Erasmus + Project: Crisis Resistant Digital Education and Training

Intellectual Output 1 – Activity 6

Review on Educational Objectives

DISCLAIMER

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OVERVIEW

1. DEFINITIONS

EDUCATIONAL APPROACHES enable educators to implement and adapt different methods (using the appropriate tools) to reach the intended learning outcomes in specific environments and conditions.

EDUCATIONAL METHODS are predefined sets of activities, whose sequence is meant for the achievement of intended learning outcomes.

EDUCATIONAL TOOLS are the means to support the successful delivery of educational activities.

2. CATEGORIZATION OF EDUCATIONAL GOALS/OBJECTIVES

Bloom's Taxonomy defines different learning objectives that are important in pedagogical exchanges so that educators and students can match their expectations on the purpose of any exchange. For educators, it helps to design the appropriate strategies, tasks and instructions, so that the intended outcome is met. For students, it helps to clarify the objectives of taking a course.

ORIGINAL TAXONOMY

First published in 1956, Bloom's Taxonomy categorizes educational goals in six major categories:

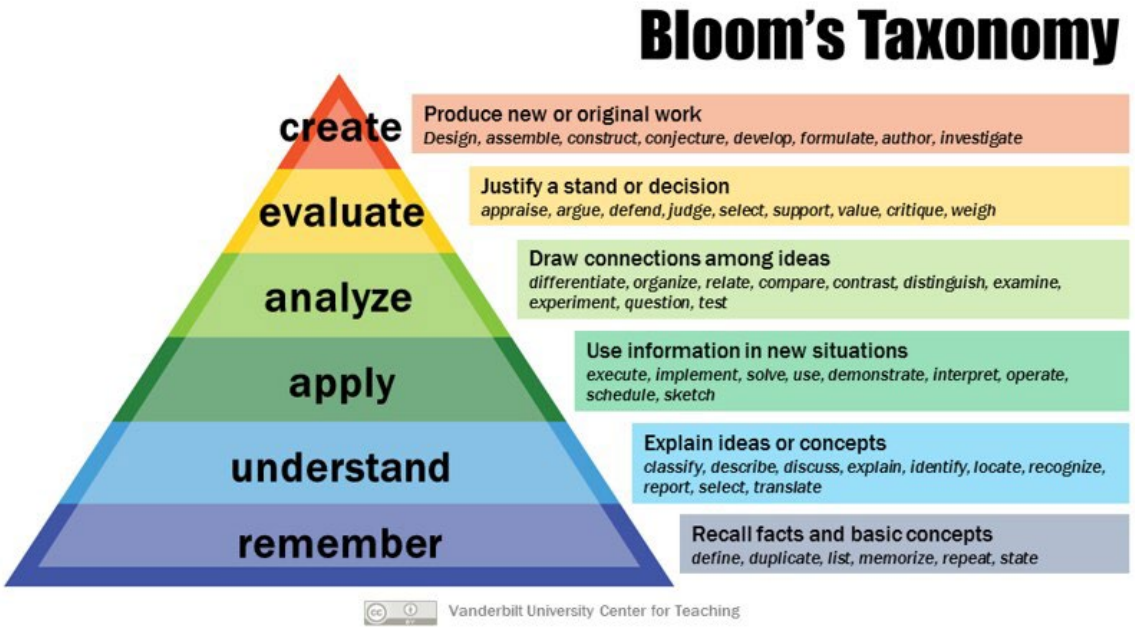

Figure 1: Bloom's Taxonomy (Image source: Vanderbilt University Center for Teaching, accessed via https://www.flickr.com/photos/vandycft/29428436431)

- **Knowledge (remember)** "[...] involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting. This involves little more than bringing to mind the appropriate material."
- **Comprehension (understand)** "[...] represents the lowest level of understanding. It refers to a type of understanding or apprehension such that the individual knows what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications."
- **Application (apply)** involves the "use of abstractions in particular and concrete situations. The abstractions may be in the form of general ideas, rules of procedures, or generalized methods. The abstractions may also be technical principles, ideas, and theories which must be remembered and applied."
- **Analysis (analyse)** includes the "breakdown of a communication into its constituent elements or parts such that the relative hierarchy of ideas is made clear and/or the relations between ideas expressed are made explicit."
- **Synthesis (evaluate)** includes "the putting together of elements and parts so as to form a whole. This involves the process of working with pieces, parts, elements, etc., and arranging and combining them in such a way as to constitute a pattern or structure not clearly there before."
- **Evaluation (create)** involves "judgments about the value of material and methods for given purposes."

REVISED TAXONOMY

In 2001, a revised version was created that focuses more on the dynamic conception of classification:

- **Knowledge (remember):** recognizing and recalling
- **Comprehension *(understand)*:** interpreting, exemplifying, classifying, comparing, and explaining
- **Application *(apply)*:** executing and implementing
- **Analysis *(analyse)*:** differentiating and organizing
- **Synthesis *(evaluate)*:** checking and critiquing
- **Evaluation *(create)*:** generating and producing

The Bloom's taxonomy, therefore, can be used as a reference element for the definition of the Intended Learning Outcomes (ILOs) of any educational activity, event or set of the same. The definition of the ILOs, therefore, concerns the educational objectives to be achieved through the implementation of approaches that combine the adoption of methods and tools.

An appropriate definition of ILOs for the educational activities should consider the hierarchy that lies within the taxonomy: in order to reach educational objectives at the higher layers of

the Bloom's pyramid depicted above, students have to consolidate their knowledge (which here should be intended as a metacognitive element that spans the whole taxonomy and does not just refer to remembering the basic elements of the same) at the lower layers. In other words, any educational activity should start by defining ILOs at the lower levels of the pyramid and/or verify that students achieve and consolidate those objectives, before moving on towards the higher order skills described by the taxonomy. In other words, moving from the top of the hierarchy towards the lower layers, a student cannot create (i.e. master its skills to generate new concepts with that) without the ability to evaluate what is done by itself and by others. The skill to evaluate the results of any activity (that obviously might change depending on the focus of the educational target and topic), in turn, requires the student to be capable of analysing what he perceives with its senses and/or interprets according to the experiences previously gained. The skills related to the analysis of existing elements should not be mixed with those related to the understanding. Proceeding with the opposite path, thus from the lower layers towards the top ones, it is impossible to understand any concept if one does not remember its main constructs: memorizing these constructs is the basis to figure out how these basic elements are connected with each other. These connections among the different elements constituting the theoretical basis of the topic the students should learn about are critical to make it possible to apply what is understood in context. It is clear, then, that all these skills are related to knowledge in different ways.

- Remembering is about knowledge recalling, potentially also in an unstructured way.
- Understanding refers to the knowledge of connections among basic elements of constructs of a specific topic, thus to create a meaning that goes beyond the ones that the elementary elements get per se.
- Applying is about implementing knowledge in a specific context to execute operations, which were impossible without a clear understanding of the matter.
- Analysing is about knowledge organization. It concerns the investigation of applied knowledge in order to depict general patterns, thus including skills of abstraction.
- Evaluating is about leveraging knowledge for the formulation of judgement on knowledge applied and analysed. This can be referred to the evaluation of the self or of third parties.
- Creating refers to the generation of new knowledge based on the previous one, coherently with the outcomes of analysis and evaluation of previous experience, thus finding new meanings and making them available for the self and the others.

3. CATEGORIZATION OF EDUCATIONAL METHODOLOGIES

Educational methodologies (also pedagogical methods, learning methodologies, teaching methods, or teaching theories) describe the way in which education-related activities are implemented with the aim of achieving specific educational goals.

The methodologies can be categorized on the basis of two parameters: the centering (teacher-centered versus student-centered) and the technology level (low-tech versus high-tech). The characteristics of the two parameters are not strictly delimited, allowing different intermediate levels (e.g. mid-tech, low-mid-tech, etc.)

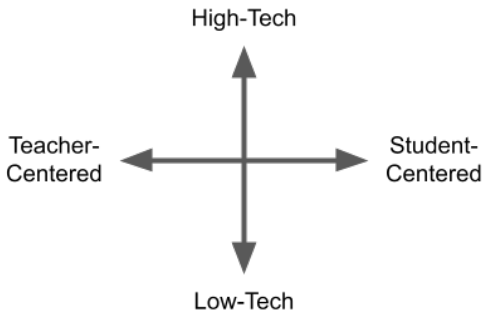

Figure 2: Categorization scheme for educational methodologies

TEACHER-CENTERED APPROACH

In the teacher-centered approach, educators primarily impart their knowledge to their students through direct teaching, such as physical lectures or online presentations. Assessments aim to measure the success of knowledge transfer through different types of tests.

STUDENT-CENTERED APPROACH

In the student-centered approach, students learn from various educational activities such as group projects or class participation. The educators act as intermediaries who accompany their students on the learning path. Assessments are mainly based on the content created and participation.

HIGH-TECH APPROACH

High-tech approaches use modern technologies such as the internet, notebooks or smartphones to connect students and provide them with information.

LOW-TECH APPROACH

Low-tech approaches rely on traditional learning techniques that work without the inclusion of modern technologies such as the internet, notebooks or smartphones.

4. LEARNING STYLES

Within the perspective of a student-centered approach, it is important to consider that not all the students are the same. They have different cognitive abilities or, better, they are more familiar and find it easier to leverage some of their skills to acquire new knowledge and reuse it across the different abilities set by the Bloom's taxonomy.

Honey and Mumford defined four categories of learners, which are characterized by behavioural characteristics that aim at distinguishing different styles of learning as well as the conditions that favour the acquisition of knowledge and the achievement of learning outcomes.

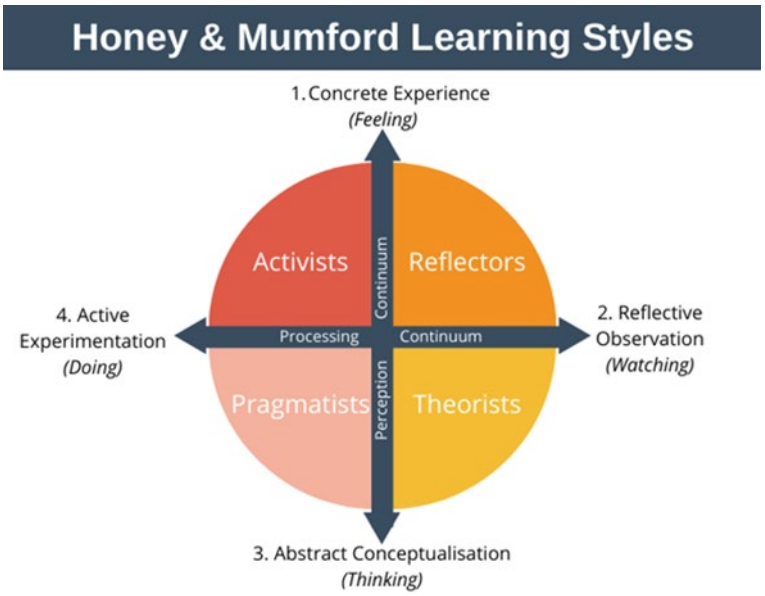

Figure 3: Honey & Mumford Learning Styles (Image source: Minute Tools Content Team, Honey and Mumford Learning Styles, Minute Tools, Oct, 2020, accessed via https://expertprogrammanagement.com/2020/10/honey-and-mumford/)

The four different learning styles are associated to four different profiles of learners: the Activist learner, the Reflector learner, the Theorist learner and the Pragmatist learner.

Activist learners mostly acquire knowledge and skills through a learning by doing approach, with an active engagement in new activities and experiences, despite they get bored with implementation and longer-term consolidation.

Reflector learners need to elaborate on what they observe which means that they do not necessarily need to experience in first person new situations and that potentially they mostly benefit from comparing different experiences before they draw definitive conclusions.

Theorist learners have a natural preference towards more abstract concepts that describe the contents they need to learn, which they assemble into a rational pattern (e.g. a model) that they build with analysis and synthesis.

Pragmatist learners mostly tend to acquire knowledge and skills if these have a direct and usable implication in the real world and in their own life: they want to check experimentally their applicability and their usefulness through direct practice.

These four profiles are not descriptive of every learner. They should be interpreted as general characteristics that describe the four main ways of learning, while every individual has its own style, which could be a blend of the above ones. This also means that the educators have to plan their activities according to these four learning styles in order to be effective with their audience. In other words, the educational approach should be planned and designed so that every individual they are addressing has the opportunities to learn in an effective way, by means of the style he/she is more familiar with.

An educational approach that includes a variety of activities has, therefore, higher opportunities to enable the whole class to learn efficiently and effectively, as it would be impossible to compose classes with learners of just one type.

Moreover, it will be extremely important to train the learners to start acquiring knowledge also with the learning styles they are less familiar with, so that these individuals can get the higher educational benefits in a wider variety of conditions and have higher chances of becoming life-long learners.

5. PRINCIPLES OF COURSE PLANNING

From a teacher's perspective the attention is on instructional planning, course pacing and provisioning of learning materials. Gagne et al. (1992) devised a set of nine principles of instructional design that in conjunction with Bloom's revised taxonomy and Honey and Mumford's learning styles can help in laying out an engaging and meaningful learning path for students.

Figure 4: Gagne's Nine Events of Instruction (Image source: Course Arc, 2015, accessed via https://www.coursearc.com/gagnes-nine-events-of-instruction/)

GAIN ATTENTION: Attract students' attention so they will pay attention as the educator presents the lesson material.

- Share a narrative or a problem that needs to be solved to get students interested in the subject. This can be supported by using icebreaker activities, relevant events and news, case studies or digital media
- Use technology, such as clickers and surveys, to get feedback on a contentious subject or to pose leading questions before lectures

INFORM LEARNER OF OBJECTIVES: Communicate learning objectives to the students and give them time to arrange their thoughts about what they are about to see, hear, or do.

- Include learning objectives in the syllabus, the lecture notes, and the guidelines for assignments, projects, and papers
- State in the course syllabus how the course will be delivered and assessed in the event of a crisis. This can help to seamlessly adapt and prepare in advance

- Define the performance standards
- Explain the criteria for standard performance

PRIOR LEARNING: Encourage the recall of prior knowledge.

- Make new information more understandable by connecting it to prior knowledge or personal experiences
- Recall the contents from the previous lecture
- Inquire about the comprehension of earlier presented concepts

PRESENT CONTENT: Use a variety of approaches to provide new material, such as lectures, readings, exercises, projects, multimedia, and others.

- To prevent cognitive overload, arrange and chunk the information.
- Mix the information to improve memorability
- Bloom's Revised Taxonomy can be utilized to assist in grouping the lessons into varying degrees of difficulty, which will aid with lesson sequencing
- Honey and Mumford's Learning styles/ Kolb's cycle can be utilized to assist in facilitating different types of student learners

PROVIDE GUIDANCE: Inform students of resources and learning practices that will help them understand the material and are less likely to waste time or become irritated by basing performance on false information or poorly understood concepts.

- Demonstrate various learning techniques, such as mnemonics, idea mapping, role-playing, and visualizing
- Utilize examples as well as non-examples for reference

PRACTICE: Let students use their newly acquired knowledge and abilities.

- Encourage student elaborations by asking students to elaborate or explain details and add more complexity to their responses.
- Ask deep-learning questions, make references to what students already know, or have students work with their peers
- Ask students to recite, revisit, or reiterate information they have learned

PROVIDE FEEDBACK: To evaluate and promote learning, give pupils immediate feedback on their performance.

- Take into account group or class-level feedback by highlighting common mistakes, providing instances or models of desired performance, and demonstrating to students what you do not want
- Take into account peer feedback
- Demand that students explain how they applied feedback to subsequent works

EVALUATE PERFORMANCE: Check to see if the anticipated learning outcomes have been attained in order to assess the efficacy of the instructional events.

- Performance ought to be determined by previously declared goals
- Use a range of assessment techniques, such as exams and quizzes, written tasks, projects, etc.
- Formative assessments: more frequent and low-stakes evaluations to keep students engaged in the course, provide feedback on the overall achievement of ILOs and stimulate positive learning behaviour
- Summative assessments: High-stakes evaluation for final grading to compare to defined performance requirements

ENHANCE RETENTION AND TRANSFER: Encourage students to apply knowledge to their personal contexts to improve information retention and transfer.

- Give students the chance to connect their academic work to personal situations
- Increase exercise opportunities

6. COMMON EDUCATIONAL METHODOLOGIES

METHODOLOGIES

INSTRUCTIONS

Instructions refer to the traditional teaching method where the content is presented by the educator to the students. The idea is that students learn by listening to the presentation and/or by looking at instructions.

PROJECT-BASED LEARNING OR PROBLEM-BASED LEARNING

Project-based and problem-based learning imparts knowledge on the basis of concrete real projects or problems. The students often have to communicate and work together in teams. In addition, complex skills such as critical thinking and problem solving are developed.

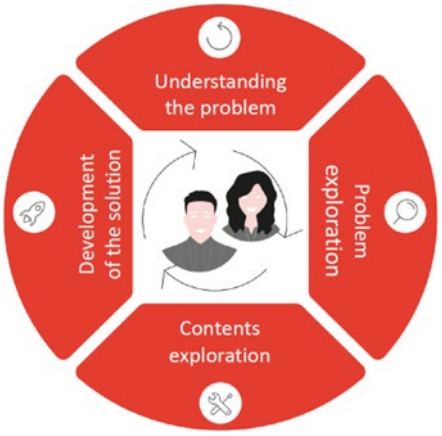

Figure 5: Project Based Learning Method

FLIPPED CLASSROOMS

Flipped Classroom is an approach where the teaching materials (e.g. recorded lessons) are studied by the students themselves at home. Then key elements are taken up again in the classroom. The main benefit of the approach is that it gives students the freedom to study the materials in the way and speed they want. In addition, the classroom time is optimized.

Figure 6: Flipped Classroom Method

GAME-BASED LEARNING / GAMIFICATION

Game-based learning actively involves students in the learning process and imparts knowledge through games. In such games, students work on specific tasks to achieve specific learning goals and earn rewards such as experience points in the process.

COOPERATIVE LEARNING

In the cooperative learning approach, small groups of students are formed in which each member has a specific role. Coordinated collaboration is required to achieve the goals, with each team member performing his or her role.

KOLB'S CYCLE

Coherently with the learning styles described in Section D, Kolb developed a pedagogical approach that favours the learning for the four profiles of learners. This is carried out through a cycle of activities that has to be completed in order to ensure the consolidation of knowledge. It is, therefore, a student-centered approach to learning as every phase of the cycle aims at addressing one or two profiles of learners. However, differently from the above presented methodologies it can be implemented both with high or low-tech means, as it can take place in different settings.

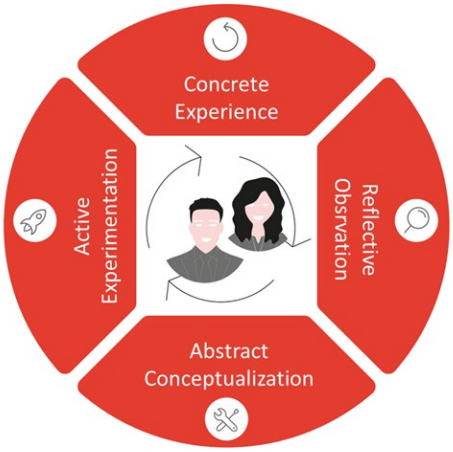

Figure 7: Kolb's Cycle Method

Definitions:

Concrete Experience: A new experience or situation is encountered, or a reinterpretation of existing experience; being involved in a new experience

Reflective Observation: Watching others or developing observations about one's own experience.

Abstract Conceptualization: The process of forming abstract concepts, which may be general and apply to numerous particular instances (e.g., dog, fish) or wholly intangible and have no specific material referent (e.g., liberty, youth). Emergence of new concept, or a modification of an existing one (the person has learned from their experience).

Active Experimentation: Using theories to solve problems, make decisions. The learner applies their idea(s) to the world around them to see what happens

CATEGORIZATION

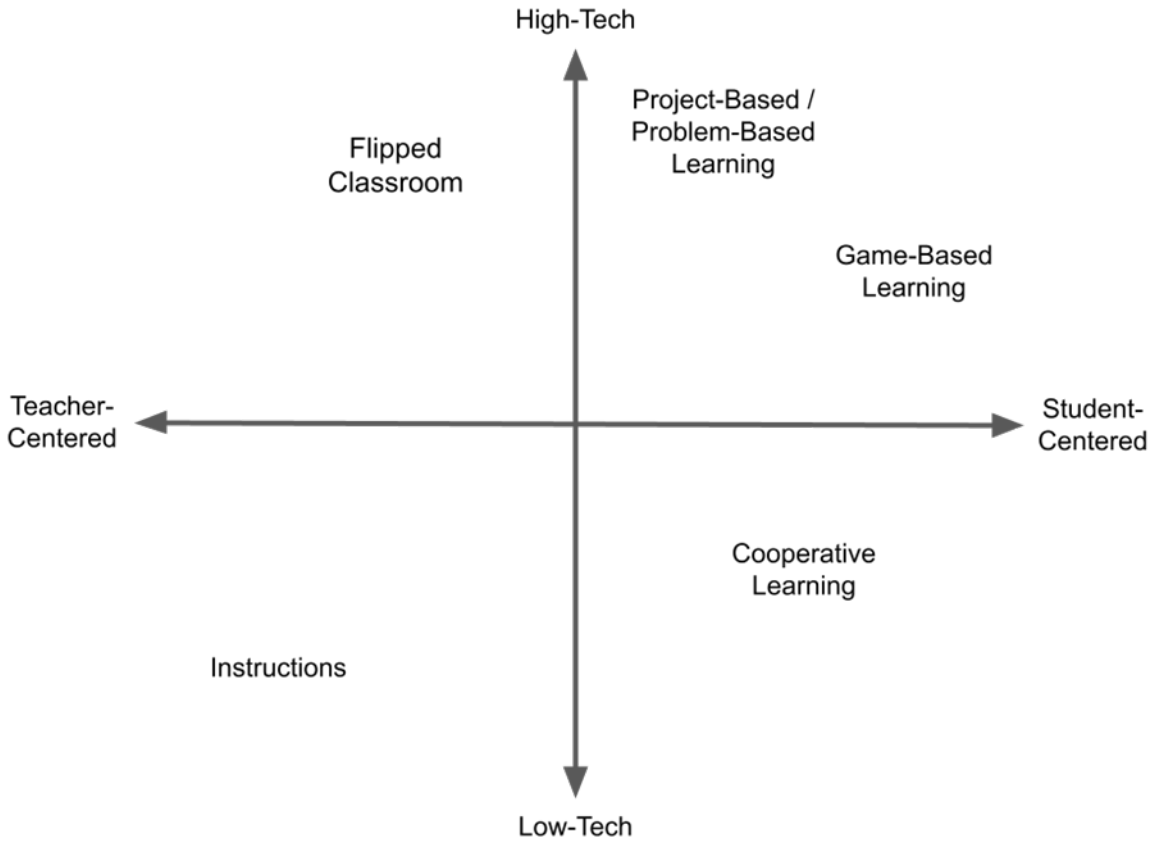

Figure 8: Categorization Scheme for educational methodologies

7. COMPREHENSIVE LISTING OF EDUCATIONAL METHODOLOGIES (UNIVERSITY OF SAN DIEGO)

Lathan he University of San Diego has compiled a list of 87 teaching methods that includes most of the teaching methods currently in use. The list has been revised to exclude teaching methods that are considered unsuitable for engineering education and been extended for items that particularly apply in the virtual product development domain.

Educational Item	Description
Appointments with students	An appointment between student and educator encompasses the delivery of feedback on tasks, individual tutoring, or serves as question time. Appointments are held in presence or virtually.
Author's chair	A tool for students to present project results, that have already been revised based on constructive criticism, to peers. The aim is to receive positive feedback and to enhance critical thinking by giving and receiving feedback.
Bulletin boards	A tool to visualize and display information regarding a specific topic on a single page or surface, similar to a physical pin-board.
Brainstorming	A group method to generate new ideas to a specific problem. Individuals spontaneously suggest new ideas without being impeded by criticism.
Case studies	A case study is an in-depth examination of a task representing a real-world scenario.
Class projects	A student assignment to deepen knowledge through active exploration of real-world challenges. Requires students to plan activities and assign roles. Can be carried out either in groups or individually.
Classroom discussion	A classroom discussion aims at reflecting and

	processing teaching contents. It can include or exclude the educator, and can either be moderated or unmoderated.
Video reporting	A tool used to report on project assignments to enhance student engagement and ultimately lead to better learning results.
Collaborative learning spaces	A space to encourage students to advance projects, work on assignments or have group discussions. Collaborative learning spaces should facilitate student learning pairs as well as groups of varying sizes.
Montages and Collages	An adaptation and combination of text, photographs and other multimodal elements to create a new whole. Can be used to visualize a new product or concept.
(Current events) quizzes	Written or verbal quizzes aim at regularly assessing the learning progress of a student.
Live polling	A tool to support lectures. Increases students engagement, helps to start discussions and enables the educator to check student comprehension of lecture contents.
Debates	A formal discussion where participants state and exchange arguments (often opposing). In an educational context, debates are used to improve critical thinking in students and train scientific argumentation.
Designated quiet space	An area in which students and educators can recuperate from emotional stress and practice self-reflection.
Discussion groups	A discussion group formally or informally negotiates and exchanges information on an academic subject. Participation is not restricted to students and educators, but also external experts. Similar to classroom

	discussions and group discussions.
DIY activities	Do-it-yourself activities comprise the creation of objects without the help of experts, using raw and semi-raw materials. They aim at enhancing student motivation, foster creative thinking, and give the students an opportunity to apply theoretical concepts to real-world challenges.
Educational games	Educational games are intentionally designed to impart education. They aim at helping students to understand teaching contents and developing problem-solving skills.
Educational podcasts	A podcast is a series of digital audio files that can comprehend audio lectures, discussions and expert interviews.
Essays	Essays in higher education are argumentative pieces of writing that can be classified as descriptive, narrative, expository and persuasive.
Exhibits and displays	Exhibitions and displays can comprehend presentations and the demonstration of a product or a project. Students creating an exhibition learn how to present their learning outcomes. Students attending can learn from reflection on the exhibited items.
Field trips	An excursion is a course-related activity with educational purpose outside the classroom.
Flash cards	Small note cards to improve memorisation capabilities. Flash cards usually comprise a prompt on one side of the card and the corresponding information on the other.
Flexible seating	A student centered learning approach wherein the student can decide on their preferred seating option. Flexible seating

	aims at creating a comfortable learning environment to enhance student engagement.
Gamified learning plans	Gamification is the process of integrating gaming elements into a learning plan to enhance student engagement.
Genius hour	Genius hour or Passion Pursuit is an allocated period of time for students to pursue individual learning in a field of their interest.
Group discussion	A group discussion aims at participants exchanging information and reflecting on it to reach a goal. Similar to classroom discussion and discussion groups.
Guest speakers	Guest speakers can contribute specific expertise via guest lectures and by answering student questions.
Hands-on activities	Hands-on activities are carried out physically by the students.
Individual projects	An individual assignment to deepen the students' knowledge through active exploration of real-world challenges. Requires students to plan activities.
Interviewing	Students conducting interviews with experts in a specific field of research. The conduction of expert interviews is a method to generate qualitative or quantitative data.
Journaling	Journal writing (learning diary) is a tool to reflect on learning contents, habitual thinking and behavioural patterns.
Laboratory experiments	Experiments are similar to hands-on activities but are characterized by a processual execution, withing a controlled environment, to test a hypothesis.

Learning stations	Learning stations are dedicated stations in a classroom. A supervisor at each station can give instructions and initiate reflection on the finished task. Students rotate between stations to solve tasks, using provided materials.
Lecturing	Lectures are large classes held by a professor. They cover well-organized, tightly constructed and highly polished presentations of methods and contents of a subject in consideration of specific problem formulations, formation of concepts and solution approaches.
Oral reports	Oral reports are student presentations of academic contents to develop presentation competencies.
Peer partner learning	Peer learning involves two learners that share knowledge and experience. Peer partners can be of the same year or from different semesters.
Photography	A tool to support the delivery of theoretical concepts. Choosing and creating photographs and setting a textual context requires the student to reflect on an academic topic.
Posters	Posters are used in academia to visually present research studies and their findings. Posters are often displayed at scientific conferences to generate interest and initiate scientific exchange with other participants.
Problem-solving activities	Problem-solving activities require students to develop a method to solve a set of tasks they have not yet been confronted with.
Reflective discussion	A reflective discussion aims at reflecting, processing and deepening the understanding of information. Similar to classroom and

	group discussion.
Research projects	An assignment to answer a research question with the aim of deepening the students' knowledge through active exploration of real-world challenges. Requires the student to plan a structured approach to answering the question.
Role playing	Role playing requires students to engage in taking on the perspective of another person or a specific job role to gain affective, cognitive, and behavioral understanding.
Science fairs	Science fairs are events for students to present science project outcomes. Students have to demonstrate how a hypothesis was tested and to which conclusion they came. A science fair can be of competitive character. Otherwise, similar to exhibitions.
Scrapbooks	Scrapbooks are arrangements of scraps, which can be images, objects with a specific connotation and text to relate concerns and opinions of a researcher. Scrapbooks are shared and reflected upon collaboratively to enable self-learning.
Storytelling	Storytelling is a communication tool to convey information, ideas and implicit knowledge by telling fictional or non-fictional stories. The aim is to establish increased memorability in the recipient.
Student podcasts	A podcast can comprehend audio lectures, discussions and expert interviews. Student podcasts require the student to research a topic and choose an adequate auditive medium to present it.
Student portfolios	A portfolio is a collection of work samples and other evidence that represent knowledge. It can be used for student self reflection and

	to assess student abilities.
Student presentations	A presentation is a speech to impart an audience with information and ideas and to influence their attitude regarding a specific topic. Students learn how to structure and present their learning outcomes and develop public speaking competencies.
Student-conceived projects	An assignment conceived by students to explore their field of interest and deepen their knowledge through active exploration of real-world challenges. Requires the students to plan activities.
Reading assignments	A student assignment to read teaching material. Students acquire an understanding of theoretical concepts and can comprehend intellectual debates.
TED talks	TED Talks are presentations and short talks on scientific claims in a variety of fields hosted by the nonprofit organization TED (Technology Education Design). However, speakers are not obliged to restrict to peer-reviewed findings.
Team-building exercises	Team building activities aim at improving efficiency and performance of a work team by improving interpersonal relations and establishing trust within the team.
Team projects	A student assignment to deepen their knowledge through active exploration of real-world challenges. Requires students to plan activities and assign roles.
Term papers	Term papers are extensive assignments that require students to conduct research on a topic and document findings in a written report.

Textbook assignments	A textbook is an instructional teaching material containing theoretical concepts of a subject, often paired with practice problems that apply to the concepts. Textbook assignments can consist of reading and problem-solving tasks.
Timelines	A timeline is a depiction of a sequence of events within a time frame, which allows students to analyze cause and coherence of events. Creating a timeline allows for the structuring of learning plans and projects.
Use of community or local resources	A mutually beneficial collaboration of universities with public and private entities to foster teaching and research.
Video creation	The process of creating video content. Students learn to structure and present video contents.
Video lessons	Video lessons are recorded lectures of an educator. Videos can substitute or be incorporated into live lectures. Asynchronous media such as video allows for increased student-centered learning.
Web quests	A web quest is an instructional tool designed for web learning, prompting learners to solve tasks using internet resources. The educator provides sources of information, guidance and a description of the learning process.
Workbooks (Exercise Book)	A workbook contains instructional exercises and practice problems that are supplemental to understanding and applying theoretical concepts.
Design specific tools and methodologies (extension)	
Physical Prototypes	Physical prototypes are tangible, three-dimensional representations of a product,

	process or concept. Students create physical prototypes to validate design choices.
Virtual Prototypes	A virtual prototype is a digital mock-up comprising geometrical and functional simulations with the aim to validate its design. Digital mock-ups can easily be subjected to change and are therefore created before a physical prototype is produced.
Artistic sketches	Artistic sketches are rough drawings to visually explain concepts, processes and ideas.
Technical drawings/ Technical sketches	Technical drawings follow standardized norms on how parts and products are visually represented to explain their function and how they are constructed. Drawings are created using drawing instruments or computer aided technologies. A technical sketch is similar to a technical drawing, but is created by hand.
Standards	Technical standards are norms to establish uniform criteria for products, processes and methods.
Market research	Market research describes activities to determine customer needs and preferences. Qualitative and quantitative methods to obtain data can be employed.
Network of Problems	A tool to analyse complex problems by breaking them down into sub-problems and partial solutions. A semantic map visually arranges and depicts relationships of problems and solutions.
Gallery Method	A method to generate and advance ideas in a group. Group members are introduced to a problem statement and are prompted to sketch solutions individually. The sketches are then put on a wall and reviewed by the group. In the final step, each individual

	refines their sketch based on inspiration gathered during the review.
Hackathons	Hackathons are collaborative events during which teams develop novel software or hardware products in the scope of a given problem or theme.
AR-visualization	Augmented reality visualization enhances real world objects and environments by overlaying computer graphics. It can be employed to explain abstract concepts and processes and to make visual and spatial inspections of virtual prototypes.
VR-visualization	Virtual reality visualization is a three-dimensional computer simulation. Users can interact with this environment via visual and auditory output devices. It can be employed to explain abstract concepts and processes and to make visual and spatial inspections of virtual prototypes.

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