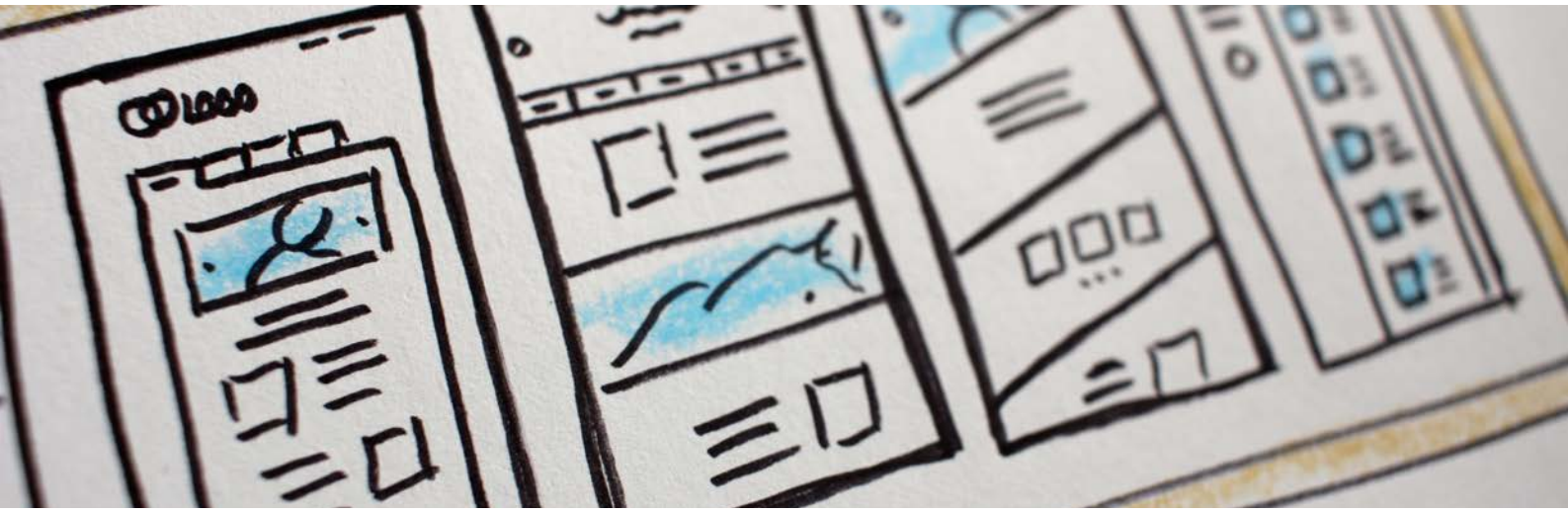
4.3 ELEKTRA MODEL



Overview of the model is presented on the Figure 1:

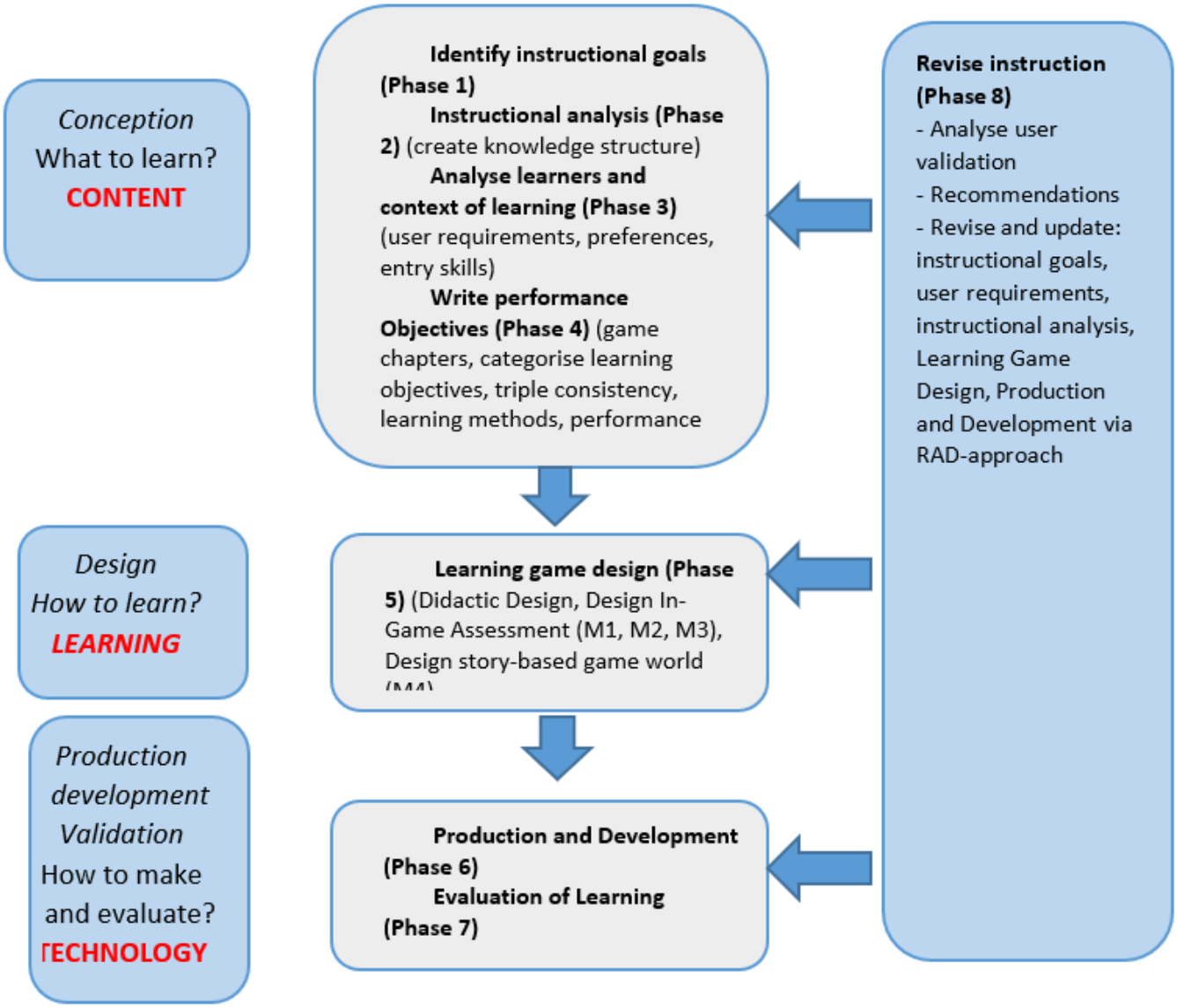


Fig. 1: Overview of the ELECTRA Model. Source: Own Authors based on Linek et al., 2009, p. 137.

4.3 ELEKTRA MODEL

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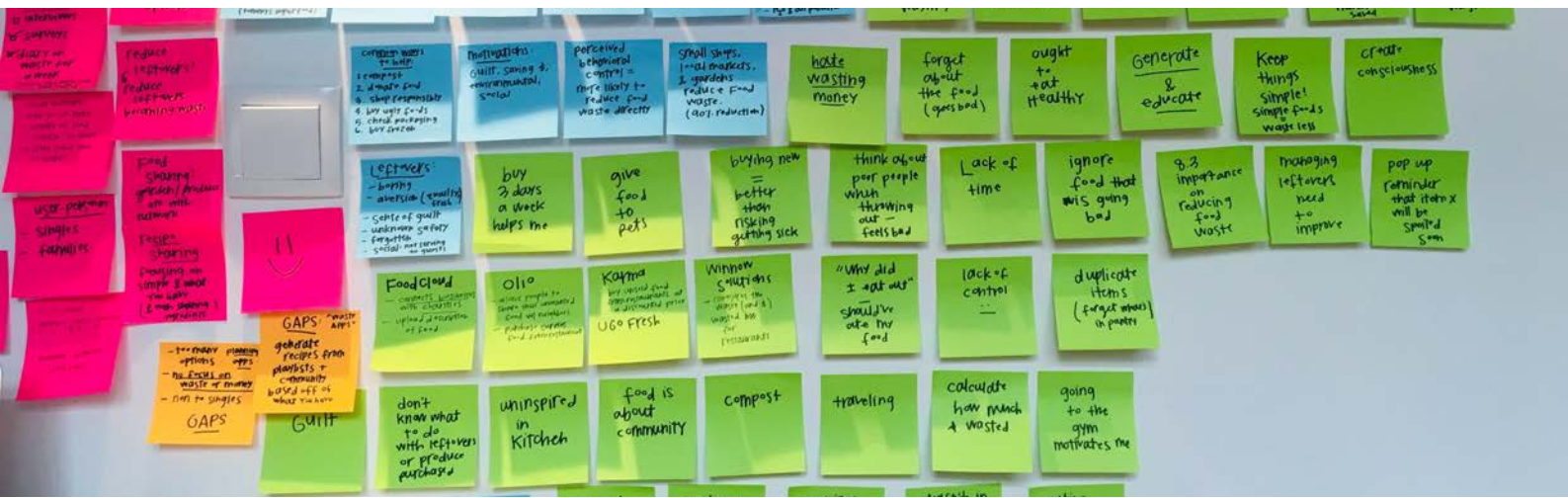
The very core of the ELECTRA methodology is Phase 5, where the integration of learning and gaming takes place. The main task in this phase is to develop detailed descriptions of each situation in the game: Learning situations (LeS), gameplay situations (GpS), and storytelling situations (StS). Every situation must be described in terms of stage, possible actions, and events that happen in the environment in reaction to the player's activities (Linek et al., 2009). The crucial challenge is how to integrate the learning valid activities with the attractive virtual game-based environment.

Both presented methodologies/models are very flexible and can be used as a framework for designing a broad spectrum of educational games.



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5.1 EDUCATIONAL ROLE-PLAYING GAME TO FOSTER INTERCULTURAL AWARENESS

Storyland of options (SLO game) is a role-playing game inspired by various geographical, economic, cultural and historical features. The player has to cooperate with his fellow players, famous Slovenian people, from different regions, follow the roads of Slovenia and find the missing parts of the map through different missions (GameIT. Story Land of Options - SLO Game).

Learning goals:

- increasing general knowledge of Slovenia and Slovenian culture;
- practising and developing communication and collaboration skills in English;
- practising and developing intercultural awareness and tolerance for differences;
- Improving decision-making skills and increasing ability to take practical and effective action, etc.

Fig. 2: Game Storyland of Options, step by step. Source: GameIT. Story land of Options - SLO Game.

5.2 EDUCATIONAL CIVILIZATION BUILDING GAME TO FOSTER CRITICAL THINKING

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Planet Hexagon is a competitive/cooperative civilization building game in which players build their civilization by collecting and placing hexagonal tiles on their game board. The game is designed for 4 players or groups of players, who compete against each other in creating a new community through collecting different tiles and building houses and public buildings, acquiring forests, water and fields and setting up factories and farms. Different combinations of tiles score points, and the player or team that scores the most points win (GameIT. Board game. 2017–2020).

(Learning) goals:

- development of creative thinking;
- communication;
- intercultural awareness;
- cooperative skills;
- english language skills.

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5.2 EDUCATIONAL CIVILIZATION BUILDING GAME TO FOSTER CRITICAL THINKING

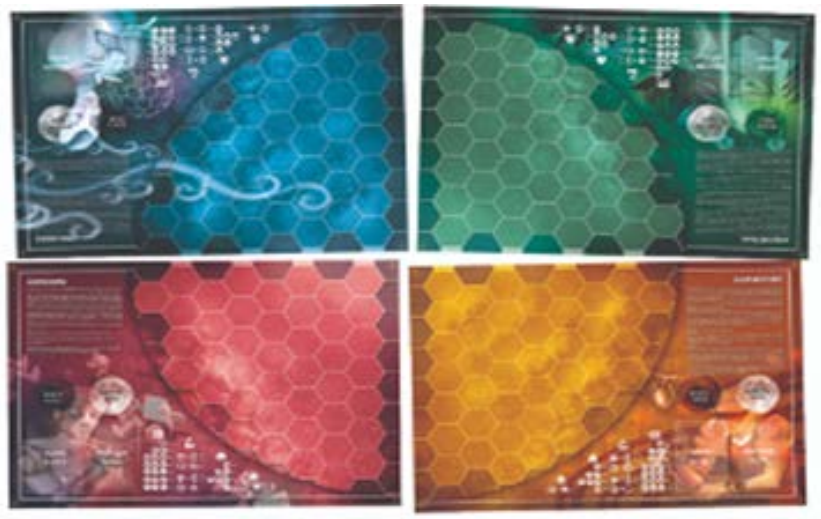

Fig. 3: Game Planet Hexagon, boards. Source: GameIT. Board game.

Fig. 4: Game Planet Hexagon, tiles. Source: GameIT. Board game.

5.3 EDUCATIONAL GAME FOR BUILDING PROGRAMMING SKILLS

Co-funded by the Erasmus+ Programme of the European Union

Coding4Girls has developed a web-based platform where teachers can create their own coding course using Snap! as a serious educational game, track their students' progress and access a public database of courses created by other teachers. To support teachers, 22 learning scenarios for teaching coding in Snap! have also been developed, which teachers can integrate into a serious educational game on the developed web-based platform. The learning scenarios describe end-to-end blended learning activities that deploy the CODING4GIRLS serious game and design thinking approaches. In each scenario, the teacher has an example of a full code created in Snap! and a semi-finished scenario for students to solve. In addition, each scenario includes general and specific learning outcomes, objectives, tasks, and a brief description of the activity, information on duration, learning and teaching strategy and methods, teaching styles, a summary of the lesson, and other tools and resources for the teacher and students (e.g., instructions for students to help them work independently and additional tasks for advanced students).

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5.3 EDUCATIONAL GAME FOR BUILDING PROGRAMMING SKILLS

Learning goals:

- to prepare young learners to enter computer science careers by building programming skills;
- to enable learners to apply the newly developed programming knowledge in wider learning contexts;
- to build transversal competencies related to programming, such as analytical and critical thinking;
- to foster positive attitudes towards computer science among girls and boys with the objective of promoting the uptake of related educational and career paths;
- to raise awareness on the links between ICT and the real-world through learning scenarios that demonstrate how ICT solutions can enhance quality of life and address common needs;
- to empower learners to think entrepreneurially for introducing solutions to real-world problems through design thinking mindsets.

Fig. 5: Coding4Girls, The Students' Game Environment. Source: Tuparova et al., 2020.

5.4 EDUCATIONAL COMPUTER GAME FOR NUTRITION EDUCATION

Co-funded by the Erasmus+ Programme of the European Union

The educational computer game Uživajmo v zdravju (Enjoy in Health) was developed within the frame of Enjoy in Health project, financed by Norwegian financial mechanism, the goal of which is to encourage learners to develop a healthy lifestyle. Through the game, learners should familiarise themselves with and implement fundamental recommendations of a healthy lifestyle. Its goal is that learners recognise and learn to plan and carry out healthy daily movement and nutrition activities, and evaluate their own lifestyles. The contents of the game are connected to the contents defined in the syllabus of the Slovenian nine-year elementary school (Kostanjevec et al., 2017; Jedrinović et al., 2018).

Learning goals:

- Understanding recommendations applying to healthy food.
- Classifying foodstuffs in groups regarding the prevailing nutrient.
- Developing the skills of the healthy choice and combination of foodstuffs to ensure adequate variety in meals.
- Recognising energy needs of a person according to various body activities carried out.
- Getting familiar with nutritional and energy values of foodstuffs.
- Developing a positive relationship to healthy nutrition.
- Encouraging a sufficient intake of liquids, particularly water.
- Raising awareness on the importance of sufficient movement activities for health.
- Understanding the significance of sleep.
- Encouraging healthy behaviour patterns that support a healthy lifestyle.

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5.4 EDUCATIONAL COMPUTER GAME FOR NUTRITION EDUCATION

Fig. 6: Scenes from the game Enjoy in Health. Source: Author's own from the game system.

5.5 GAME-DESIGN BASED LEARNING IN PEDAGOGICAL PROCESS

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We can also involve students in the design and development of games to promote game-design based learning. And students can also build on the SADDIE model to further deepen their knowledge of their chosen topic by creating games. In the following, we present an example of a pedagogical process among future computer science teachers, where students design and build games, often in collaboration with students from other faculties, thus enhancing collaborative skills in addition to game design skills. Students also test the games with the target audience and, based on the results of the testing, upgrade the games for use in the teaching process (Rugelj, 2015; Zapušek & Rugelj, 2013).

(Learning) goals:

- a deeper understanding of the chosen topic;
- creating different learning situations;
- application of knowledge in different learning situations;
- creating interactive learning materials in the form of games;
- learning about and using different tools for creating games.

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5.6 STRATEGIC MANAGEMENT GAMES

Strategic Management Games (Virtual Business Strategic Games) is a web-based business simulations (game) designed mainly for the academic community by different Consortiums led by Poznan University of Economics and Business, on the basis of ADDIE model. The tool has been designed and elaborated with the support of the European Commission in different projects, thus having different versions and forms. One of the current versions can be found under the link https://bizarena.ue.poznan.pl/

The structure of the game is presented at Figure7 and consists of different decision areas of marketing and sales, Research and Development, Operations, Human Resources, Finances, Strategic Management and Reports.

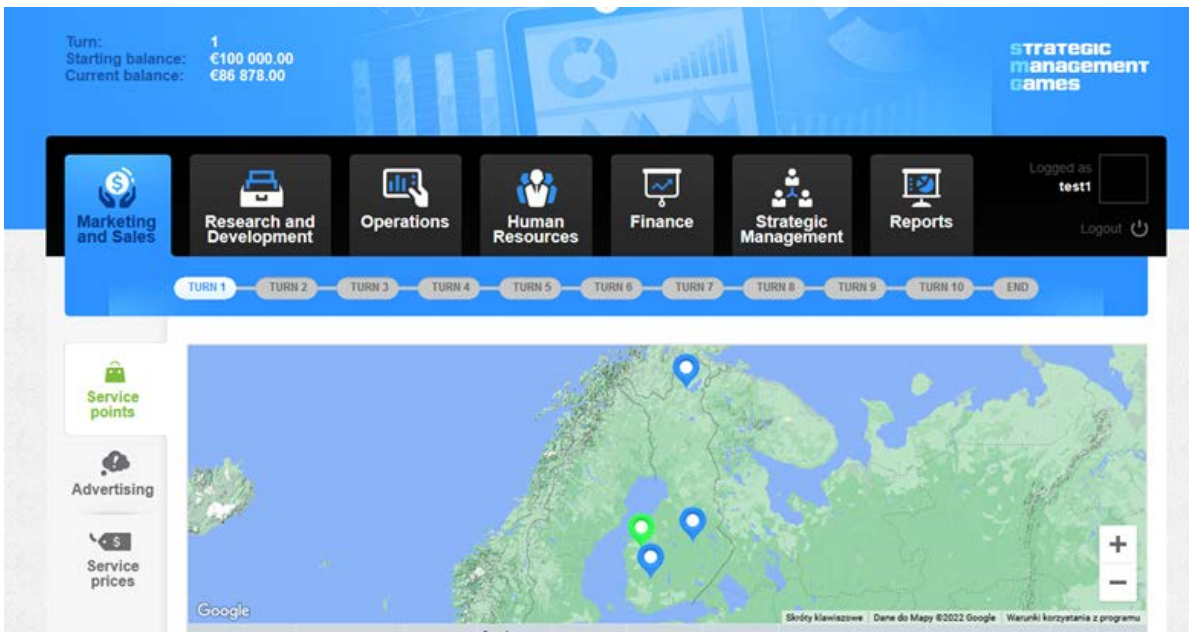

Figure 7 Interface of the Strategic Management Games. Source: Author's own from the game system

5.6 STRATEGIC MANAGEMENT GAMES

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Learning goals:

- gaining knowledge about the creation and development of a company in the global marketplace;
- acquisition of practical knowledge on the creation of competitive advantage of a company active on global market;
- increase students' awareness of the complexity of running business;
- develop students' skills, like teamwork, analytical, decision-making;
- increase students' knowledge about running business in competitive environment;
- increase effectiveness of the learning process through combining education and entertainment.

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6. GAMIFICATION

Two main perspectives on the use of games in higher education developed – game-based learning in which actual games are used in the classroom to enhance learning and teaching, and gamification which advocates the use of game-design elements in non-game contexts (Nemanič et al., 2020c; Lee et al., 2012). Gamification can be understood as the use of game elements in different learning situations to motivate learners.
Definition by Karl M. Kapp (2013): 'Gamification involves game elements, aesthetics and thinking about games in order to motivate learners, encourage active individual engagement, learning and problem solving'.

Gamification is the meaningful integration of game elements into non-game activities. Game elements are the tools, techniques, or devices that we use as building blocks of our material to motivate players to do activities. Some of the most commonly used game elements are (Nemanič et al., 2020a; Kapp et al., 2013):

- **POINTS**: Users like points, they like to collect and win them. Points can be used to reward players at different levels so that within the same page or app, we can use different points to encourage different types of behavior. Points can be used as a status indicator and can be used to access additional content or to acquire virtual goods. Points encourage a good feeling in players, as people like to be rewarded and to feel that they have gained something.
- **LEVELS**: Levels represent e.g. different classes, color belts in martial arts, job titles, etc. So they show the achievement of a certain level or milestone. Different levels also indicate the player's status and allow them to open new content.

6. GAMIFICATION

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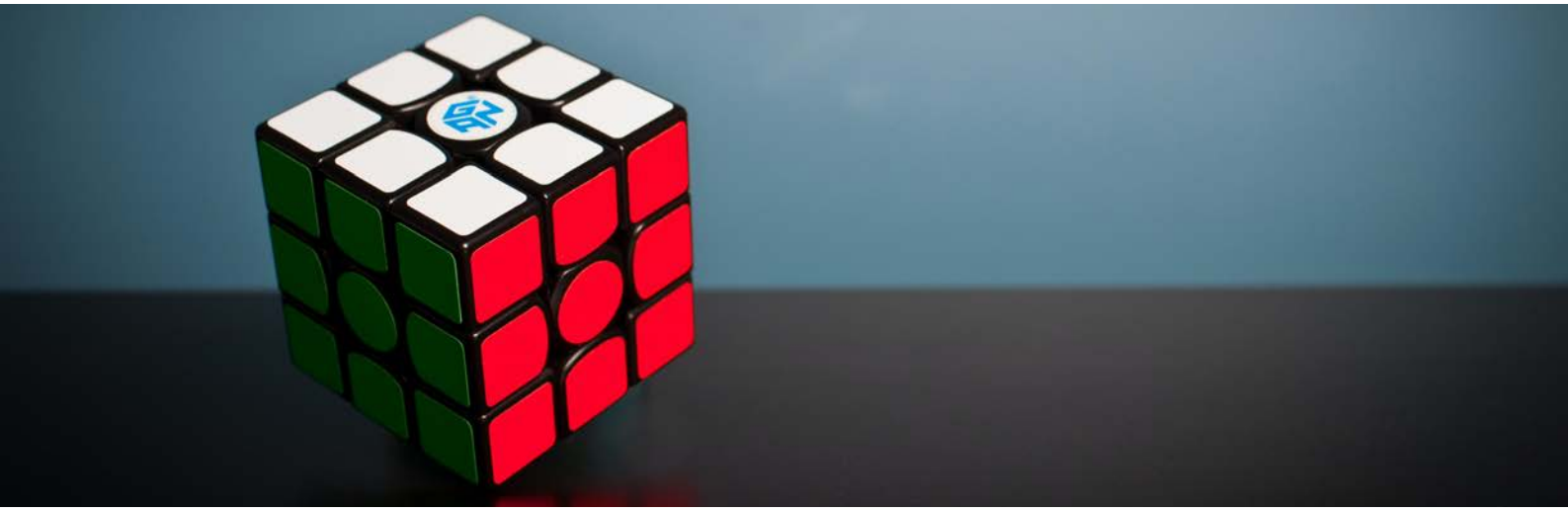

- **CHALLENGES** (trophies, badges, achievements): Challenges (trophies, badges, achievements) present players with "missions" to complete, for which they will be rewarded. Challenges are used to set goals for players and encourage a sense of achievement. It is common practice to define challenges based on objectives and reward players for reaching milestones with trophies, badges and achievements. Trophies, badges, etc. are a visible representation of reaching a level or completing a challenge. One of the key things about awarding badges and trophies is that if they are to be effective, they need to be publicly displayed (e.g. through a player profile).
- **VIRTUAL GOODS**: These are non-physical, virtual objects used in online environments. They can be e.g. swords, coins, potions, digital gifts or clothing for avatars and virtual rooms. Virtual goods allow players to spend their points, buy gifts and express themselves.
- **LEADERBOARDS**: Most successful games have implemented leaderboards. Leaderboards contribute to greater effort and bring "glory". They indicate how we are performing compared to others. In the context of gamification, leaderboards are used to monitor and display certain activities and to use competition to achieve certain behaviours among players.
- **COMPETITION**: Competitions allow players to challenge each other to achieve the highest possible score in an activity. When the activity is completed, the user with the highest score wins and gets a prize.

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6. GAMIFICATION

Moodle
Kahoot
Edmodo
H5P
Socrative
Wordwall

		GAMIFICATION MEHANISMS									
		POINTS	BADGES	RESTRICTED ELEMENTS	PROGRESS BARS	VIRTUAL GOODS	AVATARS	ALTERNATIVE PATHS	CERTIFICATES	LEVELS	LEADERBOARDS	CONTENT SHARING
HUMAN DESIRES	REWARD	Level up! Kahoot Edmodo H5P Socrative Wordwall										
	ACHIEVEMENT		Moodle badges Edmodo	Restrict access H5P								
	BELONGING			Q&A forum								
	COMPLETION				Completion progress H5P Wordwall	Stash						
	SELF EXPRESION					Mootivated		Group choice Lesson				
	RECOGNITION								Custom certificate			
	STATUS									Level up! Edmodo		
	COMPETITION										Level up! Kahoot Socrative Wordwall	
	ALTRUISM											Forum Glossary H5P Socrative

Fig. 8: Demonstration of the possible use of ICT and gamification mechanisms to support human desires. Source. Nemanič et al., 2020a.

6.1 TYPES OF GAMIFICATION

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Delving deeper into the concept of gamification, we come up with two types of gamifications. The first type is STRUCTURAL gamification, and the second type is CONTENT gamification. It is important to note that these two types are not mutually exclusive, as both can be used within the same content or activity for learners. They are most effective when used together (Nemanič et al., 2020b; Lee et al., 2011).

- **Structural gamification** (points, badges, leaderboards, levels, achievements) is the introduction of game elements to a piece of content without significantly changing the content. The content does not become a game, but the structure around the content becomes a game. The main purpose of this type of gamification is to motivate learners to go through the content and engage them in a rewarding learning process (Nemanič et al., 2020b; Lee et al., 2011).
- **Content-based gamification** (challenges, stories) is the use of game elements and game thinking to change the learning content to make it more game-like (Nemanič et al., 2020b; Lee et al., 2011).

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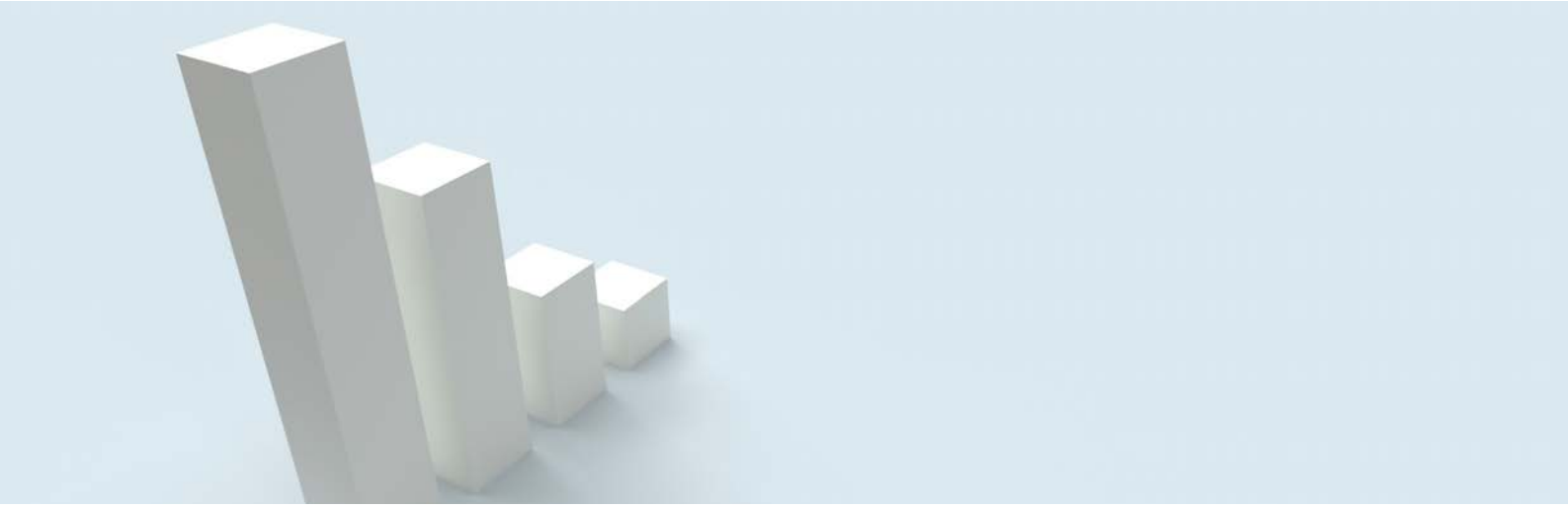
6.2 WHEN TO USE GAMIFICATION IN THE TEACHING PROCESS?



Gamification can be used to achieve a wide range of learning objectives. As with any learning material, gamification is not the answer to all learning situations and it does not make sense to gamify all learning content. Gamification is particularly effective when it is used to encourage learners to progress through content, or when it is used to actively engage individuals in the learning process, or when it is used as a stimulus in problem solving (Nemanič et al., 2020b; Plass et al., 2020).

- **Advantages of gamification**: motivating learners, getting feedback on learners' knowledge, increasing learner participation, formative monitoring of knowledge, active involvement of learners in the learning process, bringing fun and enjoyment into different contexts, encouraging learners, improving behaviour, stimulating innovation, skills development, knowledge acquisition, simplicity and speed of implementation, no need to create a complex game (Nemanič et al., 2020a; Nemanič et al., 2020b; Bugris et. al., 2021). Game-based learning can have a positive impact on students' development of collaborative and teamwork skills, both at secondary school (Di Blas, & Paolini, 2014) and university (Vásquez, 2017).
- **Disadvantages of gamification**: elements of the game are strenuous for some learners, effectiveness depends on how it is used, it affects individuals differently, some elements of the game (e.g. leaderboards) can create a divide between learners (Nemanič et al., 2020a; Nemanič et al., 2020b; Bugris et. al., 2021). Also, a decrease in attention span represents a common problem in games (Vásquez, 2017).

7.1 ESCAPE ROOM

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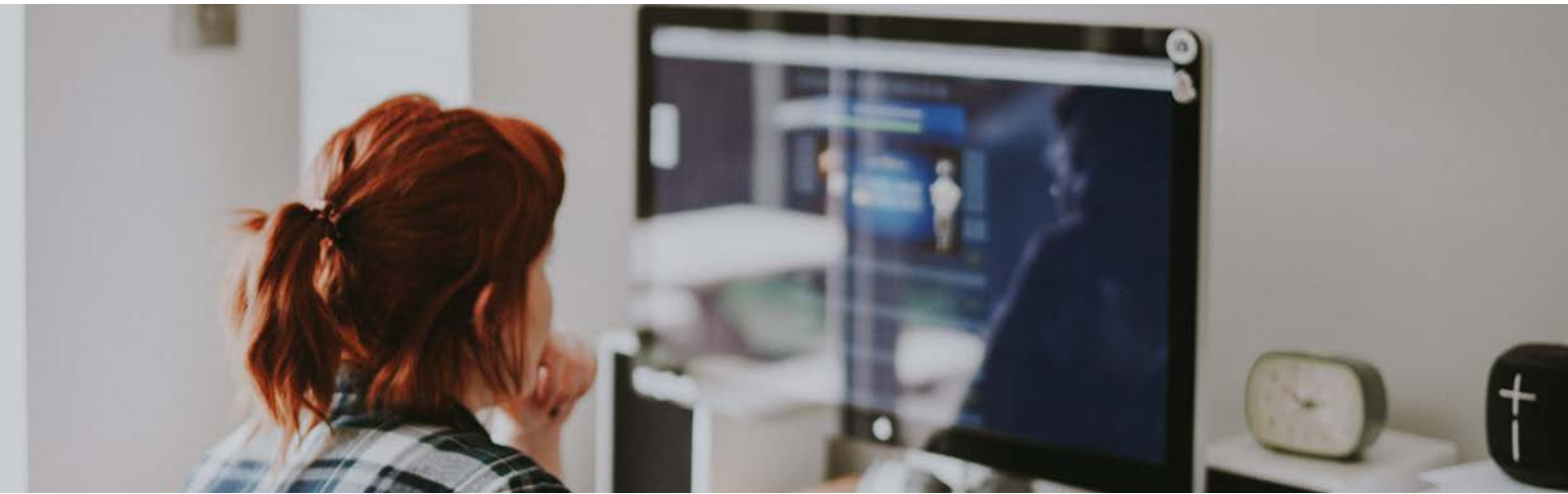
An example of good practice comes from the Faculty of Civil and Geodetic Engineering University of Ljubljana. The starting point for the inclusion of gamification in the teaching process was the teachers' desire to make the preparation for the colloquium more interesting and effective, and to give students immediate feedback on content they do not fully understand and cannot yet apply successfully to mathematical problem solving. The teachers set up an escape room in the Moodle online classroom with successive quizzes. Students solved the problems in groups on their own devices during the practical exercises. Groups of students competed against each other.



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7.1 ESCAPE ROOM

Students who solved the escape room on time got bonus points in the colloquium. The number of bonus points depended on the position on the leader board (Kramar Fijavž et al., 2022).

(Learning) goals:

- Checking understanding of study content and getting immediate feedback
- Solve maths problems in groups on your own devices (laptops, tablets, mobile devices) during practical exercises
- Including game elements to increase students' motivation to study

Game elements included: points, progression, competition.

7.2 MOODLE GAME CRYPTEX & DIGITAL BADGES

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The two teachers from the Faculty of Arts Universitiy of Ljubljana have introduced gamification into the teaching process. To review and test their knowledge, students played a Moodle game called Cryptex, where they searched for the correct classification codes and checked the answers. Students were motivated and then rewarded for successfully solving tasks by receiving virtual badges in the Moodle online classroom, which were also used to improve their scores in the formal assessment (Šauperl et al., 2022).

(Learning) goals:

- Checking understanding of study content and getting immediate feedback
- Including game elements to increase students' motivation to study

Game elements included: points, badges.

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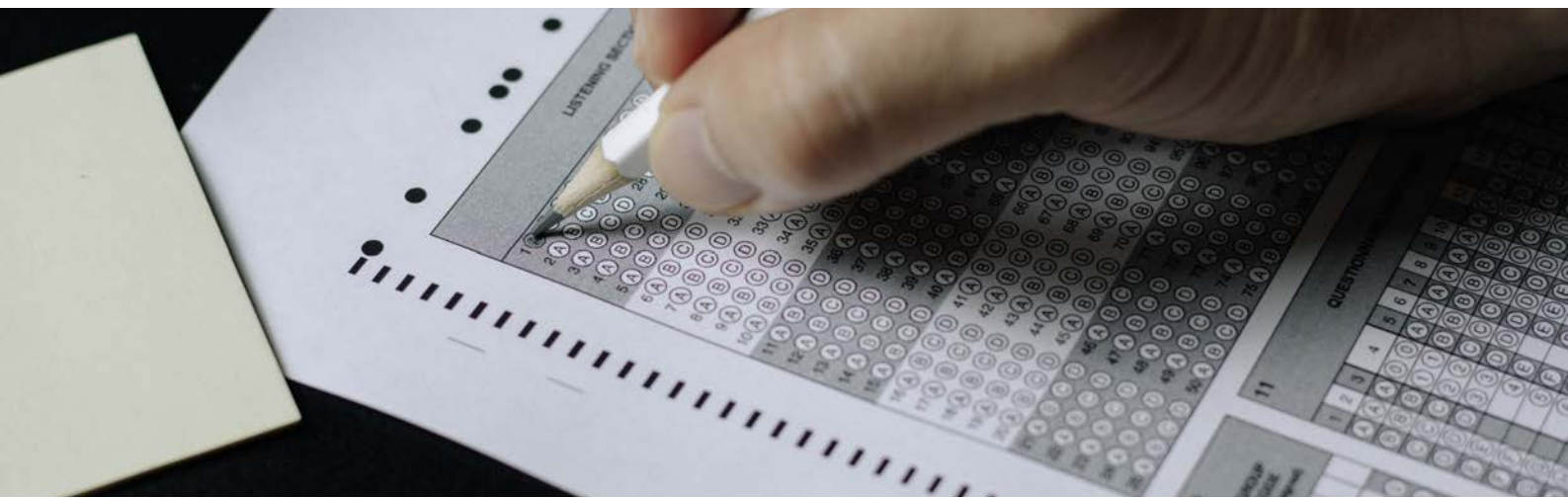
7.3 QUIZZES

Authors at the University of Hong Kong (2020) studied the use of innovative ICT and gamification to create e-quizzes for formative assessment of students' academic performance. The study presents an ICT-enhanced perspective on knowledge assessment in the context of collaborative and exploratory learning. Students took different quizzes: 1. quizzes enriched with a “SpaceRace” competition and a final score display using the Socrative tool; 2. Quizizz quizzes, where students could see their scores as they were being solved, as well as the leaderboard; 3. iSpring quizzes, where students received a certificate at the end of the quiz, in addition to their current scores and the leaderboard (Zainuddin et al., 2020).

(Learning) goals:

- formative assessment of knowledge
- collaborative problem solving
- developing critical thinking

Game elements included: points, competition, leaderboards.



7.4 SOCRATIVE QUIZZES

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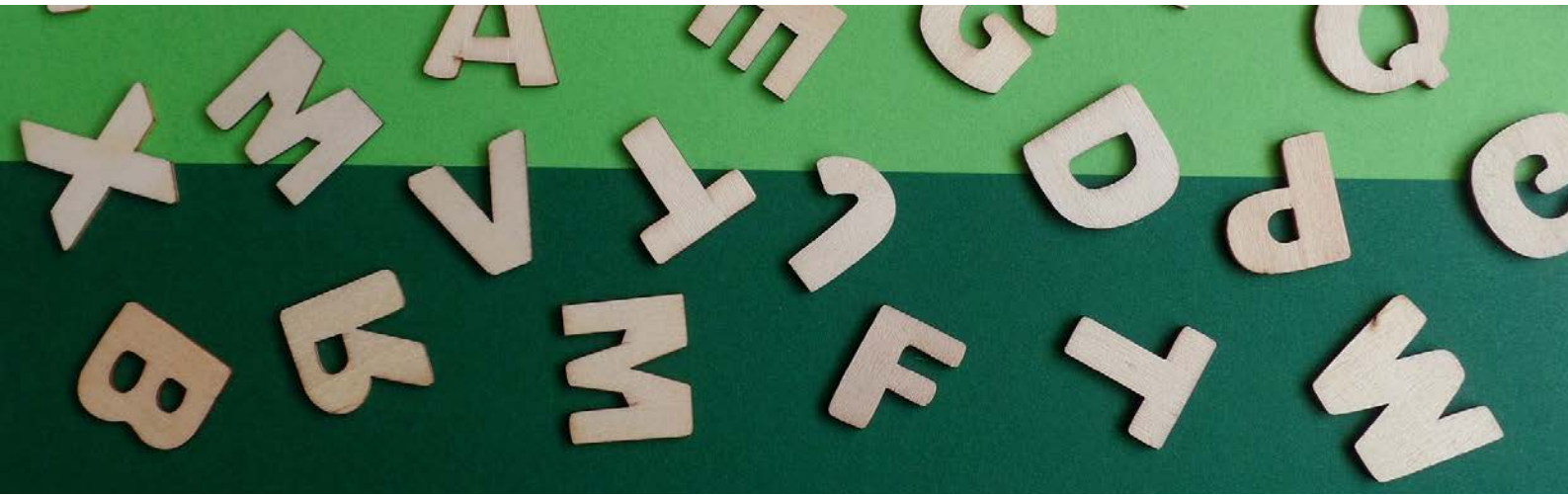
The Socrative tool was used by university teachers to teach students, future teachers of English. Students were given a variety of quizzes to check their understanding of a text they had to read or to review and consolidate their knowledge at the end of the semester. The Socrative tool was also used to include a group quiz competition. In addition, the tool allowed them to see the current scores of each group and a leaderboard (Faya Cerqueiro et al., 2019).

Learning goals:

- increasing interaction with students, motivation to work and learn, mutual cooperation and active involvement of students in the study process;
- increasing students' attention during lectures and checking their understanding of the main content points.

Game elements included: points, competition, leaderboards.



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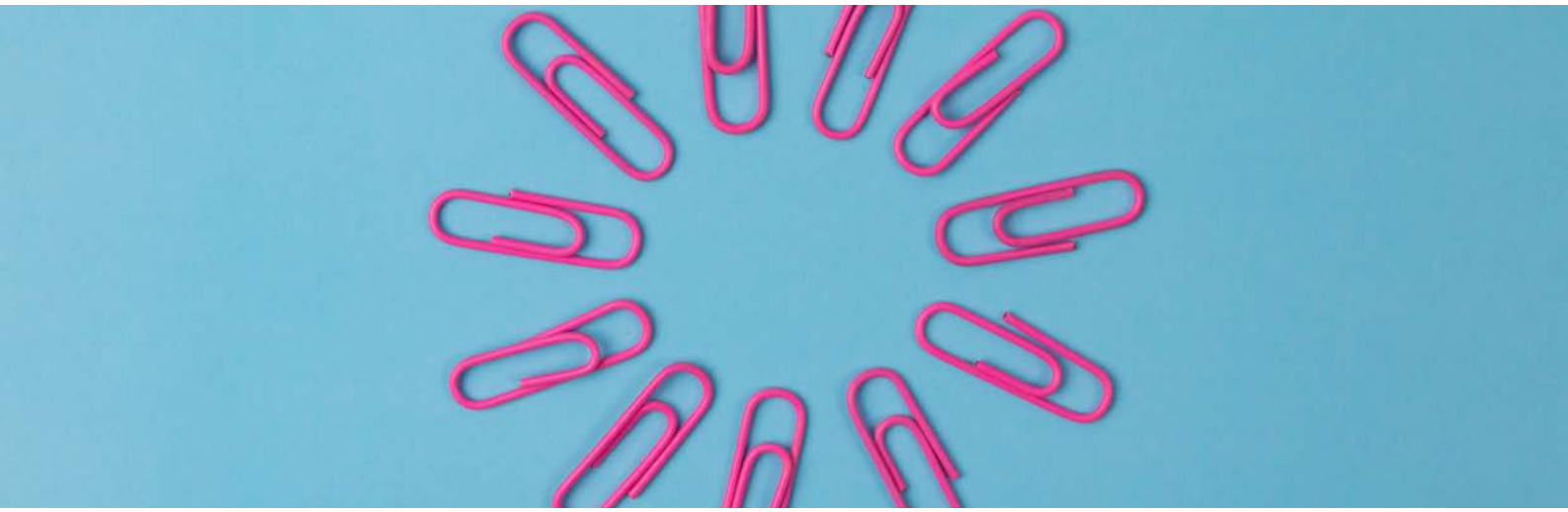
USEFUL LINKS



One can find below a few links that relate to game-based learning.

https://bizarena.ue.poznan.pl/ - business game at Poznań University of Economics and Business

https://www.marketplace-simulation.com/ - US business game

https://www.teacheracademy.eu/blog/game-based-learning/ - educational material about game-based learning

https://www.frontiersin.org/articles/10.3389/fpsyg.2021.749837/full - research paper on how to Implement Game-Based Learning in a Smart Classroom

https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/educational-technologies/all/gamification-and-game-based-learning - educational material about game-based learning

https://educationaltechnology.net/the-addie-model-instructional-design/ - explanation of Addie model

https://www.researchgate.net/publication/266388812_The_Strategic_Management_Virtual_Game_Method_In_Business_Education - Gaweł A., Pietrzykowski M. (2014), book about business simulations in business education

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KEYWORDS

edutainment, movie education, engagement, short movies, audio-visual

In this chapter you will learn about:

- What is Movie Education
- How to run Short Movie Laboratories
- How Audio-visual Production works
- Enable your students gain a deeper understanding and knowledge of contents
- Enable your students boost individual creativity, team working, problem solving, time management, and emotional-relationship capabilities
- Tools and practical examples of movie education

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ABSTRACT

Movie Education represents one of the most innovative and recent approaches in edutainment, being a new methodological model combining entertainment and learning and improving the learning experience of students. Through an integrated methodology, focused on the learner and the use of audio-visuals, the Movie Education approach enables teachers to provide contents and educational stimuli in a more engaging and effective way, turning students into the real protagonists and creators of contents.

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ABSTRACT

The Movie Education approach includes two main tools:

1. short movie laboratories (with learning by acting modality): through the use of basic audio-visual production techniques, the student can become the author, screenwriter, interpreter and "director" of his/her own learning contents, while acquiring analytical, critical and communicative skills;
2. audio-visual production (with learning by watching modality): while watching audio-visual products, such as web series and educational TV programmes, of high educational value, the student can explore further interactive contents, by selecting key-words provided in the story.

Thanks to the large variety of stories to be created, acted or simply watched, the Education Movie approach can fit with the majority of disciplines and a large variety of topics.

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ABSTRACT

Students engaged in a Movie Education experience will gain key hard skills: a deeper understanding and knowledge of contents, learning retention, production and transmission of knowledge. Students will also gain soft skills: development of individual creativity, team working, problem solving, time management, and emotional-relationship capabilities.

A list of useful links is provided to support and guide teachers through movie education tools and approaches.

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1. WHAT IS MOVIE EDUCATION?

Movie Education is a new methodological model conceived and developed by CONFORM S.c.a.r.l.[1] within the Research and Development Programme of the Italian Ministry of Economic Development (MISE), as well as a registered trademark of CONFORM S.c.a.r.l. at the Mise, whose correlated formats/methodological models have been filed with the SIAE to protect the know-how and ownership rights. Its adoption allows you to overcome the classic models of training, based on top-down logics, through an integrated approach, focused on the learner and the use of audio-visuals and combines entertainment and learning and improving the learning experience of students.

In particular, **Movie Education** bases its "raison d'être" on the awareness of the strong **educational value of the audio-visual**, due to its ability to stimulate the viewer not only emotionally but also cognitively, as well as on the need to adapt training to the evolutions that increasingly characterise the methods of production, publication, access and use of contents, determined by the growing diffusion of new technologies and digital solutions in all disciplinary and professional sectors.

Starting from these assumptions, over the years, the model has developed following **two specific directives**: "**Short Movie Laboratories**" and "**Audio-visual Production**".

[1] The company boasts consolidated experience in the field of research, training, consultancy, management and film and audio-visual production, Cfr. www.conform.it - https://conform.it/movie-education/.

1. WHAT IS MOVIE EDUCATION?

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The first is characterised by the use of **audio-visual** not so much as a "passive" means of disseminating knowledge in any educational field (*learning by watching*) (Guidi E., 2010), but rather as an "**active**" construction and acquisition **tool** for the learner (*learning by acting*).

In fact, through the use of basic audio-visual production techniques, the **learner** can become the **author, screenwriter, interpreter and "director" of his/her own learning contents**, while developing those sensitivities and skills (technical and transversal) necessary to transmit a message in audio-visual form, through a structured analytical, critical and communicative process.

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1. WHAT IS MOVIE EDUCATION?

Within this configuration, the application of **Movie Education** has been based on the integration of storytelling workshops within training courses, involving learners in practical activities aimed at re-elaborating the knowledge and skills acquired and "enacting" situations typical of the working contexts of the vocational profiles of the courses at completion.

The second evolutionary directive of the model, on the other hand, has focussed on the development of audio-visual products, such as web series and educational TV Programmes, of high educational value, with the aim of involving and attracting the spectator-learner, contaminating the film plot and/or the entertainment product, with educational elements. In this second configuration, the audio-visual product is characterised by the use of "keywords", pronounced by the actors, directly linked to the didactic contents and/or insights provided by the training courses, which the learner has the opportunity to consult interactively, independently managing the times and methods of his/her learning path.

These solutions of the **Movie Education** model - which are not mutually exclusive, but which can indeed be integrated to enrich and make the entire learning experience more enjoyable - are based, in the first case, on theoretical models known and widely adopted in the educational and training field, in the second case, on a significant analytical process of the evolutions taking place in the entertainment sector; a process that has identified and mapped those elements of a productive, media and technological nature that could be transposed into the educational field, in line with the new logic of edutainment.

2. THE THEORETICAL FOUNDATIONS

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The key elements of **Movie Education**, that is, the centrality of the learner, on the one hand, and the key role of the audio-visual, on the other, respectively find their foundations in some important learning theories and in various empirical confirmations on the use of audio-visuals in teaching methodologies.
Under the first profile, in particular:

- the constructivist model, according to which: "1. *Knowledge is not passively received but actively built up by the cognizing subject; and (2) the function of cognition is adaptive and serves the organisation of the experiential world , not the discovery of ontological reality*" (Glasersfeld E. von, 1989) . Learning, therefore, is not conceived as an act of transmitting knowledge from the educator to the learner, but rather as an active process of acquiring the principles and strategies best suited to achieving one's goals (Bozzo L., 2012).
- the constructionist variant of Papert, at the basis of which there is not only the idea of a "man builder of knowledge", but also the assumption that the construction of knowledge is much more significant in a context where the learner is engaged in the creation of something concrete and shareable. According to this model, in essence "*learning is particularly effective when it is embedded in an activity the learner experiences as constructing a meaningful product*" (Papert S., 1986); a product that, in the Movie Education methodology, is embodied in the active involvement of learners in the activity of screenwriting, in enacting and creating short films focused on behaviours and situations typical of the working contexts in which the vocational profiles obtained at the end of the training courses they haven part in, operate.

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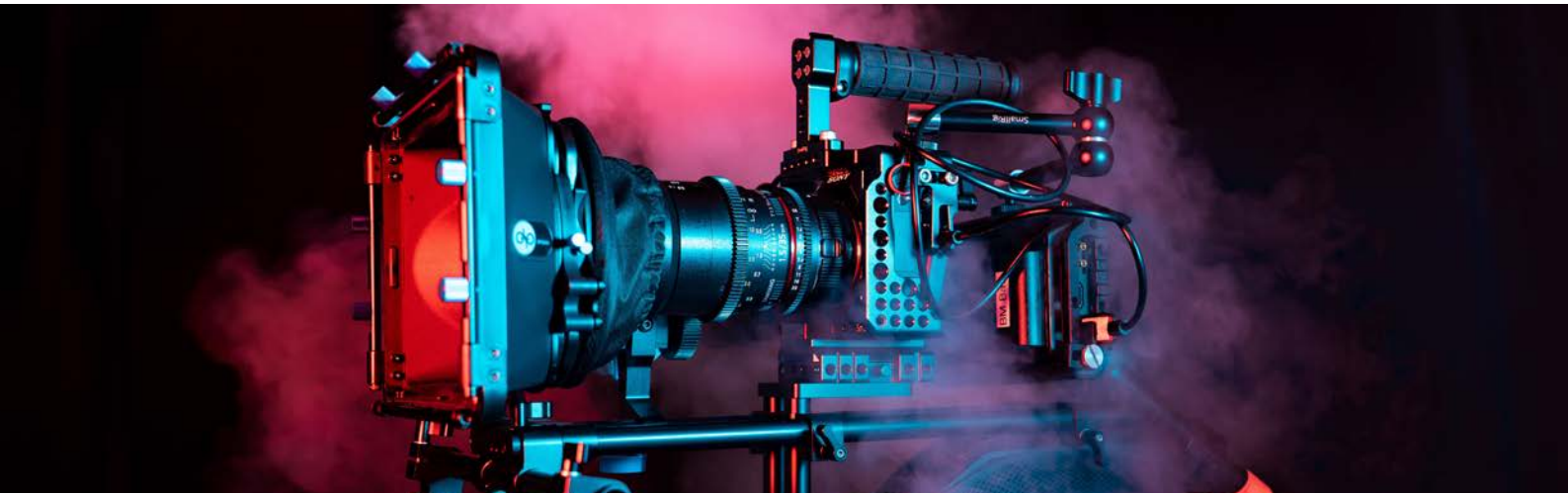
2. THE THEORETICAL FOUNDATIONS

- Kolb's experiential learning that allows learners to "*observe attitudes, develop skills, acquire and modify attitudes*", putting him/her in a position to "*make a critical reflection on assumptions, ideas, perspectives, values, attitudes, behaviours, knowledge and skills*", emphasising the value of direct experience for effective learning (De Girolamo M. V., 2020).

On a methodological level, **Movie Education** has adopted paradigms and challenge-based didactic approaches - such as Problem-Based Learning, Task-Based Learning, Cooperative Learning - which, based on the theoretical models mentioned, develop greater cognitive skills than traditional didactic approaches and favour active learning in students.



2. THE THEORETICAL FOUNDATIONS

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From the second profile, the relationship between the use of audio-visual language and learning processes does not represent a new topic for theoretical-methodological reflections in the educational/training field.
In this regard, since the early eighties, several studies have shown how, in general, people remember about 10% of what they see, 20% of what they hear, 50% of what they see and hear and 80% of what they see, hear and do (Willmot P., Bramhall M., Radley K., 2012). More recent studies and statistical reports, in turn, reveal a growing use of videos in both University (Girardi G., 2008) and Vocational Education (Bouchrika I., 2020), highlighting their impact on a pedagogical level, in particular, in terms of:

1. Interactivity with content (the learner relates to visual content, whether verbally, by note taking or thinking, or by applying concepts)
2. Engagement (the learner connects to the visual content, becoming drawn in by video, whether on-demand or real-time)
3. Knowledge transfer and memory (the learner may remember and retain concepts better than with other instructional media) (Greenberg A. D., Zanetis J., 2012).

Furthermore, the use of videos, combined with an educational approach capable of anchoring learning to real-world/real-case simulations, is likely to significantly improve the **learning retention** of learners, that is *"the process by which new information is transferred from our short-term to our long-term memory"*, described by Hermann Ebbinghaus as early as the end of the XIX Century (Andriotis N., 2017).

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PRACTICAL APPLICATION

Over the years, there have been diverse experimentations and in different learning contexts, both at national and European level of the Movie Education Model.

At national level (Italy), one of the first applications of the ***Movie Education*** methodology was developed by CONFORM S.c.a.r.l within the:

- Centro Sperimentale per lo Sviluppo delle Competenze del settore Finanziario e Assicurativo project, with the involvement of 30 learners participating in the Higher Education course for the vocational profile of the "***Bank Commercial Activities Officer***" in the conception of **9 short films**[2], of which they not only wrote the script, but as "actors", they also played the characters of the stories, after having taken part in both creative writing and acting courses;
- "***Tecnico per la valorizzazione e promozione dei beni delle attività culturali***" project[3], which saw the direct involvement of 23 students in project work to conceive, screen write, act and create **6 short films** of diverse audio-visual transmedia products[4], to narrate the cultural identity of historical personages, villages and places in Campania.

[2] https://conform.it/formazione/educazione-finanziaria/ - https://conform.it/prodotti/nove-cortometraggi/

[3] The project, implemented by CONFORM S.c.a.r.l., was funded by the P.O.R. Campania ESF 2007/2013 - D.D. n. 144 of 12/05/2015 Axis IV Human Capital Specific Objective 2 Operational Objective 2.1 (CUP B36G14002340006). Cfr. https://itinerari.conform.it/wp-content/uploads/2015/07/Brochure_Tecnico_Beni.pdf.

[4] Cfr. https://itinerari.conform.it/prodotti/i-corti/ - https://itinerari.conform.it/prodotti/i-video/

PRACTICAL APPLICATION

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The pedagogical approach adopted, thus, allowed the learners to re-elaborate the knowledge learned in the classroom and in study visits, to metabolize the values of the local culture, the landscape, the historical and artistic sites of the territory and to convey them through film communication methods, putting into effect not only creative techniques, *team working, problem solving and time management*, but also cognitive, valorial, emotional, relational and motor dimensions, as a strategy aimed at the personal and professional development of skills to promote and valorise the territory.

Movie Education was subsequently proposed and tested as part of several European projects under the Erasmus + Programme, relating to the most diverse thematic areas.

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PRACTICAL APPLICATION

In particular, in the *Erasmus + Strategic Partnership for Higher Education "INKAMS - International Key Account Management & Sales" project"*[5], code 2017-1-IT02-KA203-036707, the model was the subject of a "learning mobility" activity at the Università Politecnica delle Marche, which saw more than 10 trainers, university professors and project designers from five European countries (Bulgaria, Poland, Spain, Slovenia, Italy) engaged in an intensive five-day session on the theme of integration between traditional teaching methodologies, typical of Universities, and experimental methodologies based on *edutainment*.

During the meetings, the beneficiaries shared the ***Movie Education methodology***, acquiring its didactic approach, but also the implementation, assessment and dissemination methods necessary to activate, in each partner country, storytelling workshops for university students in partner Universities. As part of the workshops, the students were then involved in the conception, design and implementation of the screenplay for short films on the themes of "***Sales***"[6], which they then interpreted and edited.

[5] Cfr. http://www.inkams.eu/
[6] The short films created by the beneficiaries of the INKAMS project are available at the following link http://www.inkams.eu/cli-ma/, in the "short film" section.

PRACTICAL APPLICATION

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Learning mobilities, Storytelling and Movie Education labs were further tested as part of the *Erasmus + Strategic Partnership for VET "S.M.I.Le. - Sale Management, Inter-culture, Learning" project*[7], code 2018-1-IT01-KA202-006854, with the involvement of eight organisations from four European countries (Italy, Greece, Bulgaria and Poland) and 40 beneficiaries in the creation of short films. This allowed learners to create a direct link between the knowledge acquired through the use of OER (Open Educational Resources) and real situations, linked to the sales sector, stimulating their participation and taking a proactive approach to learning.

Within the *Erasmus+ Strategic Partnership for VET project "B.I.G. - Businesses' International Growth"*[8], Code n. 2019-1-IT01-KA202-007423, the methodology was tested on employees of small and medium-sized enterprises in 5 European partner countries (Italy, Greece, Slovenia, Poland and Spain) allowing them to be the authors and actors of educational sketch-coms to stage the professional behaviours of a digital, relational, commercial, negotiational, communicative and intercultural nature to adopt in international business contexts.

[7] Cfr. https://www.smilearning.eu/.
[2] Cfr. https://www.businessesinternationalgrowth.eu/

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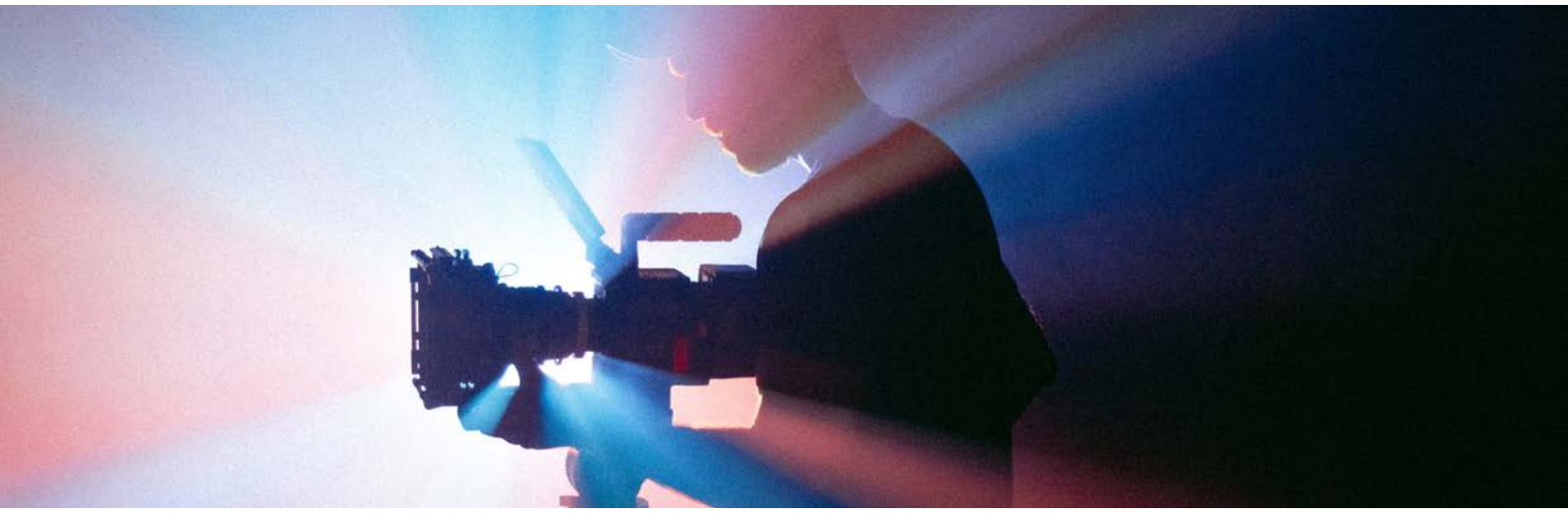
PRACTICAL APPLICATION



These examples of the practical application of the MOVIE EDUCATION model have made it possible to arrive at a shared evaluation of the efficacy of the ***Movie Education*** methodology, thanks to its further experimentation at national and international level and in social-economic contexts different from the initial ones, such as in a business environment, with the creation of a sit-com dedicated to the Italian operational headquarters of DLL, a global finance vending company with over €30 billion of assets, founded in 1969 and based in Eindhoven, in the Netherlands, which provides financial solutions in the following sectors: Agriculture, Food, Medical, Eco-sustainable Technologies, Construction, Transportation, Industrial Equipment, Office Equipment and Industries of the technological sector.

PRACTICAL APPLICATION

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The seven episodes were conceived and written by the executives and employees of DLL through their participation in multiple creative writing courses financed by the category inter-professional fund and then interpreted by the employees who were selected at the end of diverse courses on communication and acting.

The diverse experimentations carried out have also made it possible to develop and apply tools, operational guides and training materials and, at the same time, to define in detail the organisational, technological and production aspects for the implementation of the Short Movie Labs.

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1. SHORT MOVIE LABORATORIES

Introduction

The *Short Movie Laboratories* represent a *Movie Education model* that can be activated in the context of training courses focused on the most disparate issues: from economic and financial ones, to the valorisation of the territory, to new technologies, to transversal skills, etc.

The organisation and implementation of these workshops is part of a framework that foresees, in a prior preparatory phase, some formative sessions in the classroom or in a blended format (traditional lessons, seminars, lectures, e-learning, ...), during which students have had the opportunity to acquire the elements of knowledge of the topics covered by the training course.

In fact, Short Movie Labs allow students to:

- stage the theoretical notions acquired during the course, through the direct participation in the writing of scripts to produce videos capable of allowing you and other beneficiaries to acquire know-how in an easier way;
- acquire and adopt video editing techniques but also those of acting, putting into practice the behaviours related to the topics covered, also through simulation linked to the interpretation of specific roles of vocational profiles.

The workshops are set up as both as a cinematic experience, but also as a highly educational experience, which the learner tends to experience as a light hearted session in the final phase of his or her learning path.

1. SHORT MOVIE LABORATORIES

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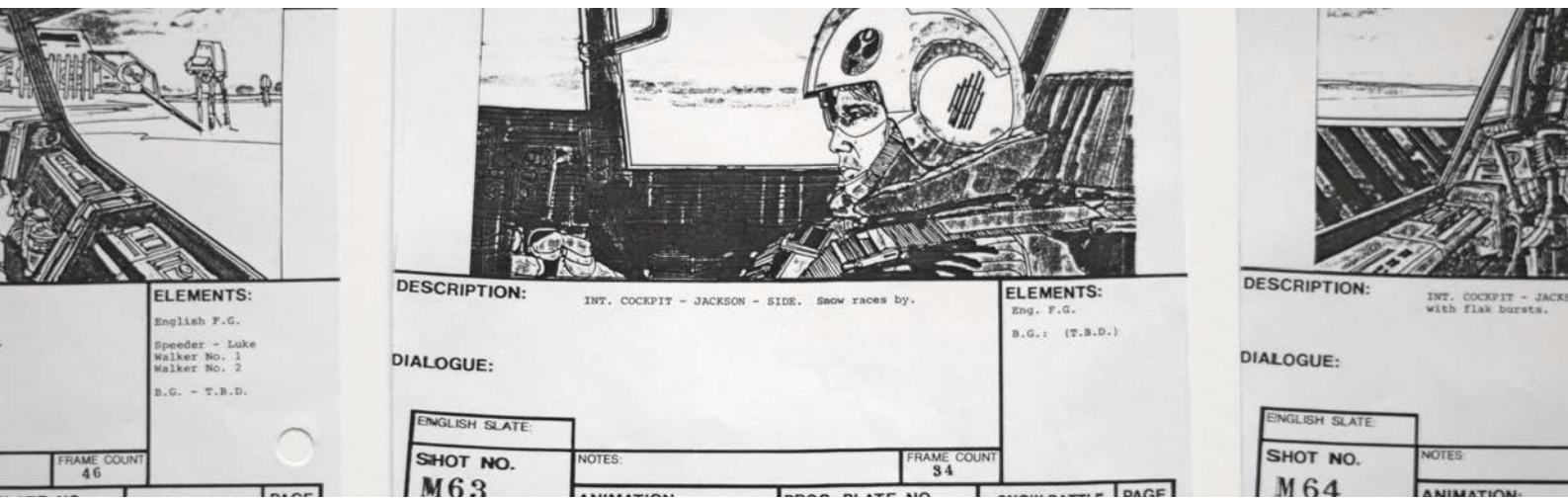
Specifically, the *Short Movie Labs* consist of theoretical-practical training sessions, the duration of which may vary according to the complexity of the themes of the training course, divided into the following interdependent and consequential didactic steps, for each of which we will indicate in the following paragraph the method, the minimum and maximum number of participants, the topic of the session, any tools and equipment to be used, the duration, as well as all the necessary information and practical and operational guidelines to facilitate the task of teachers, trainers and tutors in holding the laboratories, as well as of the personnel involved in various ways in their organisation.

Figure 1: A short movie flow (source: CONFORM S.c.a.r..l.)



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1.2 THE SHORT MOVIE LABORATORIES: OPERATIONAL STEPS AND TOOLS

Step 1: Presentation of the methodology

Method: direct/in the classroom

Number of participants: from 10 to 50

Topic: Movie Education

During this first session, the teachers/trainers present the *Movie Education* methodology and the expected results of the workshop sessions (creation of short videos on the topics covered by the training course) to the learners and then introduce the concept of storytelling.

Tools: any presentations in PPT or other media, summaries of the concepts covered by the session and the work programme of the various workshop sessions, adapted according to the target audience.

Duration: 2-4 hours

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1.2 THE SHORT MOVIE LABORATORIES: OPERATIONAL STEPS AND TOOLS

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Step 2: Storytelling Lab

Method: direct/in person + group activities
Number of participants: from 6 to 12
Topic: From storytelling to the development of the idea.

During this session, the teachers/trainers:

- present the main theories and techniques of storytelling: from the fundamental elements of the story to the models most used for its development (5Ws, 3Cs, the hero's journey);
- define, together with learners, the general theme of the videos/short films to be made, on the basis of the units/OER of the training programme;
- present the working tool of the session: the storyboard;
- create the groups of learners, with a leader/representative and a moderator (teacher/trainer).

Once the working groups have been created, through brainstorming and discussion sessions moderated by the teacher/trainer, the students:

- choose the topic on which to base the story, according to the knowledge acquired during the training course;
- define the idea;
- assign roles to each member of the group;
- write the plot.

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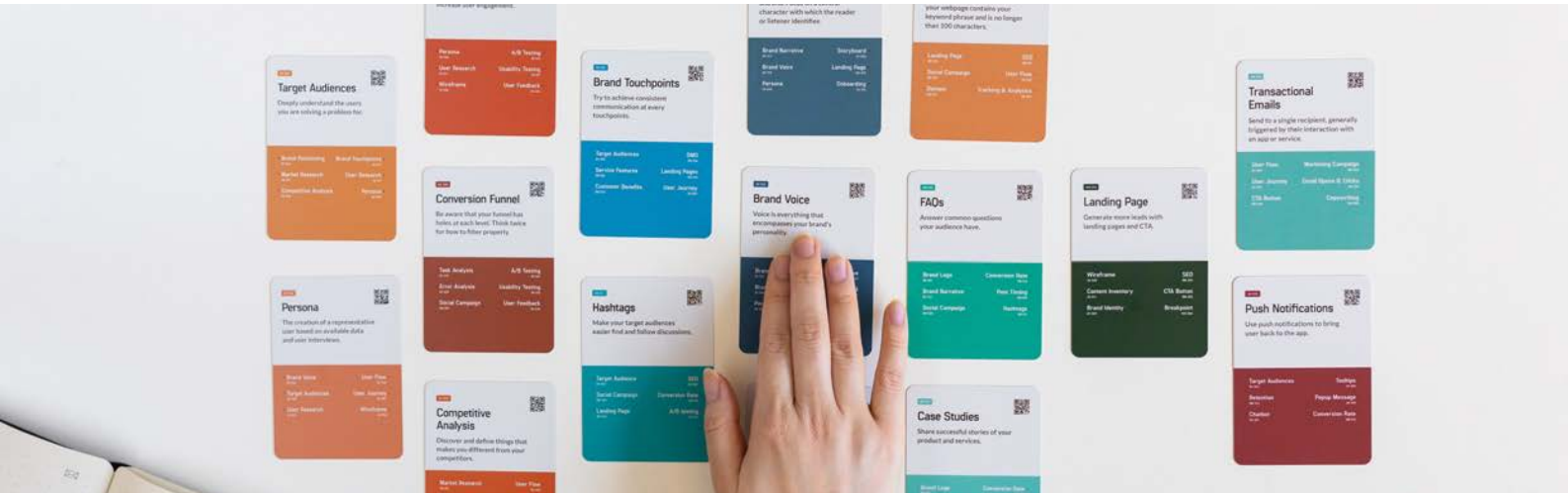
1.2 THE SHORT MOVIE LABORATORIES: OPERATIONAL STEPS AND TOOLS

Tools:

- any presentations in PPT or other media, summarizing the concepts covered by the session, adapted according to the target audience.
- the storyboard

Duration: 4-8 hours



1.2 THE SHORT MOVIE LABORATORIES: OPERATIONAL STEPS AND TOOLS

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Step 3: Development of the storyboard

Method: group activity

Number of participants: from 6 to 12

Topic: Development of the story. During this session, the students, divided into groups:

- define the main elements of the story
- write the storyboard

Tools:

- Storyboard

Duration: 4-8 hours

Step 4: Shooting and Editing

Method: direct/in the classroom + group activity flanked by the teacher/trainer

Number of participants: from 10 to 50

Topic: Presentation of the videos made by the learners in the classroom and their evaluation. During this session, the teachers/trainers provide learners with a series of practical suggestions for the implementation of the shooting and editing activities, possibly also with the involvement of sector experts.

The students, divided into groups, flanked and supported by teachers/trainers and/or by experts in the audio-visual sector:

- identify the location(s) in which to shoot
- interpret the dialogues imagined
- make audio-video recordings of the scenes indicated in the storyboard
- edit the video

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1.2 THE SHORT MOVIE LABORATORIES: OPERATIONAL STEPS AND TOOLS

Tools:

- Storyboard

Duration: 12-24 hours of which max. 2 initial hours in the classroom to present shooting and editing techniques, while the remainder in the locations identified for the shooting and independently or supported by teachers/trainers and/or experts in the audio-visual sector for editing.

Step 5: Presentation of the short films

Method: direct/in the classroom

Number of participants: from 6 to 12

Topic: Presentation of the videos made by the learners in the classroom and their evaluation. During the final session of the *Short Movie Labs*, the leaders/representatives of the different groups of students involved in the workshop sessions publicly present the works made for final evaluation by the teachers/trainers.

Equipment: beamer/large screen

Duration: 1-2 hours

2. AUDIO-VISUAL PRODUCTION

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Over time, the **Movie Education** model has been enriched by numerous audio-visual productions with a high educational value (short films, web series, films or docu-films), made by CONFORM S.c.a.r.l., with the use of interactivity. Specifically, the route pursued in the development of *Audio-visual Productions* has seen the combination of the film approach with the use of technologies that make it possible to transform an audio-visual product which is simply for “entertainment" into an interactive tool, through which you can access a plurality of learning contents.

This solution, in fact, allows learners to interact with the product, involving them and directing them to consulting different insights provided at different points of the story, to expand and consolidate knowledge, skills and behaviours that characterise specific vocational profiles or, in general, further investigate the most disparate issues.

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2. AUDIO-VISUAL PRODUCTION

In this configuration, ***Movie Education*** contributes to the transition from the model based on classroom teaching and/or *e-learning*, which conceives the *learner* as a party called to solely use "data" of educational content (*top-down*), to one in which, instead, learners can:

- on the one hand, learn in a "light" way and with a greater degree of emotional involvement, through the audio-visual product;
- on the other hand, further investigate the issues covered by the training courses independently, by accessing the educational contents thanks to special **interaction** "buttons" that appear on the screen during the use of the video, also in relation to "**key words**" pronounced by the actors during the story[9].

As far as Audio-visual Production is concerned, the first prototype created was "**DIGIT**"[10], an Educational TV Programme for university students, able to combine information and training and accompany users, step by step in their learning path, with the aim of developing a set of interdisciplinary skills.

[9] The series "5TO SUCCEED" is an example, created by CONFORM and provided within the Erasmus+ Strategic Partnership for VET project "*SUCCEED – StimUlate finanCial eduCation to foster EntrEpreneurship and Development*", aiming to develop entrepreneurial skills.
Cfr. https://5tosucceed.conform.it/.
[10] Cfr. https://digit.conform.it.

2. AUDIO-VISUAL PRODUCTION

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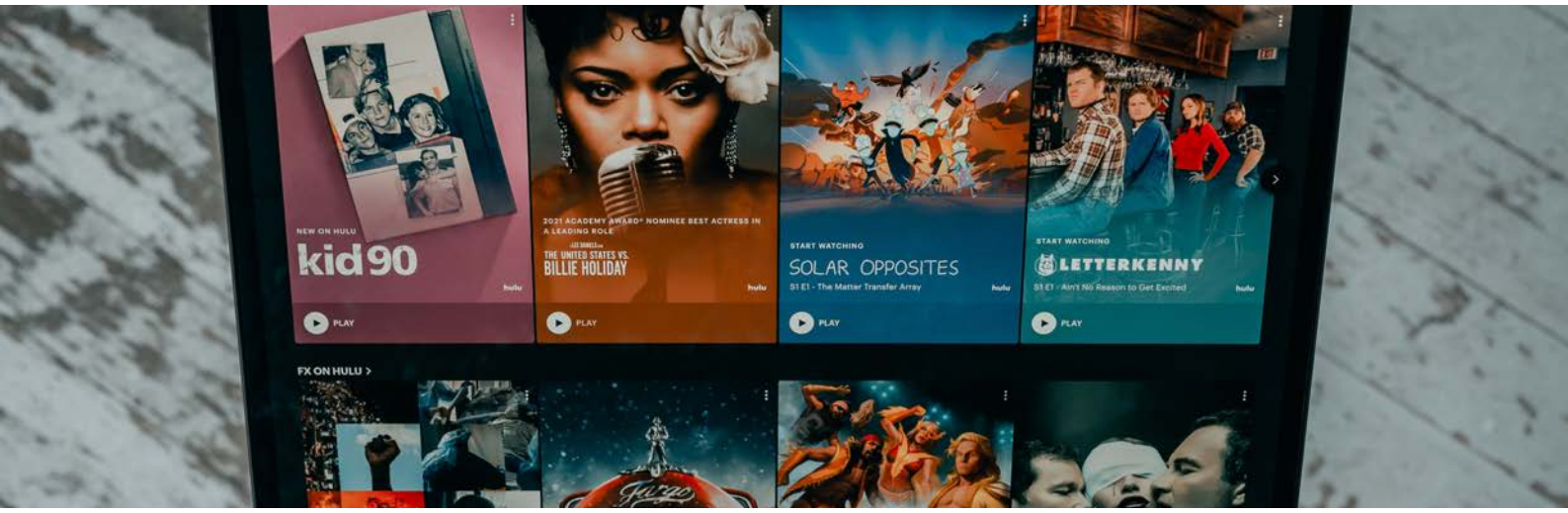

This prototype was tested in 2021 in parallel with the activities foreseen in the Erasmus + KA2 Strategic Partnership for Higher Education "***Digital Humanist***" project, code 2018-1-IT02-KA203-048291, that aimed to develop in university students from 5 European countries (Italy , Spain, Greece, Bulgaria and Poland) a set of interdisciplinary skills, useful to innovate the range of products and services to promote and use cultural assets, thanks both to the new languages and expressive codes of the digital economy and experiential land marketing, and the use of advanced technologies, such as augmented reality, virtual reality, apps, immersive environments and 3D digital set design.

The four episodes of the programme alternate sessions in the studio, in which the presenter introduces the different topics, with interviews with teachers and experts and short video clips, extracted from the "***Alice***"[11] series, which act as a bridge between the "informative" and formative sessions. In particular, the clips of the series contextualise and explain key concepts for learning (keywords) which, in addition to being pronounced by the actors on stage, appear on the screen as interactive elements through which viewers can access a plurality of didactic materials related to the topics of the episode.

[11] The series, produced and distributed by CONFORM S.c.a.r.l., is available on Amazon Prime Video.
Cfr. https://alice.conform.it/.

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2. AUDIO-VISUAL PRODUCTION

A further two testing sessions aimed to create a prototype of:

- Infotainment TV Program, entitled "**IN.TRA.: the corporate museum between Innovation and Tradition**"[12], aiming to guide the target audience, who are, at the same time learners and consist of business executives, in a path of discovery and rediscovery of company management, Industrial Heritage and contemporary creativity.

[12] Cfr. https://heritage.fondirigenti.it/infotainment.

2. AUDIO-VISUAL PRODUCTION

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The prototype was created as part of the Industrial Cultural Heritage & Brand Identity project, promoted by FONDIRIGENTI and implemented by CONFORM S.c.a.r.l., which in addition to touching on the themes of innovation and the emerging skills of a strategic managerial and artistic cultural nature, highlights the new "**art inspired**" managerial languages and behaviours, capable of permeating the Museums/Business Ateliers with contents, aesthetic, ethical and cultural values capable of enhancing their attractiveness also through the use of technologies and immersive, narrative, display and graphic digital arts. From the programme, you can access 10 video training pills, 2 audio-visual products *(Villa Canestrari: the manager as the author of the story of his/her business - The art of cinema in business promotion: examples in comparison) and 1 short film (Interpreting the managerial role)*

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2. AUDIO-VISUAL PRODUCTION

- Digital Entertainment Book, called "**VETFest Digital Story**"[13], that in addition to telling the story of the project, through interviews with teachers, participants and beneficiaries of the project, as well as in-depth analysis and interactive elements, introduces the viewer to the world of the pursuit of educational excellence. The prototype was created and tested alongside the activities foreseen in the Erasmus + KA3 Support for Policy Reform Networks and partnerships of Vocational Education and Training (VET) providers (2018/C401/09), Lot 1: National, regional or sectoral project VET provider organizations, entitled *Vet-Fest - 12 Events for Transnational and National VET Networks*.

Guarda "Digit"

Guarda "VET-Fest: Digital Story"

Guarda la sigla di "A.l.i.c.e. web serie"

[13] Cfr. https://www.vetfestproject.eu/it/.

USEFUL LINKS

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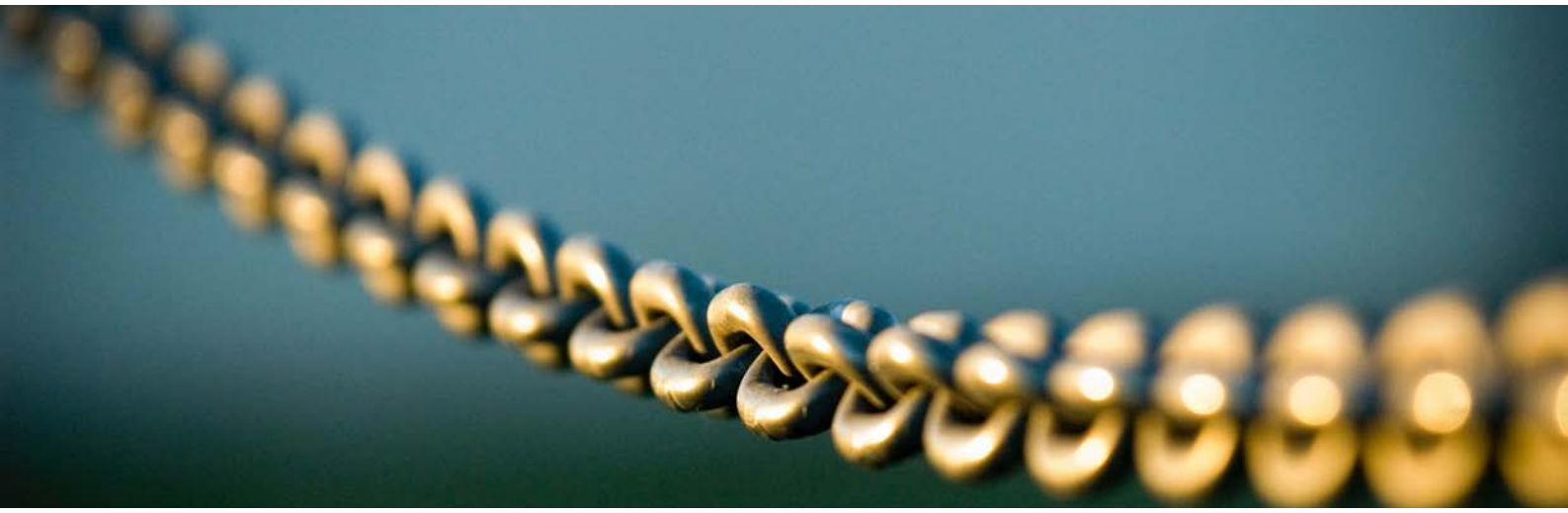


Here is a list of free tools.

STORYTELLING

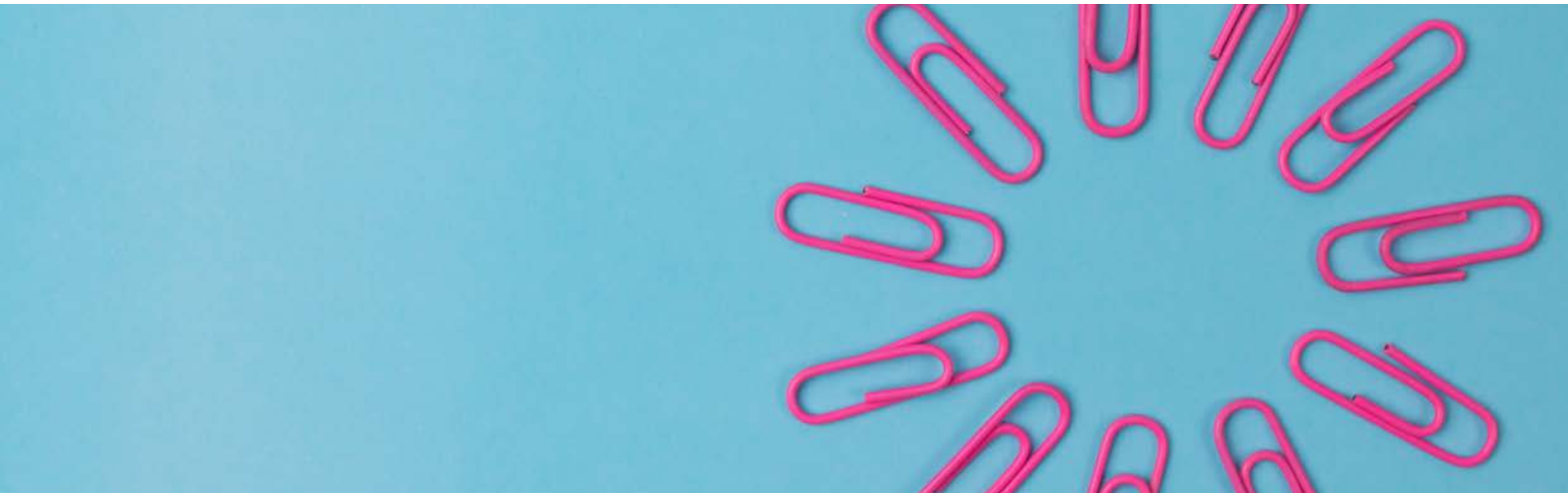
bit.ly/DH-Storytelling

Video training pill developed as part of the Erasmus + Digital Humanist project, code, 2018-1-IT02-KA203-048291, which touches on the theme of Digital Storytelling.

STORYBOARD CREATION

https://www.storyboardthat.com/it/storyboard-creatore

Storyboard That is a simple drag-and-drop authoring platform that offers a free version and a premium subscription version with lots of functions. Storyboard Creator allows people of all skill levels to create stunning images to teach, learn and communicate.



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USEFUL LINKS

https://www.canva.com/it_it/creare/storyboard/

Canva's free storyboard creation tool that allows you to bring scenes to life using Canva's image library, add headings, subtitles and body text with a single click, and easily choose colour and font by collaborating with your team in real time.

DOWNLOAD VIDEO/AUDIO FILES

www.youtube.com/editor

YouTube allows you to find Creative Commons licensed videos by simply searching for 'creativecommons' in the search filters.

www.studio.youtube.com

After creating an account and a personal channel, Studio Youtube allows you to access the «audio library section» where you can download music.

www.epidemicsound.com

After creating an account, Epidemicsound allows you to download music. On the site you can access a one-month free trial.

https://freesound.org/

After creating an account, Freesound allows you to download music.

DOWNLOAD OF IMAGES AND ICONS

www.unsplash.com

Unsplash allows you to download high quality images for free.

USEFUL LINKS

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www.pixabay.com/

Pixabay is a vibrant community of creatives, sharing copyright-free images, videos and music. All content is released under the Pixabay License, which makes it safe to use without asking permission or giving credit to the artist, even for commercial purposes.

www.freepik.com/

Freepik offers users high quality photos and graphic designs: exclusive illustrations and graphic resources carefully selected by the Freepik team to give users excellent content that can be used not only in personal but also commercial projects. Specifically, the Freepik site contains: stock photos, logos, icons, templates, etc.

www.pexels.com/

Pexels contains free downloadable, royalty-free photos, images and videos shared by creators.

AUDIO RECORDING

www.audacityteam.org/

Audacity is free software ideal for anyone who wants to work on audio content. With Audacity you can record sounds from a microphone or from the PC itself, you can edit audio tracks from other sources and create audio files.

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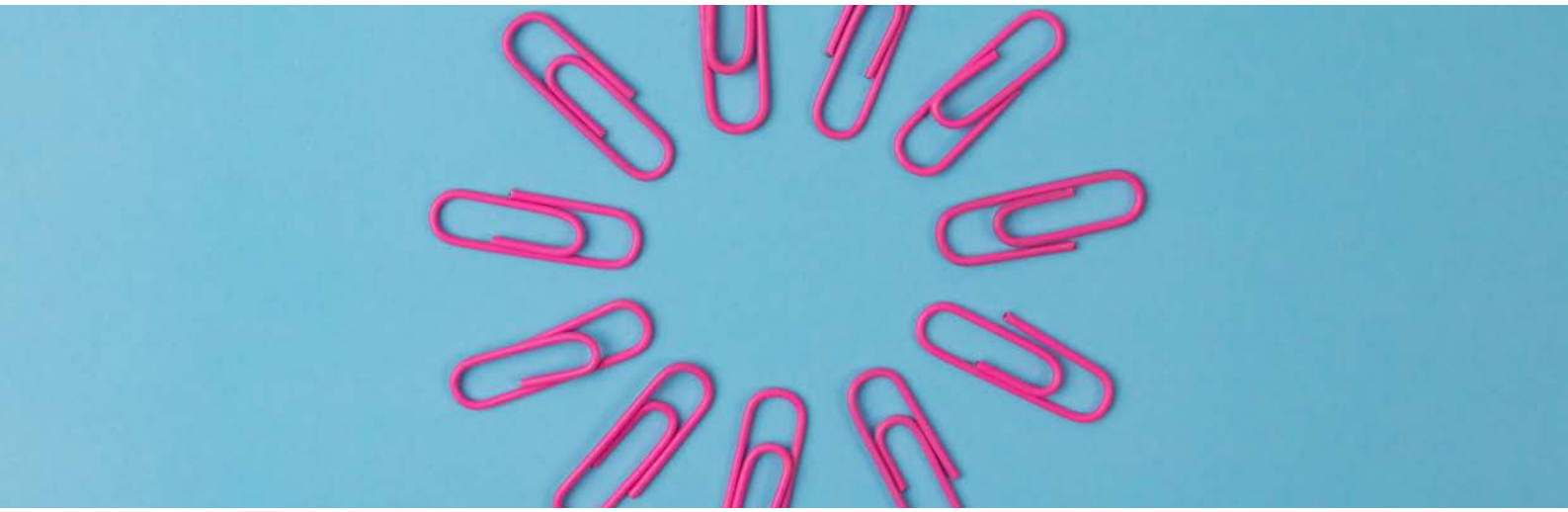
USEFUL LINKS



EDITING

https://apps.apple.com/it/app/clips/id1212699939?v0=www-it-clips-app

Clips is an iOS app for creating super fun videos to post immediately with lots of titles, graphics and special effects.

https://play.google.com/store/apps/details?id=com.camerasideas.trimmer

Youcut video editor is a free software to edit videos, add effects, create stunning videos in HD format.

www.blender.org

Blender is a free and multi-platform software for modelling, rigging, animation, video editing, composition, rendering and texturing of three-dimensional and two-dimensional images. It also has features for UV mapping, fluid, coating, particle simulations, other non-linear simulations, and 3D game/application creation.

USEFUL LINKS

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www.movavi.com/

Movavi Video Editor is a video editing programme available for both Windows and Mac.

It allows you to process the clips or photos of your travels and create creative projects to inform people about them. The programme can be downloaded for free from the site.

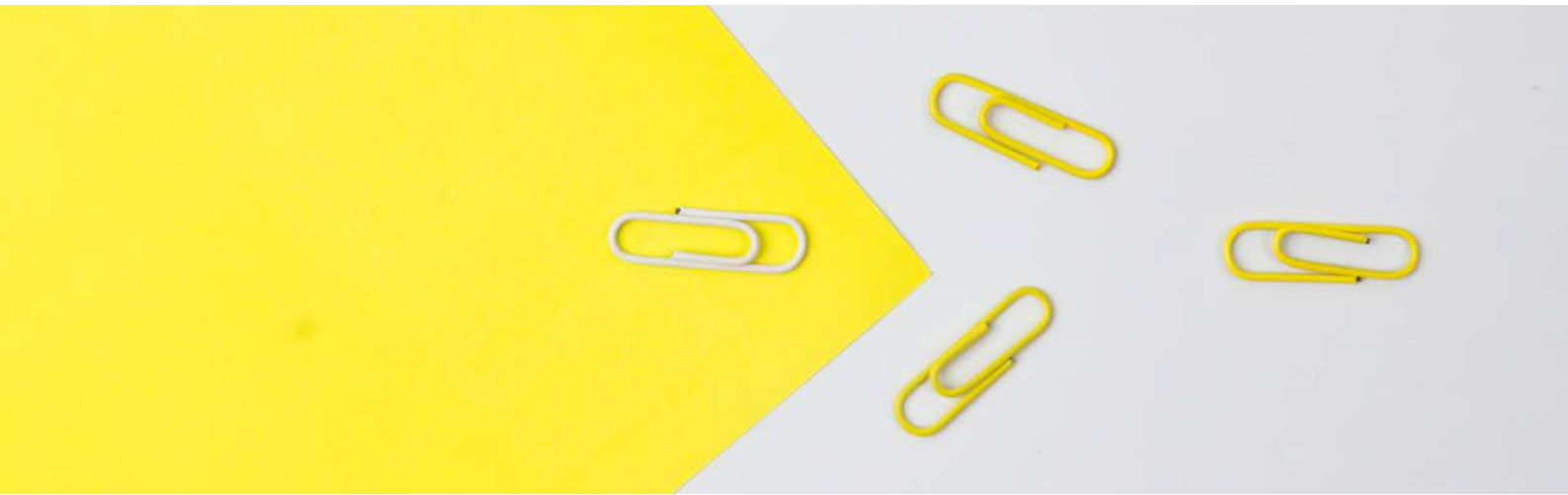
https://www.headliner.app/

Headliner is a video editor with unlimited capacity, no watermark, capable of automatically transcribing audio for perfectly subtitled videos.

SUBTITLING

www.subtitle-edit.it.uptodown.com/windows

Subtitle Edit is a free open-source editor to subtitle videos.



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KEYWORDS

Immersive technologies, virtual reality, augmented reality, innovative learning

In this chapter you will learn about:

- What are the concepts of edutainment, game-based learning and gamification
- What are the main theories connected to game-based learning and gamification (behaviourism cognitivism and constructivism)
- The game mechanics based on Bloom's taxonomy
- Models for designing games (ADDIE, SADDIE and ELECTRA)
- Tools and practical examples of gamification

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ABSTRACT

More than 190 nations, all the continents and around 2 billion students have been affected by the effects of the pandemic with a subsequent progressive increase in innovation in the education sector with more people resorting to immersive technologies such as virtual reality (VR) and augmented reality (AR) as they allow the exploration of digital learning material in new, innovative ways.

Augmented Reality (AR) systems embed virtual information into the user's real environment, creating the illusion that the information exists there. The use of AR, therefore, allows you to "add" "augmented" content to the real world represented such as, for example, from three-dimensional (3-D) models, photos, audio and video files, links to websites, documents in diverse formats (pdf, excel, ppt, etc.). AR also allows students to view static virtual objects or information within a physical space and this is particularly advantageous when the object itself has more educational value (for example: placing the virtual model of a sculpture or historical artefact in a classroom).

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ABSTRACT

The introduction of AR in teaching practice can be catalogued as an activity in line with the principles of constructivist theory. In "simple" Augmented Reality, there are two significant modes of classification, Georeferenced AR and aR as a visual metaphor.

Virtual reality (VR), on the other hand, is generally defined as the use of a three-dimensional computer-generated world with which the user can interact. It allows users to have a totally immersive experience, using special devices - viewers - which, through stereoscopy, show slightly different images to those of each eye, creating an illusion of depth, allowing the wearer to experience, firsthand, adventures and experiences, breaking down geographical barriers and simulating any setting. Virtual reality adopts the principle of “learning by doing” and allows users to “immerse themselves” in the simulated situation, to put into practice what they have learned but be aware that the creation of courses in virtual reality costs more than traditional e-Learning.

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ABSTRACT

A significant use of Virtual Reality is undoubtedly that of simulation to activate kinaesthetic intelligence. The challenge to be faced in developing a lesson model enhanced by the use of virtual reality is to combine the immersion of VR environments with the logical rigour of Problem based learning.

Tools you can use to put AR and VR into practice include "Metaverse" and further support for educational planning can come from tools such as Google Maps and Google Earth. Today, you do not need to have specific skills to create an AR or VR experience. Very good products can be made without necessarily being a computer engineer or having knowledge of programming languages. To create content, you can use the “Blendspace". Other useful tools include Google Expedition, ClassVR Metterport, EyeSpy360, Concept3D, DiveIn Studio and Tourmake.

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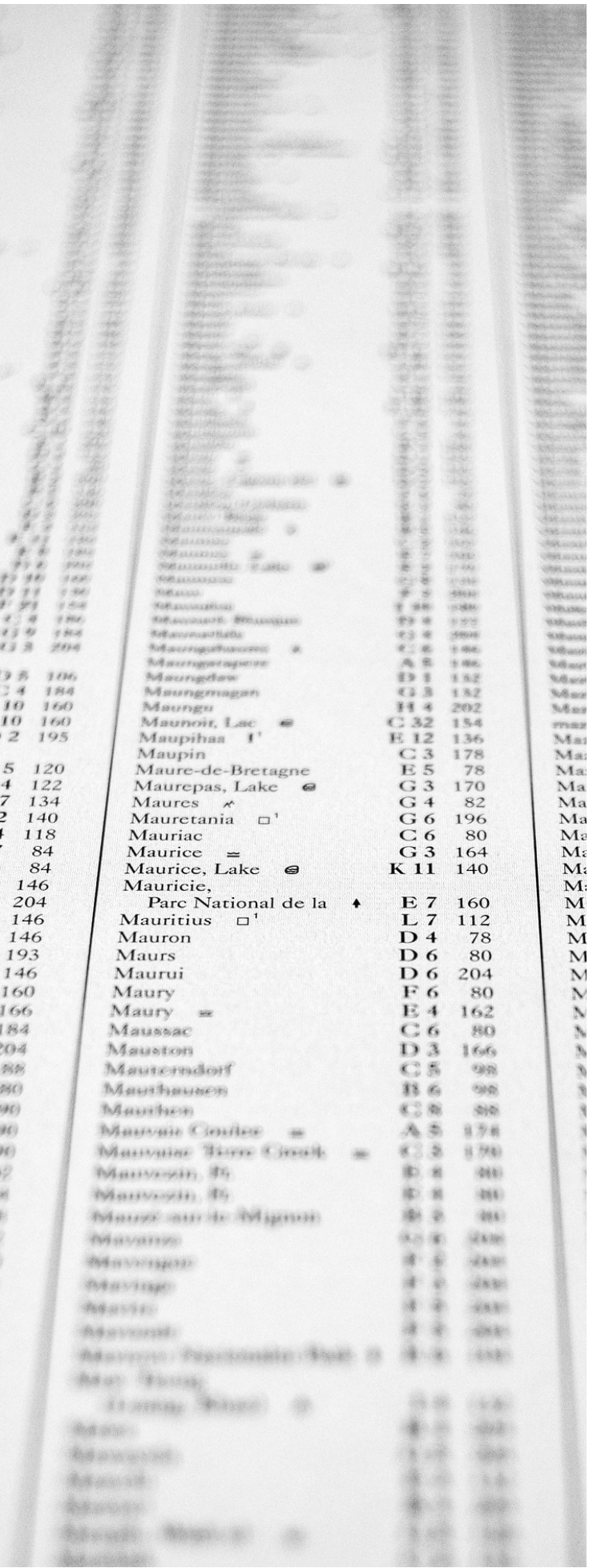

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

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The COVID-19 pandemic has had a very negative impact on the world's education systems, with the closure of schools and colleges. More than 190 nations, all the continents and around 2 billion students have been affected by the effects of the pandemic. More than half of the world's students have been adversely affected by school closures, with 98% of low- and middle-income nations suffering the most adverse effects (United Nations, 2020 - Policy Brief: Education during COVID-19 and beyond)[1].

The situation that has emerged has prompted educational institutions and Universities to make significant changes in their delivery methods to ensure continuity of learning, with a notable increase in growth in both remote education, based on the use of multiple digital platforms, and in e-learning.

There has, therefore, been a progressive increase in innovation in the education sector mainly characterised by the use of digital distance education platforms, to access teaching material provided for students, access virtual meetings, access a variety of courses in self-directed study mode and multiple online assistance services.

[1] United Nations (2020). https://www.un.org/development/desa/dspd/wpcontent/uploads/sites/22/2021/05/sg_policy_brief_covid-19_and_education_august_2020.pdf.

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

Even before the inevitable digital changes in teaching and learning due to the global pandemic, many students had already shown great interest in immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR), also thanks to an ever increasing role played by technology due to the high prevalence of Smartphones and Tablets.

Augmented Reality (AR) systems embed virtual information into the user's real environment, thus creating the illusion that the information exists there. The use of AR, therefore, allows you to "add" "augmented" content to the real world represented such as, for example, from three-dimensional (3-D) models, photos, audio and video files, links to websites, documents in diverse formats (pdf, excel, ppt, etc.).

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Virtual reality (VR), on the other hand, is generally defined as the use of a three-dimensional computer-generated world with which the user can interact, that is characteristic for the following three key elements:

- **visualization**, allowing the user to look around, using a viewer worn on his/her head;
- **immersion**, with the physical representation of objects;
- **Interactivity**, ensuring control over the experience, typically via sensors and an input device such as joysticks or keyboards.

The key difference between augmented and virtual reality is that with AR the information is superimposed on a real world, while in VR the environment is entirely simulated.
Augmented reality (AR) is an interactive graphics system that allows you to superimpose digital content and animations on existing reality that enrich or "increase" the experience.
It is designed to keep the user's connection with the real world explicit and conscious because it does not "eliminate" the real world, but uses technology to improve it, or to add potentially useful information. Data, geographical maps, audio files, videos and holograms overlap what we can already see with our eyes. Technically, augmented reality is used through apps that can be downloaded on computers or mobile devices that can scan reality and recognize special markers to coordinate and produce associated information.

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

Virtual reality (VR) makes use of ad hoc designed devices, a combination of hardware and software solutions that, by deceiving two or more senses, create an alternative-virtual world, built on the computer, which replaces the real-tangible one by allowing users to have a totally immersive experience, using special devices - viewers - which, through stereoscopy, show slightly different images to those of each eye, creating an illusion of depth, allowing the wearer to experience, firsthand, adventures and experiences, breaking down geographical barriers and simulating any setting.

Thanks to trackers attached to the devices, you can follow the movements of the user's head by continuously updating the view based on his/her real movements. Furthermore, other "peripheral" devices such as gloves or boots stimulate the senses of touch and hearing, thus significantly increasing the level of involvement and, therefore, the sense of detachment from physical reality.

Education is certainly one of the sectors where virtual reality finds the greatest place for implementation.

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

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Instruction manuals, role-playing games and classroom sessions, however effective they may be, will never be able to reproduce real and engaging environments that only virtual reality is able to create, allowing you to experience situations that are difficult or even impossible to replicate (such as, for example, for the training of surgeons, astronauts and engineers).

In the same way, it is also extremely useful for revolutionizing the customer experience, strengthening the relationship with consumers, both to improve the shopping experience, and to provide them with the opportunity to test products that cannot be tried out everywhere and whose purchase involves a considerable investment (such as, for example, in the automotive or real estate sector).

Virtual and augmented reality are, therefore, two ways of interacting between the real and virtual world and have different characteristics and methods of use in learning, making it much more engaging and effective, such as to impact on individuals' behaviours.

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

Similarly to what happens with traditional e-Learning, virtual reality creates a safe environment in which learners can try out and put their skills into practice.
Unlike e-Learning, virtual reality gives you the feeling of "really being there".

Virtual reality allows you to deliver education in an innovative and extremely engaging way, a simulation of reality that, through the use of special devices, allows users to explore the virtual environment and interact with tools, machinery, other students or simulated instructors.

Virtual reality adopts the principle of “learning by doing” and allows users to “immerse themselves” in the simulated situation, to put into practice what they have learned. The content is highly visual and multisensory: it involves sight, hearing but also body movement, and this increases mnemotechnical potential. Participants can participate in emotionally engaging experiences that remain etched in their memory for longer. Furthermore, it is also an opportunity for entertainment, which raises the attention curve as when playing a game.
It should be noted that the creation of courses in virtual reality costs more than traditional e-Learning and that the simulation design process can take a long time. For this reason, you should carefully select the thematic areas of training in virtual reality, that are ideal in cases where it is necessary to simulate complex or critical situations, which allow you to have a realistic experience in a controlled environment, a condition that reduces the risk associated with errors or dangers.

WHAT ARE THE NEW FRONTIERS OF EDUCATION?

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Likewise, it can be usefully applied in the training of students in the correct use of expensive equipment which in virtual format allows their testing without having to have a physical prototype.
The design of simulations that provide levels of increasing difficulty can prove to be particularly important, a condition that can offer students the opportunity to adapt learning according to their real needs.
In this way, those who are introduced to learn certain knowledge/skills will be able to put themselves to the test by selecting the simplest level, while students who already have a consolidated level of knowledge/skills will be able to test themselves with more advanced levels, thus making the simulation more challenging and complex.

At the end of the virtual training experience, the student can describe the challenges encountered, in order to receive any valuable feedback, which will allow the improvement of learning and consolidation of knowledge and skills acquired.
The use of augmented reality also allows the improvement of traditional learning, superimposing digital information on the real world, in order to enrich what we see with "additional" information useful for facilitating and consolidating learning.
With augmented reality, the real world is "augmented" by the superimposition of digital information.

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

This is particularly useful when you want to break down the barrier that stands between what you want to explain and what you want to do. Think, for example, of the usefulness that augmented reality can guarantee in making students understand how to use a procedure, how to assemble or maintain a machine, providing them with useful information on the individual elements on which to intervene, explaining step by step the actions to be performed, thanks to the aid of a compatible device (generally a Smartphone or Tablet) which, by framing the machine or the instruction manual, will generate pop-ups and contextualised notifications that enrich the student's experience, guiding him/her in learning.

Virtual and augmented reality will profoundly transform the STEM and STEAM curriculum, revolutionising learning through experiential simulations, modelling and spatial representation of data, while also supporting the integration of the arts and humanities into the curriculum of science, technology, engineering and mathematics.

WHAT ARE THE NEW FRONTIERS OF EDUCATION?

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WHAT ARE THE NEW FRONTIERS OF EDUCATION?

At an international level, there are already diverse experiences that are being developed, with the adoption of revolutionary implementation of immersive technologies in the field of STEM.

The Stanford Human Computer Interaction Lab[2] has released a free virtual reality simulation “The Stanford Ocean Acidification Experience”[3]with the aim of educating, raising awareness and inspiring actions on the theme of ocean acidification. Using the HTC Vive viewer, students can observe the effect of carbon dioxide on marine life and collect samples from the ocean floor.
At the University of Michigan-Ann Arbor, some STEM projects are supported by MIDEN - Michigan Immersive Digital Experience Nexus, creating immersive experiences by projecting stereo images onto the interior surfaces of a room-sized cube.

Users wear special glasses which, together with an optical motion tracking system, show digital objects in relation to the viewer's position. Since the system is "transparent", users can see their own hands and real physical objects can be carried into the space.

[2] https://stanfordvr.com/
[3] https://stanfordvr.com/soae/

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The College of Engineering uses MIDEN to experiment with 3D building models to better understand the structural stability of engineering projects. Students use it for the virtual reconstruction of archaeological sites, studies on human ergonomics and the formative simulation of dangerous situations.

There are diverse platforms that support the use of immersive VR technologies in the thematic area of STEM. For example, Labster has developed a suite of advanced laboratory simulations[4] that are accessed by more than 1,000 universities, 3,000 high schools and over 3 million students worldwide.
Labster simulations are designed to allow students to learn concepts within a virtual laboratory, through the resolution of real problems. Students' knowledge is tested by means of quiz type questions, according to a method based on investigation and deep learning.
Students can develop real-world laboratory skills in a virtual environment, where they can safely make mistakes and learn at their own pace.

[1]https://www.labster.com/simulations/?_ga=2.184424110.921394666.1660054053-733427598.1660054053

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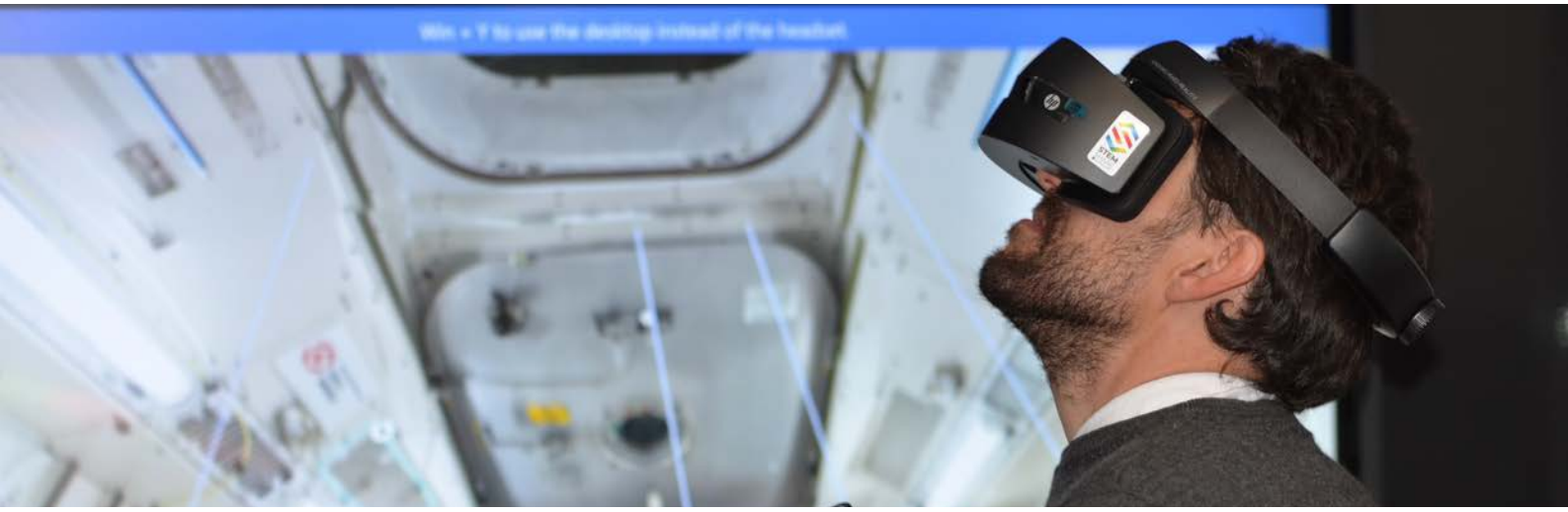
WHAT ARE THE NEW FRONTIERS OF EDUCATION?



The developments of VR headsets and software platforms such as Unity and Unreal engine are expanding the development of immersive experiences. Virtual reality applications such as Tilt Brush (https://www.tiltbrush.com/) will allow students to become creators in virtual worlds. They will not only have the opportunity to observe invisible phenomena, but to prototype solutions to complex problems.

Augmented reality and virtual reality (AR/VR), allowing students to experience digital content in both physical and virtual spaces, represent significant potential for edtech innovation, reducing physical space barriers, improving collaboration and practical learning and providing individualised learning approaches.

AR/VR as an educational tool is certainly not a new concept, but only recently has it moved from small-scale experimentation to a rapidly growing use, with the creation of virtual environments, scientific experiments, immersive simulations and more.

WHAT ARE THE NEW FRONTIERS OF EDUCATION?

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This has been further facilitated by the increasing diffusion of mobile devices and viewers, which have helped to make access to content easier and more convenient, allowing these solutions to be implemented in school and university classrooms.

The use of VR technologies offers the possibility of making virtual environments available to students where they can interact with virtual objects and other individuals in real time, thus simulating complex real-world experiences that otherwise would not be possible, and, for example, you can view microscopic objects in 3D or access 360-degree pre-recorded visual experiences, still images or videos, which, however, can only view but not manipulate.

Augmented Reality (AR) or Mixed Reality (MR) allows users to interact with virtual objects that appear within a physical environment, in which students maintain situational awareness of the environment.
As with virtual reality, AR also allows students to view static virtual objects or information within a physical space and this is particularly advantageous when the object itself has more educational value (for example: placing the virtual model of a sculpture or historical artifact in a classroom).
AR/VR-based teaching tools offer enormous potential to transform the way students of different ages and disciplines learn, improving learning outcomes by reducing cognitive load and distance, encouraging greater engagement, improving the memorization of complex or abstract topics, such as STEM subjects (science, technology, engineering and mathematics) and enabling more personalised approaches, able to adapt to different learning styles.

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PRACTICAL APPLICATION OF AUGMENTED REALITY

With the introduction of Augmented Reality (AR), a new learning concept called "**augmented learning**" appeared.

AR is a technology that requires the help of functional software equipped with specific interpretation-restitution (rendering[5]) and tracking[6] in order to be implemented. These devices, by identifying fixed points in a space, are able to track objects and/or shapes by connecting them to the desired virtual objects (images, virtual characters, writing in 3D, video stream, etc.). AR allows you to increase, enhance and amplify what is already there, connecting the diverse kinds of information levels (layers) to what the senses are able to perceive, creating what can be defined as: "a perceptual enhancement".

[5] Rendering refers to graphic rendering (or restitution), i.e. an operation performed by a designer to produce a quality representation of an object or an architecture (designed or surveyed). It deals with the superimposition of virtual elements onto real images. It has assumed a value essentially referring to the field of computer graphics, where it identifies the process of "rendering" or generating an image starting from a mathematical description of a three-dimensional scene interpreted by algorithms that define the colour of each point of the digital image

[6] Process that deals with tracking the position of the observer with respect to the scene and providing the position, in real time, in relation to the assigned reference system

PRACTICAL APPLICATION OF AUGMENTED REALITY

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In "simple" Augmented Reality, at least two significant modalities can be classified:

- **Georeferenced AR**: uses portable devices (e.g. tablets, smartphones, laptops ...), now almost all equipped with GPS for positioning or a magnetometer, capable of displaying a video stream in real time and receiving the information available online, thanks to being connected to the Internet. Using a smartphone camera, you can frame the surrounding reality in real time and the contents detected by the geolocated points of interest are shown on it.
- **AR as a visual metaphor**: requires the use of markers (also called ARtag: Augmented Reality tag), which allow the videocamera to receive information. The markers are stylized square or rectangular drawings usually in black and white and contain an image with a code (similar to a barcode) inside. Framed by a camera, using an implementation software that allows the identification and interpretation of the codes, these markers allow you to superimpose additional multimedia content (video, audio, 3D objects, etc.) on the image in real time.

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The QR Code (Quick Response Code[7]) is an example of a marker used to store information.
It consists of a two-dimensional barcode and a structure with black and white dots arranged inside a square with a white background that allows the encryption of several hundred characters.
The information contained in the code can be decoded and viewed with the aid of a Smartphone or Tablet.
QR Codes can be printed on posters, books, newspapers and magazines, corporate websites, billboards for promotional campaigns, business cards, etc., and can be enriched with digital content (photos, videos, links to websites, PDF documents, data and information) that can be accessed quickly. To read a QR code, all you need is a device equipped with a camera and a simple software installed on it, that is capable of understanding the sequence of its constituent graphic elements.

Some QR codes can be customised as you can choose new colours for the foreground and background, integrate a logo or change the design of the three squares visible in the corners of the code. Codes can also be static or dynamic. The functions and contents of dynamic QR codes can be modified later without having to replace the already printed codes.

[7] The QR Code is used under a free licence to store information. In particular, each cryptogram can contain 7,089 numeric or 4,296 alphanumeric characters, useful for encoding hyperlinks. Some online services allow you to download free software to create QR Codes (e.g: http://qrcode.tec-it.com/it, http://it.qr-code-generator.com).

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Today, print media (from a book to a poster) is still the main "monomedial and unidirectional" communication channel, but if an AR solution is applied to it, thanks to the use of the Smartphone or Tablet camera, an algorithm capable of recognizing the content of the page and a link to a cloud platform to retrieve associated digital data, it is possible to "**augment**" the text message with additional, dynamic and multimedia content, which improves understanding. The application of an AR system to printing generates a significant added value to communication, where the "whole thing" becomes more influential and significant than just the sum of the individual parts.

In the school/university environment, among the possible applications of AR to printing you can consider: popular books, encyclopaedias, books for teaching diverse disciplines, manuals, guides, etc.
Among the new ways of publishing books, we must take into account the so-called "**digital native books**[8]", an evolution of the eBook designed to offer a new literary, interactive and easily usable form.
These books are published directly online and become an interactive experience, which adds a new dimension to the traditional paper version of a story.

[8] Google has filed a patent called “Storytelling device”, at the American office of USPTO (United States Patent and Trademark Office)

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A further recent innovation in the printing sector is represented by "**Augmented Books**", where the traditional paper version of a book is proposed as a visual metaphor interface for AR, associating the printed text with interactive multimedia elements that can be used through AR display devices. These books can be used simultaneously by several students, who can interact and communicate with each other.

The evolution of the textbook will, therefore, be guided by the AR which will integrate the flat page with images, videos and 3D interactivity. Furthermore, AR will allow the contents to be updated over time and enriched with interactive features. Think, for example, of an anatomy book that uses the photo of an arm to initiate an AR experience in which a 3D model of the arm's bones is shown above the page of the book and where you can use movements to rotate in any direction or from any angle.

PRACTICAL APPLICATION OF AUGMENTED REALITY

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The application of AR in the educational and training field allows the teacher to create experiential teaching characterised by a more engaging, stimulating and dynamic study.

AR, that allows you to add virtual contents, allows the creation of a decidedly innovative study environment, where the "digital" didactic contents contribute to enrich the perception of the interaction and to "merge and blend" with the objects and tools that are already part of normal teaching activity.

The use of AR allows the transition from a "teaching-listening" method to a more active, participatory and engaging study method in which students take responsibility for their learning and become engaged participants, rather than passive observers.

The introduction of AR in teaching practice can be catalogued as an activity in line with the principles of constructivist theory, as it places the learner at the centre of his/her learning and puts him/her in a condition to verify and control his/her own acquisition process through interaction and a link with the virtual or real environment surrounding him/her.

With AR, the time associated with communicating information is reduced by favouring the time devoted to understanding, reasoning, debate and multidisciplinarity.

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PRACTICAL APPLICATION OF AUGMENTED REALITY

The use of AR by teachers is now facilitated by the availability of numerous applications that are easy to use and apply for each discipline, helping them to personally create and implement educational courses in AR, in order to permit:

- the creation of real life scenarios, that allow us to go beyond the mere theoretical description;
- the combination of theoretical information with practical-experimental activities, also using methods of play;
- learning by doing, while avoiding any real consequences should you make mistakes;
- the use of Tags and labels (markers) to activate links to different types of digital content
- the creation of different types of scenarios and thematic areas, with the possibility of using multimedia objects, games and immersive experiences.
- the creation of texts/handouts, with the addition of "augmented" content

The use of AR allows you to create new and exciting ways to learn, thrilling students with multiple ways of interacting and, at the same time, personalising the training course of each student, thanks to the possibility of exploiting digital content and three-dimensional scenarios provided by framing an object, picture, photo, etc., with his/her Tablet or Smartphone, to which news extracted from newspapers, books and/or handouts, videos, animations, sounds, and anything else that has been conceived and designed to enrich learning is linked.

PRACTICAL APPLICATION OF AUGMENTED REALITY

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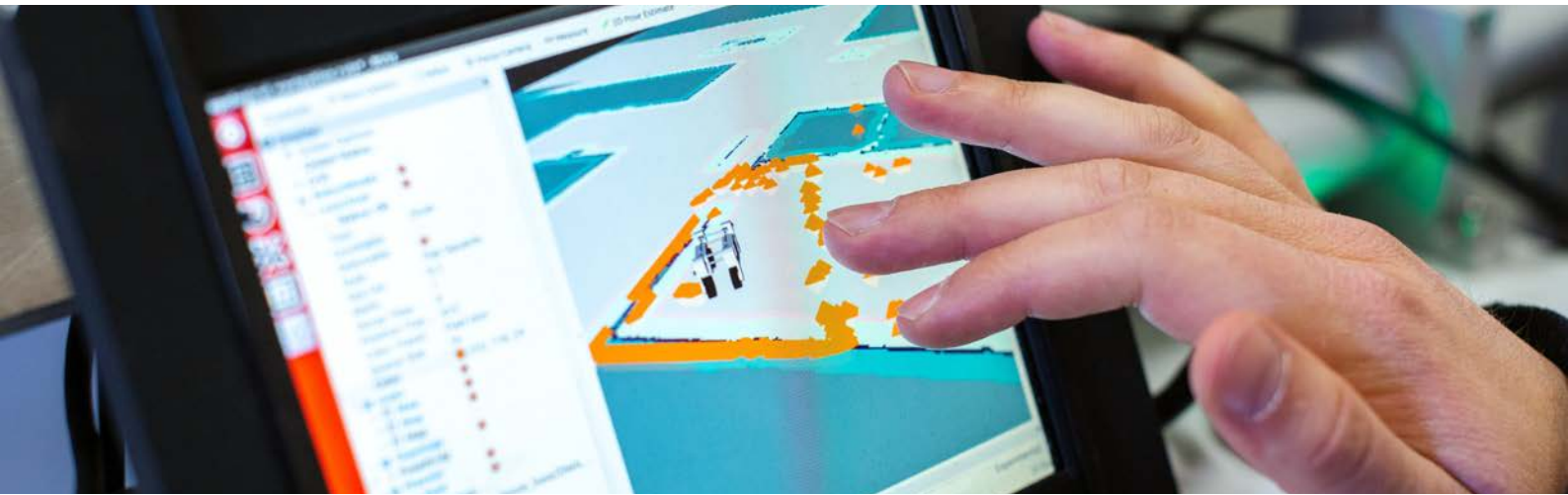
Just think, as an example, of what can be done using AR to make a visit to a museum, an archaeological site or a city of art more emotional and, at the same time, educational.

The planning of a trip and/or a study visit and/or an educational laboratory must aim to stimulate students' participation, for example, with:

- the construction of a "knowledge treasure hunt", inserting "clues/educational puzzles" in the various points of interest that students will have to find and then solve in order to access the subsequent stages of the hunt;
- the selection of additional information on the artist and/or the reference historical context, a descriptive video guide of the work, an audio guide or a link to a web page, which appear when the camera of a mobile device is used to frame a statue, a work of art or an object.



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PRACTICAL APPLICATION OF AUGMENTED REALITY

Think also of other potential uses of AR to better understand how many and what opportunities a teacher has to design the training path in an innovative way, such as:

- choose online videos or create short videos or animations that are activated and animated when students frame the pages of textbooks
- record explanations and provide examples through case studies that are "added" to the slides or handouts provided to students, who can consult them when they need them in the learning phase
- promote knowledge of the tourist and cultural attractions of a city, using AR and a dedicated app that, through the Smartphone, will support students to receive information on the history, architecture, production and traditions regarding the main points of interest, perhaps already analysed in the training course carried out in the classroom and better contextualised in the real world
- understand, in real life, the phases of work processes and in particular of machinery maintenance, allowing students visiting production and/or service companies to frame with their Smartphone/Tablet cameras objects/work tools to which they are connected to view 3D reconstructions, video tutorials, informative/operating datasheets.

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To enrich current teaching/learning methodologies using AR, however, it is good to keep in mind that the "augmented" contents must be "flexible", that is, they must be designed and configured according to the students' needs and characteristics, to maximise study with the creation of research and guided analysis opportunities, taking into account the needs related to institutional and curricular demands.

The first thing to do is to focus effort on researching and/or creating information that is considered interesting and relevant for students to investigate further. This task can also be carried out by the teacher through research work carried out in a participatory manner, with the collaboration in the classroom of all students, and then, subsequently, depending on the themes identified, initiate detailed didactic planning aimed at research or creation of "augmented" content.

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PRACTICAL APPLICATION OF AUGMENTED REALITY

A significant use of Virtual Reality is undoubtedly that of simulation, especially essential when dealing with the "too dangerous", the "too big" or the "too expensive" that prevents the real realisation of an experience, but where learning implies manipulation, physical interaction with the environment, in a word, activation of kinaesthetic intelligence.

VR experiences allow the activation of visual-spatial and kinaesthetic intelligences in the same way as in real interaction, so as to provide a perceptual basis for logical intelligence.

These experiences must be designed with the teaching-learning process in mind, structuring them in such a way that students develop skills in learning activities that contribute to a change in thinking, understanding or behaviour. For this to happen, learning experiences need to be active, meaningful, integrative and diversified, and able to motivate students to face challenges providing them with all the knowledge and skills necessary to facilitate their transition to the world of work.

PRACTICAL APPLICATION OF VIRTUAL REALITY

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The most interesting use in the classroom, however, is the one that hybridises virtual reality with game-based learning, that is, one that involves students in the creation of virtual environments and 3D spaces that can be populated with characters who act as avatars with missions - in this case of learning - to be accomplished. Through being able to relate to or identify with a character, it is possible for the student, in the protected space of the virtual environment, to "experience" his/her different identities with intrapersonal or emotional intelligence.

The didactic use of VR allows students who have the most difficulty, those who feel they are not up to performing certain tasks, because their real identity has been marked by repeated failures, to experience the effectiveness of their "virtual identity" and to see themselves suitable and competent in the field they are experimenting with, and this has significant repercussions on their self-esteem.

However, the construction of learning situations enhanced by virtual reality presupposes the adoption of active teaching, which gives space to the protagonism and creativity of students, reserving the task of structuring the methodological-conceptual framework for the teacher.
The challenge to be faced in developing a lesson model enhanced by the use of virtual reality is to combine the immersion of VR environments with the logical rigour of Problem based learning.

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The lesson must be designed taking into account both components - reality and virtuality - in order to favour the development of the skills of:

- **challenge**, understood both as the ability to let yourself be questioned by problems, and as the ability to compete fairly to achieve a goal;
- **research**, i.e. the competence in selecting and evaluating indispensable information in a knowledge –based society;
- **operate**, i.e. the spirit of initiative, the ability to work to realise your ideas;
- **say**, that is the ability to argue your point of view in a well-founded way or simply to explain your vision of reality through multimedia, a virtual environment and otherwise;
- **share**, such as the willingness to share your solutions with others, to question them, to review them, to evaluate and to be evaluated.

Now, let's focus on a possible process that the teacher could adopt for each of the operational phases to be activated with their students and precisely:

- **Challenge**: the teacher should propose the topic of the lesson through a VR experience (e.g.: a 3D simulation of a scientific experiment, a virtual, historical or geographical tour, a VR movie, etc.), which has the characteristic of immersion and is able to arouse emotional involvement, but above all that poses a problem, launches a challenge, raises a question on which to build the learning path;

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- **Research**: the students, divided into small cooperative learning groups, must search online, in textbooks or in any other didactic support provided, for materials, procedures, methods, ideas, etc., which provide an answer to the questions or challenge triggered by the challenge phase. In this second phase, the competence of analysis and evaluation of the reliability of the sources that the teacher/mentor must be able to develop in the learners will be very important. The solutions identified must then be discussed and evaluated in a debate with the entire group being trained. This should result in the operational hypotheses to be implemented in the next phase;

- **Operate**: this is the creative phase of the work in which students can express their creativity, their inventive capacity through the creation of a virtual artifact, in the diverse ways they will freely decide to adopt. The artifact could be a virtual tour, a 3D model of a scenario environment, of a historical event or a current event, the creation of a VR movie, the creation of a virtual museum, etc.;

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Virtual reality can be an incredible learning, collaboration and creation tool, helping students move through abstract topics, build empathy, unlock creativity, and connect to the world in new ways. However, the use of VR in teaching must be implemented correctly, because some disadvantages must be taken into account, namely:

- its use can deteriorate human connections. If traditional education is based on human communication and interpersonal connections, virtual reality can damage relationships between students.
- problems with the correct functionality of the virtual reality headset can delay or prevent students' learning activity.
- students can become addicted to their virtual world, just as with the excessive use of video games.
- the immersion experience can cause dizziness in students. It is, therefore, advisable not to use the VR viewers for more than 5 minutes at a time.

The use of virtual reality is particularly suitable in the education of students with autism spectrum disorder, intellectual disabilities, hearing disorders, physical disabilities and neurological disorders.
Virtual reality experiences, being based on purely visual aspects, prove to be particularly appropriate and effective for students with autism spectrum disorders (Parsons e coll., 2000) whose perception is mainly based on the visual channel.

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The ability to manipulate the surrounding environment makes them suitable and effective for these students, for whom the real world can be overwhelming due to the many and different stimuli that can create stress, anxiety and confusion, leading to poor performance.
As some communication components such as gestures, mimicry and facial expressions can be confusing and stressful for students with autism spectrum disorder, the use of virtual reality applications proves to be the ideal solution to overcome these difficulties, thanks to the possibility of identifying, isolating, reducing and monitoring the diverse external stimuli, to make them more tolerable.

The use of specific virtual reality applications is also very useful to facilitate learning for those students who have a profound or moderate intellectual disability, with problems in cognitive processes, generating greater involvement and self-confidence in carrying out certain actions, with a lower level of anxiety and, therefore, better performance, a condition that allows them to transfer the skills they have developed with virtual reality into real life.

Teachers often find themselves having to manage disengagement and lack of student interest in the material studied and always have to look for new ways to cultivate their passion. In this context, VR can be used to increase student engagement, especially thanks to its interactive and gamified declinations, which make it possible to convey any educational content in an engaging way, an aspect that is particularly useful in teaching complex or abstract subjects.

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In this regard, let's look at some examples that can be taken into consideration when designing training courses:

- The Body VR (https://store.steampowered.com/app/451980/The_Body_VR_Journey_Inside_a_Cell/?l=italian)presents a set of guided experiences that explore human anatomy and biology. The most famous is entitled "A journey inside the cell" and is available free of charge for both high-end devices such as Oculus and Vive and for mobile and integrated devices such as GearVR and Daydream. In this interactive experience, the student can navigate and observe, under the guidance of a narrator, the outside and the inside of a cell, starting from the composition of the cell membrane up to the inside of the nucleus, and genetic processes.

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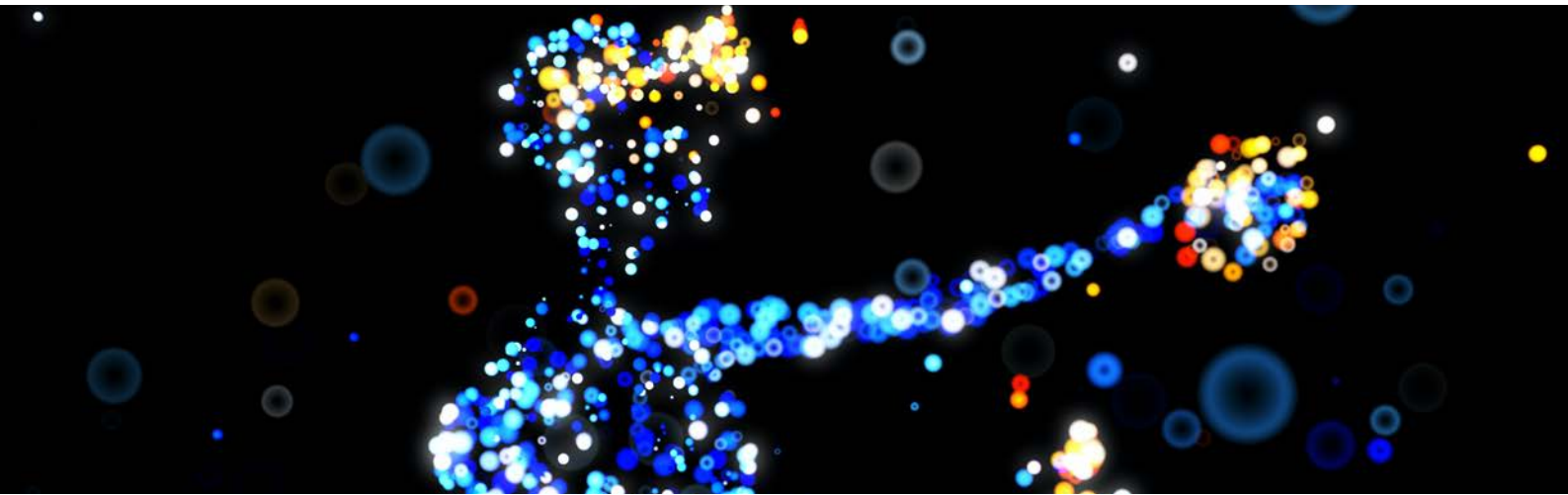
- Veative Labs (https://learn.veative.com/modules?domain=Higher+Education) is a company that offers 360° services - from the production of educational VR content to its implementation in the classroom for use. It has developed more than 500 "modules" to learn subjects such as physics, chemistry, biology and mathematics through an interactive, immersive and stimulating journey.

There are diverse systems that can use VR technology: from monitors, televisions, immersion systems in virtual reality (Oculus, PlayStation Vr, HTC), to a simple telephone thanks to the use of a black screen system. Thanks to the use of specific designs, virtual reality applications allow the improvement of teaching of social and communication skills, allowing students to have sufficient time to be able to test these skills in order to make it easier to apply them in real situations.

It becomes increasingly important to educate young people in meta-skills or transversal competences that will provide them with greater adaptability. These skills, such as critical, systemic and abstract reasoning, creativity and empathy, are difficult to teach through classical educational means.
VR can also help in this context as it is capable of promoting awareness of different points of view and ways of being in the world, through immersive storytelling, or even of enhancing systemic-abstract thinking through complex interactive simulations.



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PRACTICAL APPLICATION OF VIRTUAL REALITY

Tools you can use to put AR and VR into practice

Before briefly drawing your attention to some tools that can be used to put AR and VR into practice, let's start by focusing on "**Metaverse**" (https://studio.gometa.io/landing), a project by the Californian company GoMeta, a very good tool to start creating augmented reality experiences.

The site invites users to access the platform to immediately start to “Create Amazing Things”, whether you are operating in the educational field or operating in any market niche. It is a Web App with an internal editor to create AR experiences. The AR experience editor interface works in blocks and is extremely versatile, allowing you to enrich the perceived reality with **visual and interactive elements** that offer information and content chosen and created by those who design the experience.

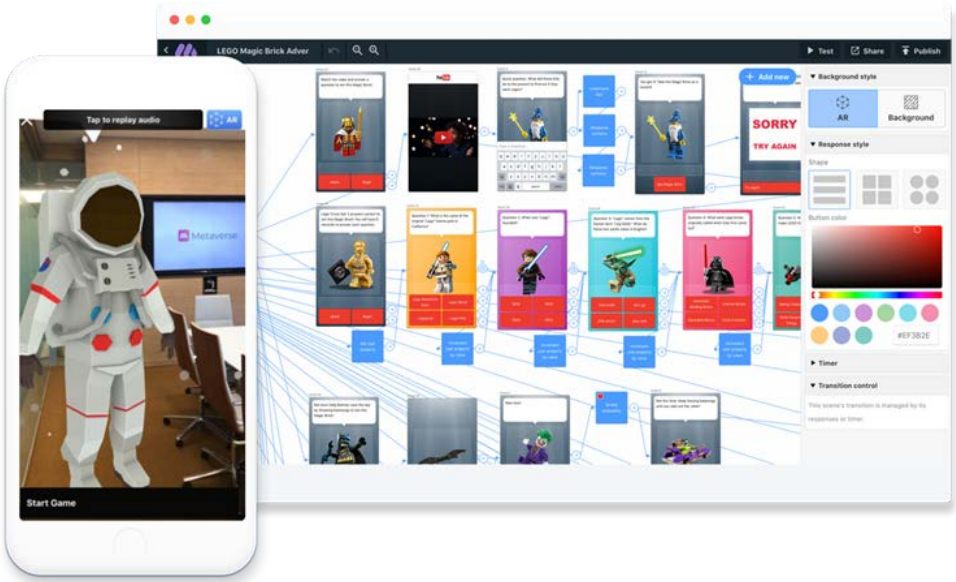

Fig 1. Source- Metaverse: Lego magic brick

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A simple QR code or correspondence with certain satellite coordinates become the access point for engaging experiences, thanks to which users can make meaningful choices and directly contribute to the success and development of a project.
Metaverse allows you to create simple interactive games, treasure hunts, quizzes, guided tours, interactive stories, and geolocated experiences.

For those who create experiences, access to the online Web App editor is provided with the free use of all the features offered on the platform.
For those who need to benefit from the experiences created, it is necessary to download the App from App Stores for Android and IOS.

The editor has a wealth of settings and features and this makes the platform suitable both to create small-scale projects and to develop complex and scenario-rich experiences.

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Access to the **Metaverse Studio** AR experience editor follows registration or authentication- also via a Facebook account - at the following internet address: https://studio.gometa.it.
The interface allows you to create and manage your own experiences, your own collection of favourite experiences and other very interesting features such as "**walls**" (virtual walls that can be used as design elements to collect texts or images posted by users) and "**polls**" (surveys for the acquisition of data relating to satisfaction and preferences).

For a brief overview of the editor, here follows the link to the video on YouTube:
https://youtu.be/N4hNoo5g_Is
For tutorials on the correct use of all functions, please refer to the following lists:
-Metaverse Tutorials: https://youtube.com/playlist?list=PLds3H0cr227f3o4rI7yU9rKcnUuxs-PWL
-Metaverse Builds: https://youtube.com/playlist?list=PLds3H0cr227fZ8pZPpFewUK1vK4KsMgc6
-Metaverse Overviews: https://youtube.com/playlist?list=PLds3H0cr227dyjuJFMjnkaNobjLXn6Dgn

The "**Create experience**" highlighted at the top of the interface allows you to access an empty canvas that you can start populating with the essential elements that make up any augmented reality experience created with Metaverse: scenes and blocks.

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The scenes simulate stimuli and contents offered to the user on a smartphone screen, which appear when certain conditions occur, while the blocks allow you to define the operating logic of the experience.

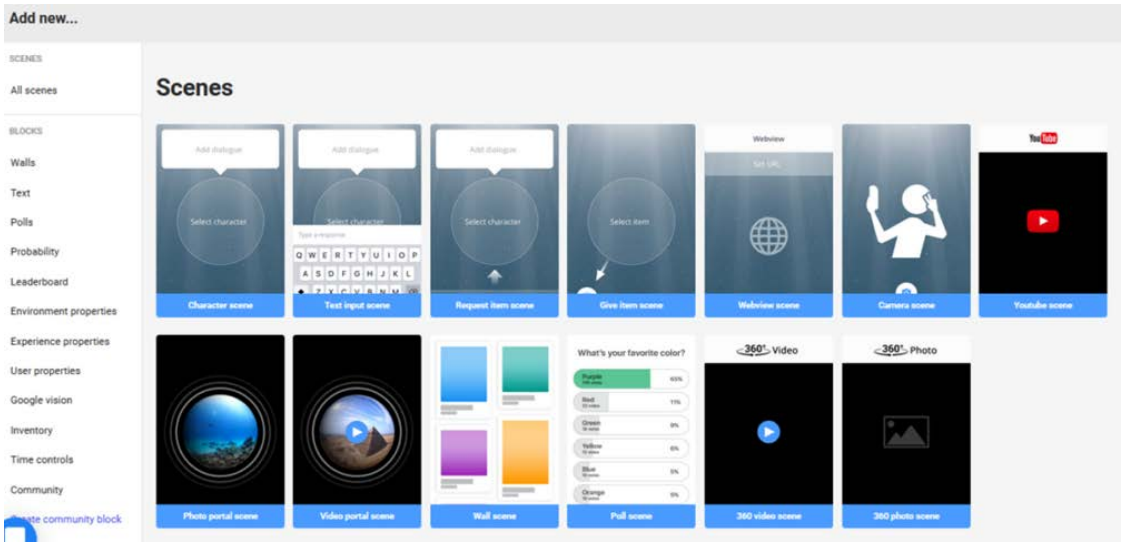

Fig 2. Source-Metaverse: Scenes

The scenes allow you to offer both multimedia and interactive content, as well as simple stimuli (talking characters floating in a void while the user searches for the right angle of view) or real experiences within the experience, such as browsing three-dimensional images or videos.

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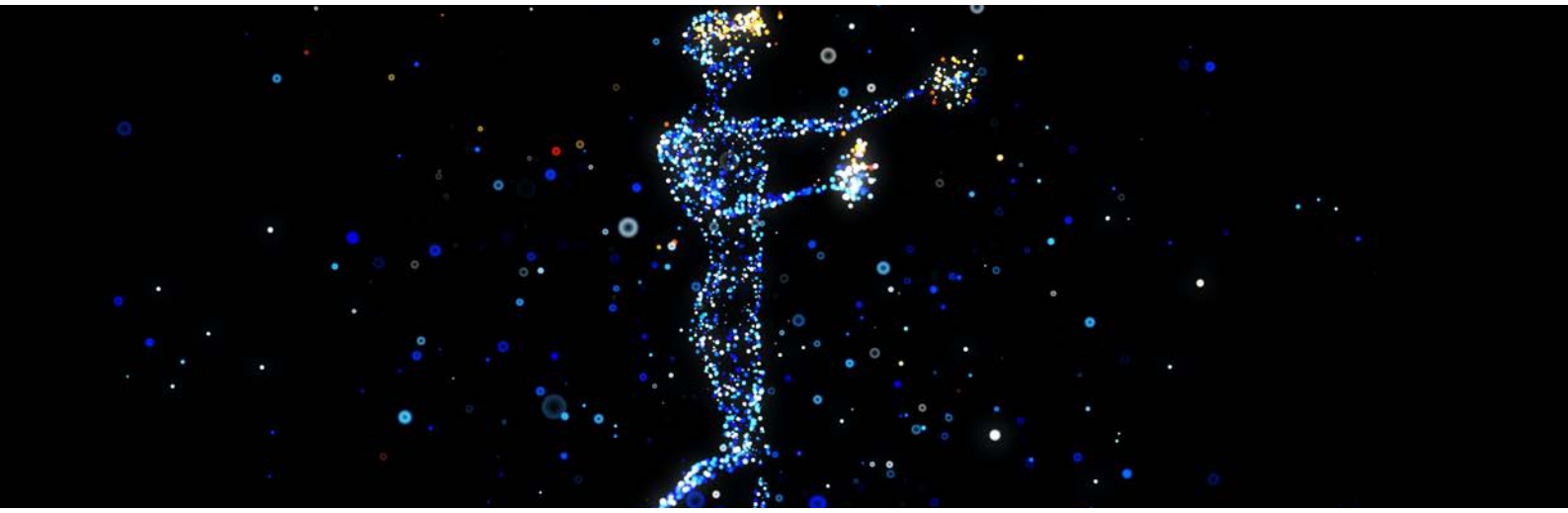

An example of using the platform without resorting to large conditional logics could consist of the creation of scenes that offer **web content**, **a video** or **a user survey** that is in a specific place and **frames a specific QR code** (non-mandatory step, since an experience can be activated via geolocation or by proximity conditions via beacon technology).

The creation of more complex projects, such as **an interactive adventure** or **a treasure hunt**, naturally requires some expedients and a little more work.
There are many blocks available, organised into categories, and some of them are sophisticated.

For example, the blocks of the **Google Vision** section allow you to acquire information on the nature of the subject framed by the user's camera (*whether it is an animal, a specific object, a text string*), those of the **Inventory** section to manage virtual objects to assign to or remove from users.

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Experiences become something that are even more challenging when you decide to use the Wall and Poll blocks. The "Save to wall" block allows you to give each user the opportunity to leave a memento (a photo or image) on a virtual wall managed by the experience administrator. The wall is associated with an URL and can, therefore, be shared or simply viewed on the web. The “Record vote” block, on the other hand, allows you to record the preference expressed by each user in a specially created survey.

In this way, each experience is not reduced to a simple use of content, but also becomes an opportunity for dialogue with users.
An experience can be used once it has been published on any Smartphone that has the Metaverse App installed.
Each experience is associated with a QR code that can be used in any way.

The platform, thanks to the specific features it provides, is also suitable for integrating gamification logics into projects relating to many areas, including educational ones.
Let’s now focus our attention on the use of viewers.

These are devices in the shape of a helmet or glasses that recreate a digital, three-dimensional environment that can be explored with the movements of your head (if you look upwards, the image moves upwards, if you are looking to the left, the image moves to the left, etc.) and with which it is possible to interact.

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Teachers who want to experiment with this technique to design training experiences can do so by using different types of viewers that are in circulation, such as those produced by Google (Cardboard), the cheapest, by Samsung (Gear VR), by Microsoft, by Facebook (Oculus).
When creating your first experiences, we recommend trying Cardboards as they are relatively cheap and can be used together with your Smartphone which becomes the viewer display and sensor.
From your Smartphone, you can search for videos on the net and start the experience: the video image reproduced, slightly offset and enlarged by the lenses, fills almost the entire field of view, creating the impression of 3D space.
To take advantage of the content already existing on the network, you can use the YouTube platform, which already provides many videos that are free of charge and suitable for use by the Google Cardboard viewer.

Here are the links to some videos or video lists:

- a journey through the human body to find out what happens when we breathe: https://youtu.be/kw9EJbezlK4
- a trip into space with a stop-over on the surface of several planets: https://youtu.be/qhLExhpXX0E
- a dip in the ocean: https://www.youtube.com/watch?v=aQd41nbQM-U
- a safari experience: https://www.youtube.com/watch?v=mlOiXMvMaZo

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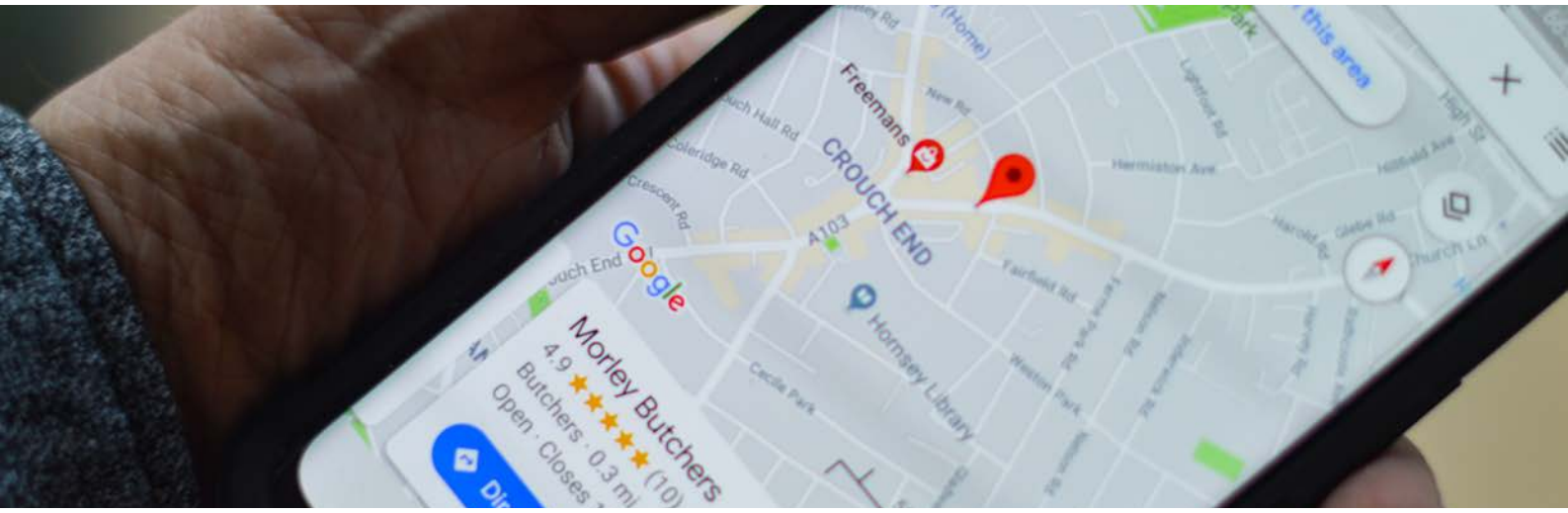

To search for a specific video, use the words “**Cardboard**” + “**VR**” + “**360**” and the specific theme that you want to investigate to find the material available.

Another support for educational planning can come from tools such as:

- **Google Maps** (https://www.google.it/maps/preview)
- **Google Earth** (https://www.google.it/intl/it/earth/)

which provide 360° horizontal and 160° vertical, panoramic views, allowing you to see parts of various cities and places around the world.

To create content, you can use, for example, the "**Blendspace**" WebApp or webware https://www.blendspace.com/lessons/), which allows you to create lessons easily and quickly, collecting and organizing resources in a virtual space to share with students.

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Furthermore, you should also take into account the following additional applications that are really useful in the design of innovative training courses enriched with additional AR and VR content:

- **Google Expedition** (https://artsandculture.google.com/project/expeditions): a free app that is part of a broader Google education program and offers teachers special guides and educational courses. The App, which can be used with one of the Google Cardboard viewers, allows you to virtually visit distant places and points of interest around the world. Also with Google Expeditions, you can access numerous scientific contents (for example: DNA and genetic strands, asteroids and volcanoes), facilitating understanding of abstract or very complex concepts thanks to interactive visualization in AR and VR.
- **ClassVR** (https://www.classvr.com/): an open platform, which supports the contents of the virtual and augmented curriculum, allowing teachers and students to create, upload and share their own contents, thus, contributing to the collaborative community of global educational resources provided by ClassVR.

In particular:

- ClassVR comes complete with thousands of virtual reality educational resources along with structured lesson plans to help stimulate students' imaginations, allowing them to have experiences that help them understand more complex educational subjects.

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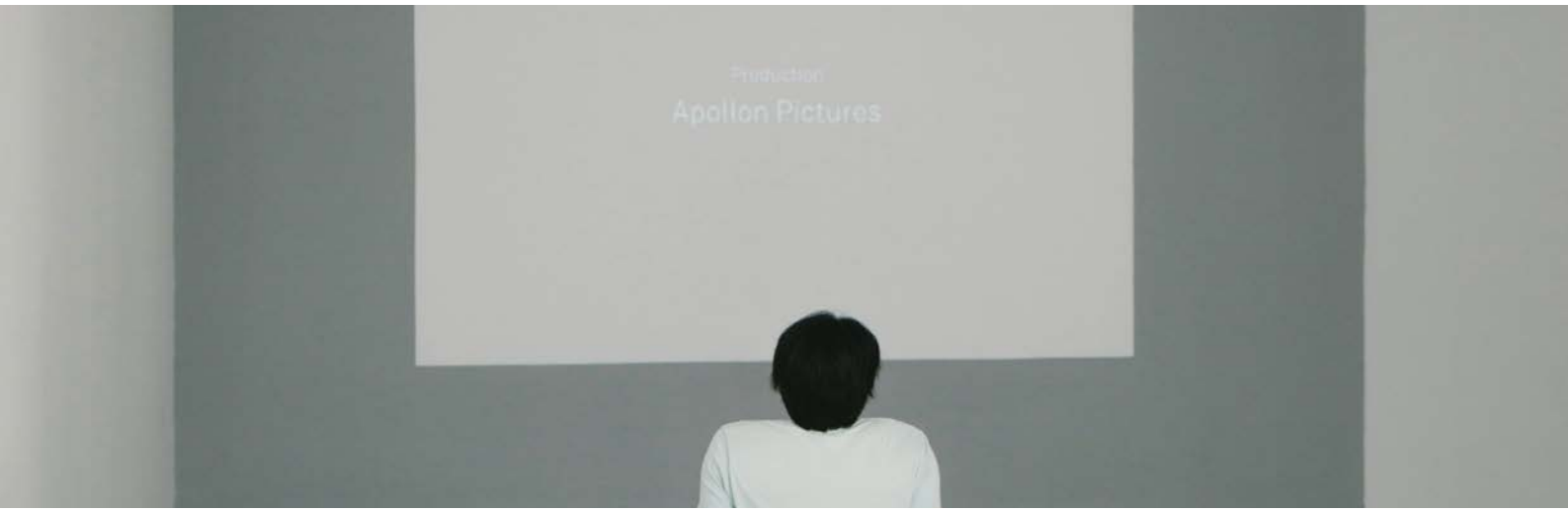

- Teachers can access the countless resources provided both by ClassVR experts and those generated directly by users from the community, which cover a wide range of topics and thematic areas. They can also add their own resources, such as photos and 360° videos, so they can create engaging lesson plans.

A subscription plan from the ClassVR portal allows you to receive lesson plans in VR and AR created ad hoc by a team of educational experts.

- The use of augmented reality allows students to view and interact with 3D models from worksheets or AR cubes. ClassVR's augmented reality content covers a wide range of topics with hundreds of pre-made activities, resources, and lesson plans. Access is unlimited both to resources created by ClassVR experts and those generated by users from the community. All 3D models can be viewed via ClassVR's augmented reality worksheets or AR cubes.

Here follow, as an example, some of the thematic areas through which you can access thousands of augmented resources, such as:

Art: in this area, it is possible to enter a virtual art gallery and accompany students on a journey around the world and through time, visiting traditional art galleries and sculptures or exploring digital works of art designed to be experienced in virtual reality to inspire creativity (e.g.: you can explore art in all its forms, from the raft of the Medusa in the gilded rooms of the Louvre to the lively atrium of the Met in New York, street art in Melbourne or 3D AR sculptures)

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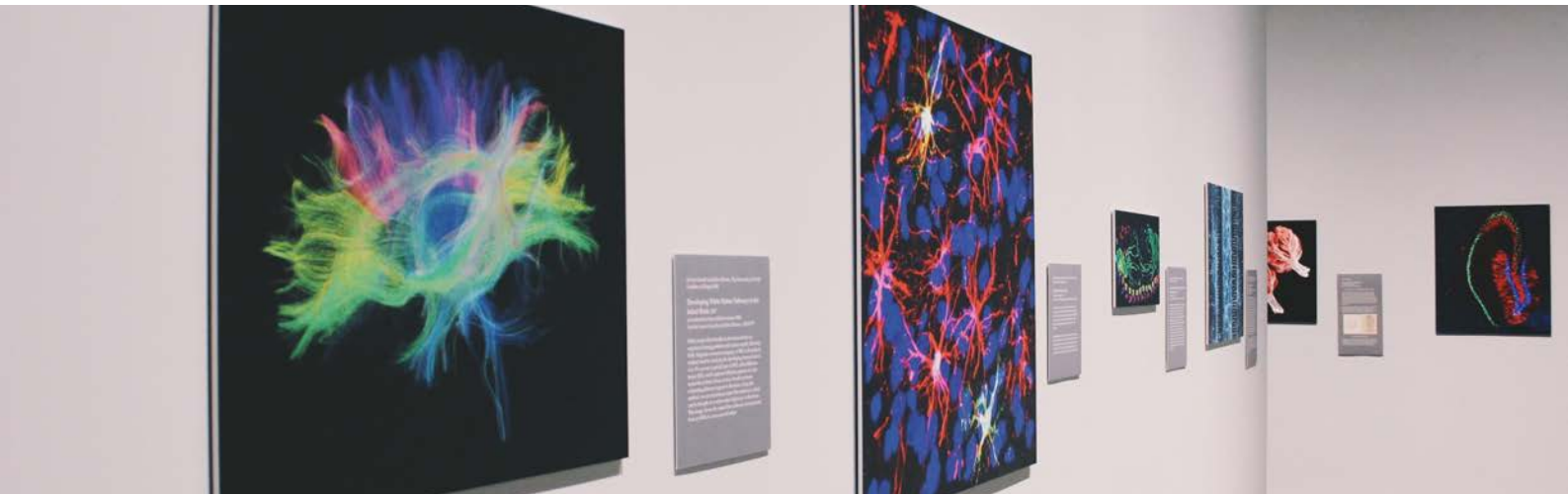
Design, technology and industrial arts: allows you to discover what is possible with technology and engineering, closely examining machines and transport. In addition, the exploration of the 3D Engineering theme allows students to combine 3D models with the ARCube so that they can examine in detail how trains, car engines, etc. work and how they are designed.

Drama, theatre and performing arts: thanks to the availability of both 3D images and models, the themes provided are ideal for stimulating ideas for drama and dramatic writing.

Literacy and Language Arts: Countless resources created to stimulate the imagination and fuel creative writing. Images, 3D models and videos will allow you to stimulate the imagination, bringing to life the atmosphere of fantastic worlds and locations full of details.



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Mathematics: the mathematical resources provided in ClassVR allow you to make the abstract concrete. From simple estimating and counting work to complex geometric shapes, ClassVR's collection of mathematically relevant resources allows students to explore complex concepts in a new and engaging way.

- the ability to explore virtual reality scenes allows students to move, discover and travel through virtual worlds and environments using a ClassVR viewer and hand controller, just as they would in the metaverse. Each scene allows you to explore and explain numerous things, thus fostering contextual learning in a highly engaging way. VR explorable scenes include multiple points of interest and allow teachers to ask students questions thus promoting independent learning and group discussions.

The ClassVR portal gives teachers the ability to confidently manage students and add value to lessons by including VR and AR resources to their lessons. Teachers can plan and create playlists, searching from thousands of VR and AR educational resources organised by topic, thanks to the use of the drag-and-drop function. In this way, teachers can:

- schedule lessons and guide students through the experiences by facilitating both independent exploration and encouraging collaboration;
- direct students' attention by setting dynamic points of interest;
- monitor ongoing activities by viewing, in real time, what and where students are exploring.

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It is possible to access and request access to Documents and to the countless VR and AR resources, consisting of reports, videos, data sheets, case studies and ClassVR lesson plans, which can be downloaded and used for free: https://www.classvr.com/downloads/

360° Virtual Tours

A final reflection should be made on the creation of 360° virtual tours, which facilitate considerable use in the design of innovative training courses as their use should not be limited only to visits to museums, churches, houses, villages, cities, moving within the virtual space thanks to the movements created with the different authoring systems that can be used to assemble the 360° images in sequence.

Resorting to the construction of these tours is increasingly on the rise to involve students in a visual idea of how to operate within an office, a commercial space, a warehouse, a laboratory, a production plant, etc., being able to contextualize the places where most of the theoretical concepts learned in the classroom find practical application, as you can interact with the different objects present in the virtualized environments and, thus, access specific insights and contents on specific work processes regarding the production of goods and/or provision of services, in relation to specific activities pertaining to the professional profiles trained at the end of their study course.

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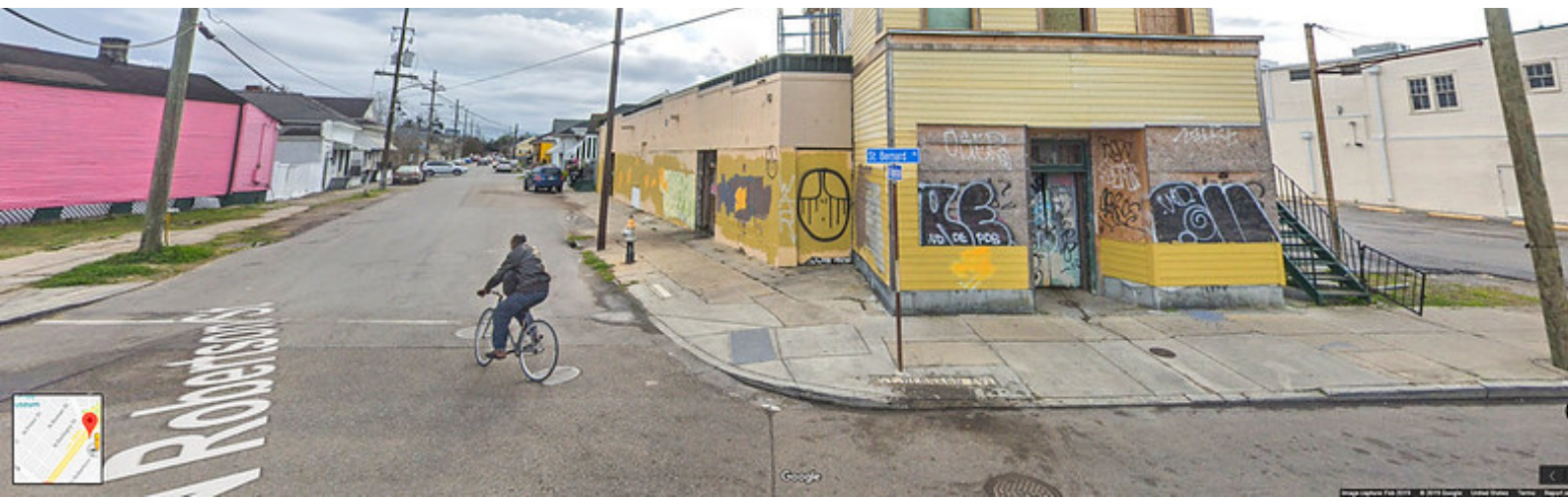
Creating 360° Virtual Tours allows you to provide students with virtual environments that are coherent with work contexts. Thanks to a set of images and panoramic videos, placed in sequence and connected to each other, you can participate in a totally immersive and highly realistic experience with which you can learn about the characteristic aspects of the different operational processes from your computer, tablet or smartphone.

Furthermore, the creation of 360° virtual tours can lead to a high level of customization, including integration into the experience of sound effects, such as music or narrations, and/or video tutorials, which describe the place, product or service, so that you can also interact, thanks to specific clickable buttons, with equipment, machinery, computers and any other object that represents the diverse production activities, thus being able to access the "added" contents provided through different didactic resources (e.g: informative datasheets, training pills, interviews with process/product owners, etc.)



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The advantages of creating a 360° virtual tour in the innovative design of a training course responds to the objective of accompanying students on an ad hoc guided tour, to valorise the activities and characteristics of the products and/or services offered.

To create an effective 360° Virtual Tour for learning purposes, you must bear in mind the following aspects:

- style to be given to the virtual tour according to the thematic areas to be explored and the type of students it is intended for
- training objectives that are to be consolidated according to the different virtual environments to be explored virtually
- number of environments that you want to create in the tour
- in-depth educational materials and/or operational tools to be provided to students for use through hot spots to be placed in the diverse virtual environments (e.g.: video tutorials, information datasheets, interviews with process/product/service experts, documents in pdf and/or excel format, etc.)
- overall duration of the experience

There are various types of virtual tour and each one has a different level of interactivity and complexity.

Starting from very simple virtual tours with little interaction (for example, what is offered by Google Maps), you can create real guided tours of rooms rendered interactive by sounds, buttons and animations that can capture and bring to life a unique and engaging experience.

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Here follow the 360° Virtual Tours grouped into 3 distinct types to be taken into consideration in the design phase of a training course based on different thematic areas and to be more precise:

- **Virtual Tours for entertainment and tourism**

Virtual tours of tourist sites and museums are the most popular. For example, the virtual tour of a hotel in a famous tourist resort, allows you to show the main spaces of the structure, for example the rooms or entertainment rooms, and allow you to satisfy your initial experience of the service offered and its characteristic and personalised elements. A similar consideration should be made for the Virtual Tours of museums, churches, monuments, castles, villages, cities and any other place of significant cultural and tourist value, offering multiple privileged points of view and the possibility to access countless multimedia resources for in-depth analysis.

- **Corporate Virtual Tours**

These Virtual Tours are suitable for presenting different businesses, allowing you to learn about the different operational and creative processes, the types of products sold and/or services provided, all contextualized in realistic working environments, a condition that favours the knowledge of characteristic and distinctive aspects of each offer, thus better understanding its value.

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- **3D Virtual Tours**

Thanks to technology it is possible to faithfully reproduce an environment and give different objects a realistic look, without giving up the third dimension. 3D virtual tours allow a very high definition and the possibility of inserting both interactive elements and those that do not really exist in the environment.

Creating a 360 virtual tour is very simple and you don't need to be a photographer or an expert videomaker.

The first thing you need is a **camera** with a wide-angle lens (recent smartphones are also capable of taking high-quality photos).

A **software** must then be chosen for the assembly and personalization of the virtual tour.

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There really are so many, most of them at a cost, such as the ones listed below:

- **Metterport**: app specialized in creating virtual tours, capable of transforming 2D panoramic images and 360 videos into 3D images. Matterpot generally offers a monthly subscription plan and, in addition to its service, it is also possible to purchase the equipment necessary to create virtual tours. The software relies on an internal cloud on which the virtual tours are saved. Matterpot also offers a free plan that allows you to create even only one virtual tour.
- **EyeSpy360**: software for creating virtual tours starting from 2D floor plans, capable of integrating multimedia files and interactive buttons with which the user can interact. It allows you to customize the digital visit with additional features and elements that enrich the customer experience.
- **Concept3D**: allows you to create customizable 360° virtual tours of external environments, such as city streets, or internal rooms, such as rooms in a building or a company.

Here follow two very valid solutions for creating 360 ° virtual tours:

- **DiveIn Studio** (https://www.divein.studio/): a simple editor for creating virtual experiences, that has the most popular functions at this point in time. The free version of DiveIn Studio allows you to only manage one project at a time, but it is still possible to make a subscription to remove this limitation. By clicking on **Sign Up**, you can register your account or, alternatively, you can log in using your Google or Facebook accounts, providing the information requested by the platform.

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Once you have entered the DiveIn Studio **Dashboard**, you will be able to consult two tours which, acting as an example, will give you a general idea of the functions available. By clicking, on the other hand, on the Create Tour button, you can access the editor. Before proceeding with the creation of the virtual tour, you should upload a 360° photo by clicking on the Add New Scene button that you can find at the top of the screen.

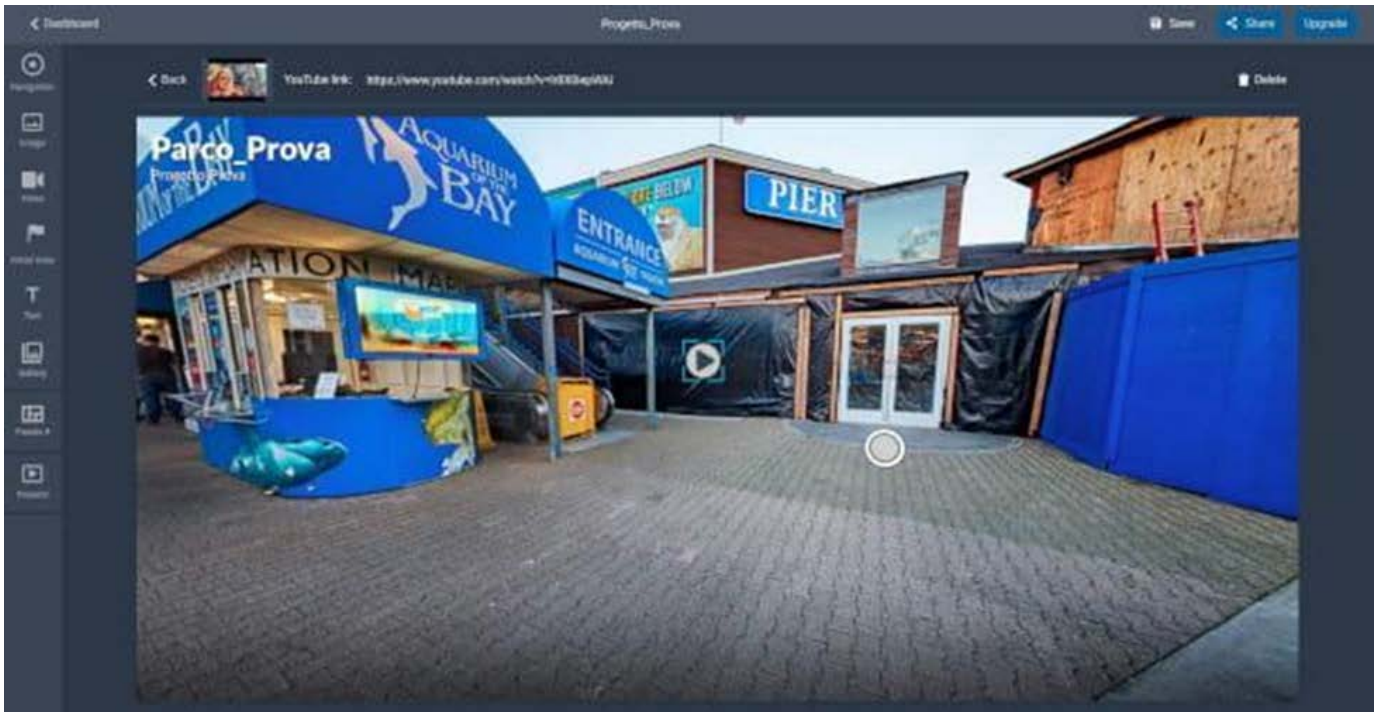

Fig. 3.Source DiveIn Studio-example of tour

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DiveIn Studio offers a fairly narrow selection of tools, but at the same time optimized for the quick creation of a virtual tour, making the editor easy to use and offering instant results.
By clicking on Navigation, you can switch from one 360° photo to another; the Image function allows you to include infographics, while Video incorporates links from YouTube, Initial View sets the starting view of the tour, Text allows you to add text, Gallery allows you to view an album of images and Panels to set pop-up options, such as those to incorporate a compass, a tour description, a floor plan and a logo.

- **Tourmake** (https://tourmake.net/): a simple, multilingual platform, with specific functions, which allows you to create 360-degree virtual tours, in absolute freedom and in complete autonomy.

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Tourmake takes advantage of innovative 360 panoramic technologies by providing an intuitive system based on a practical control panel, which allows you to load the panning shots taken, view useful information and create the connection links that will make up the virtual tour.

Among its most important features, we would like to highlight:

- the possibility to choose the desktop display mode (making Google Street View optional);
- compatibility with all VR and Cardboard viewers, a condition that allows an extraordinary immersive experience;
- the use of a new interactive menu, located in a central position to make viewing more immediate.

Tourmake offers the possibility to choose the desktop display mode (making Google Street View optional); compatibility with all VR and Cardboard viewers, a condition that allows an extraordinary immersive experience; the use of a new interactive menu, located in a central position to make viewing more immediate.

The editor allows you to divide the tour into areas of interest. Using the drop-down menu at the top left, you can navigate within the panning shot quickly and intuitively. In a few clicks, you can move through the spaces and go from one area of interest to another. In each area of interest, you can insert photos, texts and personalised multimedia content.

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Thanks to the Tourmake booking function, through the virtual tour, you can book, for example, a service offered by a specialist shop or a table at a restaurant. Once the service has been booked, Tourmake foresees ADDITIONAL DEDICATED ASSISTANCE that will accompany the user during all stages of the booking. It also offers a plugin dedicated to booking rooms within accommodation facilities.

The plugin is customised according to the type of accommodation. The user is given the opportunity to choose the service he/she wants to book. The reference datasheet contains information about the room or service you want to book and can be customised by choosing from different booking or information request forms.

With the “Reactions” function, Tourmake allows you to leave a “geolocated” and filtered comment, related to a specific area of the virtual tour. Visitors of the virtual tour can express their emotions by placing a hotspot at the exact point they want. The hotspot is characterised by textual and photographic content. From being mere spectators, visitors become an active part of the tour and can express their own impression of what they are watching at that moment in the virtual tour and use a happy, sad or uncertain expression as well as include a comment.

At the same time, visitors can get a clear idea of a place by reading the opinions left by others, contextualised in the point they are viewing.

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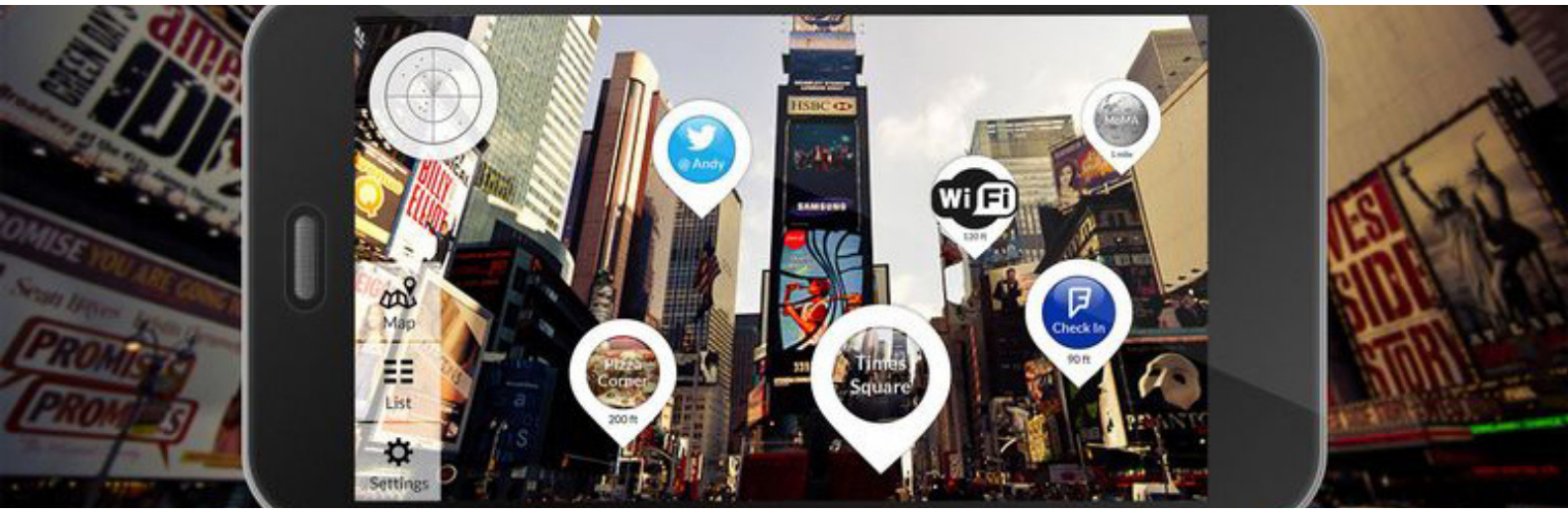
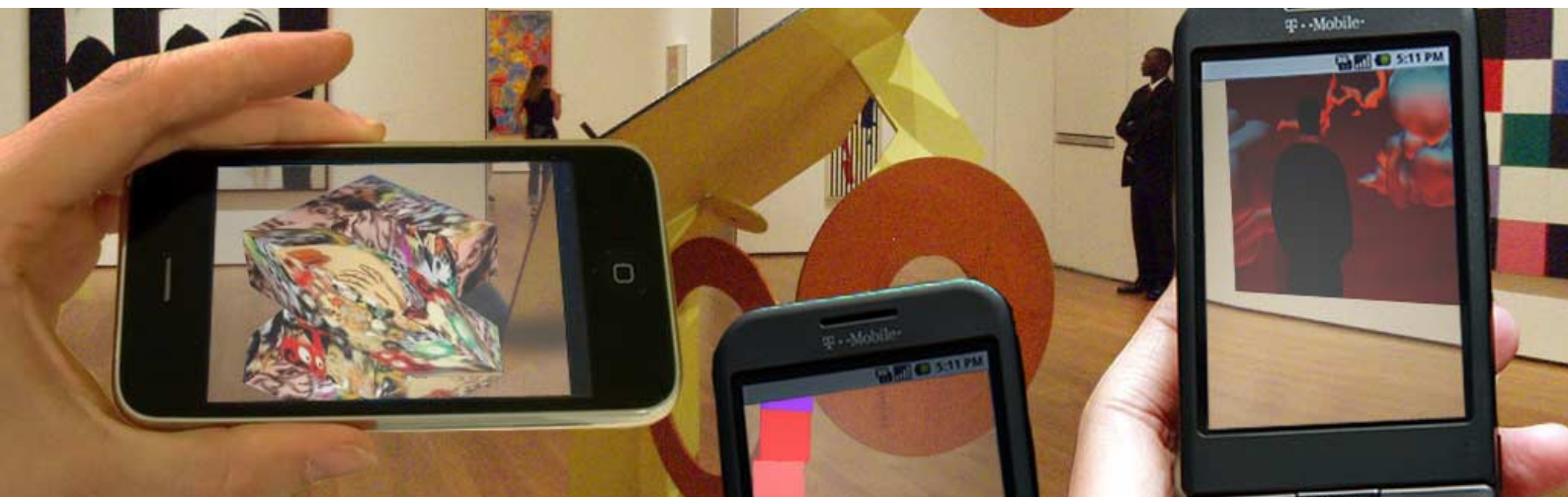


Conclusions

We have dealt with the new frontiers of learning using AR and VR solutions and we have tried to provide some suggestions on how teachers can use them to innovate educational design. In conclusion, some final considerations need to be made.
The internet can certainly be considered as a gold mine to support teachers thanks to the wealth of existing content that can be reused, thus simplifying the process and focusing attention on creating only the content not made by others or that must be designed ad hoc to allow specific goals and objectives to be achieved.

The choice of whether to use material found on the internet and/or directly create content for your students, imposes the need to consider who it is intended for and how they will use it. Bearing in mind the target of students who will be using the solutions that you have sought and/or created, you can understand if a tool can work or if there is a need to customise it in such a way as to make it compatible and usable only by a certain group of learners.



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The choice of using AR or VR, clearly different tools even if they both have to do with the virtual world, depends on your objectives when introducing these innovative approaches in teaching. Solutions in VR are certainly more fascinating but AR is more immediate, both for teachers and for students: all you need is a smartphone, unlike VR that instead needs tools such as viewers which, although they are cheap, still entail an expense for the school/university or students.
Of course, it is important to specify that the tool must be adopted on the basis of the educational objectives that must be pursued, and not because it is fashionable or the latest trend.

The important thing is, therefore, to be clear about who your students are, in order to choose the right tool and to stimulate their creativity and attention.
As regards VR, you can also try it out at a very low cost.
For example, with the viewers called Cardboard, cardboard boxes that contain two aspherical lenses, which don't cost much or at most a few tens of euros, you can insert them in your smartphone to start a virtual reality experience. Likewise, we have seen that there are several tools for free content creation.
With regard to AR, we have drawn your attention to the Metaverse Studio application, that allows you to create experiences in augmented reality without spending practically anything, using the students' smartphones to be able to see products made in augmented reality.
Finally, you should bear in mind that, for most teachers, the difficulties are often of a structural nature. If you don't have a good network infrastructure, or a certain level of WiFi available, this type of experience becomes more difficult.

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Likewise, if you don’t have any computers available, things get slightly more complicated because it is not always possible to rely on "bring you own device" to create applications, even complex ones, such as those we have talked about.
Furthermore, you do not need to have specific skills to create an AR or VR experience.
In reality, very good products can be made without necessarily being computer engineers or having knowledge of programming languages.
Applications are now available that have been designed for both teachers and students, who sometimes don't know how to use computers as well as smartphones very well.
These are tools with simplified interfaces and very, very simple features.

Using these solutions certainly allows students to engage better, affecting motivation and creativity, making them work on topics such as digital skills but at the same time on skills related to their specific subject.
However, these are activities that should not be improvised and, therefore, require very meticulous planning, especially as regards the timing and management of the various work phases, also talking to other teachers, asking them for feedback, as well as the opinions of students, which can be extremely useful for redesigning new experiences by removing the superfluous or what students found uninteresting or too difficult.

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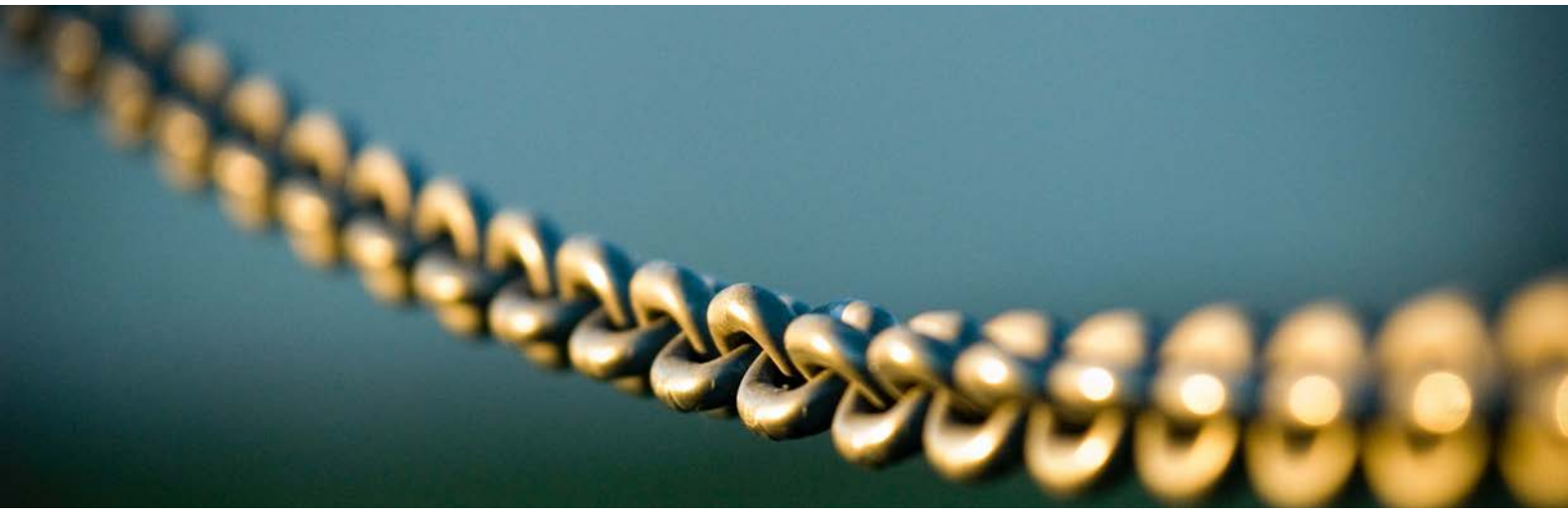
USEFUL LINKS



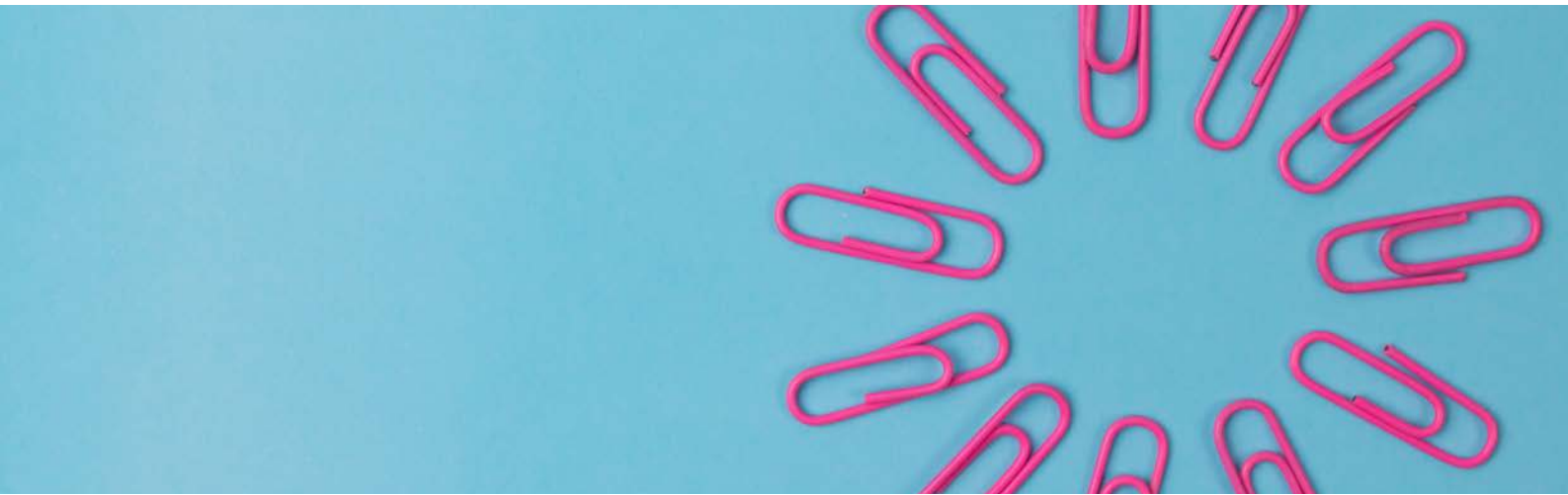
The Body VR (https://store.steampowered.com/app/451980/The_Body_VR_Journey_Inside_a_Cell/?l=italian)presents a set of guided experiences that explore human anatomy and biology.

Veative Labs (https://learn.veative.com/modules?domain=Higher+Education) is a company that offers 360° services - from the production of educational VR content to its implementation in the classroom for use.

Metaverse (https://studio.gometa.io/landing), a tool to start creating augmented reality experiences

Examples of virtual reality

- a journey through the human body to find out what happens when we breathe:https://youtu.be/kw9EJbezlK4



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USEFUL LINKS

- a trip into space with a stop-over on the surface of several planets: https://youtu.be/qhLExhpXX0E
- a dip in the ocean: https://www.youtube.com/watch?v=aQd41nbQM-U
- a safari experience: https://www.youtube.com/watch?v=mlOiXMvMaZo
- VR 360 Biggest Tsunami Wave - How to Survive a Natural Disaster: https://youtu.be/Wmdkhmuh-zU
- 58 Cities 360 videos — VR: https://youtube.com/playlist?list=PLBIsvuObDf1sKg0jh16_j24wQkLer8Ie8
- Google Maps (https://www.google.it/maps/preview)
- Google Earth (https://www.google.it/intl/it/earth/)

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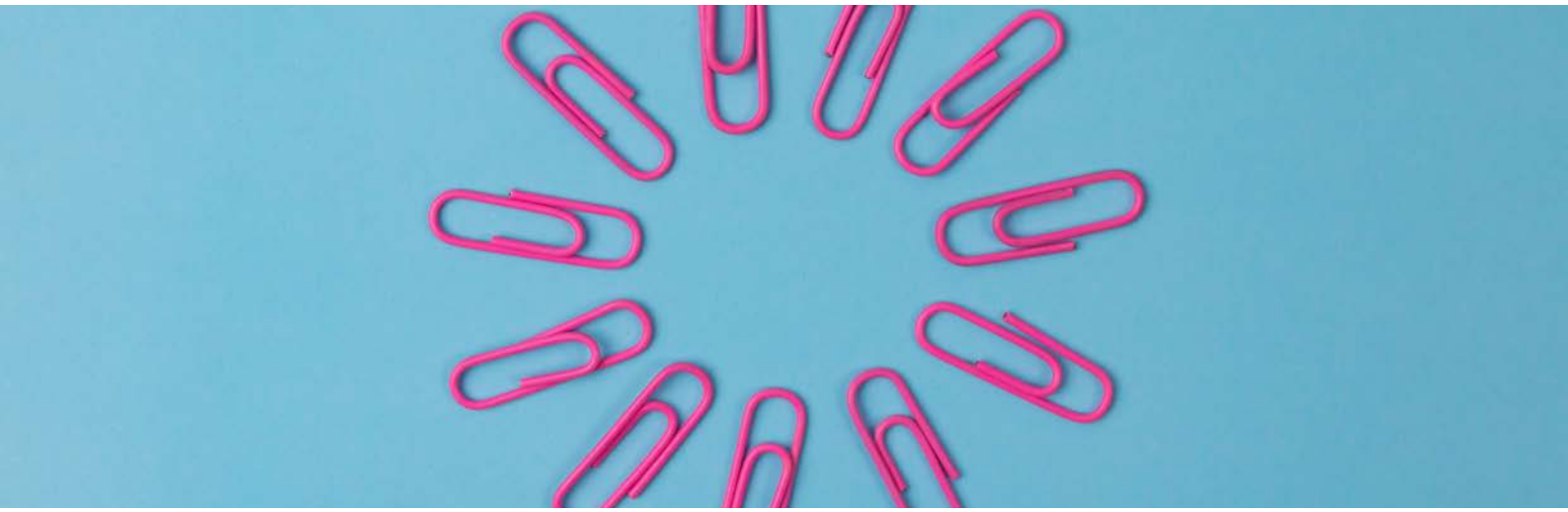

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