IO2: TRAINING THE TRAINERS MANUAL

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TRAINING THE TRAINERS MANUAL

The aim of the "training the trainers manual" is to guide PLM instructors to follow the methodology defined in the ADDIE model for e-learning. PLM instructors have different roles in e-learning such as instructional designer, subject matter expert, online facilitator and/or tutor. Therefore, they play an essential role in the ADDIE model. PLM instructors are going to use this manual for all the stages in the ADDIE model except implementation. The manual itself will be published as an e-learning course module through the project's website.

The manual consists of the instructions to do needs analysis, target audience analysis, task and topic analysis.

In the design stage, learning objectives will be defined, and the objectives will be sequenced to structure a course, the course plan in units and lessons will be designed.

The design of an e-learning course will involve using a combination of the instructional methods: expositive, application and collaborative. The PLM instructor will learn how to propose the best mix of methods and techniques for a specific e-learning course. Then, the delivery strategy will be defined to choose the appropriate e-learning artifact formats such as video conferencing, live webcasting, audio conferencing, application sharing, animations, slides, etc.

In the development stage, the manual instructs the PLM instructor how to develop content by reusing existing materials. After the content development, the storyboard will be described to show what the final e-lesson be in screen-by-screen form. The development stage continues with the practice and assessment test. Different types of practice and tests are required for different types of content. In self-paced e-learning, practice and tests mainly consist of questions associated with response options and feedback. In the final step of the development stage, the final interactive courseware is created. A selected authoring tool will be used to develop interactive content.

Lastly, in the evaluation stage, the following evaluation strategies will be defined: formative evaluation, confirmative evaluation, and summative evaluation. Different types of evaluation tests can be used for different purposes such as prerequisite tests, entry tests, diagnostics tests, post-assessment tests and certification tests.

1. ANALYSIS

The analysis and design stages are essential to ensure course effectiveness and learners' motivation and participation. Analyzing learners' needs and learning content and finding appropriate mix of learning activities and technical solutions is crucial to creating an effective and engaging course (FAO, 2011).

Course effectiveness and participants' motivation depend on several elements, including the:

> relevance of the content and course objectives for the participant: do they meet existing needs?

> type of learning activities offered by the course: are they interesting, inspiring and well-matched to the level of the participants?

> course duration, timing, and number of hours to be invested: do they fit with the participants' availability?

> technical aspects: is the technical solution appropriate to learners? Are the technical elements (e.g. the learning platform and its functions) clear and understandable to participants?

Analysis is the process of defining what is to be learned. The Analysis phase is the foundation for all other phases of instructional design. During this phase, the problem must be defined, the source of the problem must be identified, and possible solutions must be determined. Analysis outputs often include learners' profile, description of constraints, needs, problem statement and task analysis. These outputs will be the inputs for the Design phase. In the analysis phase, the designers' main consideration is the target audience (McGriff, 2000), (Peterson, 2003).

Analysis is the phase in which a problem has been identified and the designer must determine what needs to be done. The analysis phase involves a lot of detective work, background research, and information gathering. This phase should be carefully completed using a thorough and complete analysis (Reinbold, 2013).

Analysis stage consists of three substages (McGriff, 2000):

- needs analysis,
- target audience analysis,
- task and topic analysis.

1.1. Needs Analyses

First, a needs analysis is conducted to determine the needs of the audience by distinguishing between what students already know and what they need to know at the conclusion of the course. During the needs analysis, instructors or designers examine standards and competencies to establish a foundation when determining what students need by the completion of the course.

Information may also be available from previous course evaluations if the course has already been taught (Peterson, 2003).

Needs analyses is crucial to validate the need for an e-learning intervention and provide important information regarding which gaps need to be addressed to ensure that the intervention is targeted to organizational needs.

A needs analysis should be conducted at the start of any development effort to determine whether training is required to fill a gap in professional knowledge and skills; and e-learning is the best solution to deliver the training.

There might be several causes of a capacity problem, and an organization's capacity to achieve its goals can be affected by many factors, including the factors in the enabling environment (policy and legislative frameworks, rules and norms internal to an organization and political will) ;organizational aspects (the organization's formal and informal incentive and support structures, staff, equipment and finances) and individual capacity (the skills, knowledge and attitudes of individuals working in the organization).

Moreover, not all individual capacity problems are learning problems. The traditional assumption is that if an individual is not performing well, then training or other learning activities are the solution. Frequently, however, performance problems result from a lack of support in the work environment, such as bad ata, worn-out tools or poor incentives. Also, not all learning problems can be addressed through e-learning. It is crucial to understand whether e-learning is appropriate for the identified learning goals.

The needs analysis allows the identification of general, high-level course goals.

1.2. Target Audience Analyses

Target audience analysis is another crucial step. The design and delivery of e-learning will be influenced by key characteristics of the learners (e.g. their previous knowledge and skills, geographical provenience, learning context and access to technology).

PLM instructors will have different roles in e-learning such as instructional designer, subject matter expert, online facilitator and/or tutor. Therefore, they will play an essential role in the ADDIE model.

Learner characteristics can greatly impact the instructional content and design. Analysing the target audience is required to identify a variety of factors that will influence the course design. While analysing the target learners, following questions may be asked (Reinbold, 2013):

- What are their characteristics?
- What knowledge and skills do they currently have?
- What is their current environment?
- What is their motivation?

- How do they prefer to learn?
- How will they best learn?

Factors to be considered for analyzing the target audience are:

1) Region or geographic area in which learners reside. (This is needed to define language and cultural issues and to inform choices between synchronous and asynchronous tools (learners located in different time zones will have difficulty communicating in real time).)
2) Kind of organization or institution in which learners work and their professional role(s) within them. (This will help to identify specific learning objectives for each target audience group.)
3) Learners' previous knowledge and expertise on the subject. (In general, learners with a lot of prior knowledge do not need the same kind or level of training support as novices.)
4) Learners' computer skills and technical expertise. (This will help to define the complexity of the computer-based interactive activities.)
5) The amount of time available for e-learning and the learning context. (This information influences the amount of content to be provided and the need for chunking the content into small units.)
6) The location where learners will participate in e-learning and from where they can access the Internet; can they study at home, at work or in e-learning centres? (This determines how much connection time is required for the course and whether learners can download plug-ins from the Internet.)
7) Network bandwidth. (Bandwidth limitations may slow application performance and decrease user productivity. In certain situations, low bandwidth applications may be preferred since they take less time to transmit.)
8) Computer and software capabilities, such as screen size, number of colours they can display, sound playback, RAM (amount of memory), processor type and speed. (Technical requirements, including multimedia capabilities, influence the selection of the media mix and plug-ins.)

1.3. Task and Topic Analyses

A task analysis is also necessary to identify the instructional content, or the specific skills related to the job or course. The content of the course or program can be analyzed with the aid of course texts, sample syllabi, and course websites with a similar focus. With the advent of the Internet, many courses are easily accessible online and can provide a framework or workable template for instructors that are developing a course or teaching a course for the first time (Peterson, 2003).

"Last, an instructional analysis is performed to establish what must be learned (Seels & Glasgow, 1998). The designer determines the amount of instruction that is needed in relation to the needs and task analysis. If there is great variability among the members of the target audience, some students will need more and different instruction than others to reach the same goal (Seels & Glasgow, 1998, p. 11). The standards and competencies reviewed beforehand will assist in this process" (Peterson, 2003), (Ghirardini, 2011).

The analysis of learning tasks and performance measures often will clearly highlight the best delivery method. In other cases, many methods will work. Instructional delivery can include job aids, on-the-job training, instructor-led training, e-learning, mentoring, informal learning, and blended learning. Some possible factors to be considered while selecting the instructional setting are (Reinbold, 2013):

- The student characteristics, needs, time constraints, and resources.
- How often the tasks or activities needed to be performed (during and after the training).
- Whether hands-on practice or group activity was required.
- The depth of knowledge required to perform the tasks (and in what ways can the knowledge be acquired? Problem-based learning, lecture, Socratic Method?).
- Whether the students needed immediate feedback while learning (peer, self or instructor feedback).
- How long the training would take.
- Whether the training would need to be repeated or reviewed.

Analysis is needed to determine the course content:

- Task analysis identifies the job tasks that learners should learn or improve and the knowledge and skills that need to be developed or reinforced. This type of analysis is mainly used in courses designed to build specific job-related skills (also called "perform courses").
- Topic analysis is carried out to identify and classify the course content. This is typical of those courses that are primarily designed to provide information (also called "inform courses").

A course goal provides an initial definition of the content and a focus for the course design. It is very important to identify the detailed course content to achieve that goal.

Content analysis is probably the most critical step in the instructional design process. If the designer does not include accurate and relevant content, then there is little value in finding the best instructional methods and media to transfer the information to learners.

The analysis must consider the learners relate factors (e.g., previous knowledge and skills) which emerged from the target audience analysis.

Content analysis is a prerequisite for developing specific learning objectives and the curriculum outline.

Subject Matter Experts (SMEs) and Instructional Designers (IDs) work together to perform the analysis. This process helps the ID to familiarize with the content; moreover, it forces the SME to work through each individual content element and indicate the most important and challenging aspects that should be considered. During this process, both ID and SME can view the content from the learner's perspective.

Content identification and analysis can be done by applying the following methods:

- Task analysis identifies the job tasks that learners should learn or improve and the knowledge and skills that need to be developed or reinforced.
- Topic analysis is carried out to identify and classify the course content.

Depending on the circumstances, one of these methods may be preferred:

- Task analysis is used mainly in courses designed to build specific job-related or interpersonal skills (also called "perform courses").
- Topic analysis is appropriate for courses that are primarily designed to provide information or achieve broader educational objectives (also called "inform courses").

1.4. Task Analysis

Task analysis helps to define content for job-oriented learning courses that aim to develop or reinforce job-related skills (FAO, 2011).

Task analysis is defined differently in different contexts. In the context of instructional design, a task analysis is a detailed analysis of actions and decisions that a person takes to perform a job task (i.e. a well-defined unit of work), which includes identifying the knowledge and skills needed to support those actions and decisions.

Identifying course content through task analysis allows designers to:

- create a learning course that is job centered,
- focus attention on skills; and,
- create case-based scenarios that build on realistic job contexts.

As a result, learners can better integrate the new knowledge into their daily practice.

The task analysis consists of four main steps:

Step 1: Identifying tasks

Identify and describe the tasks that learners should learn or improve to achieve the course goal.

Step 2: Classifying tasks

Classify tasks as either:

- procedural (i.e. tasks that are performed by executing an ordered sequence of steps , such as "Create a table in Microsoft Word"); or
- principle-based (i.e. tasks requiring judgments and decisions to be applied in different situations and under conditions that change every time, such as "Organizing a conference").

Step 3: Breaking up the tasks

Break each task into (FAO, 2011):

- steps (for procedural tasks); or
- guidelines that should be applied to perform the tasks (for principle-based tasks). For complex tasks, requiring the application of strategic or interpersonal skills (such as "adapting" or "solving group conflicts"), different points of view may be needed to identify the guidelines.

These can be collected through interviews with several experts, e.g. by asking them about the approach they adopt in challenging situations and looking for commonalities among the various approaches to identify the skills that can help in those situations.

Step 4: Identifying required knowledge and skills

Identify the knowledge and skills needed to best perform those steps or apply those guidelines.

Topic analysis

The task analysis is usually completed by conducting a topic analysis (FAO, 2011).

If the course is intended primarily to provide information or achieve educational objectives broader than improving job performance, the ID will skip the task analysis and directly conduct a topic analysis to define the major topics and subtopics for the course.

The topic analysis aims to (FAO, 2011):

- identify course content, and
- classify content elements.

Identifying course content (FAO, 2011):

Visual instruments, such as mind maps, concept maps and process diagrams can help the ID and the SME clarify connections among content elements. Mind maps can be used to visualize and organize ideas. They can represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea.

Concept maps and causal maps are diagrams used to illustrate connections among concepts and cause-effect relationships, while process diagrams are commonly used to indicate the general flow of processes.

Classifying content elements:

Classifying content elements helps to further recognize connections among them thus contributing to the refinement of the draft course outline. Content elements can be classified according to the types of content they represent.

The following example identifies six main types of content (FAO, 2011):

1. Facts, (Unique, specific information that answers the questions: who, where, when? Facts are shown, exhibited or indicated. Examples: data, lists, historical events)

2. Procedures, (A procedure is a series of clearly defined steps, aiming to perform a task. Procedures answer the question: "How to …?" Example: "instructions for creating a table in Microsoft Word"

3. Concepts, (A concept is a group of objects, entities or ideas that: are defined by a single word or term; share common characteristics; differ in unimportant characteristics; require a definition; and answer the question: "What is …?" Example: the concept of "climate change"

4. Principles, (A principle (or rule) describe a relationship between two concepts. For example: "As price increases, the supply increases" . Some principles can be translated into strategic guidelines which can guide decisions and complex tasks. Example: "guidelines for facing price volatility"

5. Interpersonal skills, (Verbal and non verbal skills for interacting with other people. For example, content related to "negotiating" or "solving group conflict"

6. Attitudes, (Predispositions to behaviour. Example: content related to appreciate the "importance and urgency of adopting measures for limiting the negative impacts of climate change"

2. DESIGN

2.1. Learning Objectives

By looking at the tasks and content elements identified in the task and topic analyses, it is possible to translate the overall course goal into more specific learning objectives (FAO, 2011).

Learning objectives define the expected outcome of each learning unit. For example, will learners be able to memorize the steps of a procedure or will they actually be able to perform it?

What is a learning objective?

A learning objective is a statement describing a competency or performance capability to be acquired by the learner. Objectives should be specified for the course as well as for each single activity.

Let's take an example from our task analysis table (FAO, 2011):

> **Task:** Report results to decision-makers: Design effective reports for decision-makers, providing them with recommendations based on analysis results.
>
> **Guidelines:** Construct a message in a logical and persuasive manner.
>
> **Required knowledge:**
>
> Which recommendations are relevant and feasible?
>
> Structure of a message: current situation, problem, questions, response needed
>
> Consistency, relevance and brevity of supporting data.

From this information, we can develop the following learning objectives (FAO, 2011):

- Construct a logical and persuasive message.
- Explain the concept of relevance.
- Explain the concept of feasibility.
- Describe the elements of a message (current situation, problem, questions, response needed).
- Distinguish consistent from inconsistent data.
- Explain the concept of brevity.

> Learning objectives combine two main elements (FAO, 2011):

- the expected level of performance (through an action verb, such as "describe" or "explain"); and
- the learning content (i.e. the type of knowledge or skills that must be learned, such as "the main objectives of a product life cycle management (PLM)")

According to the revised Bloom's taxonomy of the cognitive domain, learning objectives can imply six different types of cognitive performance, ranging from the lowest performance level (remember) to the highest (create).

Performance levels for the cognitive domain are:

Remember: The learner is able to recognize or memorize information.

Understand: The learner is able to reformulate a concept.

Apply: The learner is able to use the information in a new way.

Analyze: The learner is able to decompose and define relationships among components.

Evaluate: The learner is able to justify a decision according to a criterion or standard.

Create: The learner is able to realize a new product or approach.

Verifying the alignment of learning objectives, activities and tests

Clear learning objectives allow the development of learning activities which are really focused on learners' needs and provide the basis for evaluation tests (FAO, 2011).

It is important to ensure that learning activities and evaluation tests aim to develop and assess the same type of performance and learning content as expressed in the learning objectives; in other words, they need to be aligned with the learning objectives.

For example, if the learning objective is to "understand the main components of PLM system," the course designer should adequately illustrate the PLM concept and develop tests to assess the learners' understanding (not only the memorization) of that concept, as shown in the table below (FAO, 2011):
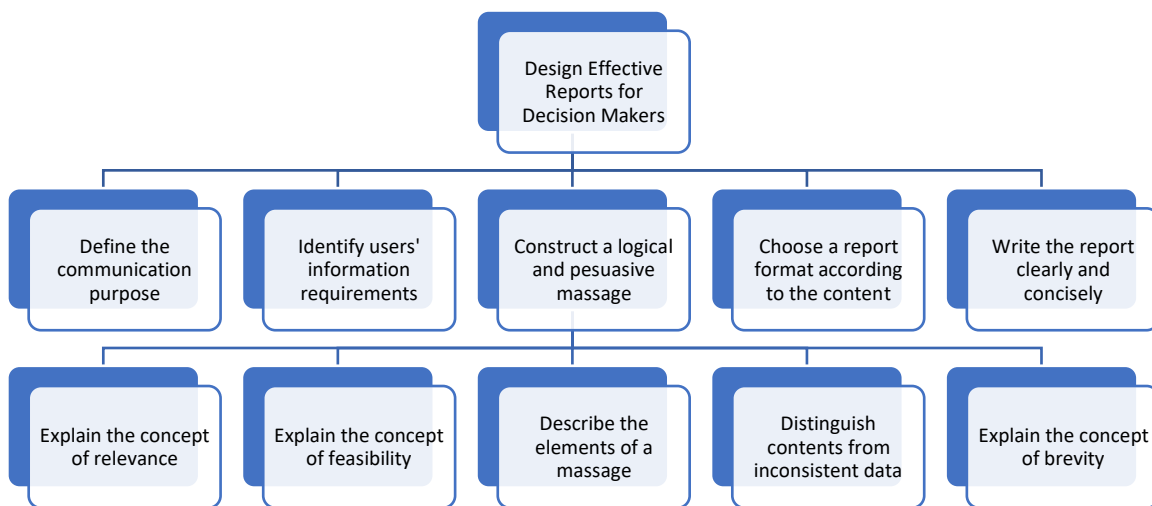
	Learning Objective	Learning Activity	Test
	Learners will understand the main components of PLM systems.	After reading the definition of PLM, learners will look at two examples of an PLM systems and will identify their main components.	Learners will give information about the status of PLM system usage in their countries.
Remember			
Understand	x	x	x
Apply			
Analyze			
Evaluate			
Create			

2.2. Defining the Course Sequence

Let's start with a question: How should the learning objectives be sequenced when structuring a course (FAO, 2011)?

One of the methods used to define the course sequence is the prerequisite method. That method uses a learning objectives hierarchy, teaching first those skills that seem to be prerequisites for all other skills. It is possible to create a hierarchy among learning objectives by using the results of the task and topic analyses.

The diagram below shows the hierarchy among the objectives that were formulated in the above example. The learning objective "Construct a logical and persuasive message" is at a higher level than the others. In fact, the other learning objectives (e.g. "Explain the concepts of relevance and feasibility") are all prerequisites to being able to construct a logical and persuasive message.

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                    │     Reports for     │
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Other sequencing methods;

There are several other methods that can be used to organize and sequence the content, and different methods can be integrated to design the best structure for your course (FAO, 2011).

Some of these other methods include the following:

- In a job-oriented course (perform course), the content can be organized to follow the order of the actions in the real job environment; this is the job-context principle.
- In a non-job-oriented course (inform course), concepts can be organized according to their structural connections, such as by:
- describing the characteristics of a class before describing its members;
- providing examples first, then definitions; or

- starting with concrete or simple information and then proceeding to abstract or complex concepts.

If learners' profiles (e.g. general characteristics, job profiles, educational background) are well-known, concepts that are most familiar to learners can be presented before those that are far from learners' experience.

The curriculum can start with a more general overview, then focus on specific topics, and at the end go back to the general conclusion; this is the zoom principle.

The curriculum can revisit the basic ideas, repeatedly building upon them until the learner understands them fully; this is the spiral curriculum.

The outcome of sequencing is a course structure where each element corresponds to a specific learning objective and contributes to the achievement of the overall course goal.

Some example sequencing pathways are (FAO, 2011):

2.2.1. Course Structure

The diagram below is an example of a structure for an e-learning course (FAO, 2011).

A course can include several units which include a number of sessions.

In a self-paced e-learning course, each session is a learning object made by a set of screens including text and media elements (FAO, 2011).
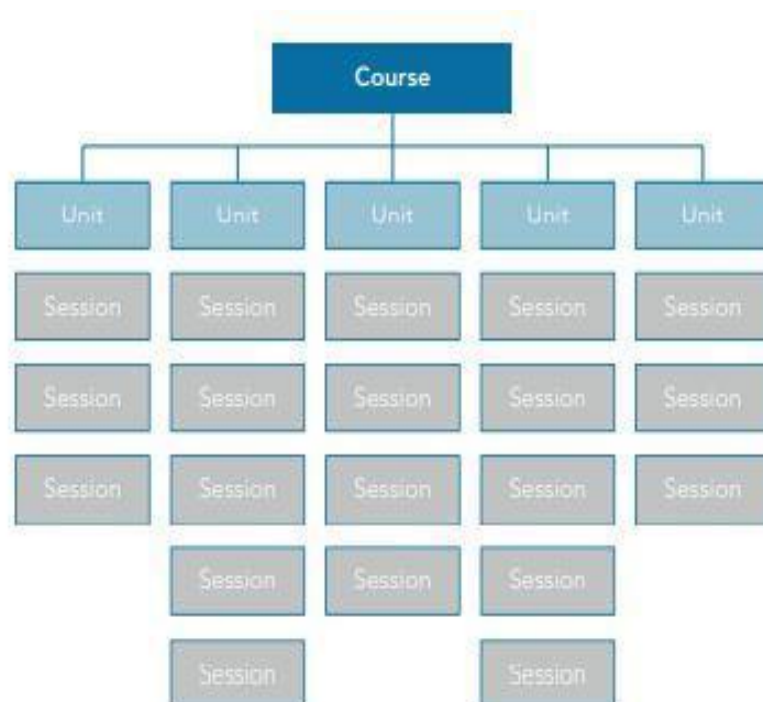
2.2.2. Personal Learning Paths

Developing the course using a modular approach allows the definition of a number of personal learning paths that respond to different individual interests and learning needs. This path is shown below (FAO, 2011).

The task analysis helps to establish a connection between learners' needs and specific course elements. This enables learners to select a subset of sessions under the main course.

Entry tests or task-related questions can be submitted to learners to help them identify the right subset of relevant course elements (FAO, 2011).
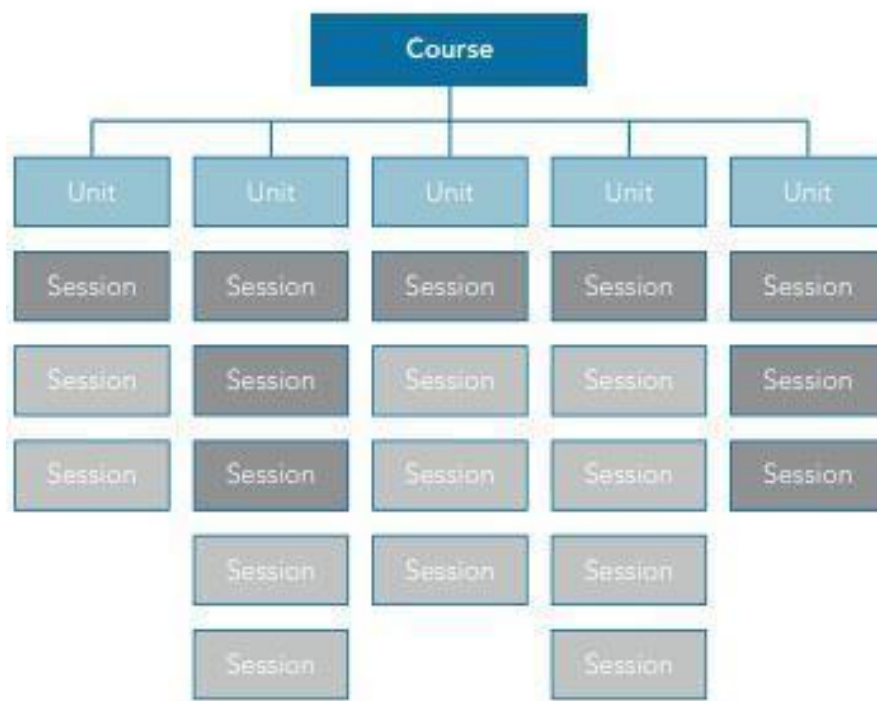
2.3. Instructional Strategy

Once the course structure has been defined, the instructional designer must propose the best mix of methods and techniques for a specific e-learning course (FAO, 2011).

The design of an e-learning course will involve using a combination of the following instructional methods:

Expositive methods - which emphasize "absorption" of new information. Expositive methods include presentations, case studies, worked examples, demonstrations.

Application methods - which emphasize the active processes learners use to perform procedural and principle-based tasks and build new knowledge. Application methods include demonstration-practise method, job aids, case-based or scenario-based exercises, role play, simulations and serious games, guided research, project work.

Collaborative methods - which emphasize the social dimension of learning and engage learners sharing knowledge and performing tasks in a collaborative way. They include online guided discussions, collaborative work and peer tutoring.

Each method can be delivered in different formats, using different types of media and communication tools.

For example, a presentation can be delivered as a Power Point file or as a recorded (or live) video presentation. An online discussion can be carried out in a discussion forum or through a Skype call. Delivery formats are selected based on additional factors related to learners, technological and organizational constraints (e.g. budget) and available time.

2.3.1. Expositive Methods

Expositive methods require learners to listen and read or observe. A SME or instructor delivers knowledge on a given topic, which can be complemented by tests and exercises to evaluate learners' memorization and/or understanding of the content (FAO, 2011).

Expositive methods are used for acquiring information, but they can be combined with other methods to create different types of learning courses. In those courses, the expositive component is normally used to provide orientation and basic concepts before going into more practical and complex stages.

Presentations, especially in video formats, can also be used to sensitize and influence learners' attitudes toward specific subjects.

Expositive methods include (FAO, 2011):

presentations: organized information on a specific topic

case studies: real, significant cases related to the topic

worked examples: examples of the topic with comments and explicit reference to the theory

demonstrations: illustrations of how a task can be performed

In e-learning, these methods can be delivered through a number of formats, as given below (FAO, 2011);

- Simple learning content, such as documents and PowerPoint presentations, with no interactivity.
- Interactive e-lessons using text, images, audio, animations and practice (i.e. questions and feedback).
- Presentations made by an expert or instructor which are broadcast in real time or recorded for learners to watch at any time. The lessons can be recorded in both video and audio formats (podcasts).
- Webinar and virtual classroom where the instructor presents the content to a group of learners who are connected to the platform at the same time. Learners can interact with the instructor, ask questions and receive feedback using video conference, audio conference or chat. The instructor can use special software called "virtual classroom

software". These programs usually include a range of synchronous tools such as whiteboard, application sharing, audio conference and chat. Learners can use these tools to interact with the instructor and other learners, ask and answer questions, vote, etc.

2.3.2. Application Methods

Application methods involve the learners in practical activities which can range from simple exercises (such as the demonstration-practise method) to more complex methods like simulations or research activities (FAO, 2011).

When using these methods, it is helpful to have a tutor or instructor to provide guidance and facilitate reflection for learners.

2.3.2.1.   Demonstration-practise method:
This method is used to teach a procedure – usually a software procedure, such as how to generate a map using geographic information system (GIS) software – using directive learning. A procedure is first demonstrated by an expert or instructor, and then learners are asked to practise the procedure by interacting with the system or software. In e-learning, this method can be realized through two formats, as shown below.
 a. Interactive e-lessons using a combination of animations and operational simulations (based on a sequence of operations) that allow learners to interact with the system and receive feedback on his/her actions.
 b. Virtual classroom in which the instructor shows the application using application sharing tools and allows learners to take control of the application to practise it.

2.3.2.2. Job aids: Job aids provide just-in-time knowledge. They usually provide immediate answers to specific questions, helping users accomplish job tasks. For example, learners may be provided with a checklist to help them draft a communication strategy for a specific audience. This method can be realized through printed documents such as checklists, technical glossaries and manuals or as online help or more sophisticated interactive online systems.

2.3.2.3. Case-based or scenario-based exercises: Case-based exercises are used to develop cognitive skills in a specific domain. Learners are asked to apply knowledge and principles to a concrete situation. Typically, this method is built around a scenario, e.g. a challenging situation where learners are required to make decisions by choosing among different options. For example, learners may need to select the best method for assessing the impact of a PLM Masters programme. They are provided with an overview of the different assessment methods, criteria and information about the specific programme to be assessed. An expert then comments on the learners' choices. This instructional method can be realized through the following delivery formats;
 a. E-learning linear lessons using text, images, audio, animations and practise (questions and feedback); feedback is provided to learners by comments on the appropriateness of their choices, after which they proceed to the next situation.

b. Electronic simulations, based on branched scenarios (also called experiential simulations); each learner's choice produces a consequence that generates feedback. The feedback is provided through a follow-up situation that produces more choices.

c. Tutored individual activities in which a challenging situation is presented together with the information and tools required to develop a solution to the problem; each learner is asked to develop his/her own solution by using the available information. The tutor can provide feedback during and at the end of the work.

d. Activities that are performed by a group rather than an individual; this also provides the opportunity to practice interpersonal skills (e.g. negotiation skills).

2.3.2.4. Role play: Role play is used to develop interpersonal skills. Learners are asked to apply behavior-related principles (e.g. communication principles) to a concrete situation. Feedback is provided to learners about their behavior. For example, learners may be divided in groups of two people – one is designated as the company staff and the other as the PLM expert. The expert must convince the company manager/staff to take action in his/her company based on the expert's recommendations. After the simulation, the tutor/instructor comments on the learners' performance. In e-learning, this method can be realized through two delivery formats;

a. Electronic simulations, based on branched scenarios (also called experiential simulations); each learner's choice produces a consequence that generates feedback. The feedback is provided through a follow-up situation that produces some more choices.

b. Role-plays conducted as a group activity by learners using communication tools such as chats, audio or video conferences and discussion forums; a specific role is assigned to each learner. Learners interact with each other to achieve individual objectives and/or a common goal.

2.3.2.5. Symbolic simulations and serious games: Symbolic simulations are used to develop scientific understanding of complex systems (e.g. ecosystems) or strategic management skills in organizations. Learners can interact with the system to understand the underlying dynamics. For example, if learners need to analyse crop status through seasons, they can play with the system to see the main crop stages based on rainfall and vegetation data, and to observe the consequences of vegetation stresses.

In e-learning, symbolic simulations, based on the mathematical model of a system, simulate a natural, social or economic system. Learning games are simulations involving a competitive component, a challenging goal and a set of rules and constraints.

2.3.2.6. Guided research: The learners are charged by the tutor or the instructor to conduct research on a specific subject. The instructor can guide the learner in collecting and organizing information. For example, learners may be asked to conduct research on the PLM systems used in their own countries. The instructor provides suggestions to learners on how to find the required information and how to illustrate the information gathered using a table.

In e-learning, this method can be realized through the discussion forums, e-mails, chats and audio or video conferences for communicating between learner and instructor or tutor. Wikis, blogs and shared documents for presenting results.

2.3.2.7. Project work: The learner is charged by the tutor or the instructor to develop a product or a project by applying learned principles and concepts to his/her specific context. For example, learners may be asked to develop a PLM report by applying the principles learned during the course.

In e-learning, this method can be realized through the discussion forums, e-mails, chats and audio or video conferences for communicating between learner and instructor or tutor. Wikis, blogs and shared documents for presenting results.

2.3.3. Collaborative Methods

Collaborative methods are based on dialogue and discussion among facilitators and learners. They add a social dimension to the learning experience, applying the principles of social constructivism and collaborative learning. They allow learners to benefit from having discussion partners and getting personal feedback (FAO, 2011).

2.3.3.1. Online guided discussions: Guided discussions are designed to facilitate learning and improve knowledge and skills. The facilitator asks learners questions to stimulate and guide reflection and critical thinking. These discussions usually complement other methods, such as a presentation, research or a case-based exercise. Guided discussions also facilitate communication and knowledge sharing among learners. For example, after individual research on PLM systems, learners may be asked to describe to the facilitator and the other learners how those systems work in their own countries.

In e-learning, this method can be realized through the discussion forums, e-mails, chats or audio or video conferences.

2.3.3.2. Collaborative work: Learners work together to perform different types of activities, such as evaluation, analysis or development of an assignment or a project. This method requires learners to collaborate, listen to each other, argue and negotiate; they develop interpersonal skills other than domain-specific and problem-solving skills. For example, learners may be divided into small groups and charged to evaluate the impact of a PLM system by applying the principles learned during the course. Each group must provide an evaluation report as an outcome of the assignment.

In e-learning, this method can be realized through discussion forums, e-mails, chats or audio or video conferences to communicate among learners. Wikis, blogs and shared documents for collaborative work. following delivery formats.

2.3.3.3. Peer tutoring: Learners monitor and support each other. They have the opportunity to learn from each other's work and to practise tutoring methods. This is a useful method for train-the-trainer projects. For example, each learner may be asked to review a PLM system report developed by another learner, and to provide suggestions on how to improve the document according to the principles learned during the course.

In e-learning, this method can be realized through discussion forums, e-mails, chats, audio or video conferences, wikis, blogs, and shared documents.

2.4. Delivery Strategy

When selecting delivery formats, a number of factors as learner-related factors, technology aspects and organizational requirements must be considered (FAO, 2011).

2.4.1. Learner-related factors: The following are important factors to consider about learners:
- their comfort with delivery channels – Audio and video conferencing can be frustrating for non-native language learners; e-mail or discussion forums are more appropriate since they allow learners to take the time they need to read and write.
- their level of technical expertise – If they have only recently experimented with e-mail, they may have difficulty working with whiteboards and video conferencing. It is important to consider how much technical support can be offered to them.
- their available time – If learners are busy, are located in different time zones or cannot conform to rigid schedules because they can only access a shared computer during certain hours, asynchronous tools will be preferred.

2.4.1. Technology aspects

Learners' computers' capabilities, infrastructure and connectivity need to be considered before making any technology decisions. Understanding whether learners have easy access to network systems is important. Some activities can be carried out only with the support of an Internet connection, while others can be developed for self-paced e-learning (FAO, 2011).

It is also important to consider what kind of computers and software programs learners use, especially when creating e-learning courses in development contexts. Technical requirements, including multimedia capabilities, influence the selection of the media mix and plug-ins.

A multimedia training course can require the learners to have special hardware configurations (e.g. a large amount of memory, fast processors, high-resolution monitors, audio and video cards). Media players, also called plug-ins, (e.g. Adobe Acrobat Reader or Flash Player plug-ins) may be needed to display media and interact with the learner. If these are required, learners should be able to freely download them from the Web. Try to limit the number of media players needed by learners so that they don't have to do too many downloads. Alternatively, if you provide offline courses, such as on a CD-ROM, you can embed in the CD all the media players that are needed to display the course (FAO, 2011).

Using several media does not necessarily improve the effectiveness of an e-learning activity. Good instructional design is more critical to achieving learning effectiveness than special

multimedia effects. For example, while audio is generally recommended, video and complex animations might not be required and could instead be replaced by a series of images.

2.4.2. Organizational requirements and constraints

A range of organizational requirements and constraints, such as the available time and budget, will influence the choice of delivery formats (FAO, 2011).

Developing self-paced learning, especially with a lot of multimedia, can require much more time than preparing a virtual classroom. When instruction needs to be provided to as many people as possible in the least amount of time, a series of large virtual classes might be the right solution. Investing in the development of a complete self-paced course makes sense to meet long-term training goals more than immediate, urgent training needs. However, development costs for interactive content have dramatically decreased because of the development of new authoring tools.

Instructor-led courses are cheap to develop but expensive to deliver, while self-paced courses based on interactive content are expensive to develop but cheap to deliver. Thus, knowing the number of learners is important in assessing the cost impact.

2.5. Evaluation Strategy

Another important decision relates to the evaluation strategy for your course. It is very important to think about this from the design stage. First, you should establish the purpose of the evaluation. The purpose might be to: check the quality of the course to improve it before it is implemented (formative evaluation); measure the effectiveness of training and learning immediately after the course has been implemented (confirmative evaluation); or evaluate an old course to see if it is still valid or needs to be modified (summative evaluation) (FAO, 2011).

Then, you will need to define if you want to evaluate learners' progress and/or provide certification. This will also influence the choice of the assessment tests that will be integrated into the course.

In fact, you may want to assess learners' knowledge and skills before the course starts, at a certain point in the course (e.g. middle evaluation) and/or after the completion of the entire course. As already stated, it is important to ensure that the assessment tests are aligned with the learning objectives. For this reason it is advisable to start drafting the assessment tests from the first stages of the project, just after the definition of the learning objectives for each learning unit (FAO, 2011).

3. DEVELOPMENT

The development phase builds on both the Analysis and Design phases. The purpose of this phase is to generate the lesson plans and lesson materials. Designers must now refer to the results from the previous two phases and construct a product for the delivery of the information during the development phase. This transitional stage transforms the designer's role from research and planning to a production mode. The development phase emphasizes three areas: drafting, production, and evaluation. Designers in this stage develop or select materials and media and conduct formative evaluations (Seels & Glasgow, 1998). Evaluations during the development stage contain a different focus than the actual evaluation format that occurs during stage 5 of the ADDIE process. Encompassing a formative approach, evaluation during the development phase calls attention to the product and the quality standards of the product. Designers are to determine if the students or audience will learn from the product and how it can be improved before implementation (Peterson, 2003).

3.1. Content Development

Content development is based on the course (or curriculum) plan, which describes learning objectives and topics to be covered. Here, a question comes to mind, if the existing course materials can be used without making any changes for the e-learning course content (FAO, 2011). These materials can consist of;

- user manuals and technical documentation;
- classroom course handouts and lecture notes;
- presentations, such as PowerPoint slide shows;
- documented case studies;
- photographs, images, graphs, tables and other illustrative materials;
- training materials, such as self-study guides, web guides and other distance learning materials; and
- reference materials, such as specialized thesauri and glossaries.

Unfortunately, existing training materials and documents cannot be automatically transformed into e-learning materials by just making them available from a Web site. E-learning differs from face-to-face training and requires specific formats. For self-paced e-learning in particular, material must be carefully designed and must embed adequate instructional support to allow learners to function independently throughout the course (FAO, 2011).

For example:

- a PowerPoint presentation developed for face-to-face training sessions is not an e-learning content, because it does not include all the explanations and examples which are supplied by the presenter in a traditional classroom; or
- a 20-page article made available online is not e-learning content because the way it is designed doesn't match specific learning objectives and because scrolling text pages is not the best way of reading online.

When developing e-learning materials, there are generally two main scenarios. If appropriate content already exists, the instructional designer will integrate content taken from different sources and may request some inputs from subject matter experts (such as additional examples, glossary terms and relevant descriptions, recommended reading and resource pointers). Otherwise, one or more subject matter experts may be requested to write the content from scratch. In either case, the subject matter experts must review the storyboard to verify that the content has been correctly interpreted by the instructional designer.

Although preparing materials is less demanding in instructor-led synchronous learning, it is still necessary to adapt existing materials to the new learning environment. In some cases, existing materials may not adequately cover the content of the outlined lessons.

Another question can be about how much content an e-lesson should include. A single e-lesson should not take more than 30 minutes of learning time. In developing the content, all the knowledge needed to meet the learning objectives should be provided and unnecessary information should be avoided. The following are some tips on authoring a course content (FAO, 2011);

Tips for Content Development:

- Before developing the content for the assigned lessons, review the proposed learning objectives.
- Make sure that the content and knowledge assessment tests and exercises 'match' the lesson objectives at every step in the workflow process.
- Provide all the knowledge needed to meet the learning objectives, including information that may seem obvious to you, but may be new to learners.
- Use examples that are likely to be familiar to most, if not all, learners. People taking the course may have different backgrounds, so use a variety of examples. This will help learners to understand and remember concepts.
- Classify topics for each lesson as follows:
  - Must know: a core part of the content; the learner needs to understand these concepts.
  - Nice to know: the learner could get by without this information, but it could help to develop a better understanding of the subject or add interest for the learner.

Following tips for the language style while authoring the content can be useful:

- Write directly, simply and clearly. To accomplish this, keep sentences short. One rule of thumb is that a sentence should not be longer than 25 words. It is important to not give the reader more ideas or information than can be handled at one time.
- Avoid jargon.
- If you are addressing a multicultural audience, avoid culture-specific slang, colloquialisms and examples.

- Be sensitive to the fact that many learners are not native English speakers. Write as you talk. Informal language and contractions (e.g. don't, we're) can be used.
- Minimize the use of compound sentences. When you see a colon or semi-colon, examine the sentence to see if it could be made simpler and clearer by breaking it into shorter sentences.
- Use personal pronouns (e.g. "you") to refer to learners. This personalizes instruction and involves your reader.
- Use bulleted lists when appropriate.
- Use gender-inclusive, non-sexist language (e.g. sexist: "Over the years, men have continued to use non-renewable resources at increasing rates;" gender-inclusive: "Over the years, people have continued to use non-renewable resources at increasing rates.")
- Use the active voice. In a passive construction, the agent of the action often disappears from the scene. Use the passive voice only when the active voice is unduly awkward.
- Spell out acronyms in full the first time they are used. Consider adding them to the glossary if appropriate.

3.2. Storyboard Development

In most cases, the instructional designer creates a 'storyboard' (also called the script). This is the design document that details the content and behavior of each element for each screen of a given lesson. These elements include text, images and other media, animations, tests and other interactive features (FAO, 2011).

The term 'storyboard' is taken from movie production, where it indicates a visual representation of the various scenes of a film. In e-learning, the storyboard describes screen-by-screen what will happen in the final lesson. The storyboard is not a final product. It is an intermediate product that is then used by web developers to create the final interactive e-lesson.

Storyboards can be created using a variety of tools, including word processing programmes, PowerPoint and specific e-learning authoring tools. The storyboard can be reviewed by subject matter experts and other stakeholders, including representatives of the target audience when feasible. Once comments from the expert and other reviewers have been integrated, the instructional designer can pass the lesson to the graphic designers and course developers, who finalize the lesson by developing media and interactivity features.

Guidelines on how to develop storyboards for e-learning interactive lessons by applying different instructional techniques and media elements are provided here. Following topics are covered (FAO, 2011):

- How to structure a lesson storyboard;
- How to use instructional techniques to present lesson content;
- How to add examples;
- How to use media elements (e.g. text, graphics, audio, video, animations); and
- How to develop practice and assessment tests.

3.2.1. Structure of an interactive e-lesson

In creating the storyboard for an interactive e-lesson, the instructional designer organizes the content into a sequence of slides, which will correspond to the screens of the final interactive lesson.

For example, the following is a typical e-lesson structure: The standard structure of an e-learning lesson reflects Gagné's nine events of instruction: 1) Gain attention; 2) Inform learner of objective; 3) Stimulate recall of prior knowledge; 4) Present the material; 5) Provide guidance for learning; 6) Elicit performance; 7) Provide feedback; 8) Assess performance; and 9) Enhance retention and transfer (Gagné, 1985).
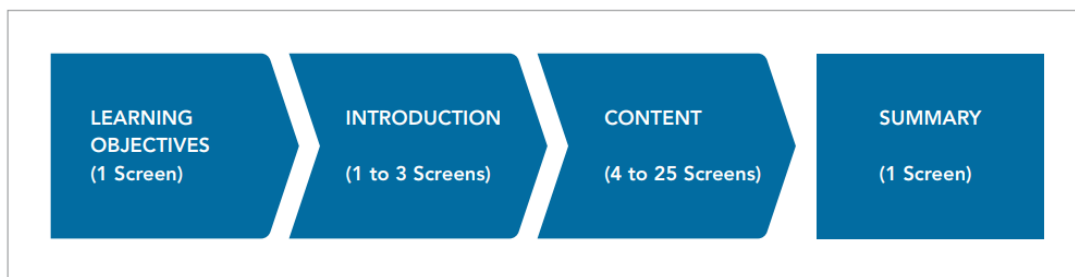
Learning Objectives: A first screen containing a clear and informal description of learning objectives for the lesson.

Introduction: One or more introductory screens describing how the knowledge gained from the course will be used and the benefits of having that knowledge. The purpose of the introduction is to motivate learners to proceed with the lesson.

Content: (core of the lesson) A set of screens (from 4 to 25) which make up the core of the lesson. These combine: text, media elements, examples, and practice questions. Their purpose is to facilitate learning of knowledge and skills. A range of instructional techniques can be used to present the content. These techniques, as well as guidelines on how to use media elements, examples and exercises, are presented later in this chapter.

Summary: List of key points in the lesson. The purpose of the summary is to help the learner memorize the lesson's key points.

3.2.2. Presenting different types of content

Analyzing the different types of knowledge elements that constitute the content can help the instructional designer to present the content properly, in order to facilitate understanding by learners. The table below offers some tips for presenting different types of content (FAO, 2011):

	Types for learning content	Tips for presenting content
Facts	Unique, specific information that answers the questions: who, where, when? Facts are shown, exhibited or indicated. **Examples:** data, lists, historical events.	Provide a clear statement of the fact. Use visuals and infographics if feasible
Procedures	A procedure is a series of clearly defined steps, aimed at performing a task. Procedures answer the question: 'How to …?' **Example:** 'instructions for creating a table in Microsoft Word'	Make clear the various steps of the procedure, e.g. by using diagrams, tables or illustrations. For complex procedures, provide a map that clarifies which step are you currently describing, and/or a summary of the steps at the end. For software procedures, consider using the demonstration-practice method.
Concepts	A concept is a group of objects, entities or ideas that: are defined by a single word or term; share common characteristics; differ in unimportant characteristics; require a definition; and answer the question: 'What is …?' **Example:** the concept of 'climate change'	Provide a definition of the concept. Especially for complex or abstract concepts, it is crucial to provide one or more examples, and non-examples. Use visuals to support understanding of complex or abstract concepts, showing relationships between elements
Principles	A principle (or rule) describes a relationship between two concepts. For example: 'As price increases, the supply increases'. Some principles can be translated into strategic guidelines, which can guide decisions and complex tasks. **Example:** 'guidelines for facing price volatility'.	Clearly state the principle or rule. Provide one or more examples, and non-examples. Use visuals to support understanding of cause-effect relationships. Consider using a scenario-based approach and serious learning games for teaching strategic guidelines.
Interpersonal skills	Verbal and non-verbal skills for interacting with other people. **Example:** content related to 'negotiating' or 'solving group conflict'	Make learners practice rather than just providing principles and guidelines, for example, by using experiential simulations. Virtual reality has strong potential for developing interpersonal skills. Consider using storytelling, scenario-based learning and serious learning games
Attitudes	Predispositions to behaviour.	Use examples, scenarios and stories showing the importance of

	Example: content related to appreciate the 'importance and urgency of adopting measures for limiting the negative impacts of climate change'	applying a given behaviour, and the negative consequences of not applying it. Pictures and videos have strong potential to influence attitudes

3.2.3. Using examples to improve learning

Adding examples is crucial to facilitate an understanding of concepts and the application of strategic principles. Examples should always be present in your e-learning content, as they can help learners to make sense of concepts. They are particularly relevant when you need to explain abstract concepts, or to show the concrete application of a given process or procedure.

Examples can be used in deductive and inductive ways:

- to illustrate a concept or show the steps of a procedure that has been previously introduced (deductive); or
- to stimulate thinking and refection before providing definitions and principles (inductive).

Deductive and inductive sequences
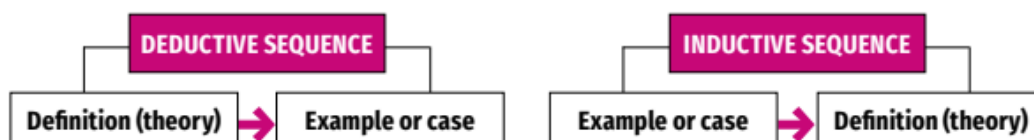
Deductive sequences reflect a behavioural approach, which emphasizes response strengthening, while inductive sequences reflect a constructive approach, where the emphasis is on the active processes that learners use to build new knowledge.

Examples can bridge the gap between theory and practice. You can give learners an example of how to accomplish a task, together with an explanation of the underlying procedure or principle; afterwards, you can ask them to answer questions about the examples to stimulate their refection, or to accomplish a similar task on a new example, to prepare them for actual performance.

Some tips for developing examples can be useful:

- Integrate different media to present the example (e.g. a picture and text or audio narration).
- If the example is long or complex, break it up into smaller components.
- Try also to use non-examples, e.g. examples of incorrect application of principles.
- Use a realistic job context for your example; this will support transfer of the knowledge to the job.

- For strategic skills, use at least two examples that illustrate the same underlying principle in different contexts. Then, ask learners to compare them and identify the common principles.

3.2.4. Developing practice and assessment tests

Practice and assessment questions should be designed to reinforce the achievement of learning objectives. It is important that questions for practice and tests are aligned with learning objectives and learning activities, in order to correctly assess the right level of expected performance and content. Questions play an important role in involving learners and keeping their attention, so you should try to use them as part of your core content, as well as for pre- or final testing. In a job-oriented course, the questions should be placed in a job-realistic context, to build knowledge and skills that can be transferred to the job (FAO, 2011).

Developing practice and assessment tests for different types of knowledge

Different types of practice and tests are required for different types of content. The table below offers some tips for promoting and assessing (FAO, 2011):

- memorization of facts;
- understanding of concepts and processes; and
- application of procedures and strategic principles

Tips for developing practice and tests	
Type of content	**Tips**
Facts	Have learners recall features or specifications. Have learners identify pictures or objects.
Procedures	Have learners discriminate between examples and non-examples. Have learners reformulate the concept.
Concepts	Have learners practice through operational simulation. Have learners actually perform the procedure.
Principles	Ask questions about the principles underlying a worked example. Have learners apply guidelines to solve a job-contextualized problem or case study
Interpersonal skills	Have learners apply behavioral guidelines to an interpersonal communication problem or case study.
Attitudes	Ask questions to reflect on a given behaviour

In self-paced e-learning, practice and tests mainly consist of questions associated with response options and feedback. They generally have the following structure (FAO, 2011):

- a question or statement;
- an operational message that indicates to the learner how to perform the required operation (e.g. click, drag, press a key);
- a series of options;
- the correct answer; and
- feedback for the correct and incorrect answers.

The most frequently used question formats include (FAO, 2011):

- true or false
- multiple choice
- multiple responses
- matching
- ordering
- fill-in-the-blank
- short answer/essay.

The following table summarizes the main characteristics of each type of question (FAO, 2011).

Types of Questions		
True or False A statement with two options (true/false or yes/no), where only one is correct. This type of interaction allows different feedback to be provided for each selected option.	**Pros**	**Cons**
	Easy to create	Learners have a 50 percent chance of selecting the right option
	Can differentiate feedback for each option	The answer is not created by the learner
Multiple choice A statement that provides different options; only one is correct. Like true/false, multiple choice allows different feedback to be provided for each selected option	**Pros**	**Cons**
	Very flexible (can be used for several purposes)	Difficult to create (you have to develop credible wrong options and write different feedback for each of them)
	Can differentiate feedback for each option	The answer is not created by the learner
Multiple responses The correct answer consists of more than one option, all of which must be selected.	**Pros**	**Cons**
	Very flexible (can be used for several purposes)	Quite difficult to create (you have to develop credible wrong options)
		The answer is not created by the learner

Matching	**Pros**	**Cons**
This type of interaction presents two series of elements. The learner must link each element of the first series with one from the second list.	Quite easy to create	Risk of being too easy for learner
		The answer is not created by the learner

Ordering	**Pros**	**Cons**
The learner has to order several elements in a sequence, e.g. the logical sequence of several phases, steps or operations to be performed.	Quite easy to create	The answer is not created by the learner

Fill-in the blanks	**Pros**	**Cons**
This can be an incomplete statement to be completed by learners; or a sentence with one or more missing words or numbers. The learner must fill in the blank spaces with the appropriate terms. The response is checked by the system, which provides relevant feedback.	Easy to create	Rarely appropriate
		Difficult to measure

Short answer/short essay	**Pros**	**Cons**
The learner is free to choose his/her own words, to formulate the response to the question. Although the learner's response will not be checked by the system, an answer developed by an expert can be proposed for comparison, or the essay can be saved and submitted to an online tutor.	The answer is created by the learner	Very difficult to measure

Developing questions

The following guidelines are valid for every type of interactive question (FAO, 2011).

Tips for Developing Questions
● Practice questions should be created for all critical topics or tasks.
● The text of the question must be as clear and unambiguous as possible.
● Incorrect options should be plausible. An obviously wrong option does not play any useful role and reduces the learner's interest.
● Incorrect options should aim not to distract learners, but to anticipate common errors, so that useful information can be provided in the feedback.
● Provide textual responses of about the same length for each option. If one of the responses is much longer than the others, the learner will think that is the correct one.

● Provide explanatory feedback: after the learner responds to a question, provide feedback saying whether the answer is correct or incorrect, with a succinct explanation. For example, feedback on incorrect answers can clarify the missed concept or point learners back to course sessions that explain those concepts. Feedback on correct answers should go beyond a simple reiteration or reformulation of the correct answer. It should further elaborate or connect the concept to future course sessions.

3.2.5. Using media elements

A number of different media can be combined to create compelling e-lessons. Pay careful attention when integrating media elements into your storyboard, to avoid overloading learners' working memory, as this can be detrimental to the learning process (Clark & Mayer, 2016).

Media elements: Text

Written text is an important 'medium' for communicating learning content. Some learning resources are completely text-based. The power of text-based resources is that learners can browse the text and find just what they need.

Careful attention should be given to the text's graphic display and integration with images (FAO, 2011).

Tips for Using Text	
● Display on-screen text to provide the best readability and clarity.	● Use lists or tables to help learners organize the information.
● If possible, use diagrams, graphs and flow charts to help the learners understand the content.	● Use list points or blank spaces to separate items in a list, or focus attention on them.
● Use graphic conventions consistently; for example, italic style must always be used for the same purpose.	● Consider word and row spacing to improve text readability.

Media elements: Graphics

Graphics include illustrations, pictures, diagrams and icons. They can range from photographic, realistic images to schematic representations or even tables.

Graphics can serve different communication functions, including adding aesthetic appeal or humour, depicting an object in a realistic fashion, providing retrieval cues for factual information, and supporting understanding of relationships between different elements and changes of an object over time (Clark & Lyons, 2010).

Graphics can play a crucial role in promoting learning. They should not only be used to add aesthetic appeal or visual interest to a screen. In e-learning, relevant graphics can facilitate learning by (FAO, 2011):

- Drawing attention to a specific content element;
- Suggesting analogies between new content and familiar knowledge;
- Supporting the understanding of concepts;
- Simulating the work environment and real situations; and
- Motivating learners by making materials more interesting.

Tips for Using Graphics (FAO, 2011)

- Try to avoid graphics that have no real function in complementing the information in your text. Purely decorative graphics do not help learners to understand the text and should be minimized.

- Images, tables and graphs should be clear and easy to read. Provide text alternatives for non-text content to make content accessible for people with disabilities.

- Use images that are sensitive to gender and reflect diversity.

- Use pictures when creating a realistic context and suggesting analogies to real-life situations.

- An animated illustration can be used to show a series of procedural steps or the stages of a process.

- A matrix, conceptual map or tree diagram can show relationships among content.

- Line charts can demonstrate trends and enable learners to make comparisons between two or more variables.

- Bar graphs are useful for comparing quantities and dimensions.

- Pie charts show relationships between the parts and the whole, and are particularly useful for showing proportions and ratios.

- Flow charts are recommended to describe complex procedures.

- Diagrams can provide organization and meaning and are therefore recommended when you are trying to help the learner store and retrieve verbal information.

- When developing a text table, ensure that sequential relationships are accurately reflected, and arrange sequences so that they are represented from left to right and from top to bottom on the page. Working contrary to this 'natural' flow can create confusion. When using text tables, provide instructions on how to interpret and use the table.

- Ensure that diagrams, graphics and screenshots correspond to their descriptions.

EXAMPLE:

Types of Graphics
Pictures
Realistic Illustrations
Icons
Conceptual Illustrations
Diagrams

Media elements: Animations

An animated illustration can show a series of procedural steps or transformations (FAO, 2011).

Tips for Using Animations
● Allow learners to focus on only one object at a time.
● Use arrows to steer attention to selected details or motion direction.
● Segment long or complex animations and allow learners to access each chunk at their own pace, rather than playing all the steps continuously (e.g. by adding Play and Pause buttons).
● Limit the use of animation effects on text because they do not have any instructional function and can irritate learners.

Media elements: Audio

Appropriate use of audio can greatly increase the effectiveness of a course. However, you need to carefully evaluate if your project really needs audio narration. In general, audio narration works best when used to explain or describe on-screen visuals, rather than to read on-screen text. You can use audio for entire course, or only for specific parts of it, such as dialogues and scenarios (FAO, 2011).

Tips for Using Audio	
● Keep the audio short.	● Use written text for key messages that need to remain on the screen for as long as desired, so that learners can refer to that information over time.
● Use audio to complement the visual elements on the screen. For example, during a procedural demonstration, audio can be used to explain animated steps.	
● It is critical that audio narration is synchronized with on-screen text, visuals or animation. This is especially important for complex animations and animated videos.	● You can also consider using audio interviews to increase credibility and authenticity to your course by adding the voices of experts, specialists, or colleagues performing similar tasks.
● Do not use audio to simply 'read' the text on the screen; instead, combine audio narration with on-screen instead, combine audio narration with on-screen text to summarize or expand on key points, or to accompany video sequences.	

Media elements: Video

Video is the only media tool that makes it possible to reproduce behaviour, processes and procedures the way that they appear in real life. It can be used to present a case study, and is

especially effective in role play to illustrate communication between people, especially if there is emotion involved.

Video interviews can also be a powerful feature to use in a course as a way of reinforcing the link between the concepts presented in the lessons and the real experience of experts, colleagues or peers.

Video can also be used in an interactive way, for example to realize experiential simulations, i.e. simulations based on branched scenarios, where each learner's choice produces a consequence that generates feedback (FAO, 2011).

Tips for Using Video	
● Consider using videos to show anything that happens over time, like processes or procedures, or to show dialogue between people. ● Avoid using video only to show a trainer speaking.	● Video sequences should always be accompanied by comments, in either written text or audio narration. Include closed captions or a full transcript to increase video's accessibility. ● In situations with limited bandwidth connections, a video sequence can be replaced by a sequence of pictures.

3.2.6. Using pedagogical agents

A simple technique to add a human sense to the content is the use of pedagogical agents – characters that guide learners through the course. If well designed, pedagogical agents can have a motivating effect and facilitate learning (FAO, 2011).

When should pedagogical agents be used?

Pedagogical agents can be used with any type of content, including information-oriented (rather than job-oriented) courses where other more job-oriented techniques such as storytelling and case-based scenarios cannot be applied.

Tips for **Using Pedagogical Agents**
● Pedagogical agents can take the form of coaches or tutors to guide learners through the course. For adult learners, it can be more motivating to choose an informal role such as a peer (e.g. a more experienced colleague) instead of a more formal, authoritative role.
● Characters should be used sparingly, rather than being present in every screen.
● Characters should use a conversational style in addressing the learner. Emphasize first- or second person forms of address (e.g. 'you' and 'your') rather than third-person forms. Include comments directed at learners, such as "Let's take a look at the result of our analysis".
● Although expressive gestures and emotions may increase learners' motivation, avoid displaying irrelevant gestures, facial expressions or motion: learners may be overloaded and consequently pay insufficient attention to the learning material due to the extraneous cognitive load caused by an engaging but distracting pedagogical agent.

- Be careful about gender and cultural issues when developing your characters.

3.2.7. Toolkit approach

What is a toolkit approach?

E-learning content can take the form of a toolkit, which allows learners to select from a set of independent topics, rather than follow a sequential approach. Learners are invited to choose the topics that interest them the most (FAO, 2011).

When should a toolkit approach be used?

The toolkit approach is a good option when you have to present short pieces of content that belong to the same category, but are quite independent from each other. The content pieces can be descriptions of tools, steps of a procedure, stages of a process, or frequently asked questions on a given topic. Learners are invited to navigate the toolkit in a non-linear fashion, since a logical order is not necessary and learners may only be interested in some of the tools (FAO, 2011).

Tips for Developing a Toolkit Lesson	
● Provide an introduction before the menu page with an overview of the various tools, to orient learners in selecting the menu options.	● Present each tool in a systematic way, such as by providing the same categories of information (e.g. description; purpose; example; strengths; weaknesses) for each tool.

3.2.8. Demonstration-practice method

What is the demonstration-practice method?

The demonstration-practice method is used to teach procedure. You first demonstrate the procedure, then you ask the learner to practice it by interacting with the system.

When should the demonstration-practice method be used?

This method can be used to teach procedures, typically software procedures (FAO, 2011).

Tips for Developing a Toolkit Lesson
● You can use an animation (e.g. a flash animation) to demonstrate the procedure. This should be accompanied by a detailed verbal explanation, in the form of written text or audio comment.
● Allow the learner to control the animation by providing play, pause, stop and reload buttons.   ● Develop an operational simulation to have learners practice the procedure.   ● The operational simulation allows the learner to perform a number of actions (e.g. selecting options or typing text). If the learner performs a wrong action, the system provides an error message; if the learner performs the right action, the system allows him or her to go to the next step, until the end of the procedure.

3.2.9. Storytelling

What is storytelling?

Storytelling provides information through a story narrative that places content in a realistic context and illustrates the actions and decisions of one or more characters. It can use illustrations, pictures or video sequences (FAO, 2011).

When should storytelling be used?

The storytelling technique can be useful when you need to (FAO, 2011):

- provide job-specific knowledge;
- describe complex processes, where different actors perform different actions. The story can clarify who does what and helps learners to follow the flow of events;
- add a human aspect to the lesson, since learners can follow the stories of real people; and
- highlight the usefulness of the knowledge, since storytelling allows you to show how this knowledge can be integrated into a real situation.

Tips for Using Storytelling
● Create a realistic and credible context. This is important for motivating learners, as it enables them to identify with the characters in your story. Learners need to feel that the story is similar to their own experience, and that the challenges faced by the characters could also happen in real life. This will help them to appreciate the usefulness of the knowledge that you are presenting.

● Characters do not need to be present in every screen. 'Story screens', which show characters' actions and dialogue, can be alternated with 'theory screens' – i.e. screens providing concepts and guidelines. Story screens can be used to focus learners' attention on specific issues. For example, you can use them to:
     o introduce a new topic: a story screen can present a topic (e.g. a specific task or a new problem that characters have to address), which is then followed by two or three theory screens to illustrate that topic; a story screen can then be used again to introduce the next topic;
     o illustrate critical actions or decisions – a story screen can describe important actions and decisions that often lead to common mistakes and doubts;
     o develop practice exercises – a story screen can be used to ask the learner questions about the story, applying guidelines to that specific situation.

● Be careful about gender and cultural issues when developing your characters. Know your target audience to better define the story characters' geographical provenience, names and style of dress. Dialogue among characters should be gender and culture-sensitive.   ● Try to make dialogue realistic by keeping sentences short and using informal language. Complex explanations should be provided in theory screens, rather than included in a dialogue.

3.2.10. Case-based scenarios and serious learning games

What are scenario-based and learning game approaches?

Case-based scenarios are built around a plausible situation. Typically, the scenario is a situation that presents a realistic challenge. Unlikely storytelling, this approach implies that the learner is the main actor, who must respond to the challenge by making a series of choices and decisions. Feedback is provided to the learners for each option (FAO, 2011).

Using branched scenarios can be an effective way of using this approach, as the feedback to learners' choices is provided through a follow-up situation that produces more choices, thereby showing the effects of learners' decisions.

Serious learning games can be considered as a specific type of experiential simulation that involves a competitive component, a challenging goal and a set of rules and constraints.

If resources allow, scenario-based content and serious learning games can also make use of virtual reality.

When should scenario-based and serious game approaches be used?

This approach allows learners to learn strategic principles by applying them to a concrete situation and observing the consequences of their decisions.

The scenario-based approach can be useful when you need to (FAO, 2011):

- develop problem-solving or interpersonal skills;
- teach strategic principles rather than conceptual and factual knowledge; or
- develop an interactive exercise at the end of a conceptual unit, i.e. as a practice lesson following a set of lessons that provide underlying concepts and principles.

This type of approach requires strong collaboration between the instructional designer and the subject matter expert, as the former needs to have enough information to design a realistic situation, provide learners with the information for the decisions that they must take, and provide appropriate feedback on their choices (FAO, 2011).

Tips for Using A Scenario-based Approach
● Involve a subject matter expert in the creation of a scenario, which must be work-realistic, relevant and credible.
● Make the scenario engaging and immersive. This can be made by using images, characters, short videos, and defining challenging situations that motivate the learner to take action, for example a mismanaged situation that needs to be repaired.
● The trigger event, i.e. the initiating event that sets the scene for scenario, should mimic the reality of the learner.
● To respond to the challenge, the learner will have to make a series of decisions. The subject matter expert can help you to understand which decisions a person would make in that situation, and can share different experiences and possible outcomes.
● Each critical decision will have possible choice options. Choices should not be obvious. Provide detailed feedback for each option by commenting on the choice, or showing its consequences.
● To make the various decisions, the learner will need some information on the situation. Make sure to provide the learner with all the information required.
● Avoid creating too complex scenarios that include unnecessary information.
● The information can be provided as part of the scenario description, or it can be made available on demand, so that learners can freely explore and interpret it.
● Additional support can be provided to help learners to make the right decisions, for example through checklists, guiding questions or tips.
● If developing a serious game, develop rules of play and formulate the content in terms of outcome rules and strategies (Allen, 2016).

3.2.11. Gamification

What is gamification?

Gamification is the inclusion of elements and techniques that are typical of games, such as (FAO, 2011);

- points
- levels
- rewards
- timers
- badges
- competition.

Adding game elements can increase motivation to engage in learning events. This should not be confused with developing serious learning games, which are designed to develop strategic skills by allowing learners to make decisions and witness the consequences of these (FAO, 2011).

When should gamification be used?

There are no specific restrictions on the use of game features in e-learning. They are very easy to implement with authoring systems. However, it is important to use gamification exclusively to support learning objectives; otherwise, they risk becoming distractions. In addition, it should be remembered that "gamifying e-learning doesn't substitute for an effective instructional approach" (Allen, 2016, s. 366).

3.2.12. Microlearning

What is microlearning?

Microlearning is a recent concept that can particularly apply to those contexts where professionals have limited time for learning, although they are expected to constantly acquire new information and apply new knowledge (FAO, 2011).

Microlearning is short-form content that can provide learners with just-in-time information. Specifically, it can be defined as content that addresses one main learning objective and can be consumed in less than 10 minutes.

Microlearning characteristics, including its brevity and design for just-in-time learning, make it particularly suited to delivery on mobile devices.

Microlearning materials do not differ substantially from those described in the previous sections. They can consist of simple text-based resources, or short e-learning courses that apply some of the techniques, graphics (including infographics), audio or video elements described so far. The key difference, in terms of format, is that microlearning materials are shorter and may be less interactive than other e-learning materials.

Examples of microlearning include:

- Short documents (max five pages), especially suitable for technical content that learners can easily browse;
- job aids (checklists, guiding questions, templates, if-then diagrams, etc.);
- short e-learning courses (max 10 minutes), that can use different media, including audio and video; unlike standard e-learning lessons, these may not need practice questions and exercises;
- short quizzes (questions & feedback);
- short videos;
- infographics, which are quick to understand; and
- short podcasts, i.e. audio recordings.

When should microlearning be used?

Microlearning can be used as a stand-alone piece of learning; to complement other types of training – for example to reinforce prior learning or prepare for a training event (especially for technical training); as a performance support tool to be used on the job; or to keep learners updated on a matter with which they are already familiar (Torgerson & Iannone, 2019).

3.3. Courseware Development

3.3.1. What does courseware development involve?

Courseware development can involve several activities. Specifically, these are (FAO, 2011):

- the creation of a graphical layout for the course, including graphical user interface and recurrent elements such as icons and standard pages (e.g. lesson cover, introductory page, test pages, summary page);
- the development of media (audio, video, animations, illustrations) and interactivity for each screen; and
- quality assurance testing.

The effort and time required at the courseware development stage depends on how complex your interactive content is, and the combination of tools and media that are necessary for its creation. Nowadays, a variety of tools are available to support the creation of the course, as well as the development of specific media elements.

3.3.2. Authoring tools

The e-learning authoring tool market offers numerous options for educators to assemble a range of diverse features, such as text, illustrations, animations, audio, video and interactivity, to create their own courseware (FAO, 2011).

E-learning authoring tools significantly reduce the time and cost related to content production, thanks to rapid authoring features such as the WYSIWYG editing space or multiple output

preview. Eliminating the technical complexity of writing codes and scripting in a programming editor, these are suited to independent authors, e-learning professionals and educators.

At the simplest level, presentation tools, such as PowerPoint (PPT) or even word processors, are regarded as e-learning tools. Nevertheless, their limited interactive features, linear navigation structure and lack of support for e-learning standards, make such tools unsuited for learning management systems to track user progress and completion.

In their early phases, many authoring tools were simple PowerPoint 'add-ons', able to convert a set of slides directly from PowerPoint. For example, iSpring Converter Pro or Presenter360 are commonly used to rapidly convert PPT presentations to highly engaging, interactive e-learning courses.

Adobe Captivate (now part of the complete toolbox for developing professional e-learning content) was born as simulation and demonstration software, but with its object styles and rich interactive elements, it has now evolved into a multipurpose development tool.

Authoring tools fall into many categories, depending on their features, level of customization complexity and installation site (i.e. desktop or cloud), ranging from simple PowerPoint converters, built-in tools inside LMS (such as eFront or aTutor), to powerful stand-alone packages that give educators the freedom to create the entire e-learning course within just one integrated toolset.

Some core functionalities of authoring tools include (FAO, 2011):

- navigation
  linear or custom navigation, menu-driven content and ability to move throughout the content;
- simple and conditional branching
  ability to move to another course section based on the result of if-then decisions or events;
- editing
  content publisher for easier changes/updates;
- visual programming
  use of buttons, icons, drag-drop graphics;
- media capabilities
  insert, modify, store, trigger audio, video image assets;
- assessment features
  use of a variety of question types, question randomization, assessment tracking;
- animations and interactions
  for a more engaging experience, enhancing the instructional value;
- templates, skin types
  formatting, modifying, sharing templates to personalize the course;
- programming with a scripting language
  support scripts to collect user input and responses, create triggers;
- preview
  ability to see or test an ongoing project;
- cross-platform interoperability
  able to run on all platforms;

- cross-browser interoperability
  able to run on different browsers;
- integration
  with leading e-learning applications and compliance models, such as Sharable Content Object Reference Model (SCORM) and Aviation Industry CBT [Computer-Based Training] Committee (AICC), for LMS delivery;
- multiple publishing options
  SCORM for LMS, Web, CD-ROM, mobile and MS Word; and
- localization and multilinguals
  to easily localize course content.

Navigation options
Enabling the learner's control over the process is particularly relevant in adult learning. Navigation is the ability to consume the content in a certain order, usually intended by the course creator. Typically, one of the simplest authored navigations makes it possible to control pacing within a lesson and move from one instruction to another with the use of next/previous swipe/buttons. Using responsive HTML5 tools, content is scrollable and displayed vertically on mobile devices. Alternatively, learners can use menu navigation, when selecting specific lessons and topics within the course. Ultimately, instructors can also enable learners to use non-linear navigation, allowing them to select their own order of information and activities, as opposed to the one displayed on the screen, so as to have a more personalized learning experience.

The SCORM model
In order to be appropriately uploaded and made accessible from an LMS, e-learning lessons and courses must conform to a set of technical and instructional standards. For example, SCORM (Sharable Content Object Reference Model) encompasses the following standards: - packaging standards that allow courses to run under different LMSs;   - runtime specifications on how LMSs can launch courses, and how they report results back to the system;   - metadata standards to create and publish metadata records about courses, lessons and topics.

Authoring tools are rapidly evolving and revamping their features. For example, rich asset libraries, now integrated in many authoring suites, offer a set of customizable and professionally ready-made templates and skins, illustrated characters, royalty-free images, videos, interactions, assessment templates, etc. for more engaging and visually consistent learning experiences. Also, some authoring environments contain a basic media editor to create, edit and/or modify images, video or audio components. This feature enables course creators to easily modify media files with no need to use dedicated software. In addition, some online user-friendly hosted services, such as those set up by the Articulate Online or Course Lab communities, allow content to be published, delivered and tracked online. In this case, hosted services act as LMSs and allow educators to set course parameters, structure and eventually invite other users to view published courses (FAO, 2011).

3.3.3. Authoring tools for mobile learning

Mobile learning (m-learning) and microlearning are growing trends in the e-learning sector. Modern authoring tools can create device- and platform-friendly learning content. Thanks to the industry-leading HTML5 format, e-learning projects that are primarily designed for desktop/laptop layout can easily be adapted to different mobile device screen size and orientation (FAO, 2011).

Some mobile-first authoring tools, such as Rise360, Elucidat, Gomo, Lectora, DomiKnow, Adapt and Upside learning use Fluid Boxes design functionality to make learning projects fully responsive and scalable. Content is fluidly repositioned, restructured and readjusted on small or large mobile devices.

3.3.4. Selecting an authoring tool

There is no right or wrong authoring tool – the best choice is the one that meets your business needs and supports your instructional approach (FAO, 2011). Before identifying a suitable solution, an organization must have a thorough understanding of its training goals and objectives, as well as the learners it aims to reach and the variety of content types it seeks to develop. Selecting e-learning authoring tools is a long-term investment, so it is important that the best fit is not only suitable for current authoring needs, but also for business challenges and opportunities in the future.

To accomplish this, an organization needs to take into consideration the learners' needs and goals, for instance, their geographical location – whether they live or travel in remote areas, their age, gender, cultural/educational level, bandwidth potential, preferred device, difficulties that they may face with some technologies, etc. A clear vision of who will consume the learning is fundamental to understanding the detailed core functions and abilities of a potential e-learning tool, so as to create the desired educational resources. For instance, it may be important to consider if the tool is able to create sufficiently effective and engaging videos and/or simulations, or perhaps, personalized learning paths, rich media content, simple slides or mobile apps.

The following are some important factors to consider in order to make the right choice. Items are not ranked according to their importance and the list is not exhaustive; many other decisive elements (such as localization abilities for multilingual content or mobile device output) could also be examined (FAO, 2011):

- **Authoring features and functions**
  The starting point when it comes to a tool selection is to create a requirement list, grouping all must-have prerequisites and functions required to support desired instructional patterns. If an organization opts for its own code-based authoring tool, the requirements list may serve as the software requirements specifications. For off-the-

shelf solutions, the must-have requirements list can be compared with the products' features. Almost all vendors give detailed descriptions of their product's main characteristics and components, organize demonstrations and offer trial versions.

- Ease of use
  The more user-friendly and intuitive an authoring tool is, the more likely that a pool of potential authors can grow. In this context, a good combination of rapid functional advantages that do not require advanced technical knowledge may speed up the production process and facilitate educators when creating content that meets evolving learner needs, such as rapid editing through a content publisher, robust panel management features, intuitive paths for performing authoring functions, a library of reusable components, templates, graphical assets editing, etc.

- **Pricing and plans**
  The available budget should match the license/subscription cost or development cost if an organization opts for its own authoring tool. Some key considerations related to budgets for the tool are: installation/deployment options, i.e. whether the tool is installed locally, on a specific device, or accessed from a web browser; upgrading and updating modalities; number and volume of projects; whether it allows collaborative or team authoring – multiple authors working together on a single project, etc. Rapid tool vendors have developed a range of pricing and subscription-based services to accommodate practically any business need: pay per author, pay per audience, pay per project, pay per gigabyte; perpetual, one-time, limited time license, volume and upgrade discounts, etc. Freeware authoring tools may also be an option for tight budgets or for a limited number of projects. It might be worth considering a freemium, a recent business model whereby basic functionalities are granted free of charge, while updates, access to repository and add-ons are changed separately.

- **Packaging formats**
  This feature determines the way that learning content is delivered and made ready to be consumed by the end users. The output format should be packaged to run smoothly, not only on the organization training delivery infrastructure, but also on the user operating system and browser. Output packages are mainly determined by an organization's training delivery methods and needs. Options may include SCORM packages for training methods via LSM; CD-ROM or printable formats to reach learners with low or unstable connectivity; and offline mobile learning apps for a workforce travelling in remove locations. Video (or work-related video) that combines visuals with learning information can be a strategic method to increase retention levels. MOOCs and virtual classrooms make use of text, video and other formats.
  Mobile learning is a relatively new delivery method for 'anytime, anywhere' learning. According to the current trends and growing demand, learners expect an identical browsing experience on the multiple end devices that they use (PC, tablet or smartphone). In order to fulfil learners' expectations, it is important to consider whether content can be delivered satisfactorily on any or all of these devices.

- **Industry/community support and training**
  Having 24/7 support available worldwide is essential for troubleshooting, problem-solving and acquiring useful tips. Also, the more widely-used tools are supported by online forums and user groups and blogs, which provide free technical support to users, publish manuals and guidelines and organize web seminars and online classes. Some examples of product communities include: Articulate Community, CourseLab Community, Adobe Captivate Community, Elucidat Blog and Lectora blog. Robust support documentation, including tutorials, examples, references and user material is essential. In addition, many vendors deliver web-based or on-site customized training sessions.

- **Collaborative or individual authoring**
  Some complex development projects require centralized development in terms of multiple author collaboration, as opposed to individual authoring and sequential tasks. Similarly, a good production workflow must support content creators to interact and share content and collect consolidated feedback from reviewers, SMEs and other stakeholders. It is also worth considering whether to choose a collaborative or individual workflow system, as this not only determines the installation type of the potential tool, but can also streamlines the review/approval process and cut down on production time.

- **Courseware production team**
  The number of team members, their skillsets and ability to handle different tasks are decisive factors when it comes to selecting or developing the tool. Rapid authoring tools covering all authoring needs are ideal for tight budgets, quick turnround projects, and/or teams without dedicated specialists in courseware design. Certain training formats or complex custom interactions require the use of highly specialized tools with a steep learning curve. This means that content creators may have to invest time in becoming proficient in performing a wide range of actions and understanding a tool's full potential. The adoption period can be quite challenging for creators, who will slowly progress to more complex authoring tiers as their skills mature.

- Creative authoring
  This feature refers to the ability of a tool to accommodate a variety of interactions, navigation elements, branching, quizzes and other instructions in course design. Highly customizable tools facilitate the creation of elaborated content in a fast and easy way, allowing course creators to build a more sophisticated learning experience. Conversely, tools with poor customization capabilities can impose constraints on instructional creativity.

- Accessibility features
  Web accessibility means that websites, tools, and technologies are designed and developed so they can be used by everyone, including users with disabilities (adapted from UNICEF 2021). The Web Content Accessibility Guidelines (WCAG) set standards and guidelines for the web and web technologies. Web applications and tools are increasingly integrating accessibility features such as compatibility with screen readers,

keyboard shortcuts, text alternatives for any non-text content (images, buttons, graphs), closed captioning for audio and video segments.

- Integration
  This specifies whether a tool is compatible with leading LMS and/or other software, such as PowerPoint, or other media programmes and tools.

Specialized reviews and e-learning research institutes regularly perform exhaustive studies of all the currently available authoring tools. They establish criteria to guide you through the selection process and provide profiles and information on each tool's authoring process and rapid development features. Some examples include (FAO, 2011):

- The eLearning guild
- The Centre for Learning and Performance Technologies
- The Brandon Hall Group.

4. EVALUATION STAGE

The last stage of the Addie model is evaluation. The evaluation phase is an essential component of the ADDIE process. It is very important evaluation student progress, quality and improve course effectiveness and future learning events and content for online courses. In this section, it is given an overview of learning activities and facilitation tasks and how assessment tests can be used to measure learners' progress.

The evaluation phase can be consistent with in the Formative, Confirmative, or Summative:

- formative evaluation,
- confirmative evaluation,
- summative evaluation.

Formative Evaluation is in progress during and between phases. The goal of this type of evaluation is to evolve the instruction before the final version is performed. Summative Evaluation usually happens after the final version of instruction is applied. This type of evaluation assesses the overall effectiveness of the instruction. Data from the Summative Evaluation is often used to decide about the instruction.

Confirmative evaluation is the process of collecting, examining, and interpreting data and information in order to determine the continuing competence of learners or the continuing effectiveness of instructional materials. It is the logical next step beyond summative evaluation. As the adjective "confirmative' suggests, the purpose of confirmative evaluation is to "confirm" the continuing worth of instruction or the current competencies of an individual. By administration of criterion-referenced instruments, and observation of learners' performances or products of performance, confirmative evaluation becomes a powerful tool in the instructional process. It allows the evaluator to determine whether learners or materials continue to meet requirements and standards that were specified earlier. Failure to meet requirements may result in modifying or terminating the instruction or in retraining the learner (Hellebrandt & Russell, 1993).

An e-learning project can be estimated for evaluation objectives. Learners' reactions, the achievement of learning objectives, the transfer of job-related knowledge and skills, and the impact of the project on the organization may be evaluated.

The evaluation phase can often be overlooked due to time or economic factors, because of compulsory practice. The evaluation phase should be an integral part in the progression of analysis and effective implementation of future courses and programs.

The purpose of evaluation at the end of the course is to measure the effectiveness of education or examine a past course. Learners' reactions, learning, behavior, and results are four levels related evaluation according to Kirkpatrick model. If learners participate actively and if they like the course, evaluating learners' reactions means understanding how those who participate

in the program react to it. At the end of the course, it can be measured through questionnaires and surveys. Evaluation of learning measures the performance of intended learning objectives. According as the type of course, this can mean that participants have increased knowledge, developed skills, and/or changed attitudes because of attending the course. Learning can be assessed through direct observation, assignments, and tests. Evaluating behavior means understanding the extent to which participants' behavior has altered because of the training program. It can be done by observing learners' performance on the job. Eventually, evaluating results consists of identifying the results that taken place in the organization because of the participants. The final results can include increased production, improved quality, decreased costs (Peterson, 2003), (Ghirardini, 2011).

5. ANNEX I: H5P

H5P is an abbreviation for HTML5 Package. It enables educators to create content such as interactive videos, quizzes and presentations. H5P content can be created in the Content bank or on the h5p.com/org site, or with the LUMI app for desktop, and added to your course as an H5P activity (new in 3.9 onwards) or embedded into any other activity or resource (docs.moodle.org, 2021).

H5P makes it easy to create, share and reuse HTML5 content and applications. H5P empowers everyone to create rich and interactive web experiences more efficiently - all you need is a web browser and a web site with an H5P plugin. H5P content is responsive and mobile friendly, which means that users will experience the same rich, interactive content on computers, smartphones and tablets alike. H5P enables existing Content Management Systems (CMS) and Learning Management Systems (LMS) to create richer content. With H5P, authors may create and edit interactive videos, presentations, games, advertisements and more. Content may be imported and exported. All that is needed to view or edit H5P content is a web browser (H5P Org, 2021).

Through H5P.com, H5P content may be embedded in any platform that supports embedded content (iframes). H5P.com also provides integrations for LMSs like Moodle, Canvas, Brightspace, Blackboard, and other systems that support the Learning Tools Interoperability (LTI) standard. In addition, H5P has plugins for Moodle, WordPress, Drupal and several other publishing systems (H5P Org, 2021).

5.1. H5P in Moodle

This section is about adding interactive content to Moodle courses using the H5P Plugin.

Important information for H5P users in languages other than English

Currently (April 2021) the names and descriptions of the H5P modules when using the Moodle Content bank are in English language only, but when using LUMI[1], these names and descriptions may be translated to other languages (docs.moodle.org, 2021).

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[1] LUMI is a desktop app that allows you to create, edit, view and share interactive content with dozens of different content types. It's free and open source.

Important notice (warning)

Due to how H5P behaves in Moodle, most content types allow for unlimited attempts by students. You should not use H5P for major assignments such as exams. For summative assessment, such as exams, it is recommended for security reasons to use the Quiz activity rather than H5P (docs.moodle.org, 2021).

There are many H5P tools currently available in MoodleCloud sites. Here is a list of them:

Accordion	Essay	KewAr Code
Agamotto	Fill in the Blanks	Mark the Words
appear.in for Chat and Talk	Find Multiple Hotspots	Memory Game
Arithmetic Quiz	Find the Hotspot	Multiple Choice
Audio	Find The Words	Personality Quiz
Audio Recorder	Flashcards	Questionnaire
Branching Scenario (beta)	Guess the Answer	Question Set
Chart	Iframe Embedder	Single Choice Set
Collage	Image Hotspots	Speak the Words
Column	Image Juxtaposition	Speak the Words Set
Course Presentation	Image Pair	Summary
Dialog Cards	Image Sequencing	Timeline
Dictation	Image Slider	True/False Question
Documentation Tool	Interactive Book	Twitter User Feed
Drag and Drop	Interactive Video	Virtual Tour (36)
Drag Text		

Source: (moodle.com/faq, 2021)

5.2. How to set up H5P for Moodle?

https://h5p.org/moodle

Install the H5P plugin

1. Log in to your Moodle installation as an administrator. Under Site Administration, Plugins in the admin menu, press Install plugins and then the button labelled Install plugins from the Moodle plugins directory.
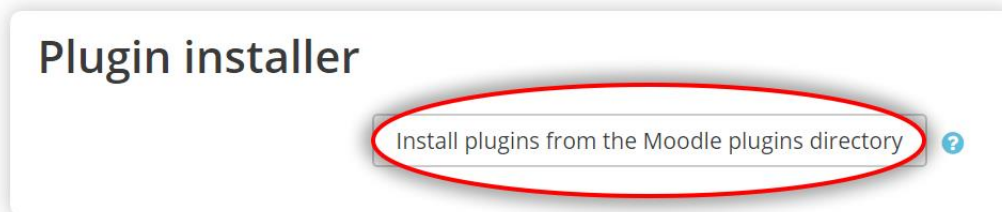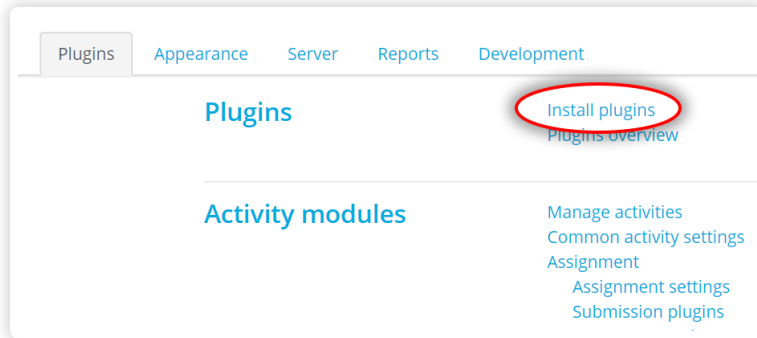
5.3. How to create and edit H5P contents in Moodle?

H5P is open-source content software allowing you to create interactive content in Moodle. So, H5P contents can be easily created by "content bank" in Moodle.

The H5P activity enables H5P content created in the [Content bank](#)[2], or on the [h5p.com site](#), or the [LUMI](#) app for desktop, to be easily added to a course as an activity.

After creating the course in Moodle and get inside it, instructor can reach to the content bank in the navigation drawer and can upload existing H5P content or can create a new content from the Add dropdown.

5.3.1. Adding a new H5P in Moodle

1. In order to add an H5P Database Management (DM) lesson first go to "Adding a new H5P".

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[2] The content bank is an area in Moodle where content (currently H5P content) may be stored, edited and created.

Database Management

H-P Adding a new H5P ❓
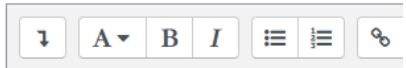
▾ General

Name   ❗   Concern of The Semantic Web

Description

> Start answering basic questions.

☐ Display description on course page ❓

2. Then from "File picker" click content bank.
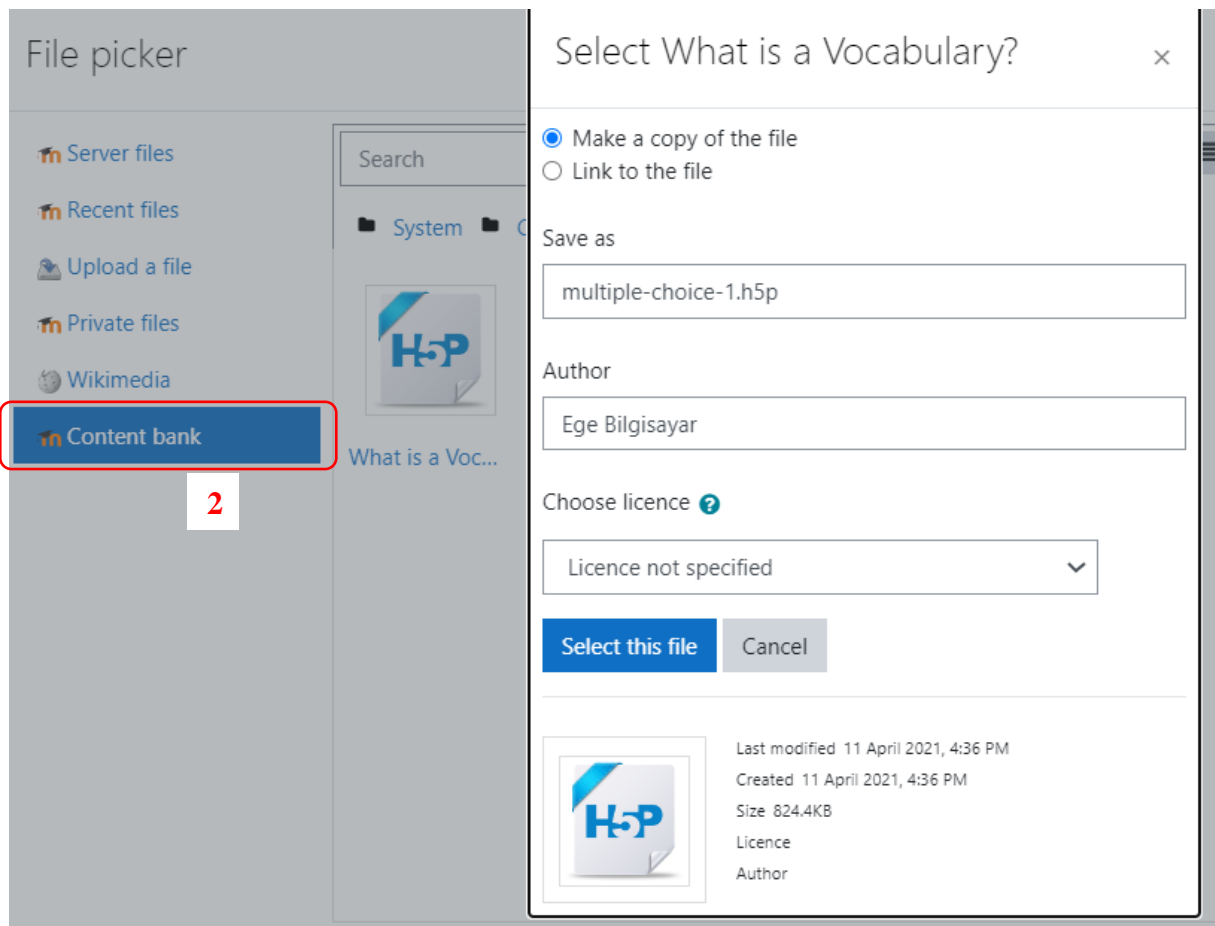
5.3.2. Create an H5P activity in Moodle

After instructor creates the course and get inside of the course, instructor goes to the content bank in the navigation drawer can upload existing H5P content or can create new content from the Add dropdown.

1. In order to add an H5P activity to Database Management (DM) lesson first go to content bank.

2. Then click add select the activity you want to add.
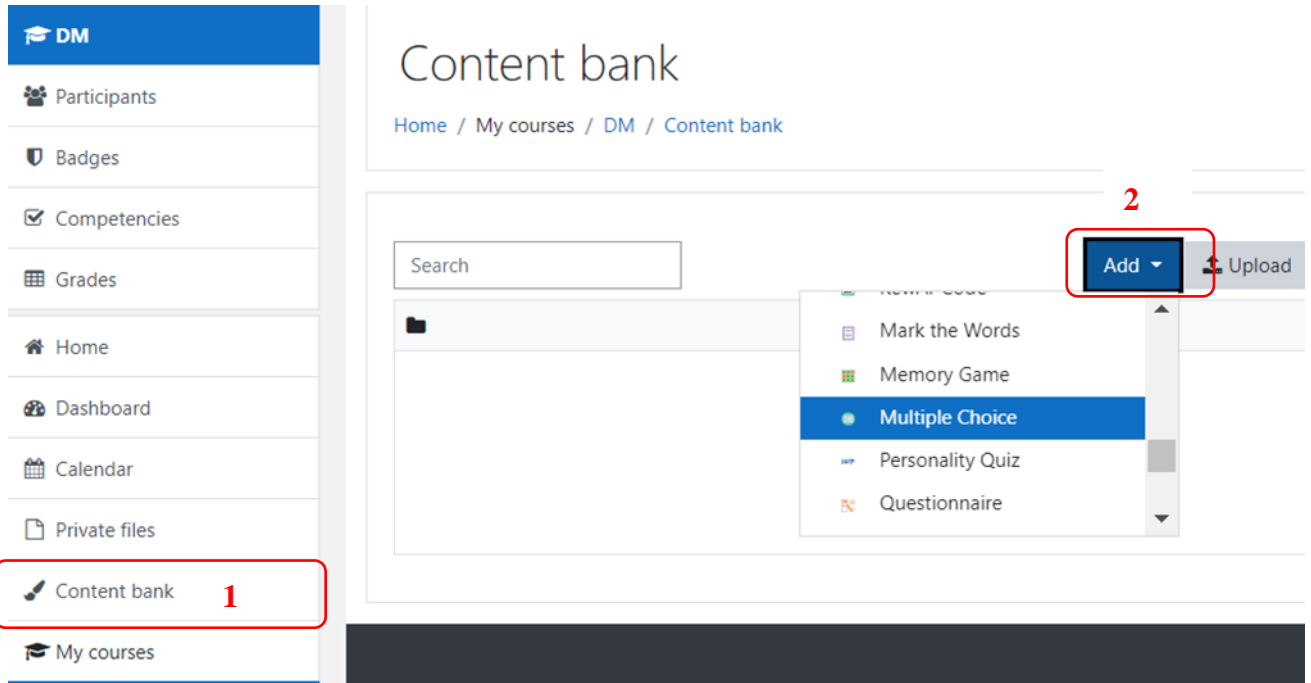
3. Click H5P.
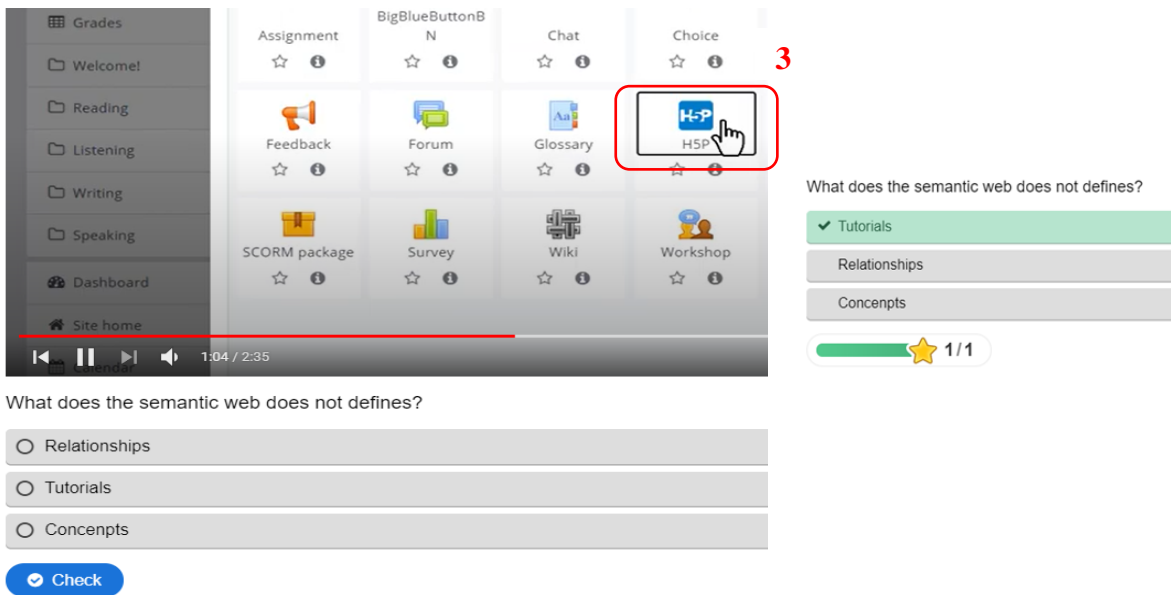
5.3.3. Creating and editing H5P content in the Content bank

To create and edit H5P content,

1. Go to the Content bank, accessible when in a course from the Navigation drawer (Boost theme) or from Site pages in the Navigation block (Classic theme).

2. Click the Add button and select a content type.

5.3.4. Creating and editing H5P content elsewhere

You can go to the h5p.com/org site, or you can install the LUMI app for desktop (Windows, Mac and Linux versions available), Make sure you download the newly created H5P file that you will later upload to your Moodle course. You must be aware that some parameters limit the file upload size for H5P objects in your server. Course file size limit is one of them.

https://h5p.org/moodle

Create an H5P activity

1. Log in as an administrator or a user that has the permission to create H5Ps inside a course.
2. Go to the course you wish to add the H5P content to.
3. Press "Add an activity or resource."

4. Select H5P - "Interactive Content" and click "Add".
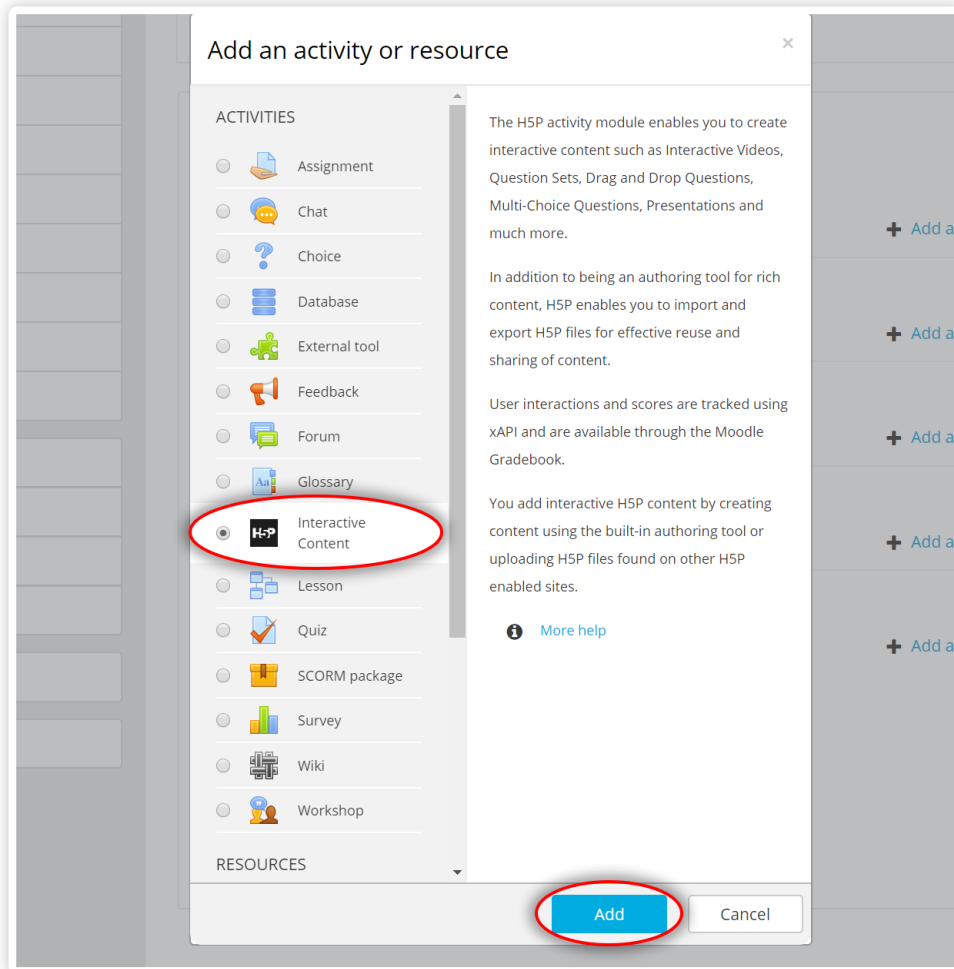
5. Click "**Select Content Type**" to open *the H5P Hub*
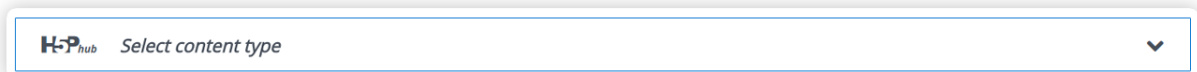
6. Once you open the H5P Hub - you will get the list of all content types that are available for installing. Click "Get" on any content type to proceed to the Content type details page.

   There are two lists of content types to choose from: "All" and "My content types".

   "My content types" will give you the list of all content types you have installed on your site.

"All" will give you the list of all H5P content types that are available. All new content types we release are available here for installation.
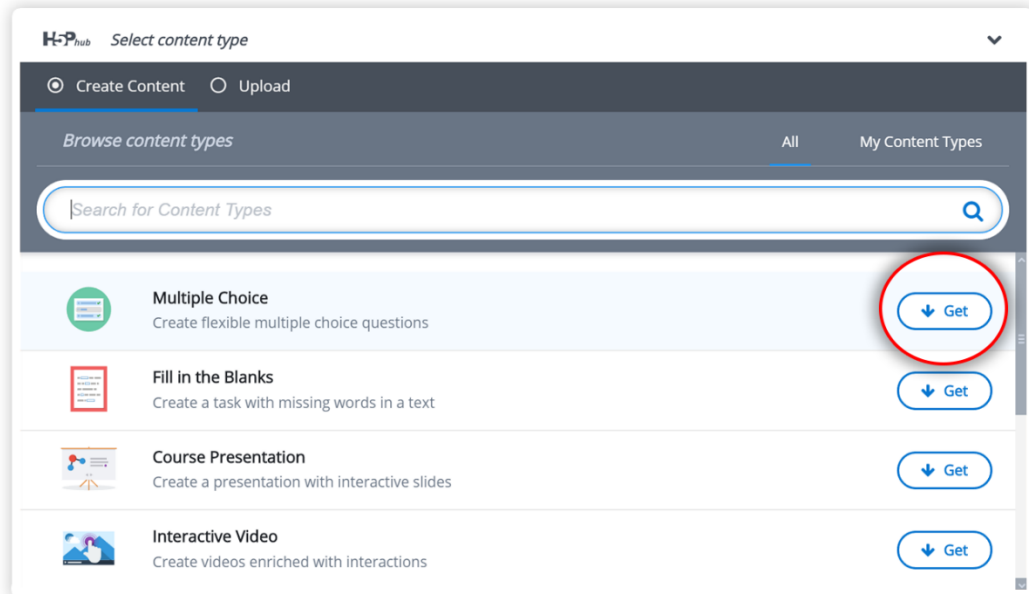
7. On Content type details page, you can read the details about each content type, see the screenshots and examples of use. Click "Install" to install the selected content type.
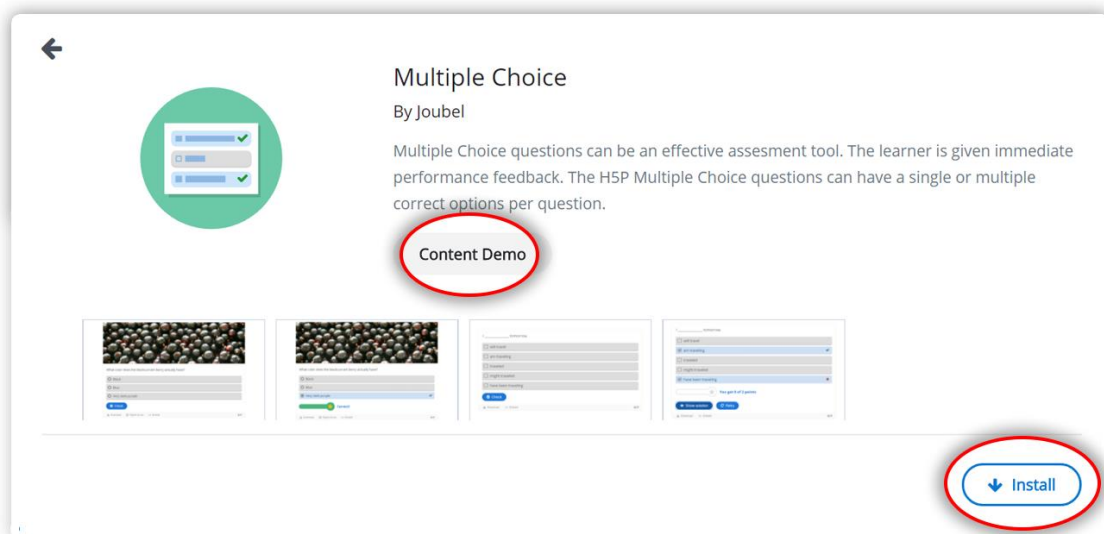
8. The content type is now installed and ready for use. Click "Use" to open the editor and start creating the content.

Multiple Choice successfully installed!   ✖

Use
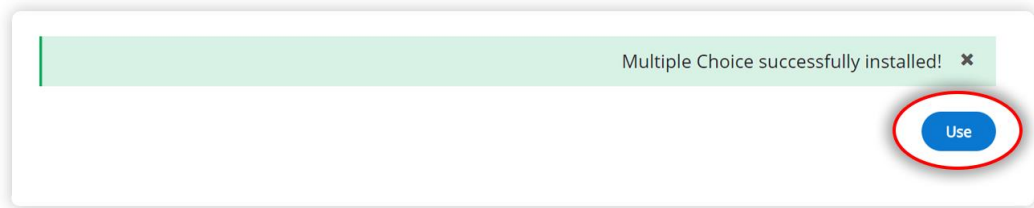
9. Using the H5P Hub you can upload existing h5p content. Click "Upload" tab at the top to upload an existing .h5p file.
    Finish creating or uploading your H5P content

5.4. Embedding H5P into other activities

5.4.1. H5P button in the Atto editor

You can embed H5P content into other activities and resources such as a Lesson or a Book, by clicking the H5P button in the Atto editor.

To embed H5P from the Content bank:

1. Click the H5P button in Atto then click 'Browse repositories'.

2. Browse the Content bank repository and select an H5P file.

3. Choose to either make a copy of the file or create a shortcut.

4. Click the button 'Select this file'.

5. Click 'Insert H5P'.

Note: If you create a shortcut to the file, you can edit it in the Content bank and any activities with a link to the file will be updated.

Atto editor toolbar:
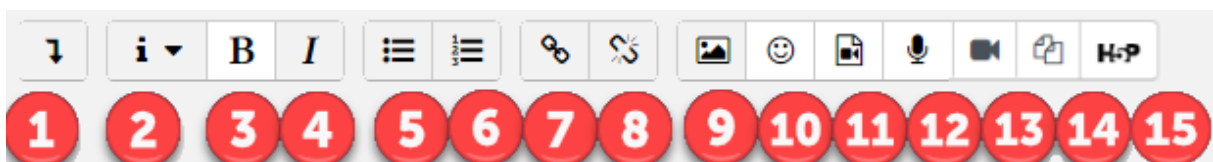
Atto Row 1 default buttons:

1. Expand	2. Style	3. Bold	4. Italic
5. Bulleted list	6. Numbered list	7. Add link	8. Unlink
9. Add image	10. Add smiley (if enabled)	11. Add media	12. Record audio
13. Record video	14. Manage embedded files	15. H5P	

Source: (moodle atto editor, 2021)

5.4.2. H5P & Accordion

A free HTML5 based accordion content type allowing users to add accessible WAI ARIA (Web Accessibility Initiative – Accessible Rich Internet Applications) enabled accordions in publishing systems like Canvas, Brightspace, Blackboard, Moodle and WordPress.

https://siteimprove.com/en-us/accessibility/introduction-to-wai-aria/#:~:text=WAI%2DARIA%20refers%20to%20the,accessible%20to%20people%20with%20disabilities.
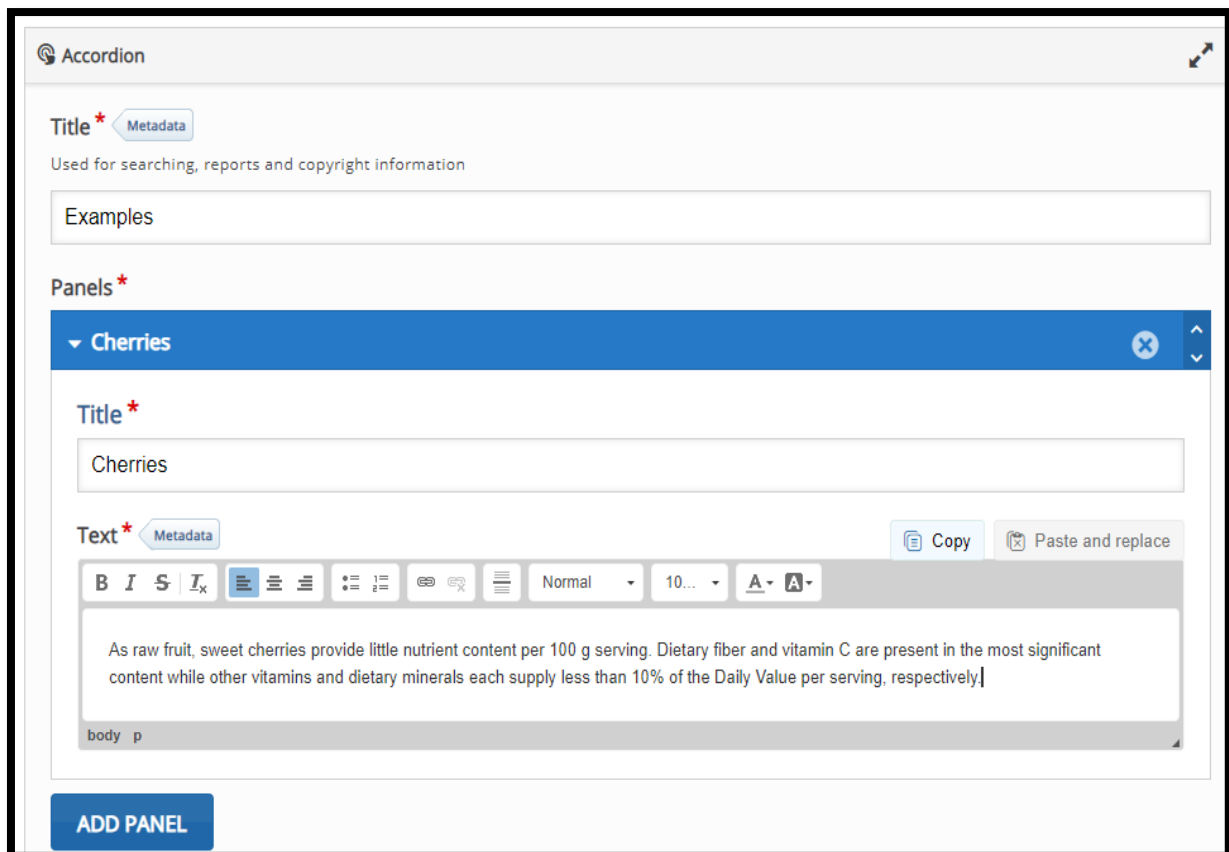
Cherries

As raw fruit, sweet cherries provide little nutrient content per 100 g serving. Dietary fiber and vitamin C are present in the most significant content while other vitamins and dietary minerals each supply less than 10% of the Daily Value per serving, respectively.

> Cranberries

5.4.3. H5P & Agamotto

https://h5p.org/agamotto-tutorial

Add a sequence of images that people are supposed to look at sequentially, for example, photos of an item that changes over time or images that reveal more and more details.

You can optionally add some text information that describes the current image. You can use Agamotto for any kind of content where you want to display several images that people are supposed to look at sequentially.

Four Seasons

5.4.4. H5P – Arithmetic Quiz

Create arithmetic quizzes to test the learner's knowledge in Basic Arithmetic Operations or in Linear Equations.

The author chooses the number of questions and the type while the Questions are generated automatically.

https://h5p.org/tutorial-arithmetic-quiz

Arithmetic Quiz
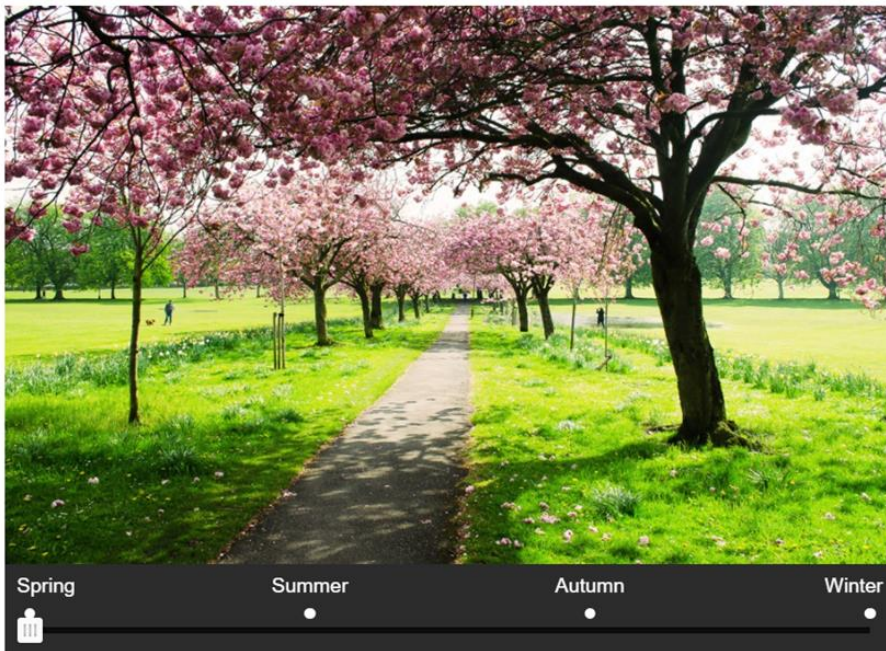
Title * Metadata

Used for searching, reports and copyright information

Arithmetic Quiz-01

Intro

The intro text (maximum 100 characters)

Solve these addition quizzes as fast as you can! Start

Quiz type *

Arithmetic Operations Quiz ⌄

Arithmetic Operations Quiz
Linear Equations Quiz

Addition ⌄

Max number of questions *

5

For Arithmetic Operations Quiz you can choose between:

- Addition
- Subtraction
- Multiplication
- Division

Arithmetic type *

Addition ⌄

Addition
Subtraction
Multiplication
Division
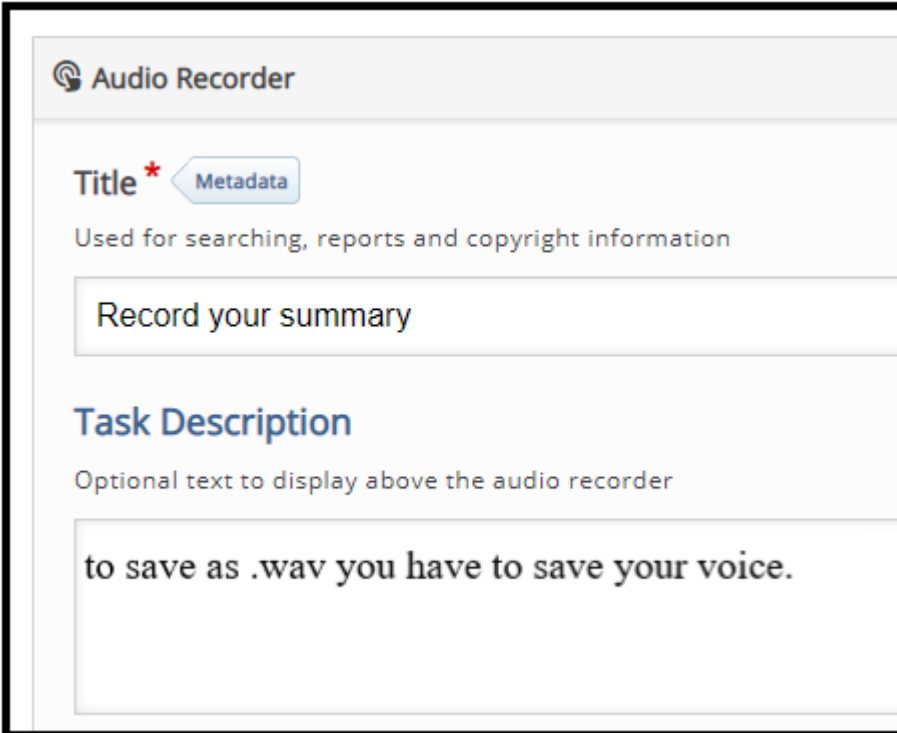
Solve these addition quizzes as fast as you can!

Start

5.4.5. H5P – Audio Recorder

A free HTML5 audio recorder. Record your voice and play back or download a .wav file of your recording. A great tool for LMS' and other e-learning websites.

https://h5p.org/blog/may-2017-release
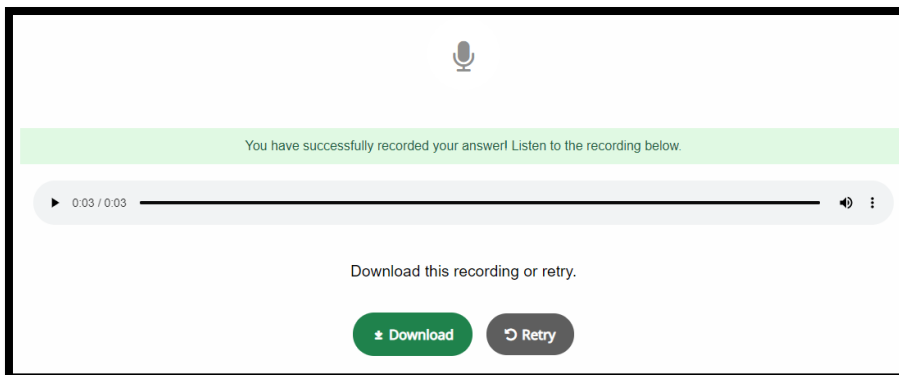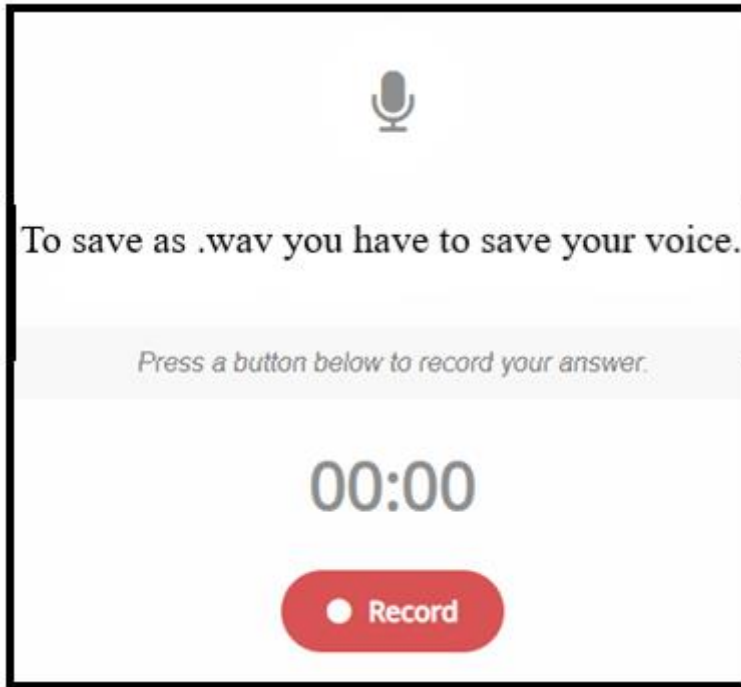
5.4.6. H5P - Fill in the Blanks

The Fill in the blanks allows eLearning designers to create cloze tests. Portions of words or sentences are removed from a text and the learner is asked to replace the missing text.

https://h5p.org/tutorial-fill-in-the-blanks

Example

Here's the Fill in the blanks we'll create in this tutorial:

Fill in the missing text about Strawberries!

Insert the correct plural form of the noun *strawberry*: [   ]

The strawberry is a juicy, edible fruit which has a [   ] color when it is ripe.

Tom has 2 strawberries. Jill gives him 4 more strawberries. Now, Tom has [   ] strawberries.

✔ Check

Example

Here's the Fill in the blanks we'll create in this tutorial:

Fill in the missing text about Strawberries!

Insert the correct plural form of the noun *strawberry*: ~~a~~ ✖

The strawberry is a juicy, edible fruit which has a red ✔ color when it is ripe.

Tom has 2 strawberries. Jill gives him 4 more strawberries. Now, Tom has ~~blue~~ ✖ strawberries.

You got 1 of 3 blanks correct.

★ 1/3   👁 Show solutions   ↻ Try again

Fill in the missing text about Strawberries!

Insert the correct plural form of the noun *strawberry*: ~~a~~ ✖ **strawberries**

The strawberry is a juicy, edible fruit which has a red ✔ color when it is ripe.

Tom has 2 strawberries. Jill gives him 4 more strawberries. Now, Tom has ~~blue~~ ✖ **6/six** strawberries.

You got 1 of 3 blanks correct.

★ 1/3   ↻ Try again

5.4.7. H5P – Essay

The text which learners have created will be scanned for keywords that have been defined by an author beforehand.

https://h5p.org/tutorial-essay

Example
Here's the Essay content we'll create in this tutorial:

Please describe the novel *"The Hobbit"* by J.R.R. Tolkien with at least 100 characters and up to 500 characters.

In a hole in the ground there lived a hobbit ...

Remaining characters: 500

Check

Example

Here's the Essay content we'll create in this tutorial:

Please describe the novel *"The Hobbit"* by J.R.R. Tolkien with at least 100 characters and up to 500 characters.

In a hole in the ground there lived a hobbit ...

You must enter at least 100 characters!

✓ Check

5.4.8. H5P – Course Presentation

The Course presentation content type allows you to create a slide-based presentation of your learning material. Elements such as slide titles, links, pictures, audio and video clips, as well as various quiz types can be embedded seamlessly right into the presentation for a richer learning experience.

When to use Course presentations? Course presentation enables you to author and deliver your course material directly in your browser. Course presentations contain slides where you can add various multimedia- and interactive elements to engage the learner.

Course presentations are used when you want to package a piece of learning content in a structured and interactive format. Learners swipe through slides to experience the learning material while solving various quizzes or watching videos along the way.

Try Course presentations as an alternative to presenting your learning content as Powerpoint presentations, PDFs or text-based web pages. Course presentations are very flexible to use, as they are simple to create, publish and edit.

https://h5p.org/tutorial-course-presentation

https://h5p.org/presentation

5.4.9. H5P – Interactive Book

A free content type for creating interactive books. It allows users to put together large amounts of interactive content like interactive videos, questions, course presentations and more on multiple pages.

https://h5p.org/content-types/interactive-book

https://bit.ly/3odnP8o

5.4.10.H5P – Interactive Video

The Interactive video content type allows you to add interactions on top of video clips. Interactions such as images, elaborating text, links and quizzes pop up while the learner watches the video.

https://h5p.org/tutorial-interactive-video

First, instructor must add a video then can start to add the contents.
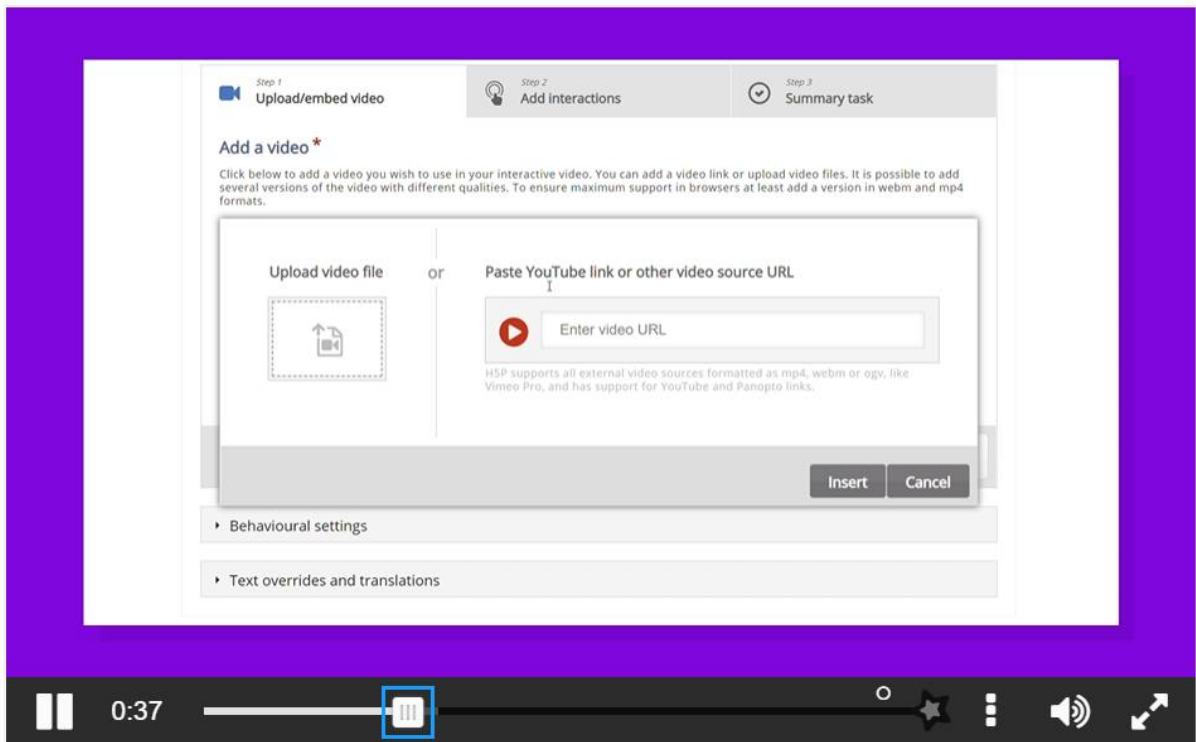
Press the "+" button and then press the "Upload video file" button:

Edit the copyright information by pressing the **Edit copyright** button below the black video clip icons:
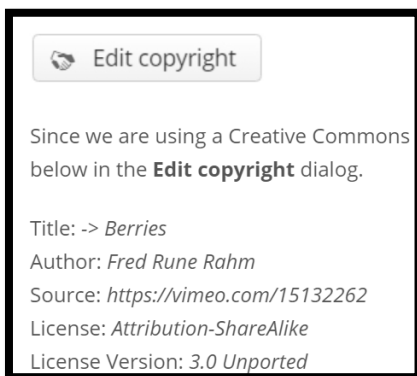
Instructor can give a title below and can add a poster for the video.

Second step is adding movie interactions.
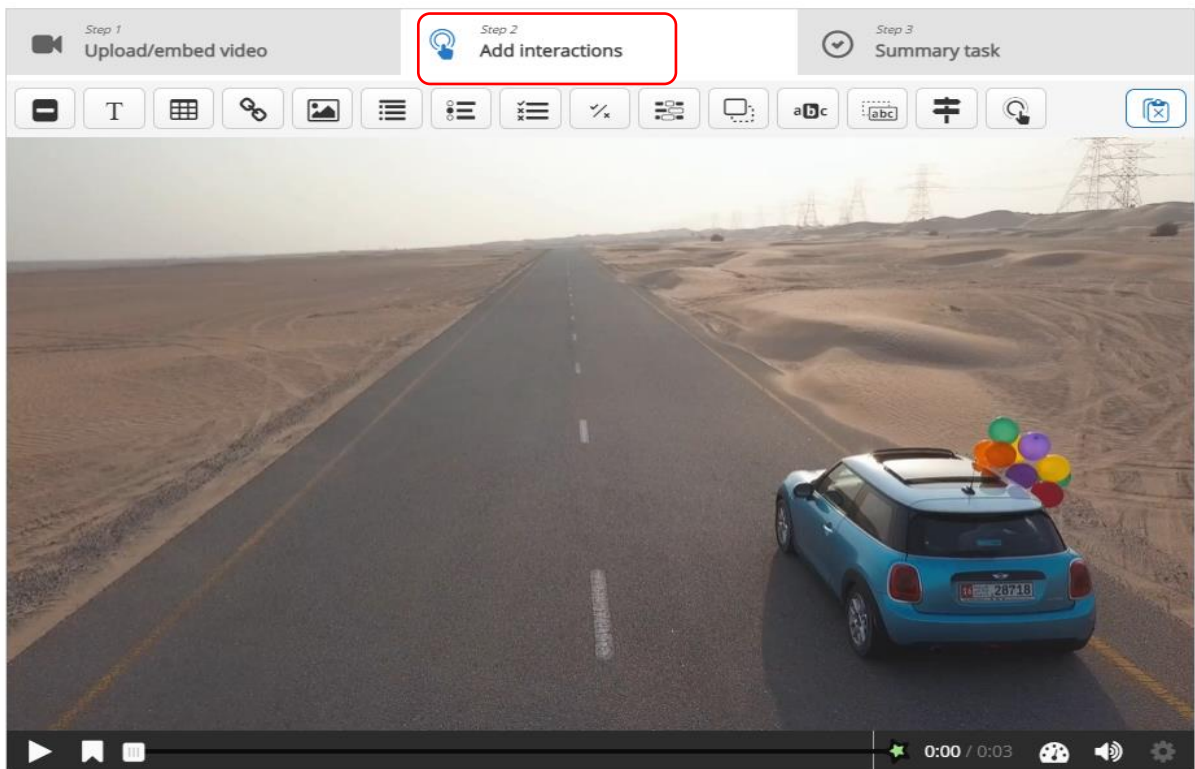
We use the toolbar above the video clip to add interactions:

There are three different types of interactions:

- Quiz interaction (Question), presented as a blue button
- Simple interactions (Text, Image, Table), presented as a purple button and
- Adaptivity (Go To) interaction

5.4.10.1. Text interaction

We'll add a short text about "Road Map" which the learner can choose to read.

First, add a Text interaction by pressing the Text button on the toolbar, then drag it on top of the video and drop it in the middle of the video. A dialog will appear when you drop the interaction.

1. Display time can be selected.
2. When display of the text appears video can be paused or not.
3. The text appears when the participants click the button.

Display time *

| 0:00 | - | 0:02 |

1

☐ Pause video

2

Display as

◉ [Button icon] Button   ○ [Poster icon] Poster

Button is a collapsed interaction the user must press to open. **Poster** is an expanded interaction displayed directly on top of the video

Label

Label displayed next to interaction icon.
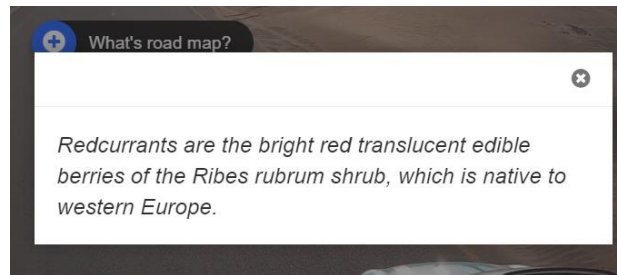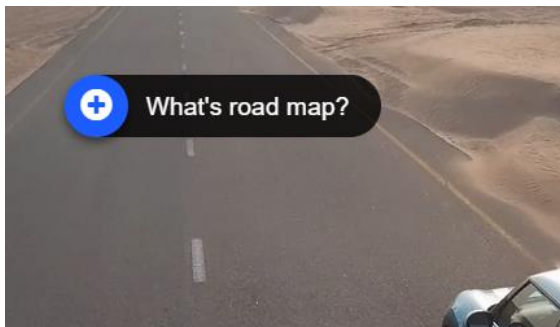
What's road map?

Text * ⟨Metadata⟩

| B | *I* | S̶ | I̶ₓ | ≡ | ≡ | ≡ | ≔ | ≔ | 🔗 | 🔗̶ | ≣ | Normal ▾ |

Redcurrants are the bright red translucent edible berries of the Ribes rubrum shrub, which is native to western Europe.

3

body   p   em

▸ Go to on click

Done   **Delete**

Other interactions are:

• Text interaction • Label interaction • Table interaction • Link interaction • Image interaction • Statement's interaction • Single choice Set interaction	• Multiple choice interaction • True/False Question interaction • Fill in the blank's interaction • Drag and Drop interaction	• Mark the works interaction • Drag Text interaction • Crossroad's interaction • Navigation Hotspot interaction

5.4.10.2. Summary Task

At the end of an Interactive video, you can add a Summary. The Summary is intended to make the learner reflect on the learning content presented in the video.
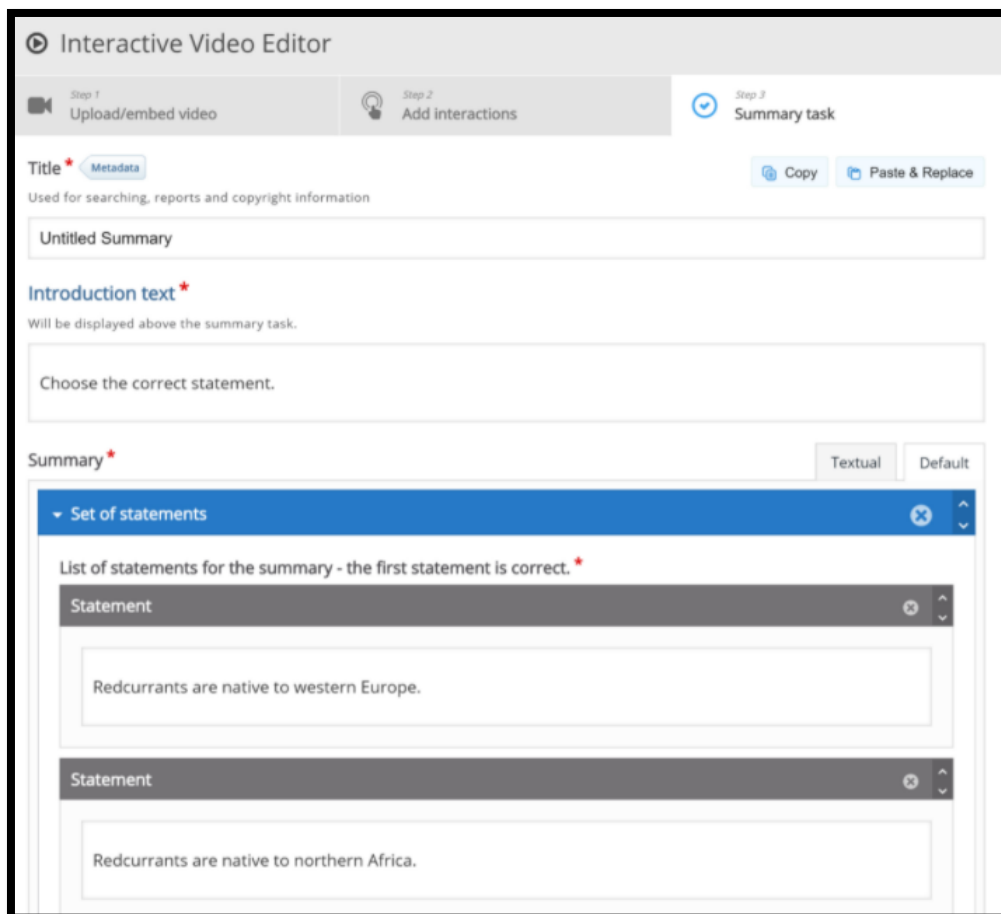
The first statement in the above figure is the correct one.

5.4.10.3. Bookmarks

Even if the video you are using is short, you can add some bookmarks to it. Bookmarks are used to indicate a new topic, an important interaction, or an event within the video.

Head back to the Add Interactions step by pressing the tab at the top of the editor.

Bookmarks are displayed in the Bookmarks menu, which is opened by pressing the Bookmark button next to the Play button:

You can add a bookmark by moving the play-head to a desired point in the video and pressing the Bookmark button. You may add a bookmark where each interaction appears in the video.

1. Move the play-head to 0:00 and press the Bookmark button.
2. From the menu, press Add bookmark:
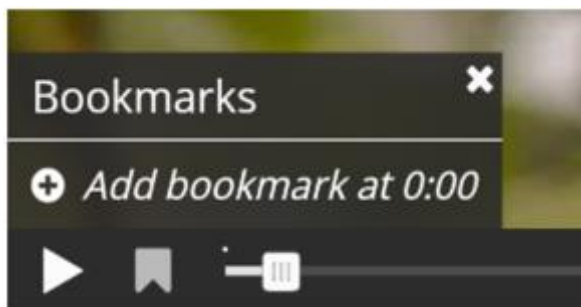
Note:

You can edit a bookmark label by moving the playhead so that the bookmark you want to edit is displayed, place the cursor in the bookmark text and edit the text directly. You delete a bookmark by pressing the button to the right of the bookmark label.

6. References

Allen, M. (2016). *Michael Allen's guide to e-learning: Building interactive, fun, and effective learning programs for any company.* John Wiley & Sons.

Clark, R., & Lyons, C. (2010). *Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials.* Pfeiffer.

Clark, R., & Mayer, R. (2016). *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning.* Wiley.

docs.moodle.org. (2021). Retrieved 09 09, 2021, from https://docs.moodle.org/311/en/H5P

FAO. (2011). *E-learning Methodologies: A Guide for Desingning and Developing E-learning Courses.* Rome: Food and Agriculture Organization of the United Nations.

Gagné, E. (1985). *The cognitive psychology of school learning.* Boston: MA: Little, Brown and Company.

Ghirardini, B. (2011). *E-learning methodologies A guide for designing and developing e-learning courses.* Rome: Food and Agriculture Organization of the United Nations.

H5P Org. (2021). Retrieved 09 09, 2021, from https://h5p.org/

Hellebrandt, J., & Russell, J. (1993, July). Confirmative evaluation of instructional materials and learners. *Performance Improvement Quarterly, 32*(6), 22-27. doi:https://doi.org/10.1002/pfi.4170320608

McGriff, S. J. (2000, 09). *Instructional System Design (ISD): Using the ADDIE Model.* Retrieved from Instructional Systems, College of Education, Penn State University: https://www.lib.purdue.edu/sites/default/files/directory/butler38/ADDIE.pdf

moodle atto editor. (2021). Retrieved 9 9, 2021, from https://docs.moodle.org/311/en/Atto_editor

moodle.com/faq. (2021). Retrieved 9 9, 2021, from https://moodle.com/faq/h5p-tools-currently-available-in-moodlecloud/

Peterson, C. (2003). Bringing ADDIE to Life: Instructional Design at Its Best. *Jl. of Educational Multimedia and Hypermedia, 12*(3), 227-241. Retrieved from https://www.learntechlib.org/primary/p/2074/

Reinbold, S. (2013). Using the ADDIE Model in Designing Library Instruction. *Medical Reference Services Quarterly , 32*(3), 244-256. doi:https://doi.org/10.1080/02763869.2013.806859

Torgerson, C., & Iannone, S. (2019). *Designing microlearning.* American Society for Training and Development.