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Modernization of curriculum of Textile Engineering and Textile Technology in Indonesia, Malaysia and Pakistan

WP 4 - Deliverable 4.1
Methodological guide for new teaching/learning methods

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Contents

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Abbreviations and Acronyms

Abbreviation	Full name
BL	Blended Learning
CT	Concept Test
DEL	Deliverable
F2F	Face to Face
MOOC	Massive Open Online Course
OCW	Open Course Ware
PjBL	Project-based learning
PbBL	Problem-based blended learning
PDF	Portable Document Format
PI	Peer Instruction
SEC	Student Engagement Core
TAs	Teaching Assistants
TIC	Information and Communication Technology
UPV	Universitat Politècnica de València
WP	Work Package

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1. Innovative teaching and learning methods

Using innovative methods of teaching is crucial skill for teachers and education staff. Scientific research has shown that innovate teaching methods and approaches can significantly enhance the student learning process. Innovating our teaching strategies is no easy feat. It can be scary because, just like our student, it places us out our comfort zone in a position where we can fall. However, experimenting new methods and strategies we can improve student engagement, motivation and attainment is a win-win for both students and teachers.

Teaching nowadays, learning process begins by understanding the youth, which are mainly the wide majority of attendants.

The classrooms are full of people called Z generation, which are characterized by:

- Digital natives
- Impatient
- Lack of trust on the educational system
- Being self-learners

Consequently, it is necessary to organize in a different way and the student must be involved in the learning process:

- Formulate and publish clear instructional objectives.
- Establish relevance of course material and teach inductively.
- Balance concrete and abstract information in every course.
- Promote active learning in classroom.
- Use cooperative learning.
- Give challenging but fair tests.
- Convey a sense of concern about students´ learning.

All of this is only effective for highly motivated students. Knowing the retention rate of the students represented in the pyramid (Figure 1):

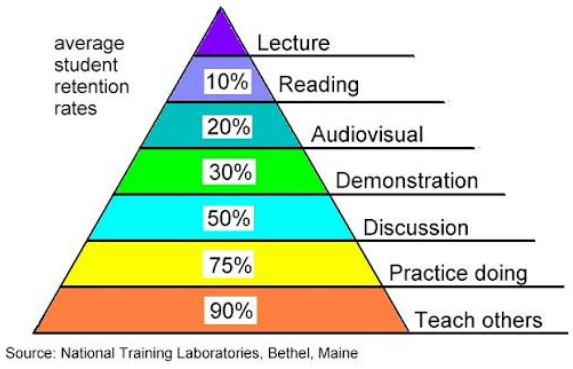

Figure 1. Learning Pyramid

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How can we motivate the passive learner to become an active learner? Using Active methods.

Active methods are innovative teaching and learning methods where the student is actively involved in the learning process. Some of these methods are:

- Project-based learning (PjBL): Project Based Learning is an instructional approach built upon learning activities that engage student interest and motivation. These activities are designed to answer a question or solve a problem and generally reflect the types of learning and work people do in the everyday world outside the classroom.
- Problem-based blended learning (PbBL): Blended learning, as the name suggests, consists of a blend of at least two pedagogical approaches: within the context of this research, blended learning is the integration of the PBL face-to-face learning in a classroom with an e-learning environment.
- Service Learning: Combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs.
- Flip Teaching: The flipped classroom, which is also known as the inverted classroom method, is changing the role of duties performed in class and at home. Theoretical knowledge from lectures and course materials are posted online for the students to study prior to the class session. Then, in class, the learners interact with the instructor to discuss the topic, clarify open questions, and solve exercises.
- Gamification: to learn practicing or experimenting by playing games.
- Peers Instruction (see 3.2.3): is a teaching strategy in which two-three students discuss and explain their thinking in relation to a specific topic.
- Case study: Students in engineering fields need to have in-depth theoretical knowledge, but often have no idea how to apply it to real-life situations. The case study method improves problem-based learning, which requires both self-directed and teamwork skills. To enhance the critical thinking ability and an increase in student performance.

2. Engagement

To begin with, we must define what we understand by engagement.

Student engagement is defined as the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning. Motivation of students to learn and progress in their education is an extension of student engagement. Students' commitment to, valuing of, and connection with the people, educational goals, and outcomes promoted by a school

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enhances their motivation to learn and persist in difficult tasks. The next figure (Figure 2) the Student Engagement Core (SEC) can graphically explain it.

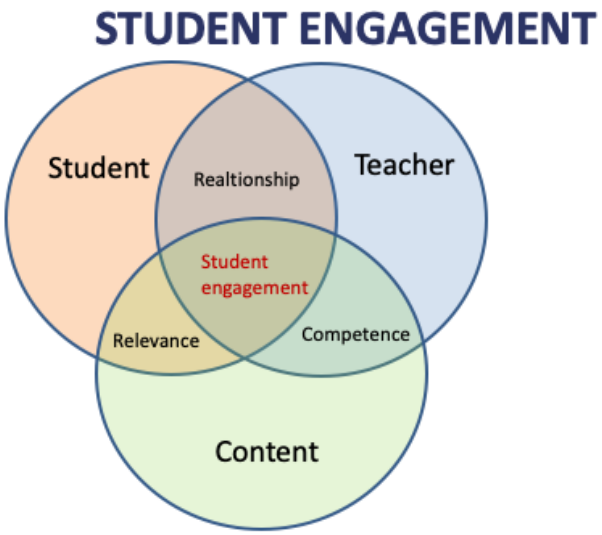

Figure 2. Student Engagement Core

There are different levels of student engagement according to Phillip Schlechty (Figure 3):

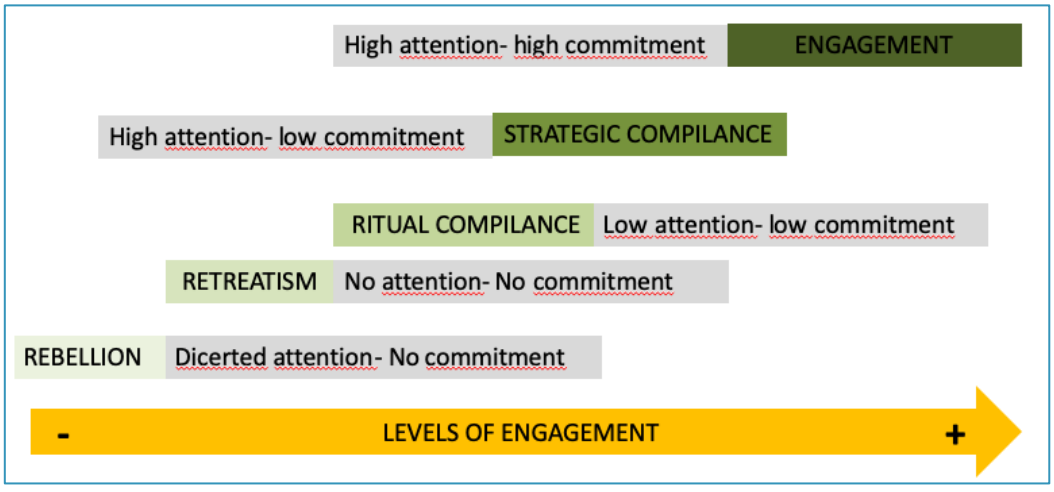

Figure 3. Levels of student engagement

- Engagement: The student associates the task with a result or product that has meaning and value for the student. The student will persist in the face of difficulty and will learn at high and profound levels.

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- Strategic compliance: The task has little inherent or direct value to the student, but the student associates it with outcomes or results that do have value to the student (such as grades). Student will abandon work if extrinsic goals are not realized and will not retain what is learned.
- Ritual compliance: The student is willing to expend whatever effort is needed to avoid negative consequences. The emphasis is on meeting the minimum requirements. The student will learn at low and superficial levels.
- Retreatism: The student is disengaged from the task and does not attempt to comply with its demands but does not try to disrupt the work or substitute other activities for it. The student does not participate and learns little or nothing from the task.
- Rebellion: The student refuses to do the work, acts in ways to disrupt others, or substitutes task and activities to which he or she is committed. Student develops poor work sometimes negative attitudes towards formal education and intellectual task.

2.1 How to improve the engagement of students

1. Find out what kind of students there are in the classroom:
    - Active: They actively take part in the learning process and consume everything you share. For example:
        - ✓ They watch every video.
        - ✓ They listen to every audio.
        - ✓ They read every PDF, do every exercise, quiz or activity.
        - ✓ They even start and comment on discussions within your course community.
    - Passive: This category of students makes up the vast majority. Passive students read the materials, watch the videos, and maybe even take some notes. Unlike Active student, passive students are only there primarily to consume information.
    - Lurkers: These are the students who are neither active nor passive. They buy your course, log into your member's area, skim through a few modules, but generally leave it at that. These students don't participate in community or interact with you.
2. Measure Student engagement rates. For example, to know:
    - When did your course students start consuming the course material?
    - How much time does it take for a student to finish your course as compared to the expected time?
    - Do they watch and download course material?

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- Did they complete their courses?

3. Ensure students Implement what they learn.

2.2 Phases of Engagement

The Phases of Engagement helps design activities that build trust and facilitate the growth of an active-learning community during the course of a semester (Figure 4). Activities are designed to first get students comfortable talking to one another in low-stakes assignments. Students get to know classmates, and the instructor has an opportunity to explain the value of active-learning strategies. As the weeks progress, course activities increasingly focus on the application of course content during collaborative assignments like peer-review and small group work. By the end of the semester, students cooperate to create new content or new solutions to course issues.

	PHASES OF ENGAGEMENT				
	CONNECT	**COMMUNICATE**	**COLLABORATE**	**CO-FACILITATE**	**CONTINUE**
TIME	1-2week	3-4weeks	5-6weeks	7-16week	On going
INSTRUCTOR´S ROLE	Host & Guide	Cooperator	Facilitator	Community member & Callenger	Encourages students to see online skills and collaboration as tools to carry into classes
STUDENT´S ROLE	Newcomer	Cooperator	Collaborator	Peer Leader	Self organising
PROCESS	Instructor provides instructions for students to meet one another and orientation to the course	Instructor forms groups of 2-3 and students complete critical thinking, reflection or brainstorming activities	Instructor presents activities which require small groups to collaborate, to solve problems and effect on experiences	Activities are learner designed or learner led	
ACTIVITIES	Introduction to ice-breakers, community discussion, forum for questions, netiquette guidelines,	Peer review of work group critique or analysis assignments	Connect discussions, role-playing, debates	Group presentation & projects student led discussions	Talk about the benefits of active learning (deeper learning for those doing the work) and the collaboration skills are requested by any jobs

Figure 4. Summary Flow Chart of Conrad and Donaldson's "Phases of Engagement"

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Aspects for student engagement in a virtual classroom:

- Student contact
- Collaborative Learning
- Active learning
- Prompt feedback
- Diverse methods
- High expectations
- Time devoted / activity
- Weekly tasks

2.3 Activities used to intensify the online teaching

Some of these activities:

- A well-designed discussion can help to stablish students´ cooperation.
- Student must present projects to learn actively.
- Teacher must provide information and ensure the student has received.
- A deadline must be provided since the first moment.

There can be activities focused on:

- Remembering
- Understand
- Apply
- Analyze
- Evaluate
- Create

Describing the activity is not enough for online courses. Some help must be provided:

- Results/ objectives of the activity must be clear
- Define the context of the activity
- Mode: individual, group, collaborative…
- Explain the process step by step
- Inform about the resources to use
- Define deadlines

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2.3.1 WebQuest

WebQuest is a methodology that helps students become more creative, critical, etc. There are different types of WebQuest:

- **Retelling:** students can report on what they have learned by way of PowerPoint or HyperStudio presentations, posters or short reports.
- **Compilation task:** a simple task for students is to take information from a number of sources and put it into a common format. The resulting compilation might be published on the Web.
- **Mystery task:** for example, begins with a mysterious package being delivered to your door. At the end of a sequence of information-seeking activities, your task is to explain the significance of the package and how it portrays.
- **Journalistic Task**: ask your learners to act like reporters covering the event. The task involves gathering facts and organizing them into an account within the usual genres of news and feature writing.
- **Design task:** design is "a plan or protocol for carrying out or accomplishing something." A WebQuest design task requires learners to create a product or plan of action that accomplishes a pre-determined goal and works within specified constraints.
- **Creative products Task**: like engineers and designers, creative artists work within the constraints of their particular genre. Creative WebQuest tasks lead to the production of something within a given format.
- **Consensus Building task:** the essence of a consensus building task is the requirement that differing viewpoints be articulated, considered, and accommodated where possible.
- **Persuasion Task**: a persuasion task goes beyond a simple retelling by requiring students to develop a convincing case that is based on what they've learned.

You can use different tools to help you catch student's attention. Find below some examples:

- Kahoot
- Wordcloud
- Trello board
- Whatsapp
- ….

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2.3.2 Peer Instruction. An applied example

Peer Instruction is a teaching strategy in which two-three students discuss and explain their thinking in relation to a specific topic. The objective of the discussion is a deeper understanding of the topic or problem under discussion, which makes them much more likely to remember and use the concept and ultimately produce more quality learning (Figure 5).

In order to develop the Peer Instruction method, it was necessary to create the Concept Test (CT). Eric Mazur has created them for specific topics while teaching physics concepts. In this case the subject was based on textile materials and the previously designed were not suitable. To begin with this method 3 specific concepts from the syllabus were selected: fiber length, tenacity and pilling. The CT were designed so that the student had to demonstrate a deep understanding of this part by selecting the suitable application of a material depending on the technical characteristics given.

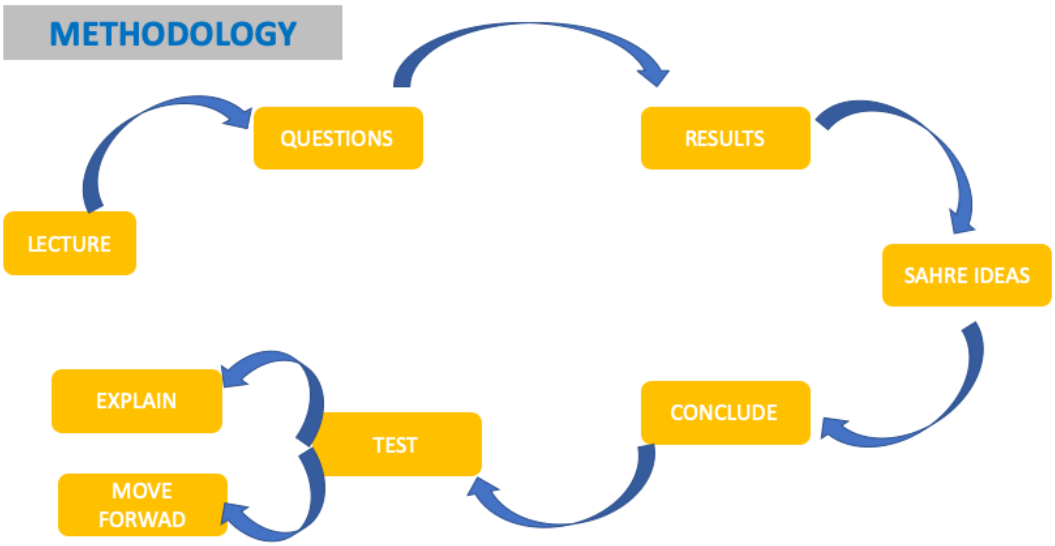

Figure 5. Methodology of Peer Instruction

In our case, the concept explanation sessions were conducted by Flipped lessons. Previous to the classroom session the student was given some links (maximum 3) with videos of the teacher explaining briefly (no longer than 10 minutes) the basic concept to develop. In order to ensure the student had studied it before attending the classroom an online test was performed. On the face-to-face session, the student had to work in teams of 3 except one of 4 persons. They had 50 minutes to discuss the same questions answered on the online test and reach an agreement about the correct answer. Then, a new answer, consensus, was offered by the group. The score was 20% individual mark + 80 % group mark. Later on, a feedback on the correct answer was offered to the student and discussion was opened to make the student understand, if so, their mistake.

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The process is described as follows (Figure 6).

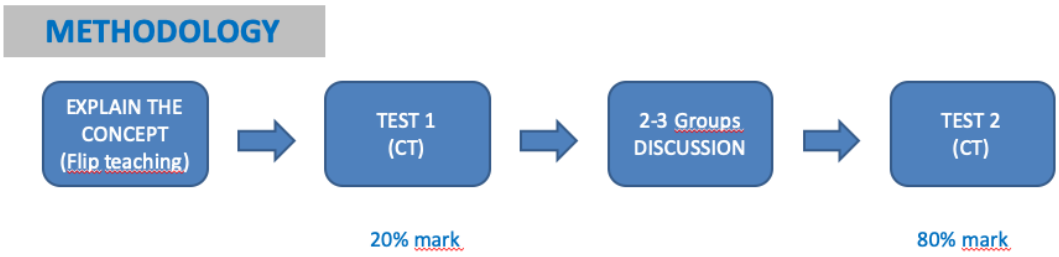

Figure 6. Process used in the Peer Instruction method by Flipped lessons

As a conclusion we can state that:

- ✓ The act of explaining and defending what one has understood against the alternative explanations of others, helps students to become deeply involved in learning.
- ✓ The work in teams, the students have discovered it usefulness and how it can help to strengthen the knowledge about a topic. Moreover, the student is convinced the professor has a deep preparation for the lessons taught by PI method.
- ✓ The student's impression was the importance the PI method gives to work in teams and how it reasserts the knowledge at individual level in every student.

3. E-learning

3.1 Introduction

Even though the transition from a traditional to e-learning model began two decades ago, the most significant increase in the adoption of technological solutions by the educational sector is happening right now. In 2020, due to the pandemic situation, the demand for technological solutions that would provide all the conveniences of distant learning, has reached maximum heights.

E-learning is training and learning through networks, the Internet and TICs in general (Information and Communication Technology) allowing immediate access to resources and content.

It is a new training strategy, compatible and complementary to other more traditional training models. Because traditional methods must evolve due to the constant changes that have occurred and continue to occur in the social and technological environments.

It is a complementary methodology that improves the overall effectiveness of teaching and learning.

The characteristics of e-learning are:

- ✓ The form of presentation of the contents.

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- ✓ The role of teachers and students in the new learning situations.
- ✓ The use of synchronous and asynchronous communication tools.

Advantages:

- ✓ The student has access to a wide range of information.
- ✓ Easy to update information and contents.
- ✓ It makes the information flexible, independently of the time and space of the teacher and the student.
- ✓ Improve the interactivity between teachers, students and information.

Aspects to consider about e-learning:

- ✓ Requires more time invested by teachers.
- ✓ Technological knowledge or competences of teachers.
- ✓ The student must have or develop skills for autonomous learning.
- ✓ If there is not an adequate teacher-student ratio, the quality of the training may decrease.

3.2 Communication tools for e-learning

There are several types of communication tools that can be used in e-Learning training. Communication tools can be classified in two ways: synchronous and asynchronous, depending on when the communication takes place.

You can successfully integrate two or more e-Learning communication tools in your face-to-face or virtual courses. However, before doing so, evaluate the type of activity or interaction you want to perform what you want to obtain.

Take into account the student's profile and communication preferences. But the essential is the active participation of the tutor, who must encourage and stimulate the rest of the members to participate.

3.2.1 Synchronous communication tools

In synchronous communication, communication takes place in real time and the feedback and response to questions is instantaneous.

The most common synchronous tools used in online education are: chat, skype, social networking sites, etc.

Strategies:

- Provide an agenda and a list of discussion questions.
- Communicate your expectations for participation and behavior online.
- Icebreaking is really important.

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- Chat can be a useful tool but there are many others.
- Be aware of connectivity problems.
- Breaks pauses are necessary.
- Fix protocols (no eating, background noise ….).
- Keep student active (Students prepare their own questions).

3.2.2 Asynchronous communication tools:

In the asynchronous communication:

- Not live comunication.
- More flexible.
- Student works at their own pace.

The most common synchronous tools used in online education are: mails, fórum, blogs, videos, wikis digital library, etc.

Strategies:

- Student organises the rhythm.
- Objective: Progress in knowledge.
- Teacher is the guide in the process of learning.
- Shorter sessions.
- Contents are provided in an organized way and gradually.
- Student can restart whenever he wants.

3.3 Materials for e-learning

The success or failure of e-Learning training depends on the materials used for the training.

The essential steps for e-Learning:

3.3.1 Objective

The Objective is the Result of learning. Thus, it is important that the objective is:

- To be clearly stated.
- Subject is the student.
- Should be as specific as possible.
- To be realistic in terms of the format and duration of the course.

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3.3.2 Content of e-learning training

Once the contents have been defined, it is time to organize them. Decide on the order in which students are to be presented, as well as their structure. There is a wide range of organization criteria: category, chronology... Which one to choose depends largely on the type of course and the contents them.

I. Online teaching materials are really important:

- Characteristics for material: You must be Original and Creative.
  - ✓ Catch students´ atention.
  - ✓ Keep the student interested in the subject.
  - ✓ Help to understand and memorize contents.

  It may help:
    - Combining images and text but avoiding excessive use of texts and images onscreen.
    - Presenting the information in a clear, standard and labeled way (by using bullet lists, charts, different fonts, etc.).
    - Using clear and succinct language in the texts.
    - Using appropriate colors to help learners identify main ideas and to discriminate different kinds of information.
    - Having icons that help learners to visualize and recall recurrent information.
    - Choosing clear images/graphics, multimedia for specific and well-defined.
- Different material:
  - ✓ Basic Material: Covers the knowledge of objectives.
  - ✓ Complementary Material: In order to know more.

II. Time-scale:

Online vs. face-to-face time-scale equivalencies.

- Video 10 min= 30 min.
- Text (pdf) 5 pages = 1 hour.
- 1 day: 4- 5 hours.

III. For videos:

Video in e-learning is an excellent resource:

- A picture, is worth a thousand words.

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- Provides dynamism.
- Reinforcement of other types of content.
- Eye-catching and meaningful.
- Involvement of the learner.
- Easily remembered.
- Accessible on multiple devices.
- Motivation.

Here are some tips that should be followed in order to create an instructional video:

- The video length should be short to avoid students' boredom, keep them engaged by videos. In order to make cognitive load, you can create mini videos, ranging from 5-10 min.
- With cover.
- Independent: Not linked to a subject (NO subject 1: XX).
- Structure:
  - ✓ Explicit aims (Objective): In order to produce a video, you need to have clear aims and objectives. Having a clear aim is helpful to create your video more effective. Spend some period of time in conceiving what learners will obtain at the end of the video.
  - ✓ Content: Make a detailed outline of what the eLearning video should include, all the visual elements that are absolutely necessary in order to convey your message, as well as the activities to be included in your eLearning video.
  - ✓ Summary.
- Characteristics person:
  - ✓ Clothes timeless.
  - ✓ No references to time.
    - Good morning/ good afternoon (NO). Hello (YES)
    - Last day/ next day … NO
  - ✓ No references to subjects.
    - In the previous topic …. NO

IV. Materials structure

- Introduction:
  - ✓ Must catch students´ attention: rhetorical questions, examples, etc. Ask prompting questions both in the videos and in discussions that

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follow. These allow learners to process the content in a more active/critical way, rather than solely watching passively.

- ✓ Give instructions to study and progress with contents.

- Content:
  - ✓ Use easy-to-understand language
  - ✓ In what order you are going to present the contents and what will be its structure. Structured ideas (primary, secondary, ..).
  - ✓ The use of audiovisual resources will increase the student's attention and comprehension, while stimulating the retention of information: Pictures, graphics, images, Flow-charts,etc.
  - ✓ Call atention: We are not only looking to inform and share information, we must also connect with the reader and keep their attention. Use real facts, show research results, statistics, etc.
- Conclusion:
  - ✓ Summary of main ideas.
  - ✓ Offers clues to remember.
  - ✓ Prepares student to future topics.

3.4 How to evaluate

The evaluation can be understood as the system that indicates how and the extent to which some objectives and competencies have been attained, taking into account the following points:

- What to evaluate?

  All items that are an essential part of the course are evaluable. Objectives and procedural and attitudinal concepts will be evaluated.

- Who has to evaluate?

  The evaluation will be carried out by the teacher or tutor who instructs the teaching-learning process, but also students are involved themselves, who also provide information about the teaching and learning process.

- When to evaluate?

  The evaluation process accompanies the learning process itself, therefore, it is an ongoing process. However, three stages can be identified: an initial phase in which an initial assessment is performed, another phase with continuous assessment and a final evaluation phase.

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- How to evaluate?

  The way in which the evaluation process is conducted consists of the techniques and evaluation methods to be used, which depend largely on the work methodology implemented in the course.

3.5 On-line learning materials: additional material

For content design, we can use the following resources will increase the student's attention and comprehension:

- Recording: A recording is a 5-to-10 minute educational video. This shows the lecturer's image and sound synchronised with a screen where the presentation contents are displayed. An interactive-board, a presentation programme or a combination of both can also be used.
- Screencast recording: 5-to-10 minute educational learning item in video format. The contents are elaborated through a series of computer screencasts, plus the editing of the lecturer's or professor's voiceover. The lecturer's image is not shown. The student can only watch the lesson's contents and listen to the lecture's voice.
- Didactic videos: Illustrative video snippets (approximately between 5-to-10 minute), mostly with action and movement. They are made from one or more video camera recordings and its later edition. The video sound recording can be done while filming or added as a voiceover during the video edition.
- Didactic articles: Short unpublished texts in digital format (approximately between 5 and 10 pages long) whose purpose is to help the comprehension of the aforementioned didactic items.
- Video-notes: Automatic masterclass recording system for teaching periods longer than 20 hours. Lesson recording and editing must be carried out by trained technicians, who will give technical support and will help the professor during all the process.

3.6 New developing methodologies proposed and tested at present

Information that used to be owned by educators and was only available in a limited number of books in the library, is now available at our finger tips on the Internet. This phenomenon is clearly having a knock-on effect on the way learning is delivered. These advances in the areas of web and video content delivery have aided the growth of technology-based teaching methodologies, including the flipped classroom model, blended learning, MOOCs, and more.

3.6.1 Blended learning

Blended learning (BL) is a form of education that takes place both online and face-to-face (F2F) instruction. Both of these modalities are integrated into a cohesive learning experience for the student. In blended learning scenarios, "face time" between students and teachers is not

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replaced by online course delivery. Rather, the online component of the learning experience usually consists of exercises or additional content that complement the in-class lesson.

3.6.2 Flipped teaching

A flipped classroom is a form of blended learning in which students learn contents online by watching video lectures, and homework is done in class with teachers and students discussing and solving questions together. Teacher interaction with students is more personalized - guidance instead of lecturing. This teaching method is also known as backwards classroom, inverted classroom, reverse teaching, and the Thayer Method.

3.6.3 Massive open online course - MOOC

A massive open online course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problems set, many MOOCs provide interactive user forums to support community interactions between students, professors, and teaching assistants (TAs).

MOOCs build on the engagement of learners who self-organize their participation according to learning goals, prior knowledge and skills and common interests.

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