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Version	**Date**	**Changes**	**Contributors**
0.1	30/06/2010	Structure Proposal.	MOMA
0.2	19/07/2010	Integration of contributions by all workpackage leaders. First version of the document ready.	CRMPA, TUG, COVUNI, MOMA, UOC
0.3	16/08/2010	Requirement extracted. Second version of the document ready.	MOMA
1.0	31/08/2010	Minor revisions to integrate some ideas from WP3 on Live and Virtualized Collaboration and from WP5 on New Forms of Assessment. Final version ready.	MOMA, TUG, UOC

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1 Executive Summary

ALICE aims at building an innovative adaptive environment for e-learning combining personalization, collaboration and simulation aspects within an affective/emotional based approach able to contribute to the overcoming of the quoted limitations of current e-learning systems and content. The proposed environment will be interactive, challenging and context aware while enabling learners' demand of empowerment, social identity, and authentic learning experience.

Six work packages within ALICE are devoted to the elaboration of the six core aspects of the project:

- Affective and Emotional Approaches (WP 2)
- Live and Virtualized Collaboration (WP 3)
- Simulation and Serious Games (WP 4)
- New Forms of Assessment (WP 5)
- Storytelling (WP 6)
- Adaptive Technologies for e-Learning Systems (WP 7)

The ALICE starting point will be an already existing e-Learning platform named IWT developed exploiting experiences and know-how gained in several EC projects.

This Requirements Report aims at defining the overall functional requirements that need to be fulfilled for a successful achievement of the objectives of the ALICE System. The functionalities described are used to achieve and share a common understanding of what the ALICE Project will realize, in terms of software system. Such requirements will be used by each partner as starting point to drive the development of the ALICE Software.

The methodology adopted to define requirements is scenario-based. A panel of experts - composed by domain experts, technologists, students and teachers selected by/among all involved partners - have designed a set of usage scenarios and personas that describe some typical interactions that users can have with the system in order to achieve a goal.

Scenarios have been proposed for the two contexts chosen for the experimentation, "Science teaching at University" and "Emergency and civil defence training in secondary schools". In such scenarios, interactions have been described by focusing on a specific context (described with a cross cutting focus on all the research topics) and by research topic (described with a single context focus).

After a selection and refinement process of the scenarios, significant process have been identified and have been described using UML diagrams and narratives. Finally, functional requirements have been extracted, analysed and structured.

The end result of all requirements gathering is summarized in the following recommendations, collected by WP.

WP2 deals with issues regarding the capability of intercepting emotional and affective aspects and to manage and adapt them with respect to the educational offer. To address such issues the WP2 team recommends providing services able to detect abnormal behavioural patterns and providing tests designed to gather affective emotional information in response to such detection. The behavioural pattern detection service will work by analysing actions and performances of users

inside the ALICE system, that is, analysing user tracking information. The system will be able to analyse the answers provided by users and to assess their affective/emotional state.

All ALICE subsystems can benefit from the use of affective/emotional services and can get a result in terms of affective/emotional state. Such result can be used to evaluate a possible strategy to change the user status. The WP2 team recommends adding metadata information to resources in order to allow the search for educational material depending on the user's emotional state.

The WP3 team recommends developing a complex learning resource able to reproduce - as animated cartoon-style movie sequence - a virtualized version of a live collaborative session (Virtualized Collaborative Session, VCS). The playback shall be mainly based on information automatically extracted by the recorded session, such as content inside posts, post timestamp and topics automatically extracted from the content. A VCS is useful to reuse the knowledge elicited during collaborative learning activities without losing their main advantages after the closure of the live sessions. The system shall provide an authoring tool to augment the information extracted by the recorded live session with alternative flows, additional contents, character's emotional state, etc.

A VCS is conceived as a dynamic object where the story evolves in different directions/flows as consequence of the learner answers/interactions. The WP3 and WP5 teams recommends developing VCS as an interactive object where users can make choices and answer tests that affect the progress of the narrative flow.

The WP4 and WP6 teams recommend developing engaging, interactive, game/game-like complex learning objects able to engage students in learning activities where virtual worlds, sounds, images, video and audio are assembled to tell stories, experiences and events, from an educational point of view, and which allows the student to develop at the same time, cognitive development and competence for actions in specific contexts.

The WP4 team recommends developing a Serious Game CLO presenting immersive environments and virtual worlds in 3D that simulate earthquake situations within a school. The game will be based on methodologies for the creation and management of educational simulative resources that can be reused to develop more games later. The simulated environment should reproduce as much as possible a real school environment.

The WP6 team recommends developing Storytelling intended as a complex learning object that expresses a new way of telling stories (with cross-linked narrative sequences) which integrates different forms of expression - some typical of the narrative, some of the script, and some of the game - with the advanced techniques, exploiting the potential of multimedia technology and simulation.

Both such complex learning objects could be very appropriate to teach correct behaviours in specific situations and to achieve emergency and civil defence training in secondary schools,.

The WP2, WP4, WP5 and WP6 teams recommend providing - both for Serious Game and Storytelling -

- scenes/situations designed to assess user's knowledge/ability about one or more specific associated concept/skill,
- scenes/situations designed to assess user's affective/emotional state,
- tracking and, consecutively, evaluating actions taken by users in the game and particularly in the assessment scenes.

The WP4, WP6 and WP7 teams recommend providing - both for Serious Game and Storytelling - the ability to update the user's cognitive/emotional state and adaptivity basing on her current state

and performance information.

The WP7 team recommends providing enhancements to some of the features that underlie the adaptive capacities of the reference platform IWT. The team recommends introducing the notion of

- context intended as a set of attributes related to a group of learners that record information about their didactic objectives, the tools to use (blended learning, mobile systems, …) and so on.
- skill intended as the ability to complete tasks and solve problems. Skills may be connected to concepts of the knowledge model or not.

Both context and skill information are used to:

- provide the ability to build personalized context-aware courses taking in account the learner preferences, and the context information. The resources selected for the course are the most appropriate for the specified context;
- provide the ability to meet demands for user's learning needs requests with personalized context-aware courses that take into account the context information and skill development request;
- provide context-aware learning objects, able to adapt the navigation basing on context information.

Given the different nature of the learning experiences available within the system ALICE system, the WP5 team recommends different assessment strategies and tools to be used in different learning experience.

The WP5 team recommends developing peer review strategies for online tests, collaboration activities and homework learning objects. Such learning objects shall provide various execution modes where participating students have a task and then participate in the review of the peer's task; at the same time, a group of tutor performs the same students' task by providing reference values for an automatic assessment.

Also, the WP5 team recommends developing an "Automatic Question Generator" tool able to create simple questions (single, multiple-choice, and fill-in-blank) based on text content. The questions are used by ALICE assessment module to automatically create tests in a self-regulated learning experiences where the students use keywords (concepts to be learned) to search their learning materials.

The ALICE team recommends providing localized content to teach in English speaking and Italian speaking contexts.

2 Introduction

ALICE aims at building an innovative adaptive environment for e-learning combining personalization, collaboration and simulation aspects within an affective/emotional based approach able to contribute to the overcoming of the quoted limitations of current e-learning systems and content. The proposed environment will be interactive, challenging and context aware while enabling learners' demand of empowerment, social identity, and authentic learning experience. The defined system will be able to effectively involve learners in educational, cultural and informative activities in two specific contexts: university instruction (with particular emphasis on scientific topics) and training about emergency and civil defence (as for example the behaviour to take at a personal and collective level when the treat of a big risk shows up e.g. a natural event like earthquake, or a fraudulent one like terrorist attack).

The ALICE starting point will be an already existing e-Learning platform named IWT developed exploiting experiences and know-how gained in several EC projects. ALICE results will be experimented with real users in real learning and training settings in order to evaluate the impact of the offered innovative features.

Six work packages within ALICE are devoted to the elaboration of the six core aspects of the project:

- Affective and Emotional Approaches (WP 2)
- Live and Virtualized Collaboration (WP 3)
- Simulation and Serious Games (WP 4)
- New Forms of Assessment (WP 5)
- Storytelling (WP 6)
- Adaptive Technologies for e-Learning Systems (WP 7)

The core outcomes of these work packages are models, methods and tools. This report aims at capture and express the will of the partners on the software system to be developed.

2.1 Purpose

This project milestone report is the Requirements Report based on the activities T1.1 of WP1. The main objective of this report is to define - using brief and clear descriptions - the overall functional requirements that need to be fulfilled for a successful realisation of the objectives of the ALICE System.

The functionalities described in this report are used to achieve and share a common understanding of what the ALICE Project will realize, in terms of software system. Such requirements – as well as the models and methodologies developed in the research activities of the different WPs – will be used by each partner as starting point to drive the development of the ALICE Software.

The process of defining the requirements is conducted in the initial phase of the project for the development of the main draft; such draft will be iteratively refined at the same time of the other activities of the project until the end of phase one.

2.2 References

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2.3 Document Overview

This section provides an overview of the whole document.

Section 0 describes the overall approach used in the determination of the requirements. Describes the modeling method(s) so non-technical readers can understand what they are conveying.

Section 0 contains:

- Pilot scenarios (narratives text) the main-users' motivations for using ALICE
- Data flows and Use Case diagrams describing the main interesting functionalities
- Extracted requirements

The report also contains a glossary of the most relevant and important terms that aims at create a common background for the project.

2.4 Tables legend

DefXXX	Definition – It is used to define/explain a domain concept
CXXX	Describes a current feature, present in the IWT reference platform.
FXXX	Describes a future feature to be developed in the ALICE system

3 Methodology

The formulation of requirements and the analysis of the system are critical for the functional integration of the outcomes of the project.

The main objectives of this activity are:

- To define the overall requirements of the Integrated System in terms of usage scenarios, entities and actors involved, gap with the current state
- To analyse the requirements to create a Domain Model that defines the conceptual framework
- To create a concise and common understanding of ALICE concepts and the outcomes of the project among the partnership

3.1 Functional Requirements

The process that led us to the definition of requirements can be summarized as follows.

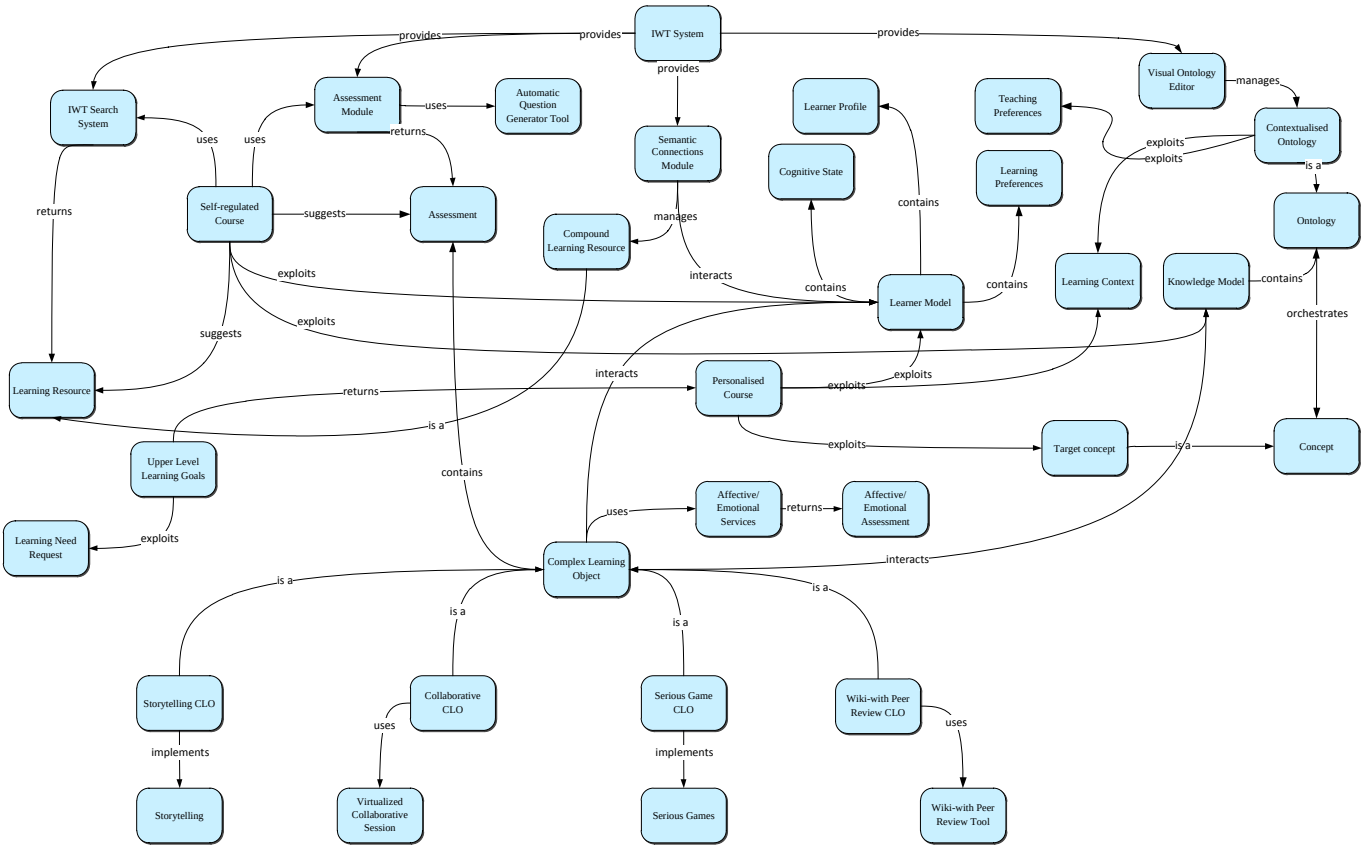
1. Identification of the experts/stakeholders panels - Based on the general objectives defined by the project, for the scenarios definition two contexts pilot of "Science teaching at University" and "Emergency and civil defence training in secondary schools" have been considered. For each pilot context, we created a panel of domain experts, technologists, students and teachers selected by/among all involved partners. This choice allows us to use the same scenarios for the experimentation design and execution activities (WP1, WP8).
2. Scenarios definition - The process used for the requirements specification starts with the capturing of user requirements for the ALICE system. The technique used to capture such requirements is based on Personas and Scenarios design [5]. The resulting Usage Scenarios describe some typical interactions that one or more users can have with the system in order to achieve a goal.
   The initial scenarios are designed by the expert panels. Some of them are focused on a particular research topic selected among those related to the project. In this case, the activities described tend to highlight the benefits of using components, services and tools of the system to be implemented to achieve the objectives of a specific research topic. Other scenarios have been designed with a cross cutting focus on all the research topics and highlight the integrated and harmonious use of the various components and tools of the ALICE system in one of the two pilot context.
3. Scenarios selection - Following the scenarios definition, we made a selection in order to avoid including in the next stages the scenarios considered far or not suitable to the project objectives. Some of the scenarios - considered of lower priority or not perfectly in line with project goals - are provided as annex documentation in 0. They will be reconsidered in the second iteration of the project.
4. Scenarios refinement - The processes for the scenarios definition and selection have been conducted in a collaborative way. For this purpose, all the stakeholders have been invited to carry out their work within a collaborative web environment. A wiki and a related discussion tool have been set up to allow stakeholders to contribute to all the scenarios (with observations, opinions, ideas, insights, proposals and whatever considered relevant) continuously and during the entire development process. Such choice allowed us to make a progressive refinement of the developed scenarios.
5. Requirements extraction and specification - The last stage deals with the extraction of use cases and data flows diagrams from the usage scenarios. Each use case indicates a macro-functionality of the ALICE system. Each data flow describes a significant process identified in a scenario. Processes are described using UML diagrams and narratives. All the relevant

scenarios and processes for the system have been identified, described and analysed. Finally, functional requirements have been extracted and structured.

It is important to highlight that this is a recursive process and requirements are improved during the two cycles of the project. The first version of the requirements contained in this document will be used to perform a Gap Analysis before the development stage of each WP.

3.2 Domain Model

In order to illustrate a whole picture of the ALICE integrated system, the report also provides a conceptual model of the domain. It is designed to document the key concepts and vocabulary of the domain system ALICE. The model identifies the main entities within the system and the relationship among these and provides a structural overview of the system that can be integrated with a more dynamic view provided in the Use Case Model.



4 Definitions

	General
Def001	**Classroom Learning:** it is a didactic experience of class. It is carried out to the inside of a class and is the same for all the students.
Def003	**Didactic Approach**: It is the discursive description at the high level of the general characteristics of the different modalities to explain the didactic contents.
Def004	**Knowledge Representation:** It is a formalism used to represent knowledge in computer-tractable form. For instance, the ontology is a graph structure that represents a knowledge domain through a specification of the concepts and the relationships between them

	Current State
Def005	**Knowledge Model:** The Knowledge Model describes, in a machine understandable way, the piece of the educational domain that is relevant for the e-learning experience we want to define, concretize and broadcast. The mechanism used by the Knowledge Model is named **Ontology.**
Def006	**Learner Model**: The Learner Model states which are the learner properties to model and the way we can represent them. In particular, every learner is represented by his/her cognitive state and by the set of his/her learning preferences.
Def007	The ***Cognitive State*** representation reports a measure about the knowledge acquired by a learner at a given time and it is represented by a list of subjects (concepts within e-learning ontologies) that the learner has encountered during the execution of one or more learning experiences. In the aforementioned list, each subject is associated with a grade whose values (real numbers) are taken from the interval [0,1], where 0 testifies the complete absence of acquired knowledge with respect to a given subject, whilst 1 tells us that there is an optimal knowledge about the specific subject. A subject will be considered as "learnt by the learner" if the above defined grade is greater than a previous fixed threshold (fixed by experimentations). It's important to underline that the grade, held by a learner for a given subject, is not constant in the time but it can vary depending on the assessment results of the learner. Assessment phases, realized by several kinds of tests (e.g. multiple choice test, etc.) are embedded into e-learning experiences and are used to assess learner knowledge about studied subjects.
Def008	The properties in a ***Learning Preferences*** state declare the properties that learning resources (learning objects or learning services) should have in order to fit with the learner's characteristics and thus achieving the most effective and efficient learning process.
Def009	**E-learning experiences**: E-learning experiences are defined as: (i) a set of Target Concepts (TC), i.e. the set of high-level concepts to be transmitted to the learner; (ii) A Learning Path (LP), i.e. an ordered sequence of atomic concepts (subjects) that is necessary to explain to a learner in order to let him/her learn TC. Given the personalization on a particular learner, the sequence does not contain subjects already "learnt" (i.e. known with a grade greater than the fixed threshold) by that learner; (iii) A Presentation (PR), i.e. an ordered list of learning objects that the learner has to use in order to acquire knowledge about subjects included in LP. This Learning Model allows the construction of **personalised e-learning experiences** through the execution of a building process based on Learning Path Generation Algorithm and Presentation Generation Algorithm.

	Current State
Def010	The **Learning Path Generation Algorithm** determines the ordered sequence of atomic concepts needed to reach a satisfactory knowledge about selected TC on the basis of a reference e-learning ontology, a set of TC and a given cognitive state. A more detailed description can be found in [3].
Def011	The **Presentation Generation Algorithm** selects and orders a set of learning objects, explaining all the concepts in the Learning Path, that best fits with the given learning preferences state. A more detailed description can be found in [3].
Def012	**Didactic Method**: Corresponding to a fixed Didactic Approach, there can be various didactic methods, that give the practical guidelines for the instantiation of the Approach (e.g. problem based learning, example-based, activity learning …). These didactic methods determine different learning activities within a teaching-learning process, structured in specific ways the learning contents. For this reason they can be schematized with some activity workflows, which describe the different sequence of didactic activities for each method. In order to define the suitable workflow for these methods it is necessary to identifies the role of the different learning actors in the learning process. The choice of a didactic method, in the production of an learning process based on technological infrastructure, influences the definition and the structure of single Learning Object, in order to respect the general indications of the different didactic approaches.
Def013	**Learning Activity**: It is a set of Learning Objects and Services (like the one provided by collaboration tools).
Def014	**Learning Experience Model:** It is the whole structure of a course according to different level of granularity as lesson blocks, single lessons; similarly it defines if and when intermediate exams, test, self-evaluation, barrage test … have to be fixed; establishes general learning strategies such as collaborative or not; tutoring modalities; etc.
Def015	**Unit of Learning:** An abstract term used to refer to any delimited piece of education or learning, such as a course, a module, a lesson. A unit of learning represents more than just a collection of ordered resources to learn; it includes a variety of prescribed activities (e.g. problem solving activities, search activities, discussion activities), assessments, services and support facilities provided by teachers, trainers and other staff members.
Def016	**Learning Object (LO):** Any reproducible and addressable digital or non-digital resource used to perform learning activities or support activities. A single learning object can be associated to an e-learning ontology through a metadata field, namely subjects list, that memorizes references to all subjects, coming from one or more ontologies, explained by the learning object content.
Def017	**Learning Objective:** The intended outcome for learners. It is possible to define learning objectives both at the global level of the unit of learning and for every single learning activity in the learning design.

	Current State
Def019	**Ontology**: it is a graph structure that represents a knowledge domain through the specification of a dictionary of concepts and the identification of relations between them (Gruber, 1993). It is an engineering artefact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary words. In the IWT approach vocabularies are composed by terms representing subjects that are relevant for the frame of the educational domain we want to model. Subjects are associated to other subjects through a set of three conceptual relations: *HasPart* (in brief HP) that is a part-of relation, *IsRequiredBy* (in brief IRB) that is an order relation and *SuggestedOrder* (in brief SO) that is a "weak" order relation. The ontologies constructed following the few aforementioned informal rules are named e-learning ontologies. You take care that when we refer to concepts in e-learning ontologies we are referring to the subjects of the educational domain we are modeling.
Def020	**Learning Object Metadata:** is the EEE standard used in IWT to annotate and index Learning Objects.
Def032	**Compound Learning Resource** (CLR): is a LO made of different learning resources connected with several kind of relations. Each resource is a web document connected to other documents with a (sort of) hyperlink. Connections are navigable links with associated semantics and can be activated and deactivated from the user to deepen a specific aspect of learning resource.
Def034	**Learning Need Request** (LNR): is a natural language text that expresses a learning need for a user. The IWT System maps such request on one or more target concepts and provides a set of personalized courses (Def009) to satisfy the request. Target concepts are extracted from the request by comparing it with ontology concepts (for each available ontology) exploiting sentence similarity algorithms.
Def038	**Contextualized Ontologies**: is an extension of the IWT Ontology (Def019) which provides the capability to store some teaching preferences information on concepts. Such information is used to drive the learning material selection in a personalized course in which a teacher wants to override user's preferences**.**

	Future State
Def021	**(A-C)Advanced Content/(CLE)Complex Learning Experience:** in the ALICE context, these terms have the same meaning. An Advance Content is, from a conceptual point of view, a new form of learning experience, composed by CLO (traditional textual content, simulation, high emotional contents, collaborative experience, storytelling), assessing material (both cognitive and affective-emotional) able to generate an effective kinds of learning such as reflective learning, experiential learning, socio-cognitive learning.
Def022	**Complex Learning Object (CLO):** It's defined as a Learning Object with a more high complexity, whose instructional material is an aggregation of Learning Objects. In this case video game based simulation, serious game, digital storytelling could be considered a Complex Learning Object. A Complex LO can be treated exactly as any other LO.

	Future State
Def023	**Collaborative Complex Learning Object/ Collaborative Complex Learning Resources (CC-LO/CC-LR):** In the ALICE context, these terms have the same meaning. A CC-LR is defined as special types of learning resources obtained by registering live collaborative sessions, executed in Web-based environments, and augmenting (during an authoring phase) the tracked data with author-generated information (questions & answers, alternative flows, assessments, dependencies, etc.). That is obtained in order to define interactive and attractive resources to be played by learners in several and different learning experiences. See VCS, Def 026.
Def024	**Virtual Scientific Experiment (VSE):** A VSE is considered a Complex Learning Object, characterized by specific Learning Object organized in sequence. Each LO covers a specific phase of a particular Didactic Method (the VSE Method).
Def025	**VSE Method:** It is a specific didactic method for an inductive-experiential didactic model. It explains how the learner is involved during a virtual scientific experiment, establishing the implication modalities of him.
Def026	**Virtualized Collaborative Session** (VCS): is a challenging, animated, cartoon-style, complex learning resource (Def022) created recording a live collaboration session and augmented by alternative flows, additional contents, etc. In the animated phase, virtual characters discuss about some subject topics and learners can observe how people discuss and collaborate about one or more topics, how discussion threads grow and how the knowledge is constructed, refined and consolidated. The subject topics exposed in a VCS are extracted from the live session and replayed; the interactions among the characters are based on the actions of the live session. The flow is based on a storyboard (ordered sequence) of scenes and scene parts extracted from the threaded discussion of the live session. A VCS is an interactive CLO and can contain interactive scenes (questions to answer, choices to make, …) and/or assessment material. A VCS is a dynamic object: the story may evolve in different directions/flows as consequence of given that the learner answers/interactions.
Def027	**Contextualized Ontologies:** is an extension of the current IWT Contextualized Ontology (Def038) which provides the capability to specify teaching preferences and structure information (on concepts and relations) for a specific learning context (Def028). Such information is used to specify "how to" teach specific concepts and "how to" modify the ontology structure in different contexts.
Def028	**Context**: It describes the students class, the procedure through which the class will access to the material linked to the ontology and the objectives of the learning experience constructed from the ontology. The context can be described with a set of attributes that record information related to the learning group, the didactic objectives, the tools to use (blended learning, mobile systems, …) and so on.
Def029	**Affective/Emotional Assessment:** is a Complex Learning Object consists of a kind of test designed to gather information about the affective-emotional state of the user. It can be a form based test, a multiple choice test, an interactive video or a test of any other kind. The user interface will play a role in the selection of the assessment experience depending on the user profile preferences. The test content is designed to gather information about the affective-emotional state of the user in as much non-invasive way as possible.

	Future State
Def030	**Storytelling**: within the ALICE System, is an educational Complex Learning Object characterized by cross-linked narrative sequences, which we call story **scripts**. A Storytelling CLO deliveries a story as an interactive multimedia web video (the narration is supported by audio and video elements as well as interactive items). The following elements characterize the Storytelling CLO: • Stage: the background for the situations of a Storytelling CLO • Situation: the combination of circumstances at a given time and place in the flow of the Storytelling CLO • Event: something that happens at a given time and place and that can determine or change a situation • Action: a possible action to be performed in a situation In a Storytelling CLO, a script is a logic composition of various situations, based on the phases of a visual story portrait (beginning, call adventure, problem, middle transformation, solution, closure). In a Storytelling CLO a user plays a specific character (chosen among an established range) and has one or more roles to portray, according to the situations and the flow of the story. Any chosen character has his/her own group of related six co-protagonist in the storytelling., established by default. According to the one the user meets on his/her way the character portrays a different role. A role may be chosen by the user, achieved, ascribed or it can be accidental in different story situations. A role can be played by a character, possibly more than one (depending on the type of aims and it is possible to speculate a remedial work that makes a change of view).
Def031	**Serious Game** (SG): is a Complex Learning Object whose content consists of a game designed for the primary purpose of teaching a (set of) concept(s). In the following we will refer to a particular SG designed to teach how to behave during an earthquake (for the emergency and civil defence context). The SG presents immersive environments and virtual worlds that simulate earthquake situations within a school . The game uses a 3D model of a school for the evacuation scenario. The environment allows interactive behaviour (e.g. opening/closing doors and windows). The structure will also be 'set-dressed' with relevant objects such as chairs, tables, and desks. In a SG, the virtual environment is populated with characters animated by appropriate behavioural model. The SG presents a range of increasingly challenging evacuation scenarios in which both actions and time taken are assessed and fed-back to learners. The SG covers a range of different scenarios within the building in which various exits are blocked and therefore the optimum evacuation route differs. Each scenario is associated with a set of concepts (that will be learned during the game execution) and skill (that will be developed during the game execution). The SG presents a range of increasing difficulty levels. The design considers the difficulty of the various scenarios from a game design perspective as well as their validity from a real-world viewpoint.
Def037	**Skill:** it is intended the ability to complete tasks and solve problems. Skills may be connected to concepts of the knowledge model (e.g. to be able to solve problems on kinematics, to be able to write Java programs, etc.) or not (e.g. creative thinking, leadership, etc.).

	Future State
Def033	**Compound Learning Resource** (CLR) . In ALICE a CLR is Complex Learning Object and improves the IWT CLR (Def032) so that connections are navigable links with associated semantics and can be automatically activated and deactivated basing on context, teaching preferences and learning preferences.
Def035	**Self-regulated Course** (SeRC) is a LO that only defines topics to be learned but does not provide learning material. A SeRC has a curriculum section to synthesizes the summary information about it: topics (concepts from an ontology), learning goals, assessment approach. Topics represent the concepts that the learner has to learn as part of the learning objectives and goals. Topics and associated keywords and description are provided by the Course instructor to support learners in selecting and looking for some Course materials from the content management system as well as from the internet or digital libraries.
Def036	**Wiki with Peer Review** (WPR) : is an assessment CLO. A WPR allows to execute a process of peer-review for a wiki. It consists of: • An enhanced wiki tool, • A group of participant users; • An evaluating rubric, • feedback information A WPR tracks the users' interactions/contributions/reviews and provides enhanced visualization of such information

5 Scenarios, Processes and Requirements

5.1 Upper Level Learning Goals - Learner View

5.1.1 Scenario Description

1. Marcovaldo logs into ALICE and enters the "Express your Learning Needs" section.
2. He enters in a textbox his learning needs in natural language i.e. "inelastic collisions".
3. He presses the "submit" button.
4. ALICE composes and presents a list of personalised courses, called "Upper Level Learning Goals (ULLGs)" covering expressed learning needs: a course "exercises on collisions for secondary school" (30% match) and a course "exercises on inelastic collisions for university" (100% match).
5. Marcovaldo can request more information for each course by reading descriptions of composing learning resources or by looking at a preview.
6. He selects the best course for him and it is included in his courses portfolio.
7. He selects the course from his courses portfolio and totally enjoy it. At the end of fruition, he can express a feedback through a simple rating mechanism.

5.1.2 Scenario Description

From 1 to 5 as previous scenario.

6. He isn't satisfied with the resulting courses so he decides to proceed with the instant definition of an own formative need from system's suggestions through the activation of a replacement search.
7. ALICE presents all available concepts that are relevant to the expressed need.
8. Marcovaldo selects the concepts that will constitute the goals and creates his formative course. Then, it is included in his courses portfolio.
9. He selects the course from his courses portfolio and totally enjoy it. At the end of fruition, he can share his formative course to all other users.

5.1.3 Scenario Description

1. Marcovaldo logs into ALICE and enter "Learning Needs" section without a specific learning goal.
2. ALICE presents to him the list of all available courses (pre-defined ULLGs) created by teachers (i.e. more than 100).
3. Marcovaldo has not time to analyse the list because it is too wide so he asks what courses are recommended by the system.
4. ALICE identifies this type of courses, checking which ones are selected by other users or may be relevant according to Marcovaldo's profile information (i.e. 6 resulting courses) and presents to him.
5. Marcovaldo visualises the goals and the information associated to the six courses and he decides that one of these could be interesting for him.
6. He totally enjoys course and can express a feedback through a simple rating mechanism and share it to other users.

5.1.4 Scenario Explanation

The reference platform IWT already supports two processes of course building starting from upper level learning goals, the first mapping an explicit request on pre-defined ULLGs, the second mapping an explicit request directly on available domain models.

Relevant points in the above scenarios are point 7 of first scenario, points 7 and 9 of second

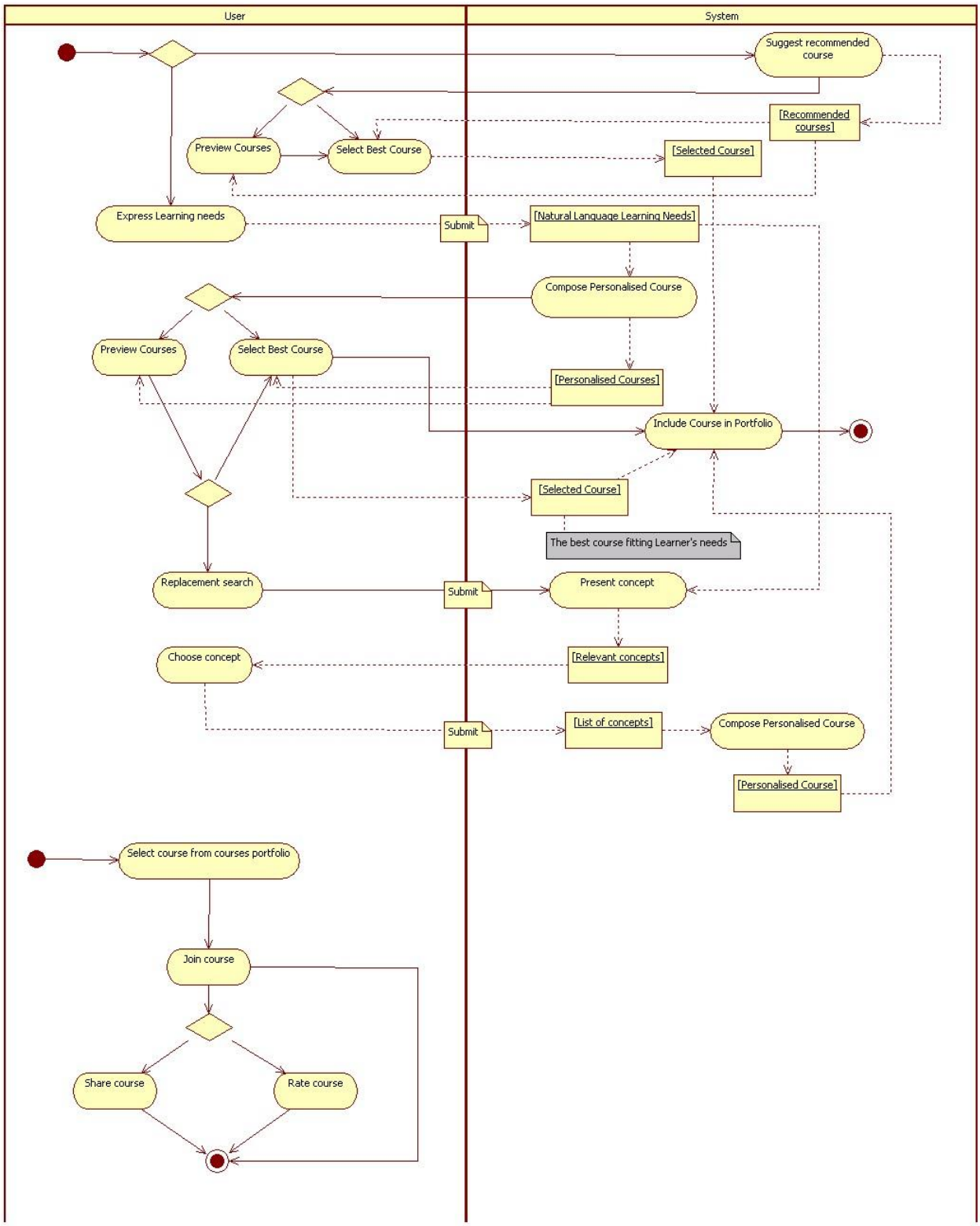
scenario, points 4 and 6 of third scenario-.

To support them IWT needs the following improvements:

1. a third process of course building starting from an implicit request rather then from an explicit one. In other words, a methodology to recommend ULLGs basing on the analysis of a learner' cognitive state and on the comparison of this cognitive state with cognitive states of similar learners is provided. To do that an user-to-user collaborative recommendation algorithm will adapted and extended. The algorithm consists of the following steps.
   - **Concept mapping**: for each learner, known concepts plus concepts currently under learning (i.e. part of units of learning the learner is enrolled in) are identified.
   - **Concept utility estimation**: for each learner, the utility of each unknown concept is estimated by looking at concepts known and under learning by similar users (i.e. by users with similar concept mappings).
   - **ULLG utility estimation**: the utility of each available ULLG is calculated for each learner by aggregating utilities of composing concepts.

   Once the utility of each ULLG is estimated for a learner, the *n* ULLGs with the greater utility can be suggested to him. The following paragraphs deal with the description of each of these steps;
2. the opportunity for the learner to find domain concepts covering a learner query through the *Concepts Selector* component. This can lead to a learner-generated ULLG obtained composing its textual description from the learner query (optionally enriched by the learner itself) and by associating selected target concepts to it. The so generated ULLG can be directly shared to other users;
3. the opportunity for the learner to rate ULLGs created by teachers or by learners to provide guidance to other users. This rating can be also exploited by recommender algorithms as explicit feedback to improve recommendations.

5.1.5 Process Data Flow



Process name	**Upper Level Learning Goals – Learner View**
Goals	To obtain a dynamically generated Learning Course starting from a textual description of a learning need to be fulfilled. To obtain recommended courses. To rate personalised and recommended courses and to share them to other users.
Success criteria	The ALICE System composes and presents a list of personalised courses covering the learning need expressed by the user. The ALICE System presents a list of recommended courses that could be interesting to the user. The user can rate and share the personalised and recommended courses.
Started by	The user is a valid registered user for the ALICE System and has a valid Learner Model. The user can have or not a learning need to be fulfilled. The user joins the personalised and recommended courses. Event – The user enters the "Express your Learning Needs" section and express his learning need in natural language; then he submits the request. Event – The user enters to his courses portfolio and selects a course.
Results	The ALICE System produces a list of personalised courses each (partially or totally) covering the learning need expressed by the user. The ALICE System suggests recommended courses that are interesting to the user. The user can rate joined course(s) and share it (them) to other users.
Elements	User, ALICE System

Actions

1. The user has a learning need to be fulfilled.
2. The user enters the "Express your Learning Needs" section in order to find appropriate teaching material to cover his own learning need.
3. The user writes what he wants to learn in a (free text) natural language form.
4. The user submits the request.
5. The ALICE System composes a list of personalised courses covering the expressed learning need.
6. The user can get more information about the composed courses:
    a. The user can read a description of composing learning resources for one or more courses.
    b. The user can take a preview tour for a specific course. He can repeat the request for more courses.
7. If the user is not satisfied with the resulting courses he can make a replacement search.
    a. The user submits the request.
    b. The ALICE System presents all available learning concepts that are relevant to the expressed need.

c. The user chooses the concepts and creates his formative course.
d. The ALICE System stores the course in the user's courses portfolio.

8. The user chooses one or more courses he deems more appropriate for his needs.
9. The ALICE System stores the selected course in the user's courses portfolio.

1. The user hasn't got a specific learning need to be fulfilled.
2. The ALICE System presents to user the list of all available formative courses.
3. The user asks which of these courses are recommended.
4. The user submits the request.
5. The ALICE System identifies this type of formative courses and presents to user.
6. The user can visualise the goals and the information associated to these courses.
7. The user can select one or more courses because interesting for him.
8. The ALICE System stored the selected course(s) to user's courses portfolio.

1. The user selects a formative course from his courses portfolio.
2. The user joins totally the course and at end he can decide to rate and share it.

5.1.6 Requirements

Current State

ID	Description
C001	For a given Learner Model a set of target concepts the IWT System generates a personalised course (Def009, Def010, Def011). The System builds personalised courses on the basis of a learner model and starting from a set of target concepts belonging to one of the available ontologies (each covering a learning domain).
C014	The IWT System composes personalised learning experiences/courses (Def009) in response to a Learning Need Request (Def034).

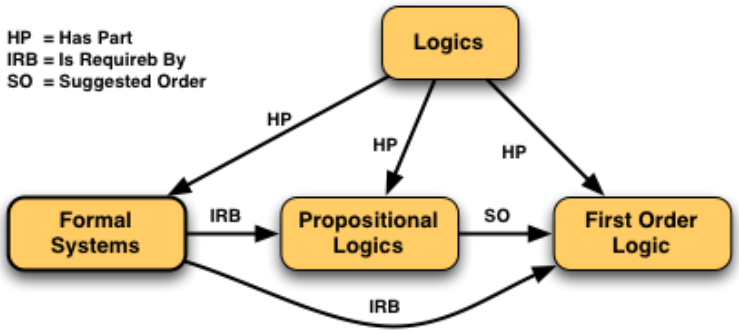
Requirements

ID	Description	Scenario/ Process	Ref.
F003	In the ALICE System, for an user who requests it, a list of recommended learning courses generated, for example, by checking which ones are selected by other users or may be relevant according to user's profile information (e.g. learning context and skill) must be provided.	Upper Level Learning Goals – Learner View	Def028 Def037
F004	In the ALICE System, an user can rate personalised courses generated for his Learning Need Request or recommended courses and share them to other users through simple rating and sharing mechanisms.	Upper Level Learning Goals – Learner View	F003 C001 C014

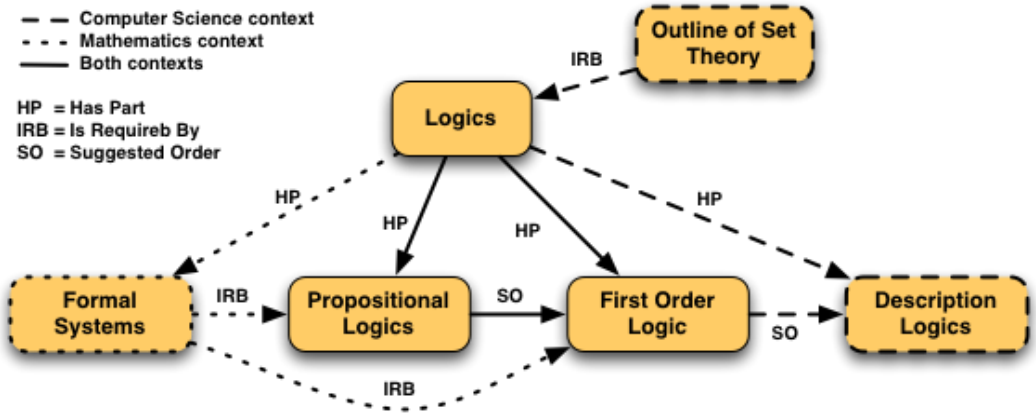
5.2 Knowledge Model Contextualization

5.2.1 Scenario Description

1. Leopoldo logs into ALICE and enters the "Ontology Editing" section.
2. He opens the following Logics ontology he uses to build courses for mathematicians.



3. He uses the visual editor in order to add specific concepts and relations for computer scientists and to specify the context of each one of them.



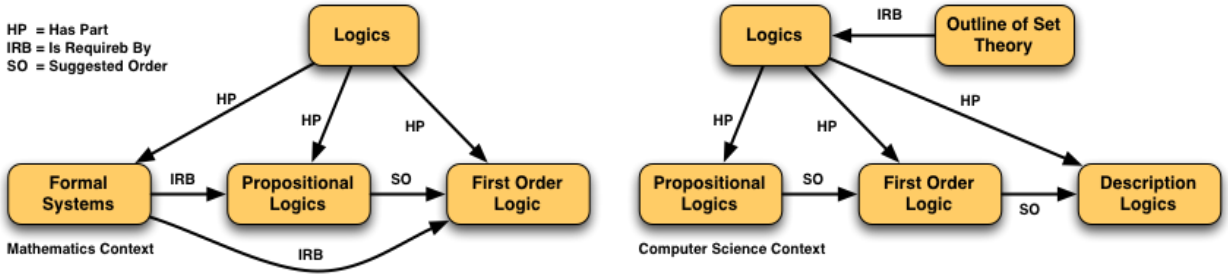
4. He uses the visual editor to modify teaching preferences (e.g. didactic method, activity type, interactivity level) for the new concepts and for the concepts shared by the two contexts.
5. He saves the modified ontology.

5.2.2 Scenario Explanation

The reference platform IWT already supports the modelling of learning domains by using ontologies with three main kind of relations: Has Part (stating that a sub-concept is part of a super-concept), Is Required By (stating that a concept is pre-requisite to understand another concept) and Suggested Order (stating that is desirable but not mandatory to teach a concept before another concept). IWT also supports "teaching preferences" defining feasible learning strategies for available concepts [6].

From the methodological point of view, relevant points in the previous scenario are point 3 and 4. To support them IWT needs the following improvements:

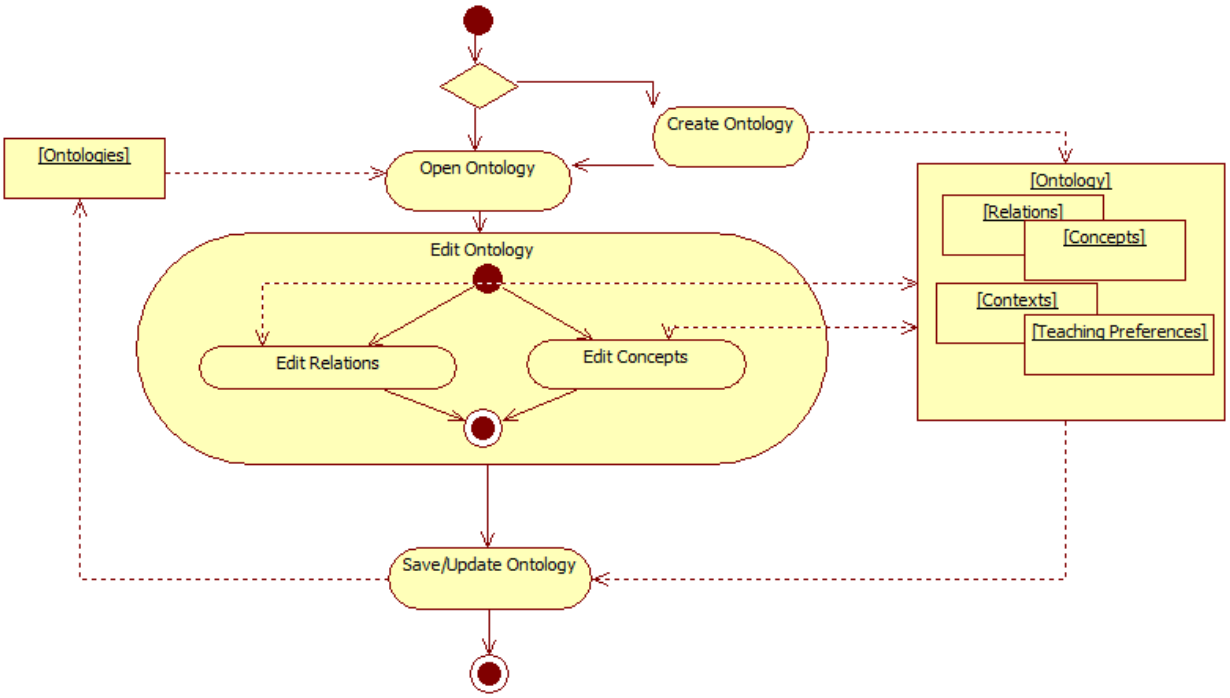
1. an updated versions of the "domain model" to support the notion of **context**, to associate it to each concept and relation and to associate teaching preferences to couples (concept, context) rather than simply to concepts;
2. a "**contextualisation algorithm**" able to generate a contextualised ontology starting from a general one, e.g. from the ontology depicted in the point 3 of the scenario the following contextualised ontologies can be obtained (each with appropriate teaching preferences);



3. an updated version of the "learning path generation algorithm" able to run the "contextualisation algorithm" before any other step in order to obtain the right ontology for a given context.

From the technological point of view the implementation of this scenario requires the design and the development of an advanced visual editor for general ontologies able to manage contexts in a user friendly way. Moreover an updated version of the existing Learning Intelligent Advisor (LIA) component of IWT is also needed.

5.2.3 Process Data Flow



Process name	**Knowledge Model Contextualization**
Goal	To build an ontological description of a teaching domain that is automatically adapted with respect to a context.
Success criteria	The resulting ontology is used to build a personalized course. The success criteria shall be tested in the following way. For any two users that: have different learning context (specified in the user's profile) request the same personalized course have the same knowledge state at the time of the request the ALICE System provides a personalized course with a different learning path, where the differences are based on a "contextualized" selection of concepts. Each learner will be provided with a learning path tailored on his specific context.
Started by	The user accesses the Visual Ontology Editor (VOE) to add contextualization information.
Results	A new version of the ontology is created. The new ontology contains contextualization information that are used by the system to build personalized courses tailored on specific learning contexts.
Elements	User, ALICE System

Actions

1. The user accesses the Ontology Editing section

2. The user launches the Visual Ontology Editor (VOE)
3. The user opens an ontology
    a. If the desired ontology exists, the user open the ontology
    b. Else the user creates a new ontology
4. The VOET shows a graphical representation of the ontology
5. The user edits the ontology with the VOE
    a. Optional - The user performs the usual editing operations on a relation
    b. Optional – The user specifies a learning context for a relation
    c. Optional – The user specifies teaching preferences for a relation
    d. Optional - The user performs the usual editing operations on a concept
    e. Optional – The user specifies a learning context for a concept
    f. Optional – The user specifies teaching preferences for a concept
6. The user saves the modified ontology.

5.2.4 Requirements

Current state

ID	Description
C002	The reference platform IWT supports the modelling of learning domains by using ontologies (Def005, Def019) with three main kind of relations: Has Part (stating that a sub-concept is part of a super-concept), Is Required By (stating that a concept is pre-requisite to understand another concept) and Suggested Order (stating that is desirable but not mandatory to teach a concept before another concept).
C003	The reference platform IWT a Visual Ontology Editor (VOE) for creating ontologies (Def019) and concept maps based on the graph metaphor. The editor has a unique single-user editing mode
C004	The current Learner Model of the reference platform IWT supports "teaching preferences" defining feasible learning strategies for available concepts.
C016	The reference platform IWT allows the creation and management of Contextualized Ontologies (Def038).

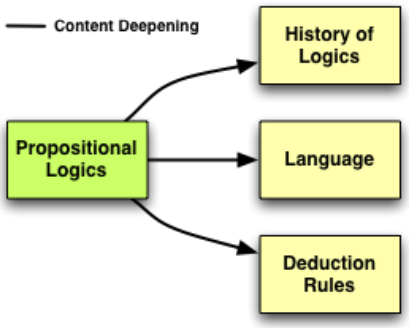
Requirements

ID	Description	Scenario / Process	Ref.
F011	The ALICE System allows the creation and management of Contextualized Ontologies as defined in Def027.	Knowledge Model Contextualization	C016 Def027
F012	The ALICE System provides a Visual Ontology Editor (VOE) based on the IWT VOE and improved with the functionalities for contextualization of relations and concepts. Specify a learning context for a concept and/or a relation Specify teaching preferences for a concept and/or a relation	Knowledge Model Contextualization	C003 F011
F014	The ALICE System is able to build personalized context-aware courses taking in account the learner preferences, and the context information. The resources selected for the course are the most appropriate for the specified context.	Knowledge Model Contextualization	F011

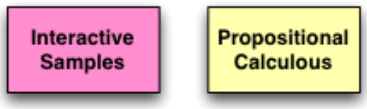
5.3 Semantic Connections Between Learning Resources

5.3.1 Scenario Description

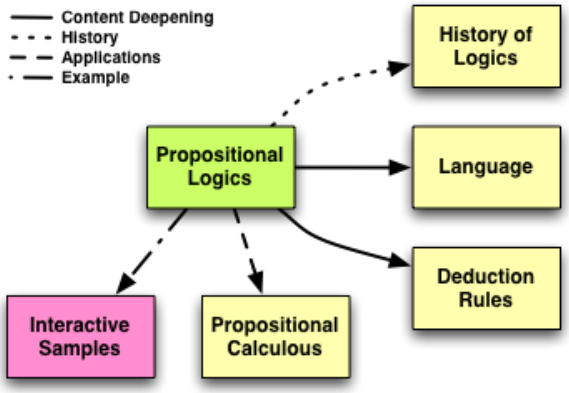
1. Leopoldo logs into ALICE and enters the "Compound Learning Resources Editing" section.
2. He opens an existing compound learning resource about Propositional Logics (thought for mathematicians) made by a core video clip and three deepening links each connected to a textual learning resource on a specific sub-topic.



3. He uploads a new textual resource "Propositional Calculus" and a new resource "Interactive Samples" where the learner can insert logic expressions and see the resulting truth tables.



4. He uses the visual editor to connect new learning resources with the old ones through different kind of semantic relations. To complete his work he also modifies some existing relations. The result is the following learning resource.



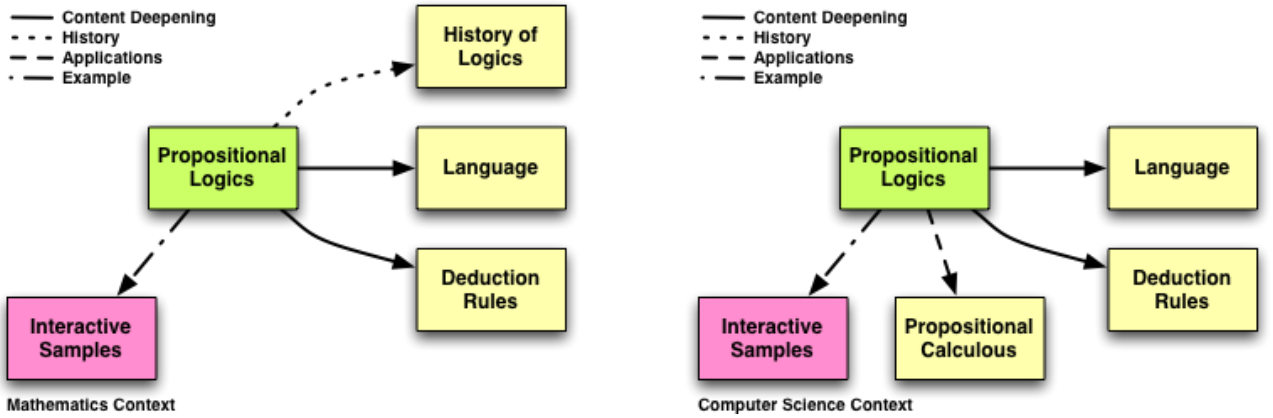
5. He connects the compound learning resource to the Propositional Logics concept of the Logics ontology (see scenario 5.2.1) through the resource metadata.
6. He specifies in the Logics ontology, through teaching preferences, that both mathematicians and computer scientists are interested in general content deepening as well as in samples. Moreover mathematicians are also interested in historical aspects while computer scientists in applicative aspects.
7. He saves the updated ontology as well as the updated compound learning resource.

5.3.2 Scenario Explanation

The IWT platform provides compound learning resource, a learning resource made of other learning resources connected with several kind of relations (e.g. content deepening, history, applications, examples). A user that plays the compound resource can select the kind of relation to be activated and obtain a customized version of the resource.

In this scenario we propose an enhanced version of compound learning resource where connections can be activated and deactivated basing on teaching and learning preferences and context information.

As an example the compound learning resource described in the previous scenario, basing on teaching preferences expressed in point 6, can be contextualised as follows for mathematicians and computer scientists contexts. Removed connections can be also optionally accessed by learners.



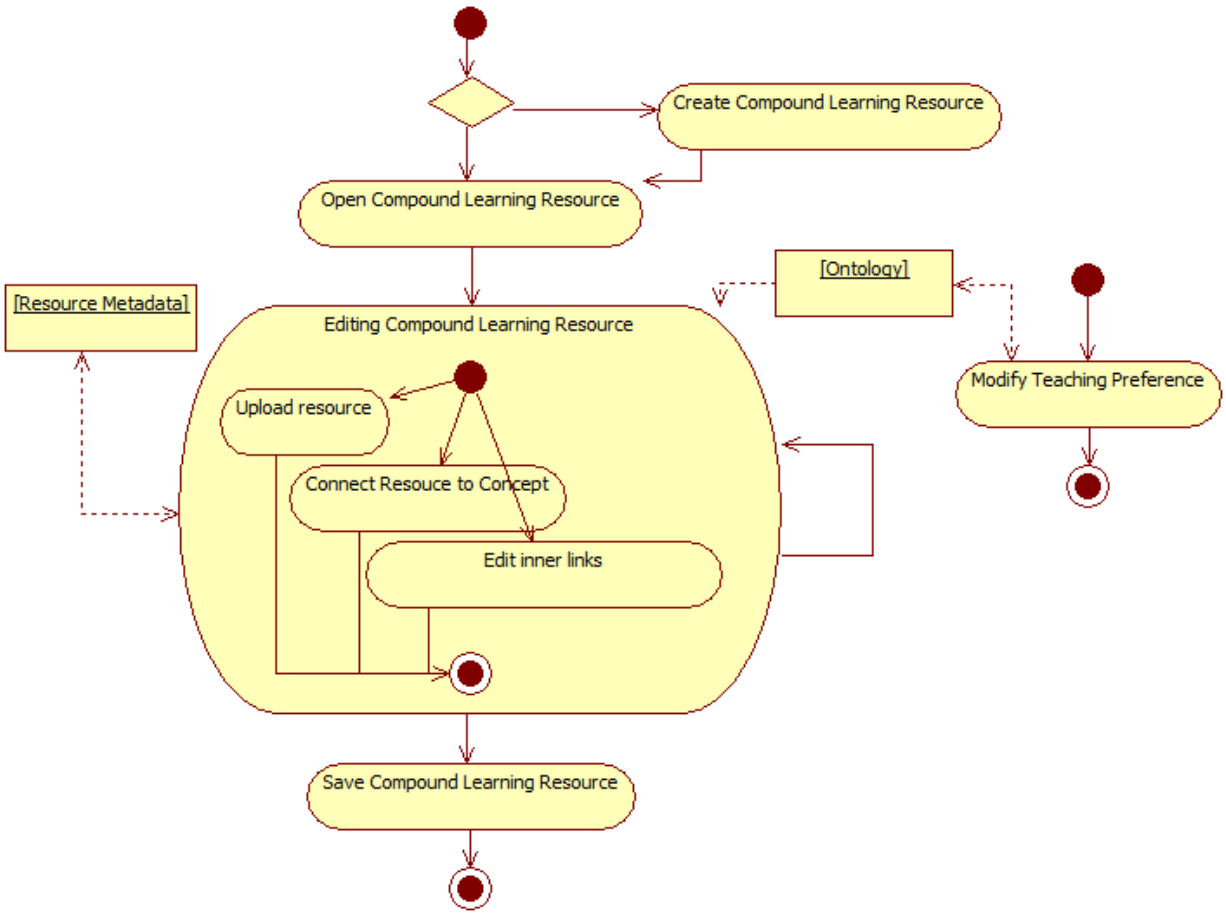
Moreover connections may also vary with respect to learning preferences e.g. a learner interested in historical issues may have the historical links activated also if it belongs to the computer science context.

From the methodological point of view, in order to support this scenario, IWT needs the following improvements:

1. a "semantic connection model" able to define how to represent semantic connections inside and outside resources and what is their meaning;
2. a "resources altering methodology" able to modify a compound learning resource with respect to teaching and learning preferences;
3. an updated version of the "learning presentation generation algorithm" able to run the "resource altering methodology" to obtain the right version of available resources when needed.

From the technological point of view the implementation of this scenario requires to define a new kind of resource: the compound learning resource. This means that a driver able to manage such resource must be designed and implemented as well as an advanced visual editor able to manage semantic links in a user friendly way. Moreover an updated version of the existing Learning Intelligent Advisor (LIA) component of IWT is also needed to support resources altering.

5.3.3 Process Data Flow



Process name	**Semantic Connections Between Learning Resources**
Goal	To build a compound learning resource able to modify its structure according to teaching and learning preferences and context information.
Success criteria	The user successfully creates a Compound Learning Resource. The navigation of the CLR will be adapted basing on each user/context information
Started by	The user wants to create a Compound Learning Resource
Results	The user uploads new resources in the system. The user connects the new uploaded resources to the Compound Learning Resource. The user specifies semantic and context information for the connections. The user successfully creates a Compound Learning Resource.
Elements	User, System

Actions

1. The user enters the Compound Learning Resource section
    a. If the resource exists the user opens it
    b. Else the user creates a new one
2. Optional – the user uploads one or more new documents
3. Optional – the user specifies typed (semantic) link (connection) among the composing documents
    a. If there is a link between two documents, a user can follow the link to the document (i.e. can navigate the document through the typed link). The link can be active only under some circumstances (see step 7).
4. Optional – the user specify additional information in the resource's metadata
    a. The user connects the resource to a specific concept of a domain ontology
5. The user saves the Compound Learning Resource
6. The user opens the ontology related to the Compound Learning Resource
7. The user specifies teaching preferences for the ontology; he maps each learning contexts to a set of typed connections. The mapping gives the rules for the link activation.
8. The user saves the ontology.

5.3.4 Requirements

Current state

ID	Description
C005	The reference platform IWT is already able to select the best learning resource for a learner basing both on teaching preferences (expressed by the teacher in the ontology) and on learning preferences (inferred by the system and maintained in the learner model).
C015	The IWT reference platform allows the creation, management and delivery of Compound Learning Resource (CLR) as defined in Def032.

Requirements

ID	Description	Scenario/ Process	Ref.
F016	The ALICE System allows the creation, management and fruition of and enhanced version of the Compound Learning Resources (CLR) as defined in Def033.	Semantic Connections Between Learning Resources	C015 Def032 Def033
F018	The ALICE System uses context information, learning preference information and teaching preference information to automatically activate or deactivate connections in the fruition phase of a CLR. Disabled connections can be also optionally accessed by learners.	Semantic Connections Between Learning Resources	F016

ID	Description	Scenario/ Process	Ref.
F022	The ALICE System tracks all the actions performed inside a CLR and analyses such information to update the user's learning preference (e.g. statistics on the most selected kind of relation). The update reflects the user preferences about the kind of learning material she likes. Following, the ALICE System will be able to select the best learning resource for a learner also basing on this information.	Semantic Connections Between Learning Resources	F016 C005

5.4 Virtualized Collaboration

5.4.1 Scenario Description

1. Leopoldo logs into ALICE and enters the "Build Virtualized Collaborative Session" section
2. He selects from a list of collaborative activities managed (or moderated) by him (including chats, forums and personal message threads) an interesting discussion forum about Ontology Building with Protégé
3. Once the collaborative activity is selected, the system asks Leopoldo to associate an ontology among those available. Moreover the system also extracts the list of users participating to the collaborative activity and asks Leopoldo to associate each user to a predefined character among those available.
4. Basing on this information, the system automatically creates a draft storyboard composed by a sequence of scenes where each scene includes a sequence of scene parts, each one composed by a character, the emotional state of the character (selected from a list of possible states), a text that the character has to say and the ontology concept connected with the text. In addition, the system provides automatic evaluation information on the collaborative activity as a whole by rating the performance for each character, which is compared to others' in terms of activity, passivity, impact, effectiveness, assessment, etc.
5. Leopoldo makes some modification to the storyboard by cutting scenes, by modifying involved characters, by selecting correct emotional states, by modifying dialogues and connected concepts. He also adds a screen-cast (connected with a scene-part) in order to better explain some concept related to the use of the Protégé system. Finally, Leopoldo refines the storyboard by involving just those characters whose performance is most relevant for the collaborative activity according to the system's evaluation. This selection is done by parametrizing specific evaluation features (activity, passivity, impact, etc.) which results in interesting characters' profiles, such as proactive, reactive, supportive, effective, etc., and a combination of them making the best contributors proposed by the system.
6. He tries the obtained result by pressing the "play" button. The forum is now transformed in a video where different characters discuss about the subject topic according to the storyboard. A base image including all involved characters is generated for each scene and characters are animated according to emotional states and text to say. The text is synthesised with a text-to-speech engine by respecting the sequence of the dialogue represented in the storyboard
7. Leopoldo adds an assessment scene where the character asks for something and the user has to provide an answer selected from a list of possible ones (multiple choice). According to the given answer, he can jump to different points of the storyboard
8. Now Leopoldo is satisfied of his Virtualized Collaborative Session and saves it among his

learning resources. He can now use it as any other learning resource in ALICE courses and classes

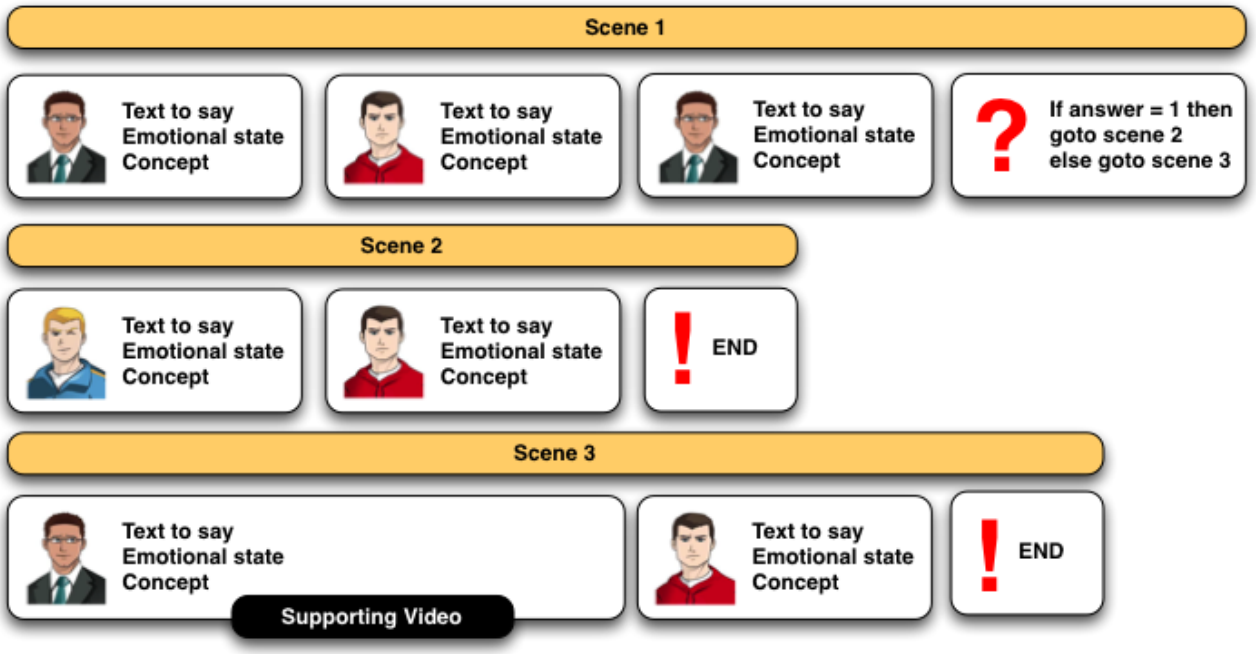
5.4.2 Scenario Explanation

The scenario foresees the implementation of an Authoring System for Virtualized Collaborative Sessions able to transform a threaded discussion (coming from a forum, from a chat or from a set of messages exchanged between different system users) in a challenging learning resource similar to a cartoon where different characters discuss about subject topics and may involve the learner himself in the discussion by asking him questions. The cartoon is also dynamic given that, basing on the learner answers, the story may evolve in different directions.

Each character has specific characteristics like a face (that may change according to an emotional state selected by the teacher) and vocal timbre used to synthesise dialogues. In addition, each character wears a short list of symbols (like medals, hats, etc.) on it representing its performance in certain aspects to the discussion, such as the most active, the most reactive, etc., and eventually the resulting "best"/"worst" contributor proposed by the evaluation component of the system. Given a character, an emotional state and a text to be said, the system automatically generates a cartoon animation moving the mouth to mimic the text while the text itself is synthesised through a text-to speech engine. The figures below show some sample characters:



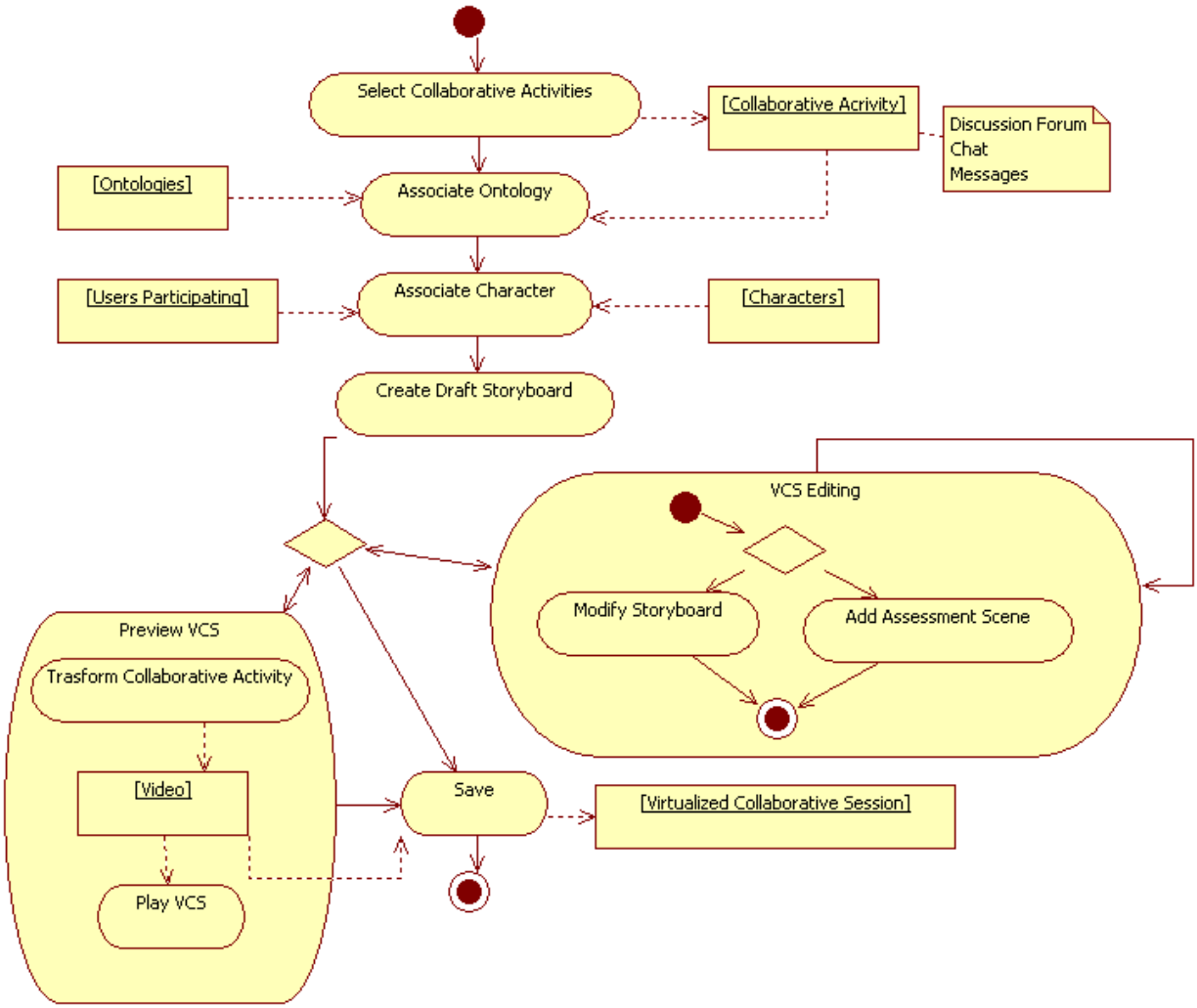
Starting from selected characters, the system automatically generates a draft storyboard composed by scenes and scene parts. The teacher can modify the generated storyboard through an user friendly interface. Among the other things he can add assessment components like tests (with optional jumps to storyboard scenes) as well as supporting videos to be connected with scene parts according to the dialogue timeline. The figure below shows a possible user interface for the storyboard authoring



The main technological component needed to implement this scenario is the Authoring System for Virtualized Collaborative Sessions (that can be optionally shared with the one coming from WP. The need for a specific player must be evaluated (probably this is not needed if the system is able to export in a standard format like Macromedia Flash or Microsoft Silverlight.

From the theoretical point of view, in order to implement the step a Methodology for Storyboard Generation starting from a threaded discussion must be also defined and translated in a software component to be connected with the authoring tool. In particular text categorisation algorithms will be used to understand ontology concepts connected with a piece of text (i.e. a forum post, a chat message, a private message). The extracted information, connected with the discussion timeline and to the discussion tree, are exploited to generate a draft sequence of scenes and scene parts to represent a collaborative session. In the same line, a machine learning approach [21] based on a small set of intrinsic text features, such as syntactic, lexical, and quantitative, to rate posts/messages will be used to automatically evaluate the discussion and the discussants' performance by means of quantitative indicators (such as total of posts/messages and length) and mining discussion text. The latter will be achieved by modelling discussion threads as a sequence of speech acts and using relational dialogue rules to identify dependencies among the messages.

5.4.3 Process Data Flow



Process name	**Virtualized Collaboration**
Goal	To build a Virtualized Collaborative Session (VCS) starting from a discussion.
Success criteria	A Virtualized Collaborative Session Complex Learning Object is created inside the ALICE System. The VCS represents a virtualized version of the collaborative activity chosen by the user.
Started by	The user starts the VCS creation.
Results	The System automatically generates a draft storyboard composed by scenes and scene parts. A Virtualized Collaborative Session Complex Learning Object is created inside the ALICE System. The VCS represents a virtualized version of the collaborative activity chosen by the user. The VCS is stored in the user's e-Portfolio.
Elements	User (teacher?), ALICE System

Actions

1. The user starts a VCS creation
2. The system shows a list of available collaborative sessions
    a. The list includes the collaborative sessions managed or moderated by the user
    b. The list includes chats, forums and personal message threads
3. The user selects one collaborative session
4. The system shows a list of available ontologies and asks to select one
    a. The ontologies shall be owned by the user (to evaluate)
5. The user selects one ontology in the list
6. The system shows the list of users participating to the collaborative activity
7. The system shows a list of predefined characters
8. The user maps each participant (in the collaborative activity) on one character
9. The system automatically creates a draft storyboard
    a. The storyboard is composed by a sequence of scenes
    b. Each scene in the storyboard includes a sequence of scene parts
    c. Each scene part is composed by a character, the emotional state of the character (selected from a list of possible states), the performance symbol of the character (selected from a list of possible symbols), a text that the character has to say and the ontology concept connected with the text.
10. Optional – The user can make modification to the storyboard in order to add meaning to the whole scene
    a. cutting scenes (delete poor/nonsense scenes)
    b. modifying involved characters
    c. selecting characters according to its performance (from the systems's evaluation)
    d. selecting correct emotional states (to enhance user feelings)
    e. modifying dialogues
    f. modifying connected concepts (from the selected ontology)
    g. adds other content in order to better explain the concepts in the VCS
    h. add assessment scene. An Assessment Scene contains some assessment material (i.e. multiple choice test, …). The flow of the story depends on the user's choices in the assessment phase.

11. The user plays a preview of the VCS (
    a. The system creates a video from the work-in-progress VCS
12. The user saves the VCS among his learning resources

5.4.4 Requirements

Requirements

ID	Description	Scenario/ Process	Ref.
F020	The ALICE System allows the creation, management and fruition of Virtualized Collaborative Session (VCS, Def026) CLO. The ALICE System provides the VCS creation functionality for a subset of the available collaborative tools. An initial VCS idea is described above in Actions. 9.a-b-c. An initial user interface for the storyboard authoring is described in 5.4.2.	Virtualized Collaboration	Def026
F021	The ALICE System provides an Authoring System (tool) for Virtualized Collaborative Sessions (ASVCS). The ASVCS allows the creation, editing, management, storage and playback of Virtualized Collaborative Sessions (VCS) from live collaboration activities. The ASVCS allows the user to add additional information (alternative flows, additional contents, character's emotional state, etc.) to a VCS subsequent to the registration phase.	Virtualized Collaboration	F020 F023
F023	The ASVCS is able to create (automatically) a draft storyboard from a collaborative activity, i.e., from a formal description (example: XML based, SIOC format, …) of: the actions (write, delete, comment, rate, …) executed during the collaboration activity the content produced during the collaboration activity a mapping of participant users on fictional characters a domain ontology (for the semantic annotation of the user generated content)	Virtualized Collaboration	F020 F021
F024	The ALICE System automatically annotate VCS content with concepts from a domain ontology provided by the VCS author. The System associates one (or more) concept to each VCS component (scene, scene part) or content (discussions, post, threads, comments)	Virtualized Collaboration	F020
F028	The ALICE System provides a VCS Player for the delivery of VCS objects. A VCS Player provides the following features: VCS playback – the user can watch a video-version of the scenes VCS interaction – the user can interact with the assessment scenes	Virtualized Collaboration	F020

ID	Description	Scenario/ Process	Ref.
F127	The ALICE System provides automatic evaluation information on the collaborative activity as a whole by rating the performance for each user. Each user is compared to others' in terms of activity, passivity, impact, effectiveness, assessment, etc.	Virtualized Collaboration	F020
F128	The system highlight user's by parameterizing specific evaluation features (activity, passivity, impact, etc.) which results in interesting profiles, such as proactive, reactive, supportive, effective, etc., and a combination of them making the best contributors proposed. Each user's character wears a short list of symbols (like medals, hats, etc.) on it representing its performance in certain aspects to the discussion, such as the most active, the most reactive, etc.	Virtualized Collaboration	F020
F129	The generation of the storyboard (VCS) is performed in two steps. In a first stage it is automatically generated from the collaborative activity, without edition nor self-assessment. In addition, the system provides automatic evaluation information and propose the selection of certain parameters so that students can personalize the storyboard. In a second stage, a teacher produce a more complex LO with assessment features after a long process of analysis and editing.	Virtualized Collaboration	F120 F128 F021 F023

5.5 Storytelling

5.5.1 Scenario Description

1. Francesco logs into ALICE system and enters in the "'EMERGENCE AND CIVIL DEFENCE LEARNED LESSON" class.
2. He selects a course concerning a specific topic.
3. ALICE system composes a Storytelling Learning Object to acquire the knowledge related to the selected topic
4. The Storytelling Learning Object shows a specific narrative scheme and a list of possible roles to be covered
5. Francesco selects the Tactician role; after that he visualizes the first scene of the Storytelling Learning Object where he can choose who or what to take with him (a virtual agent or specific objects as area maps)
6. Francesco chooses to take with him specific objects putting them in an emergency bag
7. ALICE system presents an assessment to test the correctness of the objects chosen by Francesco

5.5.2 Scenario Description

1. Francesco logs into ALICE system and enters in the "'EMERGENCE AND CIVIL DEFENCE' LEARNED LESSON" class.
2. He selects a course concerning a specific topic.
3. ALICE system composes a Storytelling Learning Object to acquire the knowledge related to the topic selected before.
4. The Storytelling Learning Object illustrates the "problem presentation" scene through a narrating voice.
5. Francesco can choose between two actions: take a shelter or advise a students group about what's happening.
6. ALICE system associates, in an automatic way, the 'Fighter' label to Francesco's profile, if he has chosen the second action.
7. Francesco must draw the safer path to carry out the selected action.
8. ALICE system provides a feedback related to the correctness of the paths selected by Francesco.

5.5.3 Scenario Description

From 1 to 5 as the previous scenario.

6. ALICE system associates, in an automatic way, the 'Observer' label to Francesco's profile, if he has chosen the first action.
7. Francesco has the possibility to move within the area to choose the place to find a shelter
8. ALICE system provides a feedback related to the correctness of the place selected by Francesco to find a shelter

5.5.4 Scenario Description

1. Francesco logs on ALICE system and accesses into the "'EMERGENCE AND CIVIL DEFENCE LEARNED LESSON'" classroom environment. Francesco starts a course from "My courses" section.
2. The LO shows a pedagogical agent that tells him a critical situation through some engaging and stimulating (from an emotional point of view) video and audio content
3. The agent asks Francesco to indicate which of the facial expressions displayed (it is possible to listen to an associated voice, too) in the scene expresses an emotion referring the situation

depicted

4. Francesco chooses a calm facial expression (this indicates a poor involvement with the situation). In response, the system presents a more compelling scene. The new scene shows the collapse of a staircase and some students that can't go downstairs: they are panicking and they asks help
5. The system presents two choices : waiting the relief supplies or making an emergency call to ask for a more rapid action
6. Francesco chooses the emergency call. The system displays some phone numbers: firemen, civil protection, school principal, etc. Francesco has to choose the one to call
7. With the right choice, the system shows the arrival of relief supplies in the scene.

5.5.5 Scenario Description

From 1 to 6 as previous scenario.

7. With the right choice, the system shows a chat box with two digital assistants shown as firemen. A call out suggests to describe the situation and the way to the place
8. With the right description, the system shows the firemen arrival on the place and the rescue of the students

5.5.6 Scenario Description

1. Francesco cannot write a good description compromising the firemen arrival (the system shows that the firemen cannot find the right place on the map). The chat box is closed.
2. The system shows a group of students in panic. Some of them try to find other ways to escape. [The situation reaches high levels of climax/tension]
3. Francesco decides to ask for help [TBD: how!] to his friends to bring the firemen on the site of the earthquake. A friend of Francesco enters the scene (the system shows the new user in chat box) and together they share a set of useful information to be given to firemen
4. The system shows how the firemen move on the map to reach the right place

5.5.7 Scenario Explanation

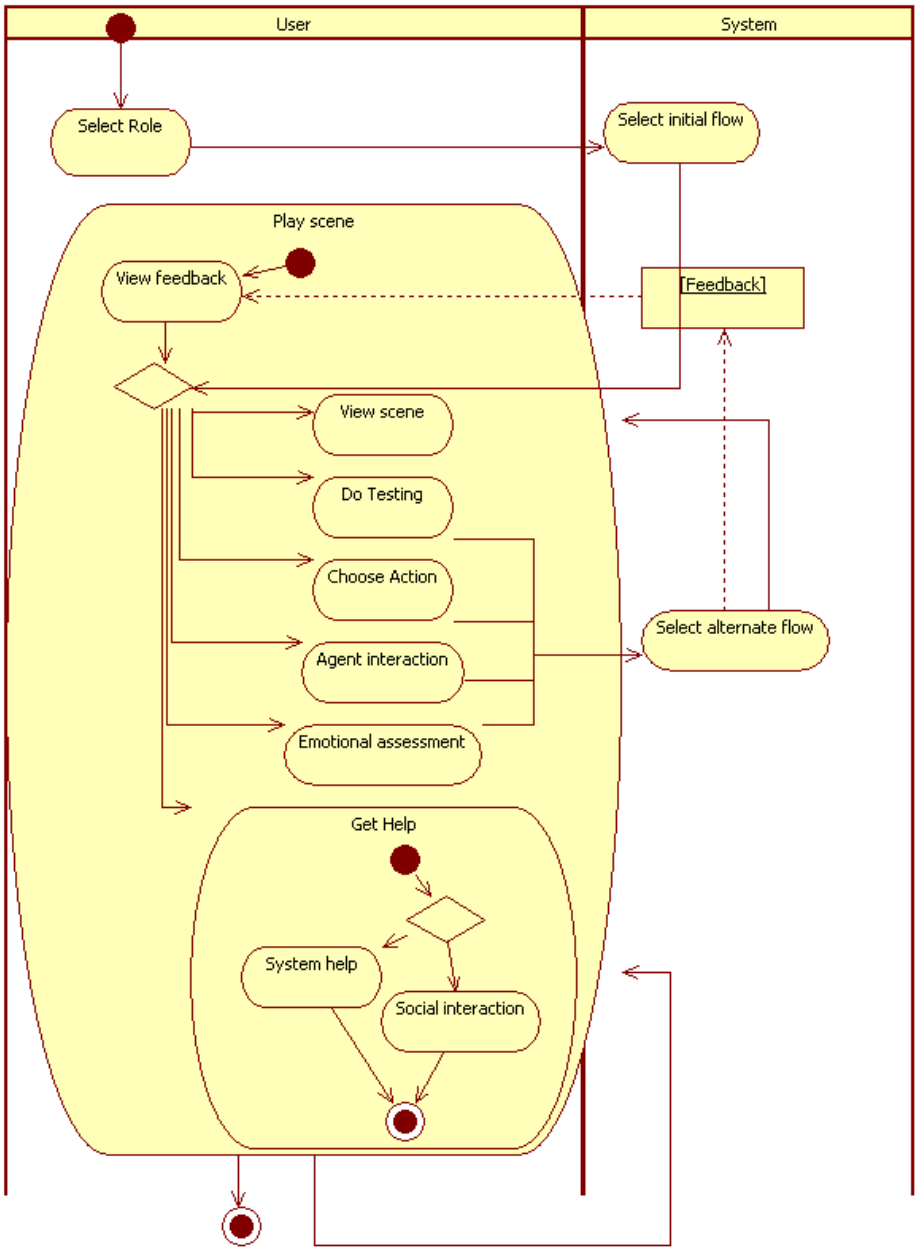
From a methodological point of view, we can highlight the following points:

1. The elements that characterize the stories are
   - **Stage**: the background for the situations
   - **Situation**: one or more events in the flow of the story
   - **Story Action**: a possible action to be performed in a situation
   - We will define the ontology of the situations (beginning of the story, adventure call, problem presentation, …), of the actions that can be performed in these situations (take, write, call, click, chose, work, etc.) of the roles that can be interpreted (v. following) and of the engaging stages.
2. The player role is the character interpreted by the student (chosen by or assigned to him). Storytelling able to manage different kind of player:
   - **Fighter** – combative and courageous
   - **Power gamer** – driven by the desire for praise or acknowledgement
   - **Tactician** – prefers to set up a plan helped by the group
   - **Storyteller** – prefers to take part in complex and intricate stories
   - **Method actor** – prefers dramatic contexts
   - **Observer** – a casual player, s/he does not like to be active in the situation, but s/he loves to observe

- For different roles/characters there are different stages/situation. There can be a sort of metadata to permit the retrieval of situations for a given role.

3. In each story there are events/situations in which it is possible to make two choices; they are a sort of joint where the flow of the story is divided. Each path has a different end but not all ends are good/correct/satisfying. There can be a explicit BIVIO (the path is chosen according to an answer of the student) or implicit (the path is chosen according to an action, an emotional assessment or a cognitive assessment).
    - In some scenarios we can see a collaborative work. We can have two kinds of collaborative actions:
    - Mediated by virtual pedagogical agents, for example, choosing to have a guide that follows the student in the story, or a chat box with firemen agents, ….
    - Direct, as in the case of the entry of other students in the scene called by Francesco to choose a strategic action.
4. We can have different kinds of assessments:
    - **Cognitive assessment**: assessment of knowledge on the considered topic. For example, when Francesco has to choose objects to put inside the emergency bag or when he has to describe the situation in the chat box. The right choice or description have a positive feedback on his cognitive state and influences the selection of the next situation.
    - **Role assessment**: the user profile (chosen by the user or assigned to him) is dynamically updated according to his actions in the story.
    - **Emotional assessment**: sometimes, the storytelling LO presents some assessment objects to track the emotional status of the student in specific situations. The emotional feedback can be used to choose a better path (eg. more compelling), a different user's role, and generally to choose a better related situation in the story.

5.5.8 Process Data Flow



Process name	**Storytelling interactions**
Goal	To show all possible interactions with a Storytelling CLO
Success criteria	The user is able to interact with a Storytelling CLO according to the manner prescribed by the Storytelling CLO (action choice, role choice, emotional assessment,…) and the flow of the Storytelling CLO changes on the basis of user actions as designed by author of Storytelling CLO.
Started by	The user selects a role in a Storytelling CLO.
Results	N/A
Elements	User (learner), ALICE System

Actions

1. The user selects a role in a Storytelling CLO.
2. The Storytelling CLO select the initial flow.
3. The user plays scene (one or more of the following)
    a. If it is not the first interaction, the user receives feedbacks from previous interaction
    b. The user views scene
    c. The user does testing
    d. The user chooses action
    e. The user interacts with agent
    f. The user takes emotional assessment
    g. The user gets system help
    h. The user gets help to a group of student
4. The Storytelling CLO selects the alternative flow.

5.5.9 Requirements

Requirements

ID	Description	Scenario/ Process	Ref.
F039	The ALICE system allows the use Storytelling (Def030) as Complex Learning Object (Def022) to deliver Complex Learning Experiences (Def021).	Storytelling	F040
F042	A Storytelling CLO automatically adapts the narrated story basing on the character/role played and on the user's Learner Model The player role is the character interpreted by the student (chosen by or assigned to him). The Storytelling enables to manage different kinds of roles. A Storytelling CLO shows interactive cognitive assessment elements that determine a micro-adaptive intervention. Micro-adaptive interventions are non-invasive (the overall narrative is not compromised) and affect the presentation of a specific storytelling LO.	Storytelling	F039
F046	A Storytelling CLO allows the delivery of collaborative experiences. Each participant user in a Storytelling is allowed to communicate with others to ask help/tips/suggestions. The communication can be synchronous or asynchronous.	Storytelling	F039

ID	Description	Scenario/ Process	Ref.
F047	A Storytelling CLO allows three different kinds of assessment: Cognitive assessment: assessment of knowledge on the considered topic. Role assessment: the user profile is dynamically updated according to user actions in the story. Emotional assessment: the Storytelling CLO presents some assessment objects to track the emotional status of the student in specific situations. The emotional feedback is used to choose a better path (eg. more compelling), a different user's role, and generally to choose a better following situation in the story.	Storytelling	F039
F049	The ALICE System allows the execution of pre and post-assessment for the Storytelling session in order to: evaluates the learner state and provide personalized content evaluate the effectiveness of the storytelling learning object comparing pre and post assessment results.	Storytelling	F039
F051	A Storytelling CLO provides feedbacks/tips about the user choices/interaction. Such feedback is designed to help the user during the story evolution.	Storytelling	F039

5.6 A Serious Game for Civil Defence Training in School

5.6.1 Scenario Description

John logs in to the IWT system, and is presented with his progress in evacuation training through a series of 'trophies' achieved in game. Eager to earn a trophy for beating a scenario that his classmates have already earned, he selects a scenario he has yet to complete.

He is presented with a virtual world through the game embedded within the web-content delivery system. The simulation, which includes crowds of virtual characters moving towards the exit, places an additional challenge on top of navigation and increases engagement. On reaching the exit, although he receives the trophy for completing the evacuation, he receives feedback from the game which penalises him for running down a stairwell, and as a result several trophies remain locked and his position on the game's leader board drops. He heads to the game forums to discuss how best to achieve these new trophies.

5.6.2 Scenario Explanation

5.6.2.1 Usage Context

It is envisaged the developed game will be deployed alongside IWT within schools. The game will be developed such that individuals can play at any time, capitalizing on the motivational and engaging characteristics of a serious game to replace leisure game time, rather than education, in the target user group. However, an initial tutor-led computer lab session would provide a platform for demonstrating the game and answering immediate questions. Hardware requirements assuming use of the Unity Engine are similar to common leisure games and thus the game would be suitable for deployment to home or school computers. Tutors should be encouraged to interact with pupils both directly and through web-forums, allowing them to monitor discussion generated by the game and

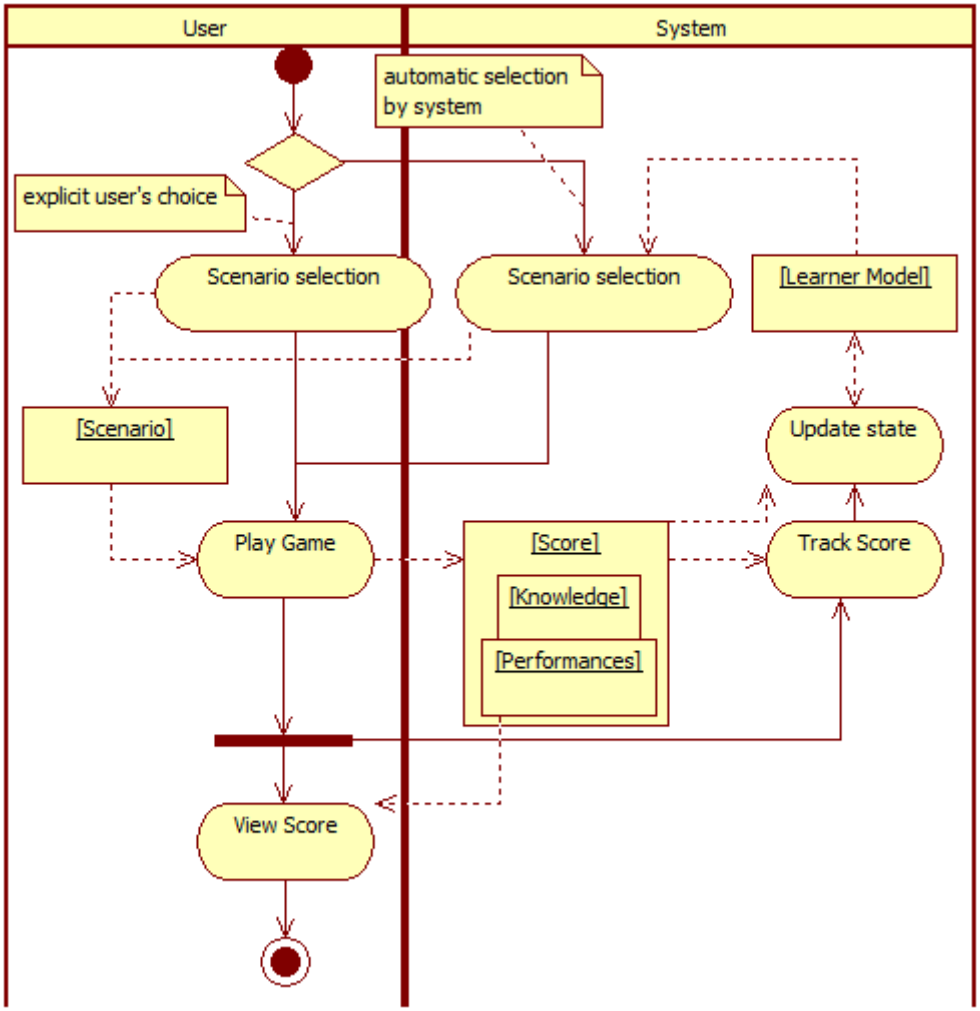
ensure learning outcomes were being achieved. This would correspond with our broad findings that serious games are often most effective as part of blended learning solutions.

5.6.2.2 Relevance to ALICE

The game addresses many of the challenges relevant to ALICE:

- By placing learners in an immersive game environment, it seeks to explore how such an environment can be used as an affective and emotional interface. Given the high-stress of an evacuation scenario, and the target demographic of school children, research and consideration will be required into how to provide such an experience safely and appropriately to this age group.
- Through the use of crowd simulation within one serious game and its repurposing into a serious game for evacuation training, development will address challenges surrounding the abstraction of simulation components. It will take the complexity of a large-scale evacuation and, by placing the learner into a first-person perspective, simplify and de-structure the experience.
- In liaison with other WPs, the game will provide a basis for new forms of assessment through an inductive approach combining community analysis, post-interview, and performance analysis. It will provide a platform for addressing the research challenges associated with implementing reflective, experiential models of learning within simulation, and scaffolding learning using game elements.
- The high-fidelity of the game, as a first-person, immersive simulation will be made highly interactive and authentic through the use of a state-of-the-art game engine and high-fidelity content.
- It will provide a challenging experience through the use of game metaphors and user-tracking and adaptivity through integration with IWT. More experienced learners can be faced with more challenging scenarios. Social identity will be supported through the consideration of multi-player aspects in-game, as well as the formation of social networks through forums, leader boards, and a trophy system outside of the game. In particular, the exploration of the impact of often controversial elements such as performance ranking and best-practices for their use will present a significant opportunity to advance the state-of-the-art in this area.

5.6.3 Process Data Flow



Actions

1. Scenario selection
    a. Optional - The user selects a scenario he has yet to complete.
    b. Optional – The system selects a scenario to be played
2. The game presents a virtual world and starts a simulation. The difficulty level depends on the user's ability
3. The user plays game.
4. The user completes game scenario.
5. The system tracks user's score
6. The system updates user's state (knowledge, skills)
7. The user receives feedback about his performance
8. The user interacts with the community
9. Optional - The user heads to the game forums.

10. Optional - The user discusses how best to achieve new trophies.

5.6.4 Requirements

Current state

ID	Description
C006	The reference platform IWT provides a set of community tools such as Forums and Blogs.

Requirements

ID	Description	Scenario/ Process	Ref.
F053	The ALICE System allows the management and the delivery of Serious Games (SG, Def031) CLO within the web-content delivery system.	Serious Game interactions	Def031, F062, F063,F064 F066,F068 F069
F066	The SG presents environments/actions/situations to assess user's knowledge and skills (Def037). The user's cognitive state is updated basing on the results of the SG execution.	Serious Game interactions	
F068	The SG presents environments/actions/situations to assess user's affective/emotional state.	Serious Game interactions	F070 F072 F075 F078
F063	The ALICE System tracks learner performance. The SG is able to deliver the adequate content difficulty basing on the learner performances.	Serious Game interactions	
F064	The SG is integrated with the community system of ALICE allowing users to compare their own times and successes with their peers through leaderboards, stimulating discussion on best practice through forums, and providing tools for educators to monitor usage and performance.	Serious Game interactions	C006

5.7 Affective and Emotional Approaches

5.7.1 Scenario Description

1. John logs into ALICE, enters the "courses" section and selects the course "Database".
2. After entering the Database course, John selects the tutorial on referential integrity constraints.
3. John performs a series of exercises and his scores never reach the sufficiency.
4. Because of this failure, the system offers an analysis of the emotional state of the learner,

through conversational elements and / or based on action scenes.

5. Alice offers a text-based evaluation form to identify the altered emotional class .
6. Alice reads the form and is unable to find the altered emotional class. The system at this point suggests conversational scenes that require multimedia interaction by the user. Consequently, the system can identify the emotional state altered and quantify the degree of impairment. Alice finds a high level of frustration and anxiety.
7. Alice offers reflections in form of collaborative multimedia content, to improve the emotional states of frustration and anxiety. The system proposes the opening of a collaborative chat through which to seek help from other users. Moreover, the user may select media content (video / slides) that show the performance of simple exercises which are also hints of theory.
8. Once the contents are consumed, the system presents new questions to measure the current status and the changes in the affected emotional states.

5.7.2 Scenario Description (2)

1. Bob logs into ALICE , enters the “courses” section and selects the course “Database”.
2. He select a course concerning a specific topic.
3. Alice composes and presents a specific Learning Object to obtain the knowledge related to the selected topic.
4. While viewing content, Bob is in a state of emotional distress after watching particular scenes.
5. While viewing content, Bob is in a state of emotional distress after watching particular scenes.
6. Alice proposes the analysis of the emotional state through conversational elements consisting of suspense scenes, based on auditory involvement which require user interaction.
7. The test allows detection of altered emotional states and to quantify the degree of impairment. Alice detects a high level of anxiety.
8. Once the contents are consumed, the system presents new questions to measure the current status and the changes in the affected emotional states.

5.7.3 Scenario Description (3)

1. Bob logs into ALICE system and enters the “Rescue in case of earthquake” class.
2. He select a course concerning a specific topic.
3. Alice composes and presents a specific Learning Object to obtain the knowledge related to the selected topic.
4. During the course, after viewing a scene with a crying baby in desperate search of his mother, the system proposes a test that identifies the best behaviour to keep, in the shortest possible time before a similar situation. The test is to select the right answers to a series of proposed questions as quickly as possible. After several attempts, through which Bob can never reach the best solution, is blocked and no longer able to interact with the course. In fact, Bob was a child lost his mother in an accident and the vision of the movie brings to life the tragic experience and then relive a negative affective state.
5. Bob, being in difficulties, requires a kind of emotional support that allows him to overcome or alleviate the condition of unease that he is facing.

6. Alice, in response to the user demand, offers analysis of the emotional/affective elements through conversational text and then, according to the answers, through conversational scenes and action scenes. The conversational scenes are scenes of dialogue media type that require the student to insert his own voice and words to remember the scene. The action scenes are interactive scenes that require specific actions at specific times.
7. The test can identify the current status as altered emotional state and also indicate the degree of impairment. In this particular case the system detects a high degree of frustration and sadness.
8. At this point, the system offers scenes with video and sound to improve his affective state.
9. Once the contents are consumed, the system presents new questions to measure the current status and the changes in the affected emotional states.

5.7.4 Scenario Explanation

The platform, in relation to a specific topic of a course provided, is able to offer exercises and assess the performance considering the responses of the learner.

From a methodological point of view, relevant points in the scenario above, steps 4-8 are involving the two main players are Alice and the learner.

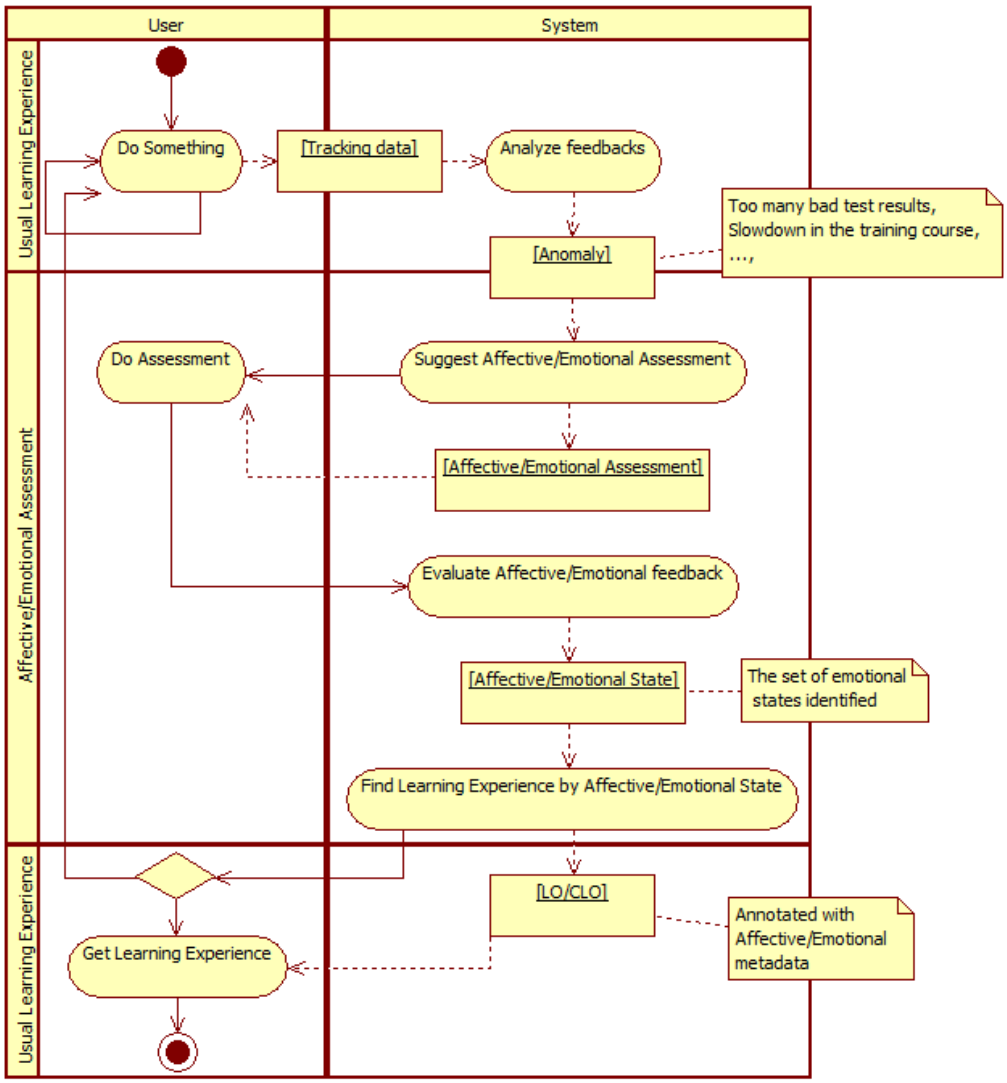
From Alice's point of view these points are carried through the following actions:

- The system, once you reach the maximum number of consecutive exercises with low vote, proposes an evaluation of the affective/emotive learner to identify a possible alteration, this evaluation process is done in two stages as described in the premise:
  1. In a first phase, through the conversational scenes, the class is identified emotional excitement, and then we'll have a boolean type of feedback (yes/no);
  2. then switch to phase measurement/quantification of the state (-1, 0. +1).
- In the scenario assumed, the system identifies a state of frustration and offers content in the form of collaborative chat and personalized learning patterns inherent in the arguments on which the user has greater difficulty.
- Once the reflective path, the system proposes new content to assess whether the emotional state has improved or not.

From the perspective of the learner stage can be viewed through the following actions:

- The learner agrees to perform the proposed route to determine the emotional state altered and becomes aware of the apparent state of frustration that is.
- The learner uses collaborative content that is offered through collaborative chat to ask other users for help and following of custom training courses that allow him to investigate the specific topic where it has gaps..
- Finally, the learner performs a new route to assess the emotional state to see if its been emotive/affective improved.

5.7.5 Process Data Flow



Process name	**Affective emotional approaches**
Goal	To automatically detect alterations of user's emotional state and to provide support for its improvement. To provide assistance to identify and improve the emotional state that appears to be altered, at the request of the learner. To provide support to identify and improve the affective state that appears to be altered, at the request of the learner.
Success criteria	The ALICE System provides learning experiences in line with the user's Affective/Emotional state.
Started by	An abnormal (the WP2 provides metrics to detect the meaning of this) behaviour of the user

Process name	**Affective emotional approaches**
Results	The ALICE System detects the user's Affective/Emotional state. Possibly, the ALICE System provides learning experiences in line with the user's Affective/Emotional state.
Elements	User; System;

Actions

1. The user is logged in the system doing things
    a. Taking a course
    b. Watching a LO
    c. Doing something
2. The ALICE System tracks the user activities
3. One of the following could occur:
    a. The user requests an Affective/Emotional Assessment
    b. The ALICE System analyses the tracked activities to find anomaly patterns
        i. Example – too many bad test results in a single course session;
        ii. Example – a slowdown in the course progress;
        iii. …
4. The ALICE System presents an Affective/Emotional Assessment CLO
5. The users takes the Affective/Emotional Assessment and submits the result
6. The ALICE System analyses the assessment to find the Affective/Emotional state of the user
7. Optional – The ALICE System find am adequate (in terms of Affective/Emotional state) Learning Experience to provide to the user

5.7.6 Requirements

Current state

ID	Description
C007	The IWT System is able to track user activities on services and Learning Objects. The tracking service can be extended to track new activities to be defined.

Requirements

ID	Description	Scenario / Process	Ref.
F070	The ALICE System allows the execution of Affective/Emotional assessment experiences (Def029).	Affective and Emotional Approaches	Def029 F078

ID	Description	Scenario / Process	Ref.
F078	The ALICE System provides a service able to analyse the results of an Affective/Emotional assessment experience and to identify the user's Affective/Emotional status. The Affective/Emotional status contains information about the presence of one or more emotions and a quantitative estimate of the same.	Affective and Emotional Approaches	F070
F072	The ALICE System is able to detect behavioral abnormalities (behaviors deviating from the normal/typical user's behavior) analyzing user tracking data. The System also provides some Affective/Emotional service able to suggest Affective/Emotional assessment experiences (CLO/Services) depending on the abnormal behaviour of the user.	Affective and Emotional Approaches	
F075	The ALICE system allows the interaction of its subsystems and services to the Affective/Emotional services. Each subsystem can request an assessment and can get a result in terms of affective/emotional state. Such result can be used to evaluate a possible strategy to change the user status.	Affective and Emotional Approaches	
F076	The ALICE System allows to add affective/emotional information in the CLO metadata. The ALICE System extends the current metadata system. Search services of the ALICE System are able to find CLOs and services by Affective/Emotional metadata information.	Affective and Emotional Approaches	Def021

5.8 Peer assessment on Wiki

5.8.1 Scenario Description[1]

1. The teacher assigns a topic and the learners in the group are free to divide the work among them and to create the pages of the Wiki. The students use a communication tool to reach an agreement on the responsibilities of the sections or pages.
2. The teacher creates assessment rubrics to be used by students to assess their own contributions (self-assessment) as well as contributions from their peers (peer-assessment).
3. During the content authoring, the students use the rubric created by the teacher for self-assessment.
4. The wiki logs contributions (content and assessment). The students use an enhanced visualization of this information (inside the wiki tool) to know other peer contributions (who did what and when) and to peer assess their work among the group.
5. By the end of the group work, they deliver the essay. Since now the teacher can view (assess) the work.
6. Groups may peer-assess other groups contribution in order to provide the teacher with more supportive assessment information.

[1] This scenario is based on A.3 from 0

7. The enhanced visualization tool (same as or similar to the one used by students) is used by the teacher to track students' contributions within the group. Supportive information extracted from the student's peer-assessment are provided to the teacher as well. The teacher can see the contribution made by each learner by turning on a visualization mode that highlights different user's contributions.
8. The teacher can evaluate in this way both the group as a whole and the individual learner.
9. The assessment is recorded and appears in the reports managed by the system.

5.8.2 Scenario Explanation

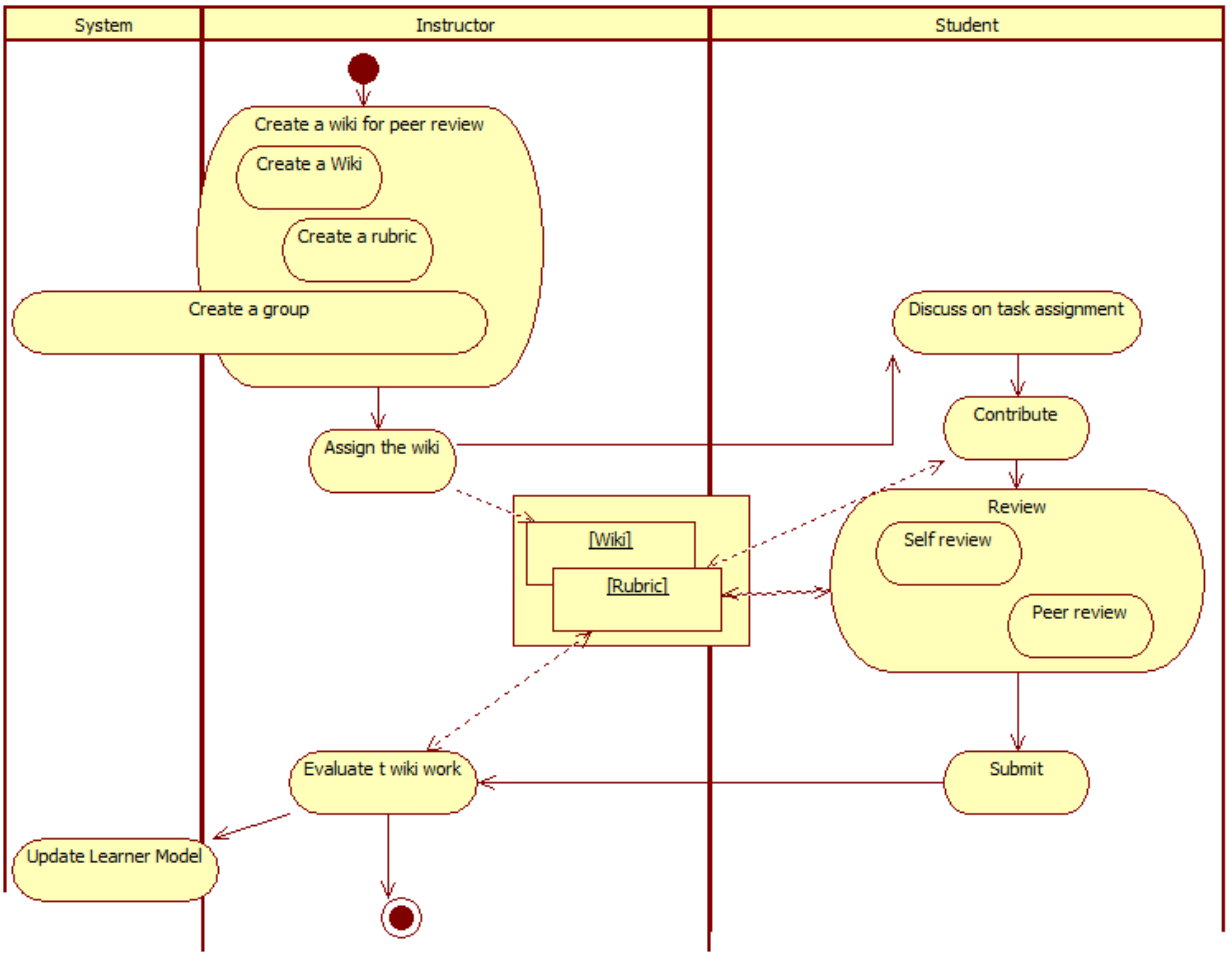
From a methodological point of view, ALICE project is concerned with having new forms of assessment for Live and Virtualized Collaboration, and Affective and Emotional learning. In this scenario a peer-assessment approach has been suggested to evaluate the learner's performance during a wiki (collaborative) activity. The course instructor should be able to provide collaborative learning activities based on the course learning goals. By finishing those collaborative activities the learner is supposed to have specific competencies and skills.

In order to evaluate and assess the behaviour and interaction of the group members within a collaborative learning activity, the instructor has to create rubric(s). The rubric contains the characteristics of the possible behaviours and interactions during the collaborative learning activity . For each group of characteristics from the same level a grade is given and a score is assigned to this grade. The identified characteristics will be provided by the collaborative learning tool so that the learner and the tutor can use them to comment on the others posts. The score is automatically computed by using the activity pre-defined evaluation rubric. The group formation of learners and the assignment of tutors and assessors are done also during the creation phase. Possible strategies can be used for group's formation: (a) random assignment by the system, (b) assignment by the instructor based on the learner's demands, or (c) assignment by system based on learner's individual characteristics. Anyway, the instructor can intervene and restructure/refine the groups. In case of third strategies, the group formation of learners as well as the assignment of the assessors and tutors highly depends on the learner's model. The instructor selects learners' characteristics such as, learner learning style, knowledge level, and competence level in assessing peer's work, as well as learner's ability to communicate with others based on the activity learning outcomes. Those characteristics can be selected based on the instructor knowledge of learners or automatically extracted from the learner model. After learners' groups have been formed the instructor has to assign tutors to evaluate the interaction and behaviour of the group members (learners).

The comparison between the group member peer-assessment and the tutors' reference assessments for the same collaborative learning activity is used to compute the individual's performance within the group. The individual's performance within the group can be summed to represent the whole group performance. Comparisons between different groups performance can be used to evaluate the group outcome performance. Different grading and evaluating schemes for groups assessment can be extracted from the literature and applied. By the end of the collaborative learning activity each group member is provided a feedback representing the comparisons with peers' assessments as well as tutors ones. The individual performance can be approved by the instructor and used to update the learner learning path (learning model) as well as the learner profile (learner model).

The collaborative learning activity, the assigned groups, the evaluating rubrics, tutors information, the peer-assessment activities, the results as well as the feedback information forms a Complex Learning object (C-LO) that can be modelled and used to create similar collaborative learning activities using the same approach.

5.8.3 Process Data Flow



Process name	**Peer Assessment on Wiki**
Goal	To provide a new form of assessment for collaborative works on wiki, where peer-assessment underpinned by assessment rubric is used to evaluate students contributions.
Success criteria	By the end of the collaborative activity each group member is provided a feedback representing the comparisons with peers' assessments as well as tutors ones the learner's profile is updated with the new acquired knowledge, skill and competencies
Started by	The instructor creates a wiki and assigns a collaborative work to a group of students.

Process name	Peer Assessment on Wiki
Results	A collaborative work based on a wiki is created. The pages of the wiki are graded with the rubric provided. Such grading is used for assessments. Learners activities are evaluated. Each group member is provided a feedback representing the comparisons with peers' assessments as well as tutors ones The learner's profile is updated with the new acquired knowledge, skill and competencies
Elements	The instructor, the learner, the ALICE System.

Current State

ID	Description
C012	The IWT System provides a Wiki tool that allows, addition to basic functionality, the export in a hyper-textual LO.

5.8.4 Requirements

Requirements

ID	Description	Scenario / Process	Ref.
F079	The ALICE System allows the creation and execution of a Wiki-with Peer Review CLO (WPR CLO, Def036) providing new form of assessment to evaluate the learner's performance during a collaborative learning activity.	Peer assessment on Wiki	Def036 C012
F099	A WPR CLO allows the participation in different roles: creator, contributor, reviewer, evaluator. The same user can be in one or more roles. Access to functionality is role based. As creator is allowed to create a WPR, setting topics, groups and rubric. The creator is the wiki owned and administrator, is responsible for organizational aspects. A contributor is allowed to create pages, to create links among pages, to add comments A reviewer is allowed to view contributions and reviews of each participant and to grade a page by using the rubric provided by the creator. An evaluator is allowed to grade contributes and reviews.	Peer assessment on Wiki	F079
F100	A WPR CLO provides tools and services to enable the communication among participant users. The participant users use the communication tools to divide and organize the work.	Peer assessment on Wiki	F079

ID	Description	Scenario / Process	Ref.
F102	The ALICE System records the activities performed on a WT and is able to deliver reports about such. The ALICE System provides a report about the performance on the WPR to each contributor at the end of the assessment stage.	Peer assessment on Wiki	F079
F103	A WT CLO provides an enhanced visualization tool to view contributions details on each wiki page. The tool allows to view details about contributions and reviews, giving easy access to information about who did what and when without having to leave the working environment. Such information is used to peer review or assess the work in the wiki. Each role can have a different information visualization (to be evaluated).	Peer assessment on Wiki	F079
F082	In order to evaluate and assess the behaviour and interaction of the group members within a WPR, the instructor creates rubric(s). The rubric contains the characteristics of the possible behaviours and interactions during the WPR. For each group of characteristics from the same level a grade is given and a score is assigned to this grade. The identified characteristics will be provided by the collaborative learning tool so that the learner and the tutor can use them to comment on the others posts. The score is automatically computed by using the pre-defined evaluation rubric.	Peer assessment on Wiki	F079
F083	The WPR interacts with Affective/Emotional services to assess the feelings of group members during the discussion. For each member the system provides an Affective/Emotional test and, on the submit, an Affective/Emotional evaluation.	Peer assessment on Wiki	F079 F070 F072 F075
F084	The ALICE System provides different strategies for group's formation random assignment by the system, assignment by the instructor based on the learner's demands, assignment by system based on learner's individual characteristics. The instructor selects learners' characteristics such as, learner learning style, knowledge level, and competence level in assessing peer's work, as well as learner's ability to communicate with others based on the activity learning outcomes. Those characteristics can be selected based on the instructor knowledge of learners or automatically extracted from the learner model. The instructor can intervene and restructure/refine the groups.	Peer assessment on Wiki	F080 F081

ID	Description	Scenario / Process	Ref.
F089	The WPR assessment is used to update the Learner Model (and the learning path if used inside a personalized course).	Peer assessment on Wiki	F079
F090	The ALICE System allows the creation of VCS based on a WPR CLO.	Peer assessment on Wiki	F079 F020

5.9 Assessment in self-regulated learning

5.9.1 Scenario Description

1. Leila logs to ALICE and uses the Course module as part of the Course "software engineering" that she has registered to this semester.
2. Leila uses the Course curriculum to know the Course topics, the learning goals required to achieve, and the Course material as well as the assessment approach.
3. She finds some keywords regarding the Course topics. The keywords are provided by the Course instructor to support learners in selecting and looking for some Course materials from the content management system as well as from the internet or digital libraries. The curriculum is prepared to have the Course topics and for each topics a set of keywords are provided. Those keywords represent the concepts that the learner has to learn as part of the learning objectives and goals. From the pedagogical point of view, the Course is self-regulated where learners have to choose the learning materials for this Course.
4. Leila uses the keywords to search the content management system of ALICE for recommended readings. Advanced search features can be provided by the content management system to support users. It is important that the content management system should consider the Leila's learner model and profile as well as the course goals and objectives not to recommend readings that do not fit with Leila's learning path.
5. Leila also uses the same keywords to search the internet and digital libraries for related learning contents. In this case she has to select the ones that fit with her needs, or she may use some intelligent tool provided by the content management module to check if the found learning contents suits her learning path as well as the course goals.
6. Leila starts the learning phase by reading the recommended content out of last two steps and whenever she is done with a topic or a learning unit, she has to enter an assessment session to make sure that she fulfilled the learning goals and objectives out of this topic and unit. The assessment is used to update Leila's learning model as well as her learning path during this Course. Moreover, it will guide her to read more materials, concentrate on some parts of the learning materials, or that she had achieved the topic objectives and goals and then can move on to the next topic within the same Course. A third-party tool is used to create single, multiple-choice questions, and fill-in-blank questions for specific concepts from the material. The "Assessment" module in ALICE creates automatically a test by selecting randomly some of the created questions covering the required concepts.
7. Leila enters the "Assessment" module and chooses the type "Automatic question generation". *[Goal: to provide a new form of assessment by automatically create assessment questions using selected text-based learning content]*.
8. Leila clicks on "Content" and the tool will ask her about the learning content that she wants to create tests for. Leila selects the content materials that have been recommended for her

and clicks the Button “Create”.

9. The selected learning content will be used to call an “Automatic Question Generator” tool with the selected materials. The “Assessment” module in ALICE will use the generated questions to create a test for Leila and the test is delivered in here tests as part of here Course page.
10. Leila takes the delivered test and receives a feedback about the progress, results, and next steps. The results will be used to update Leila’s Learning Model as well as her learning path within this Course.

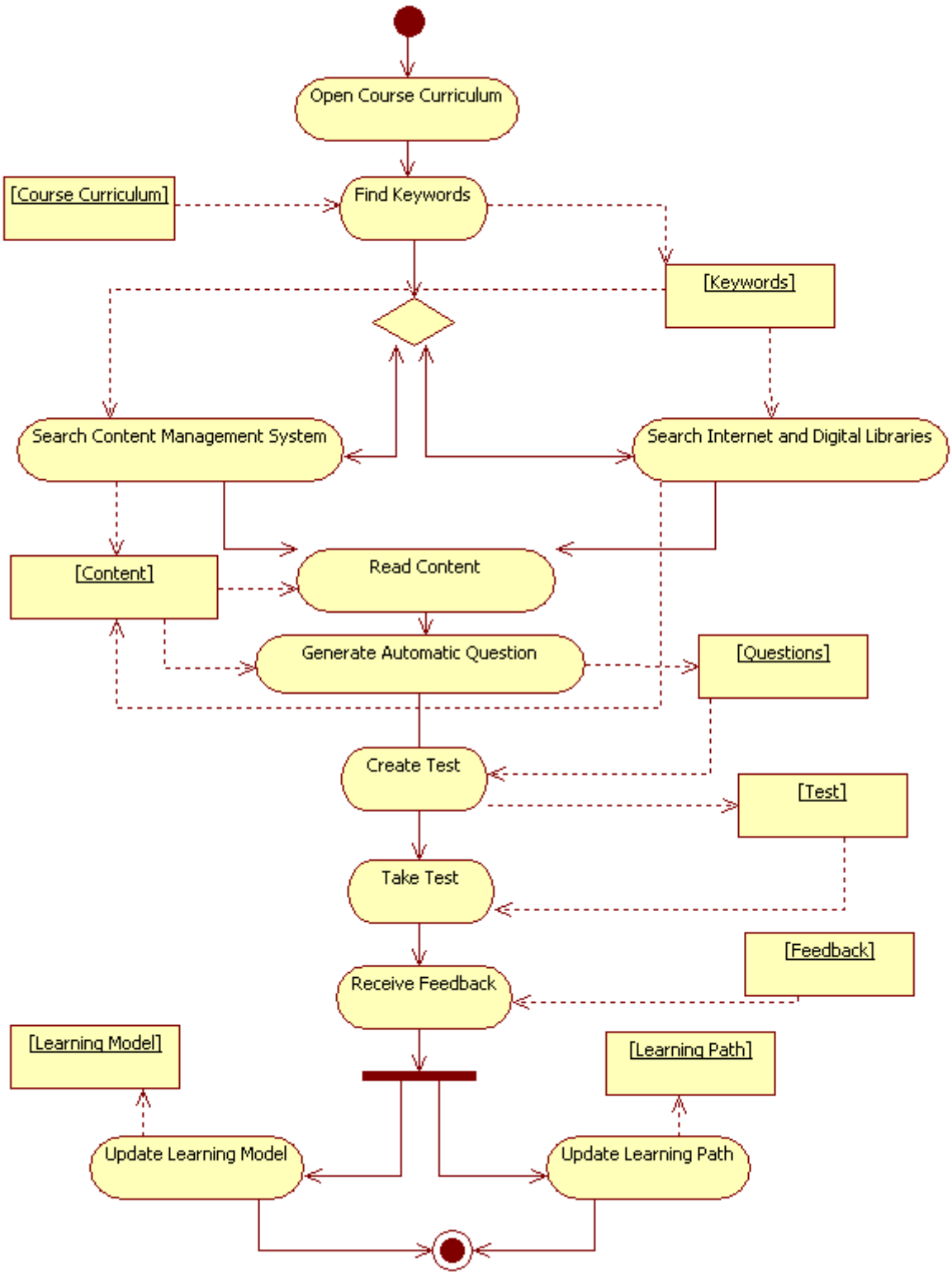
5.9.2 Scenario Explanation

From a methodological point of view, ALICE project is concerned with having new forms of assessment. In this scenario a self-regulated learning approach where the students can use some keywords from Course curriculum and use them to search and select their learning materials. The keywords represent some concepts that the learners have to understand out of the Course. An Automatic Question Generator tool is used to create simple questions (single, multiple-choice, and fill-in-blank) based on content materials. The questions are used by ALICE assessment module to automatically create tests and deliver them to the learner.

The scenario can be adapted and utilized in different assessment types, for instance the scenario can be used in a formative way to support the student learning, or it can be used to assess the students learning by the end of every learning unit in a summative way. The instructor can be given more control to intervene in the step of creating the test out of the automatically created questions for a specific topic material. He may also validate the learners selected learning materials according to the Course objectives and goals instead of the intelligent tool in step 5.

From the technological point of view, the implementation of this scenario requires a flexible extension of ALICE by integrating the Automatic Question Generator tool, The Content Management module have to have some intelligent features of extracting concepts out of the selected learning materials during his self-regulated learning phase and check if learning those concepts will fulfil the Course objectives and goals. Integration between the Assessment module, the Content Management module, the Learning Model, and the Automatic Question Generator tool is required.

5.9.3 Process Data Flow



Process name	Assessment in self-regulated learning

Goal	To provide a new form of assessment where automatic question generation is used to create assessments for self-regulated learning style.
Success criteria	ALICE assessment module creates automatically tests providing in input questions generated by an Automatic Question Generator tool. The questions are generated on the basis of the selected content materials and cover the required concepts.
Started by	The learner enters in an assessment session, opens the Automatic Question Generator tool, selects the learning contents and creates questions.
Results	Questions covering the required concepts are automatically created by the Automatic Question Generator tool selecting the appropriate learning contents. A test is created automatically by the "Assessment" module selecting randomly some of the created questions by the Automatic Question Generator tool. The learner receives feedback about the progress, results, and next steps. The learner learning model and learning path are updates by the system on the basis of assessment results.
Elements	The learner, the ALICE System.

Actions

1. The learner uses the Course curriculum to know the Course topics, the learning goals required to achieve, and the Course material as well as the assessment approach.
2. The learner finds some keywords regarding the Course topics.
3. The learner uses the keywords to search the content management system of ALICE for recommended readings.
4. The content management system recommends readings that fit with learner learning path and the course goals.
5. The learner uses the same keywords to search the internet and digital libraries for related learning contents.
6. The learner selects the learning contents that fit with his needs.
    a. The learner uses some intelligent tool provided by the content management module to check the learning contents found.
7. The learner reads the recommended contents
8. The learner enters the "Assessment" module.
9. The learner chooses the type "Automatic question generation".
10. The tool for automatic question generation asks learner about the learning content that she wants to create tests for.
11. The learner selects the content materials and chooses the "Create" command.
12. The "Assessment" module uses the generated questions to create a test
13. The system deliveries test.
14. The learner takes the delivered test
15. The learner receives a feedback about the progress, results, and next steps.
16. The system uses results to update learner Learning Model and learning path.

5.9.4 Requirements

Current state

ID	Description
C009	The IWT System provides an assessment LO for generating random tests.
C010	The IWT System allows the search of learning resources stored in the internal repository. The learner inserts Keywords in a textbox to search the contents covering the required concepts. The system shows the found internal resources.
C011	The *Presentation Generation Algorithm* (Def011). considers the user's learner model and profile as well as the course goals and objectives to find learning material that best fits the user's needs.

Requirements

ID	Descriptions	Scenario / Process	Ref.
F091	The ALICE System allows the creation and fruition of a self-regulated course (Def035) where learners have to choose the learning materials for the course.	Assessment in self-regulated learning	
F092	The ALICE System provides advanced search features to support users in finding learning material. The search services considers the user's learner model and profile as well as the course goals and objectives to find learning material that best fits the user's needs.	Assessment in self-regulated learning	C010 C011
F093	The ALICE System suggests resources that fit with learner learning path and the course goals if the content search is done in a self-regulated course.	Assessment in self-regulated learning	C011
F094	The Content Management module has some intelligent features of extracting concepts out of the selected text-based learning materials during a self-regulated learning phase and check if learning those concepts fulfil the Course objectives and goals. This implies an integration between the Assessment module, the Content Management module, the Learning Model, and the Automatic Question Generator tool.	Assessment in self-regulated learning	
F095	The ALICE System provides a tool for automatic generation of questions covering specific concepts. The tool needs learning contents as input. Generated questions can be single, multiple-choice or fill-in-blank.	Assessment in self-regulated learning	
F096	The “Assessment” module in ALICE creates automatically a test by selecting randomly some of the created questions covering the required concepts.	Assessment in self-regulated learning	
F097	A third-party tool is used to create single, multiple-choice questions, and fill-in-blank questions for specific concepts from the material.	Assessment in self-regulated learning	

APPENDIX A - Additional Scenarios

In this section are reported some scenarios considered of lower priority or not perfectly in line with project goals. They will be reconsidered in the second iteration of the project.

Goal

Create context-tailored collaborative strategies that groups can use to propose, structure and implement effective collaborative activities to build trust between peers and foster knowledge construction in a "social way".

Scenario description

1. Elena is enrolled in the Computer Science degree of a fully virtual university. She logs into ALICE and enters the "Collaborative Work" section of her workspace in the "Software Development Projects" quarterly course. She is a member of a small group (4-5 students) with the aim to develop a complete software project collaboratively in about 14 weeks. *[Goal: to engage students into a real collaborative learning experience through a Project-based Collaborative Learning (PBCL) approach in order to examine the conditions and methods that influence and enhance active learning through collaborative project development in shared workspaces as well as some methods for triggering collaborative processes]*
2. She enters into a module which provides a set of at least 20 collaborative strategies which are described thoroughly. Each collaborative strategy can be considered as a LO. *[Goal: to facilitate students concrete and effective collaborative techniques in order to structure their activities better, apply focused behavioral grupal rules, and follow effective procedures to accomplish their tasks, which will increase their possibilities to collaborate more efficiently and fruitfully]*
3. She uses the CC-LR "Discussion Forum" in order to enter a discussion with the rest of the group members so that they choose a small set of the above strategies (up to four) that best fit their individual characteristics, preferences and styles. Students are encouraged to search other resources (such as a search engine, like Google, or the Virtual Library) in order to find more details in the literature about how the chosen strategies have been used in practice, and which are the benefits and limitations of their application in real collaborative settings. *[Goal: to initiate students into a basic but important collaborative task, allow them to study and analyse the existing collaborative strategies, and let them develop important learning skills, such as information acquistion and analysis, argumentation and critical thinking]*
4. Based on this knowledge and the tasks that should be accomplished, students are then asked to design and build a CC-LO which is a new collaboration strategy that best fits the dynamics and idiosyncrasy of their group, by combining ideas and techniques of the strategies they analyzed as well as applying their own ideas, and use this innovative collaborative approach to carry out all the phases/tasks of their software project. This new strategy should clearly describe its goals and general function and, most importantly, it should specify all the steps and actions that group members should take to accomplish the collaborative practice successfully. *[Goal: to enable students to design a group-tailored collaborative methodology that is appropriate, on the one hand, for the group profile, work and learning style, and on the other hand, for the definition of all these activities and tasks that could contribute and lead to the most efficient implementation of the project]*
5. The project consists of 5 phases (i.e., "Planning", "Specification", "Design", "Implementation", and "Deployment"), where each phase is a CC-LO. The phases are

carried out sequentially and each phase is a prerequisite of the following phase. Each phase sets a number of specific tasks (LO) to be performed. The tasks engage students into online asynchronous and synchronous discussions which give group members the opportunity to experience a rather relaxed and informal interaction that allows them to perform a decision-making process and initiates them into a long-term collaborative endeavour. *[Goal: to set up a clear working methodology which decomposes a complex problem into well-defined and delimited sub-problems, each one with its own learning goals and tasks, in order to help students plan and organise their working activities more precisely]*

6. Specific resources (CC-LR) are also supplied to students to support online collaboration (such as, a discussion forum, instant messaging, collaborative tools and repository, etc). Each resource has a particular role and function and thus is used to support specific tasks of the collaborative practice. *[Goal: to provide students with all the necessary elements and tools they will need to carry out their collaborative work most successfully]*
7. At the end of each phase, the group has to elaborate a specific hand-out that is delivered to the tutor who evaluates it and assigns a mark to each student. Elena is worried about how the group will be able to carry out a constant and effective individual and collaborative work during such a long period that the quarter lasts, without losing group integrity. The tutor should dispose of the most appropriate CC-LR (methods and tools) so that s/he be able to monitor and support both individual and group work and provide personalized help and orientation adapted to the needs of each peer as well as to unexpected situations (e.g. a member drops of the group in the middle of the experience). Coordination with WP7 is needed. *[Goal: to develop an efficient monitoring and scaffolding approach so that, on the one hand, the tutor can follow group work and progess easily and efficiently and be able to intervene when necessary and, on the other hand, the students can have a clear image of their group, their achievements, their problems, and their progress toward the final objective]*
8. Since collaborative work is long and intensive, as said above first the tutor designs each phase/CC-LO in a recursive manner so that each CC-LO consists of a series of tasks (LO) with clear learning objectives, which enables the student to control the sequence of LOs that has to carry out. Then, the tutor may need to assess the affective/emotional feelings of group members during the learning experience and create/adapt the learning resources and paths taking into account the affective/emotional aspects that influence each group mood and dynamics. Coordination with WP2 is needed. *[Goal: to record and interpret emotional feelings in order to let the tutor be able to adapt the most important learning processes that intervene in the construction of the problem's solution to the indivindual anf group needs so that to help students reach their final target and complete it in the best possible way]*
9. In order to enhance the feeling of presence as well as augment user's representation and awareness during synchronous collaboration, the use of avatars and specific collaborative pedagogical models in virtual worlds are provided (e.g., Jigsaw and Fishbowl pedagogical models). Coordination with WP4 is needed. *[Goal: to support synchronous collaboration with innovative techniques that augment partners' capability to remain aware, active and effective when facing complex and time consumimg tasks]*
10. New forms of assessments are needed in order to evaluate individual and group work more efficiently. Here coordination with WP5 is needed. *[Goal: to design and develop innovative e-assessment forms, both summative and formative, that can effectively evaluate both group and individual performance]*

Scenario Explanation

From a methodological point of view, ALICE research should be able to provide the means so that

the tutor defines a complete ontology of the collaboration strategies that s/he makes available to the students. Each group should then be able to elaborate on this ontology so as to build a personalised collaboration strategy that best fits the idiosyncrasy of the group. This strategy should be described in the form of clear, specific steps which can be associated with specific tasks. In other words, they should describe how each task is carried out, who is participating, how long it lasts, which are its inputs/needs and which are the its expected results.

The tutor has to set up specific criteria for assessing both group and individual performance. We need to give both formative assessments (how are they doing?) and summative assessments (did they achieve learning and project goals?). We also need to assess both the individual and team contributions, including both the collaborative process and its individual and collective outcomes.

From the technological point of view, the implementation of this scenario requires the provision of a set of tools to both the students to carry out their work and to the tutor for the monitoring and personalized, adaptive support to each individual and group.

More details are described in [7]

A.1 Virtualized Collaborative Sessions – B

Goal

Develop students' individual and group skills while engaging them into a real collaborative learning experience

Scenario description

1. Elena is enrolled in the Computer Science degree of a fully virtual university. She logs into ALICE and enters the "Collaborative Work" section of her workspace in the "Software Development Projects" quarterly course. She is a member of a small group (4-5 students) with the aim to develop a complete software project collaboratively in about 14 weeks. *[Goal: to engage students into a real collaborative learning experience through a Project-based Collaborative Learning (PBCL) approach in order to examine the conditions and methods that influence and enhance active learning through a collaborative project development in shared workspaces as well as methods for triggering collaborative processes]*
2. She has prepared some comments on the last version of the design phase of the collaborative software project in hand and plans to share them with the rest of the group. To this end, she selects the third module called “Design phase” in the list of five CC-LOs making up five sequential phases of the software project in hand. Each phase is a prerequisite of the following phase. Each phase sets a number of specific tasks (LO) to be performed. The two last phases are not enabled so that she can move forward only after completing the current module. Alternatively, she can move backwards to the first module “Specification”. No alternative flows are possible at this stage. *[Goal: to structure and guide through the collaborative activities in an effective manner so that students feel confident with the organization of the activities and the procedures of the tasks to be performed]*
3. In the “Design phase” module, she selects “Discussion Forum” in the list of the available CC-LR resources for this module, which supports three stages in the discussion process (namely, specification, elaboration and consensus). This action plays a registered Web-based collaborative discussion session (VCS) and a new discussion thread is created. Elena can control the execution of the VCS by playing, pausing, stopping, etc., the discussion session. *[Goal: to involve students in basic but important collaborative tasks, and allow*

them to study, analyse and get experience with the existing collaborative strategies and resources in order to make progress and facilitate the collaboration]

4. Elena pauses the discussion session at the specification stage. She then selects the CC-LR "Collaborative Agenda" to propose the start-end date of the discussion. At that moment, Elena sees that the status of another group member is "active" and asks her to meet in the online meeting room (CC-LR) so as to discuss on certain topics. From this talk, Elena considers new insights on the topic discussed. Finally, she writes a post in a text box of the discussion thread. Optionally, she uploads a file on the "Shared File Repository" (CC-LR) with comments on the project design she wants to share with the rest of group. At the end, she presses the "Send" button to submit the contribution and the "Play" button to enable the discussion session to move forward. *[Goal: to strongly leverage available collaborative tools in order to develop essential skills and competences, such as proacticivity, organizational capabilities, information elaboration and analysis, argumentation, critical thinking and knowledge acquisition]*
5. Elena is working in an isolate way, and she looks forward to feeling engaged with the collaboration by being able to track what others are doing and how, thus comparing her own performance to the rest of group members. To this end, ALICE automatically registers and evaluates all the actions performed in the discussion so far according to a quantitative and qualitative. Based on this knowledge, ALICE continuously updates and shows the current status of the discussion to the group members in terms of both awareness about what is happening in the discussion and when, and complex feedback about what others are doing and how. The presentation of information is in a variety of forms; from textual to graphical with no intrusion to the receiver (an XML-based middleware is proposed to unify the source data to be presented in different formats). As a result, Elena's updated performance is compared to others' in terms of activity, passivity, impact, effectiveness and assessment. A final evaluation of the discussion as a whole is also updated for Elena and for each group member. Elena seeks this information by selecting the CC-LR called "Statistical panel". Here coordination with WP5 is needed. *[Goal: to develop new forms of e-assessment by keeping students constantly informed about what is happening during the collaboration and being automatically evaluated from different perspectives of both group and individual performance by using a variety of predifined evaluation indicators. All the information is presented seamlessly with no explicit request from the receivers. Tutors also receive information for assessment, monitoring and scaffolding purposes, some of which may be explicitily requested]*
6. By sending the new post, ALICE detects a conflict of opinions in the discussion and suggests finding consensus by proposing Elena to vote on each conflictive post. Elena moves forward the discussion session up to the stage of consensus, where she pauses. A voting system (CC-LR) appears and she can see different posts to vote. Finally, she makes a decision and presses the "Vote" button on the appropriate option. *[Goal: to make the relevant information for voting available and the selection of vote options easy in order to ultimately enhance critical thinking, consensus and decision making capabilities]*
7. ALICE shows the temporary winner option from the voting process in the "Statistical panel" (CC-LR). In addition, updated results and participation on the voting process are continuously shown and informed to the group members. *[Goal: to keep users informed about the results of the discussion thus fostering self and peer criticism and rectification behaviour]*
8. Elena stops the discussion session and logs out. As a result, the whole collaborative session is recorded and can be revisited afterwards at the chosen users' pace and by using frame search capabilities *[Goal: to let students terminate a collaborative session and separate it*

from others as well as revise selected collaborative sessions and moments in order to learn from mistakes made and success stories]

Scenario Explanation

This scenario corresponds to an extension of point 5 of the Scenario 1, and thus the learning context can be referred from the previous scenario.

From a methodological point of view, the relevant point in this scenario is point 5 and the points related to the consensus stage of the discussion process (6-7):

- ALICE research should examine evident key discourse elements and aspects that play an important role both for promoting student participation and enhancing group and individual performance, such as, the impact and effectiveness of students' contributions, among others. By making these elements explicit, a discussion process may accomplish high students' participation rates and contribution quality in a more natural and effective way. This knowledge can also be of help for tutors to monitor large discussions in a semi-automatically way.
- ALICE should examine how learning and knowledge building can be supported in the context of an asynchronous collaborative discussion in a full virtual learning environment. To this end, a complete discussion and reasoning process should be proposed for modeling dialogue and understanding how learning evolves and how knowledge is constructed during the discussion process. This process is based on three types of generic contributions, namely specification, elaboration and consensus.

From the technological point of view, the implementation of this scenario requires the provision of specific CC-LO and CC-LR tools that provide both the mentioned full knowledge management process from the analysis of interaction data and advanced features to support the discussion in comparison to traditional discussion tools used in this context. These advanced tools will also alleviate tutors and students the monitoring, tracking and participation in the discussion, such as updated feedback and awareness, complex indicators about the collaboration, threads in separated rooms and open-closed branched dialogs.

More details are described in [8].

A.2 Peer Assessment on Test

Goal

to provide a new form of assessment where students are asked to peer-assess their answers from online test so that they can use peer-assessment as a mean for learning and receive valuable feedback regarding their answers.

Scenario 1 Description

1. Arthur logs to ALICE and uses the "course" module to create the online learning phase material.
2. He selects the topic "Document Classification" to form the main material of the online learning phase. During the authoring of the online learning phase he manages the users and grants the students of the ISR course an access to the online learning phase, and schedules the online learning phase to a specific lab and in a specific date.
3. He enters the "assessment" module and creates new test. The tests' items can be selected form the items bank or can be created from scratch. He schedules the test to the same lab of

the online learning phase and sets the time to be right after the finishing of the online learning phase. *[Goal: to create an online assessment to assess knowledge acquisition level of the students from the online learning phase]*.

4. He uses the same module to create a peer-assessment using some or all the test items that have been used for the test in the last step. Again he schedules it after the online test phase. The students can have a break before the peer-assessment phase. *[Goal: to use peer-assessment as a form of assessment where the students will assess their answers from the online test phase step 3. Peer-assessment will promote students motivation and engagement, moreover it is a mean for learning where students learn from evaluating their peers' answers]*.
5. He manages the users by granting the students access to the peer-assessment as well as define how many answers each student has to peer-assess in addition to the calibrated answers. He also grants an access to a set of tutors/assessors in order to assess the answers from the online test phase. The tutors have to evaluate the whole students answers form the online test. The tutors' scores will be used to compute a reference grade for each candidate answer. *[Goal: to use the tutors evaluations of candidate answers from online test phase step 3 as reference grades for those answers and to evaluate the students peer-evaluations based on these reference grades]*.
6. He defines the grading model for the whole learning activities to be computed from the online test phase as well as form the student's performance during the peer-assessment phase.
7. He also may define some affective/emotional factors to be measured within the whole activities or within specific ones. Such factors can be used to validate the assessment approach, usability studies, attitudes and motivations, as well as the can be used to compute the student performance. Coordination with WP2 is required.
8. He defines the feedback model to be provided for the students after the finishing of the peer-assessment phase. This requires the tutors to assess the student's candidate answers the same time as the students do so the feedback can be formed out of a comparison between the student's peer-assessment scores and the tutor's reference grades . The feedback may contain the students answers and tutors evaluations for these answers (online test scoring) as well as the students peer-assessment of candidate answers and the tutors assessment of the same answers (peer-assessment performance).
9. The student's performance out of the overall online learning session should be used to update the learner profile as well as the learning model.

Scenario 2 Description

1. Alex logs to ALICE and uses the follows the link to the ISR course. Alex the other students are in a computer lab and the online learning activity is conducted in a controlled environment.
2. He clicks on the "Learning activities" and subscribes to the online learning activity created by Arthur in the first scenario.
3. After all the students have subscribed to the online learning activity, they can see that this activity consists of four main steps: Online learning, Online Test, Reference Answer Preparation, and Peer-Assessment. Following this sequence is strict and the students cannot move on to the next step without finishing the first one.
4. After a brief introduction given by the instructor explaining the learning activity steps, goals, and grading process. The students will have 45 minutes for the first step "Online learning" , in this step the students is required to read an online material selected from the ISR course and for this activity "Document Classification" has been selected.

5. Alex clicks the "Online Learning" step and starts reading the material.
6. after the end of the 45 minutes, the instructor will ask the students to close the learning material and to enter the "Online Test". In this step it is recommended that IWT is capable to prevent the students from accessing the internet of the course materials . Only the "Online Test" is accessible. *[Goal: to lock up the students computers so they can't use course materials or online materials to answer the online test (prevent cheating)]*
7. Alex starts his online test. The test consists of 5 items from different types (definition, enumeration, concept explanation.....). The "Delivering Module" should be designed in a flexible way to show a timer, flexible navigation between questions, Feedback about question number as well as how many left questions. For each test item the students has to provide an answer and a confidence value between ("0" very poor and "5" very good). The confidence value is used to evaluate the student's maturity about his answer (self-assessment).
8. By the end of the "Online Test" step the students are asked to take a break of 10-15 minutes.
9. After the break the instructor asks the students to start the "Reference Answer Preparation" step. During this step the students are required to prepare a reference answer (optimal answer from the student point of view) for some selected test items which have been selected by the instructor to be peer-assessed by the students. *[Goal: The students will use their reference answers to assess their peer's answers from the "Online Test" for the same test item. Access to the course materials or any other related is recommended (Self-directed Learning)]*.
10. Alex starts the "Reference Answer Preparation" step. In this step he receives the pre-selected test items and he has to prepare a reference answer for each item. Navigation between items is flexible.
11. By the end of "Reference Answer Preparation" step, the instructor asks the students to enter the next step of "Peer-Assessment". Answers from the "Online Test" will be delivered to the students in order to be peer-assessed. The answers are delivered based on the selected test items from the "Online Test" Step as well as a set of calibrated answers that have been created by the instructor and assigned scores. For each candidate answer the student are capable to mark parts of answer as correct, wrong, and irrelevant. Special colors are used to mark the selected part of the candidate answer based on its correctness (i.e. correct as green, wrong as red and irrelevant as yellow). A score should also be provided by the student for the answer from "0" (very poor) to "5" (very good). *[Goal: Using colored marks for the candidate answer should support the students for scoring the answer and to provide a reasonable score based on his colored marks. Moreover, the colored marks will be provided as a valuable feedback to the answer owner]*. Input-boxes for missing parts of the answer and additional notes can be provided for the students to write into them.
12. Alex starts the "Peer-Assessment" step, where the pre-selected test items and their answers provided from his peers during the "Online Test" step as well as a set of calibrated answers are delivered. For each test item Alex pre-prepared reference answer is provided. Alex uses his reference answers for each item to mark the candidate answers per item. He uses the same marker from step 11 and provides a score from "0" (very poor) to "5" (very good). He also may enter missing parts of the candidate answer and some comments. The tool should be flexibly designed to allow navigation between test items, timer, as well as to make sure that all the candidate answers have been marked and scored.
13. Alex fills in an online questionnaire after finishing his "Peer-Assessment" step. The questionnaire diagnoses his attitudes about the overall learning activity as well as each phase "Online Test", "Self-directed Learning" in preparing the reference answers, and the "Peer-assessment" one. The questionnaire may also measure other aspects such as tool and

learning approach usability, as well as get inputs for further enhancements from the students.

Scenario 3 Description

1. Dominik logs to ALICE and follows the link to the ISR course. He and the other tutors are not working in a controlled environment in a computer lab as in scenario 2.
2. He clicks on the "Learning activities" and subscribes to the online learning activity created by Arthur in the first scenario.
3. After Dominik has subscribed to the online learning activity, he can see that this activity consists of two steps: Reference Answer Preparation, and Peer-Assessment. Following this sequence is strict and the he cannot move on to the next step without finishing the first one.
4. After Dominik has received a brief introduction sent to him by e-mail explaining the learning activity steps, goals, and grading process. He starts the "Reference Answer Preparation" step and prepares the reference answers the same way done in scenario 2. *[Goal: to use the reference answers to evaluate the student candidate answers from the online test]*.
5. Dominik starts the "Peer-Assessment" step, where the pre-selected test items and their answers provided from the students during the "Online Test" step as well as a set of calibrated answers are delivered. For each test item Dominik pre-prepared reference answer is provided. Dominik uses his reference answers for each item to mark the candidate answers per item. He uses the same marker from step 11 of scenario 2 and provides a score from "0" (very poor) to "5" (very good). He also may enter missing parts of the candidate answer and some comments. The tool should be flexibly designed to allow navigation between test items, timer, as well as to make sure that all the candidate answers have been marked and scored. Each tutor has to evaluate the whole candidate answers from the students so that her/his scores can be used to compute reference grades for each candidate answer.
6. After finishing the "Peer-assessment" step, he fills in a questionnaire regarding his attitudes towards the overall learning activity and suggests some enhancements or comments about the procedure.

Scenario Explanation

In this scenario a complex learning activity of online learning activity and an e-assessment activity will be conducted. The scenario has to be used in two phases: Student Phase, and Tutors /Assessors Phase. In the students phase the scenario consists of the following steps: (1) Online learning, (2) Online Test, (3) Reference Answer Preparation (self-regulated learning), (4) Peer-Assessment, and (5) Questionnaire. The tutors/ assessors phase consists of only the last 3 steps from the students phase: (1) Reference Answer Preparation (self-regulated learning), (2) Peer-Assessment, and (3) Questionnaire.

From a methodological point of view, ALICE project is concerned on having new forms of assessment for complex learning activities. The assessment in this scenario consists of three phases the first one is an online assessment to evaluate the students' knowledge acquisition form the online learning phase. The second phase consists of two steps (a) reference answers preparation for questions that have been selected from the online assessment phase to be used by the students to peer-assess others answers (self-directed learning). (b) peer-assessment, where the student will use their pre-prepared reference answers to peer-assess others students answers from the online test. The tutors/assessors evaluations form the peer-assessment step will be used to compute reference grades. The performance of the students in during the peer-assessment step will be computed be

comparing the students evaluations (represented by scores) with the reference grades computed form the tutors/assessors phase. The student's final grade can be computed from their results in the online assessment as well as their performance within the peer-assessment step. A valuable feedback will be provided to the students with (1) their final grade represented by the online test result and the peer-assessment performance, (2) comparisons between their peer-assessments and the tutors/assessors evaluations for the same candidate answer. This scenario can be used to discuss the following aspects: (a) the students' attitudes to modern learning activities, (b) to evaluate the student's knowledge acquisition from online learning activities, and (c) to assess the student's performance in modern learning approaches. For more details about the students phase please read scenario 2 and the tutors/assessors phase please read scenario 3.

From the technological point of view, the implementation of this scenario requires the provision of a set of tools to instructors, tutors, and students.

A.3 Assessment on collaborative activities

1. Anna logs to ALICE and uses the "Collaborative Learning" module as part of the "Software Engineering" Course. Coordination with WP is required.
2. She uses an appropriate Collaborative Complex Learning Resource (CC-LR) contains Virtualized Collaborative Session (VCS) in order to learn from others collaborations as well as to gain knowledge regarding discussion threads. As VCS are designed to be interactive she can changes some discussion parameters and notice the consequences. The selection of the appropriate CC-LR can be done by the instructor during the "Authoring phase", or based on the learner model as well as the activity learning goals.
3. Within the "Collaborative Learning" module, Anna is assigned one or more collaborative learning activity created by the instructor. The collaborative learning activities have to be created carefully based on their importance to the success of the desired learning goals. Moreover, some aspects such as content learning and collaborative skills development, process and outcome goals of the collaborative peers within a group, and individual and group learning and performance have to be considered during the creation of the collaborative learning activity[2].
4. Anna selects a discussion learning activity with other group members. The selection of the learning activity can be strict or free- to- choose based on the course learning goals.
5. As part of the discussion, Anna may respond to others' posts. For each response she has to comment the post with available comments extracted from a pre-defined message characteristics in a rubric designed to assess the discussion posts. The creation of this rubric is done by the instructor based on identified characteristics for the messages that would support the learning goal as well as specifying different levels of performance (grades) for each characteristic and assigning scores for these levels[3].

[2] The scenario represents an online interaction between Anna and ALICE system to participate in a collaborative activity where we suggested an enhanced form of assessment. The whole interaction should be registered and simulated as a VCS so it can be used as a learning resource in the future. Recording assessment interactions is highly questionable. Privacy aspects must be considered especially instructors access. (Coordination with WP is required)

[3] The message represents the student post within the discussion. Message characteristics and features could be "use of course concept x" or "degree of reflection", "accuracy", "originality", "novelty" or "teaches us something new", and "well written". These characteristics and features can be used by the instructor to create a rubric to assess the posts in a discussion. Commenting the posts can be used as peer-assessment and to give feedback to the contributor as well as can be used to classify posts and make them better retrieval.

6. Anna may initiate a new post message during the discussion in synchronous or asynchronous manner. For each initiated post she has to comment on it using the same comments from the previous step. Her comments on her posts will be used to compute a self-assessment scores compared with scores computed from the tutors' peer-assessment of her posts[4].
7. After the end of the discussion the learners' peer-assessments of the group members' posts are compared with tutors' assessments for the same discussion posts. This will help in assessing the individual's performance during the collaborative learning activity. An overall performance of the group can be computed and compared with other group's performance for the same learning activity as an outcome assessment of the groups.
8. The learners' performance can be computed out of the peer-assessment performance as well as measured affective/emotional feelings of group members during the discussion. These feelings can be measured and assessed using pre-defined rubrics. Coordination with WPis required.
9. Anna will be provided a feedback contains her posts and responds as well as the peers' comments on those responses and posts. This will help her to learn from here progress during the discussion or the collaborative learning activity in general.
10. After finishing the collaborative activity Anna will be asked to answer a questionnaire to measure some aspects regarding the collaborative learning activity such as: motivation and attitudes, tools and procedure usability, as well as comments and suggestions from the learners for further improvements.
11. The discussion posts can have different formats such as a text message, a text file, a picture, or a video-audio file.
12. The whole discussion can be simulated as a VCS and provided as CC-LR for similar collaborative learning activities.
13. The learner interactions during the discussion as well as the affective/ emotional feelings are used to update the learner model. And the overall performance of the learner can be used to update the learner learning path. Coordination with WPis required

A.4 Science teaching at University

Goal

to provide a holistic scenario of utilizing ALICE main concepts in scientific courses such as software development. The scenarios represent first ideas for a holistic scenario where all ALICE WPs have to collaborate in learning activities for science education.

Scenario Description

1. Eric logs into ALICE and uses the "Course" module to create the SW-Development Course.
2. He selects the "Blended Learning" type and ALICE guides him through the Course creation wizard
3. Eric starts with a detailed plan for the Course. In this plan he defines Learning Goals, topics, learning activities, delivery modes, models of teaching, styles of learning, strategies (diagnostic, formative, and summative) and forms of assessment, and results and feedback

[4] Here we need to distinguish between a discussion responds and a peer-assessment of the response. Anna has first to peer-assess the post using the comments extracted from the rubrics, and she may respond and in this case she has to comment her response using the same comments as self-assessment.

models. ALICE has to support Eric with friendly GUIs to create this detailed plan based on pre-defined process and meta-data extracted form reference models.

4. He uses the Course Learning Goals to identify the topics that this Course will cover and starts to select and create the material for each topic "Add Topic". The material can vary from simple presentations and handouts for face-to-face sessions up to more online material that have content, multi-media, and augmented learning materials such as digital stories and simulated collaborative learning activities.
5. He creates learning activities as part of the created topics. The learning activity can have different forms such as, homework, assignment, discussion, quiz, brain storming, collaborative activity…etc.
6. For instance, he creates an exercise as part of the SW-Development learning activities. The exercise has the type of "Interactive Digital Story". The exercise goals are to use interactive digital stories as an effective way of learning, to measure some affective/emotional aspects, as well as to evaluate the student's knowledge state and competences. ALICE supports Eric to:
    a. select possible stages and to identify possible situations.
    b. identify possible actions and possible roles that can take part in the situation.
    c. identify possible intelligent agents which may take part in the story situations for the following:
        i. Collaborative activities: the agent collaborates with the user in one or more situations to achieve a goal to move to the next situation.
        ii. Guidance and Help: the agent will support the learner within the story situations either automatically or based on the user request. The help can be in different forms hints, suggestions, or feedback based on specific actions.
        iii. Assessment: the agent can be used to deliver assessments that may take several forms such as Pop-up texts of questions, or it the agent may be used for monitoring the action and reaction of the user in a formative way to feed in the Guidance model.
        iv. Emotions Evaluation: the agent can be used to monitor the users' actions and reactions as well as more Affective/Emotional aspects. The measured emotions from the agent can be used evaluate the user's level of Affective learning.
    d. create an ontology based on the story situations, actions, roles, and intelligent agents. The ontology will be used by the "Digital Story Engine" to simulate and present the story. Moreover, it can be used to update the domain model as a reference model for the students' practices for the same exercise.
7. For instance, he can also create a collaborative-learning activity for the topic SW-design. The students have to collaborate in groups on specific levels of SW-design. The collaborative-learning activity can be assessed or not according to the required Learning Goals of the activity.
8. He manages the users that will participate in the learning activity by selecting students, granting access to groups or roles of users, or set the access level to self-participation where the students selects to participate in the learning activity.
9. He schedules the exercise to be taken after a face-to-face session or after an online-learning activity which covers the knowledge that underpin the exercise evaluated knowledge.
10. Eric uses the "Assessment" module of ALICE, to create enhanced assessments that go in line with the selected assessment strategy, and schedules those assessments before, during, or after the Course learning activities.
11. He uses the "Feedback" module to create different types of feedback that vary from a simple

hint during a learning activity to a more complex one of a complete progress report at the end of the Course. ALICE should be designed to support different types of feedback as part of the learning process and learner path to feedback from an assessment or any learning activity.

12. After the students have finished the learning activity, there works have to be simulated and stored in their e-portfolios as a C-LO .
13. Eric selects some successful C-LO out of the student's participation in the learning activity and assigns them some meta-data about the concepts they cover. The C-LO as well as the meta-data are used to update the "domain learning model" so they can be provided or augmented within personalised Courses for the same learning domain and concepts.

Scenario 2. Description

1. Dana logs into ALICE and follows the link to the available Courses during this term.
2. Dana finds the SW-Development Course within the list of the available Courses.
3. Dana clicks on the Course SW-Development.
4. ALICE shows a page containing the Course curriculum where the students can read Course Learning Goals and objectives, pre-requisites, topics, learning activities, Course schedule, assessment types and forms, and Course material suggested readings.
5. Dana finds useful information about the Course delivery modes, models of teaching, styles of learning, and a link for registration.
6. Dana clicks on the "Register" link and the ALICE checks for the possibility of Dana's registration. Different check levels have to be considered such as, Course quota and registration date, Dana' level. ..etc.
7. Dana registers for the Course and ALICE suggests a diagnostic assessment to diagnose Dana's knowledge state in SW-Development learning domain. Moreover, to provide Dana with a personalised Course where she has to follow a specific learning path in order to achieve the Course Learning Goals and objectives.
8. Dana clicks on "Diagnostic Test" where a test is delivered by ALICE.
9. ALICE updates Dana's learning model with her new knowledge state, and creates a personalised Course based on Dana's knowledge state and save it to her "My Courses" module. Specific information related to the student has to update his Courses schedule. For instance, the Course schedule has to update the student calendar with lectures dates and time. In the case of SW-Development as a Blended learning Course more information have to be provided to Dana. Such information can be the teaching modes (face-to-face, online learning), the learning activities and their time schedule, the dates of assessments and their types as well as the Course materials.
10. The Course materials as well as the learning activities are organized within the Course in a specific sequence that goes in line with Dana's learning path as well as the Course schedule. Web links can be used to represent that and they can be activated according to Course schedule and Dana's competence level.
11. Dana attends the first lecture (face-to-face), the instructor teaches a topic and uses a presentation as a teaching material. By the end of the lecture the instructor gives an assignment of online learning activity (optional) about the topic and an exercise to be done after the learning activity using ALICE system. Both of the instructor and the students log into ALICE during the Course lecture and have the same presentation.
12. Dana goes back home and logs into ALICE, she follows the links to the online learning activity and reads the provided material.
13. Dana follows the exercise related to the given topic where she has to join a group of students up to 5 students.

14. The group is requested to revise the requested materials for this exercise after attending the face-to-face lecture given by the Course instructor. They also can use the internet or any other learning materials to have more understating in the learning topic.
15. Dana uses the "Public Pad " tool within the ALICE resources to collaborate with her colleagues from the same group in writing a story scenario based on the problem in the exercise. All the students from the same group can share the same pad. The tool also supports the students with chat panel and documents sharing abilities [such as: http://etherpad.org/]. *[Goal: to provide students with a tool for collaborative learning where they can write together a scenario for the problem solution which will be used to create the digital story object in the next step. It is worth to mention that the tool has to be flexible to provide colours for each student contribution in the scenario (individual assessment). Moreover, the whole application of digital stories in scientific courses in general and software development in specific is highly questionable.]*.
16. Dana uses the "Digital Story Environment" tool within ALICE resources to map the created story scenario from last step to a digital story. Each participant in the group has to do the same action alone with no collaboration. *[Goal: to assess each student level of understanding for the problem and their abilities to map the story scenario into a digital story object]*. For the sake of simplicity, Power Point slides can be used to simulate the story scenario instead of the "Digital Story Environment" tool.
17. The group participants can collaborate again to update their story after their experience in mapping the story scenario to a simulated version (for instance, a presentation). This will give the students another chance to adapt their scenario in order to have the best possible solution for the exercise problem *[Goal: story retelling for further learning]*.
18. After the end of the previous phase "learning by Collaborative- Storytelling", ALICE system composes a "Storytelling Learning Object" for measuring the student's knowledge state after the "Collaborative- Storytelling" learning activity. The ontology prepared for the exercise from the instructor scenario will be used by ALICE in this step to compose the "Storytelling Learning Object". Coordination with WP6 is required and the ability of ALICE to compose digital story learning object based on story ontology is highly questionable.
19. Dana interacts with "Storytelling Learning Object" where her actions and reactions will be monitored using the intelligent agents. Affective/ Emotional feelings will be measured. Moreover, pre-prepared assessments (cognitive assessment, emotional assessment, performance assessment) will be delivered during Dana's progress within the situations of the story.
20. As Dana requires continues guidance, an intelligent agent can be used within the story to support here with hints or feedback.
21. Dana fills in a "Questionnaire" that diagnoses aspects such as, motivation and attitude, Knowledge acquisition, affective/emotional aspects, and usability aspects.
22. The output from the assessment activities of Dana's interactions with the story are used to update her knowledge state, update the learning domain model (moderation), and to update here learning model and learning path.

Scenario 3 description - Part-time learner View

The same first 10th steps from scenario 2, in this scenario Sara has no time to attend face-to-face sessions so ALICE delivers her personalised online Course. This scenario has some extra challenges of security, plagiarism and cheating.

11. Sara follows the links to the online learning activity and reads the provided personalised material regarding a specific topic.
12. Sara follows the exercise related to the given topic where she has to join a group of students up to 5 students. Alumni students are allowed to participate in the group so that they can share their experience with inexperienced students and support them within the learning activities. Collaborative-learning fits the need of Sara as she lacks the motivation and engagement during her online Courses.
13. The group is requested to revise the requested online materials for this exercise; they also can use the internet or any other learning materials to have more understating in the learning topic.
14. Dana uses the "Public Pad" tool within the ALICE resources to collaborate with her colleagues from the same group in solving the problem in the exercise (for instance, eliciting the functional requirement for the bank cash machine). All the students from the same group can share the same pad. The tool also supports the students with chat panel and documents sharing abilities [such as: http://etherpad.org/]. Different tools can be used for collaborative activities such as wikis, and weblogs. *[Goal: to provide students with a useful tool within ALICE project that can be utilized for collaborative learning, Coordination with WP3 is required]*.
15. The student's performance during the collaborative learning activity can be evaluated as an affective/emotional aspects as well as the quality of the individuals and group output represented by the solution document.
16. ALICE provides Sara a formative assessment after the completion of specific topic learning activities (online learning material and the collaborative exercises). Based on this assessment Sara will be provided a valuable feedback regarding here knowledge state as well suggested further steps based on here results. A possible next step is to continue with the next topic, or to retake the current one. *[Goal: formative assessment will support Dana with valuable feedback about her level of knowledge and competence after finishing the learning activity, Moreover; it will support ALICE to suggest next suitable topic or learning step]*.
17. In order to avoid Sara being frustrated as well as to motivate and encourage her, a more interesting learning material can be provided by ALICE. Such material can have Collaborative Complex Learning Resources (CC-LR) which contain Virtualized Collaborative Session (VCS) in order to learn from others collaborations as well as to gain more knowledge about collaborative-learning. As VCSs are designed to be interactive she can change some discussion parameters and notice the consequences. The selection of the appropriate CC-LR can be done by the instructor during the "Authoring phase", or based on the learner model as well as the activity Learning Goals.

Scenario 4 description - Learner View

11. Christoph logs into ALICE and uses "My Courses" module to follow the learning activities of his registered Courses for this term.
12. Christoph selects the "SW-Development" Course and uses the Course curriculum to know Course topics, Learning Goals, Course schedule, and Course material as well as assessment approach.
13. He finds some keywords regarding the Course topics. The keywords are provided by the Course instructor to support learners in selecting and looking for Course materials from ALICE content management system as well as from the internet or digital libraries. The curriculum is prepared to have the Course topics and for each topic a set of keywords are provided. Those keywords represent the concepts that the learner has to learn as part of the

learning objectives and goals. From the pedagogical point of view, the Course is self-regulated where learners have to choose the learning materials for this Course.

14. Christoph uses the keywords to search the content management system of ALICE for recommended readings. Advanced search features can be provided by the content management system to support him. The content management system should consider Christoph's leaner model and profile as well as the Course goals and objectives not to recommend readings that do not fit with Christoph's learning path.
15. Christoph also uses the same keywords to search the internet and digital libraries for related learning contents. In this case he has to select the ones that fit with his needs, or he may use some intelligent tool provided by the content management system to check if the found learning contents suits his learning path as well as the Course goals.
16. Christoph starts the learning phase by reading the recommended content out of last two steps and whenever he is done from a topic or a learning unit, he has to take an assessment in order to make sure that he fulfilled the learning objectives and goals for the topic. The assessment is used to update Christoph's learning model as well as his learning path during this Course. Moreover, it will guide him to read more materials, concentrate on some parts of the learning materials, or that he has achieved the topic objectives and goals and so he can move on to the next topic within the same Course. A third-party tool is used to create single, multiple-choice questions, and fill-in-blank questions for specific concepts from the material. The "Assessment" module in ALICE creates automatically a test by selecting randomly some of the created questions covering the required concepts.
17. Christoph enters the "Assessment" module and chooses the type "Automatic question generation".
18. Christoph clicks on "Content" and the tool will ask him for the learning content that he wants to create tests for. Christoph selects the content materials that have been recommended for him and clicks the Button "Create".
19. The selected learning content will be used to call an "Automatic Question Generator" tool with the selected materials. The "Assessment" module in ALICE will use the generated questions to create a test for Christoph and the test is delivered to his tests as part of the Course page.
20. Christoph takes the delivered test and receives a feedback about the progress, results, and next steps. The results will be used to update Christoph's Learning Model as well as his learning path within the Course.
21. Christoph achieves the required goals for this topic and ALICE provides him the next one within the Course. The required learning objectives and goals from the second topic are more meta-cognitive and social skills oriented. Therefore, Christoph is required to collaborate within a group on the topic learning activities.
22. ALICE delivers a learning activity that suits the topic and Christoph takes the activity. As Christoph is inexperienced in collaborative-learning activities he asks ALICE to provide him with a learning material for that.
23. ALICE composes a "Story Learning Object" where a group of players have to interact within different roles in a collaborative basis to finish a specific task for instance SW requirements elicitation. Another possible solution is, ALICE delivers him a complex learning content where a CC-LO has been simulated from a VCS. Christoph interacts with the VCS and changes some parameters and monitor the effect.
24. After he has finished the learning phase in the last 2 steps, Christoph takes part in a collaborative learning activity.
25. He joins a group of students up to 5 and collaborates together on the tasks and learning activities required for the topic. An enhanced form of assessment is conducted where his

performance within the group, knowledge competence level, as well as affective/emotional aspects are measured. A new form of peer-assessment can be used for the assessment phase.

26. The results from the assessment phase are used again by ALICE to decide the next step for Christoph. Moreover, to update his learning path and model.

Sceanrio 5 descritpion - Alumni-learner View

11. Michael logs into ALICE and follows the link to the "Life-long Learning".
12. Michael clicks on "Personalised Content", and fills in a text box in natural language explaining his query.
13. He also may add some key-words such as, "SW-Development", "SW-Design", or "Requirements Elicitation".
14. ALICE uses the query and the key-words from Michael to compose personalised learning materials that match in somehow his requests.
15. The personalised learning materials are structured as follows: new concepts and techniques, Learn from experts, participate in collaborative learning activities.
16. Michael selects the new concepts and techniques link, where he is guided through a well prepared online learning content explains the new concepts and the emergent techniques for the concepts of SW-development he asked for.
17. Michael then selects the "Learn from experts" link where ALICE delivers a complex collaborative learning content consists of several CC-LO that demonstrates how experts deals with the same case and situation.
18. Michael is then recommended to participate in collaborative learning activities for the same learning concepts he is looking to learn. During these collaborative learning activities Michael will use his experience as well as the newly learnt concepts to collaborate with inexperienced students to solve pre-defined problems that cover the required concepts and to use new and emergent techniques as well as the old ones. In this phase, an enhanced assessment can be applied. For instance, peer-assessment where Michael will participate as an experienced peer who guides and explains concepts to inexperienced students. This will empower Michael with teaching abilities that are used to support him with learning the required concepts.
19. Michael receives a feedback with his progress as well as suggested learning materials that suits his knowledge state and competences.
20. In case that Michael requests a concept that the Course does not cover, ALICE sends his request to the Course instructor as possible Labor market requirement so that the instructor can decide the importance of the concept and if there is a need to update the Course material.

Scenario explanation

From a methodological point of view, ALICE project is concerned on having complex collaborative and adaptive learning activities where effective forms of learning such as storytelling and affective learning aspects can be used. Moreover, using new forms of assessment to evaluate the student's knowledge competencies, skills, motivation, and engagement as part of those leaning activates.

The scenario covers the concepts and goals from the ALICE research. Varity of possible user roles can take part of this scenario represented by the personas provided. I didn't mention where the coordination between the WPs has to be done as this scenario represents a holistic idea where all the WPs have to collaborate in the development of this scenario.

From the technological point of view, the implementation of this scenario requires the provision of tools to the instructors, and the students. For instance, the "Public pad" tool, the Digital story creator tool "Digital Story Environment", as well as the "collaborative-learning" tool have to be developed. Moreover, ALICE system has to be designed to provide personalised as well as adaptive learning. ALICE has also to be able to provide collaborative learning activities and digital stories

A.5 Homework with Peer Review

Scenario Description

1. The teacher assigns to a group of students a set of essays on related topics (one essay for each student). Each student is also associated as assessor for one or two other students. Each student must produce his own work by entering free text and possibly attaching a file in response to a given topic.
2. After the submission of all student's work, there is a review phase where each assessor must produce a revision in free text (possibly following an outline provided by the teacher) and an assessment of the student(s) assigned to him.
3. At the end of the review phase, the teacher can conduct his own audit and gives an assessment to each student taking into account both the essay and the revisions made.
4. Each student can see all the reviews received (by students and by the teacher).
5. The process follows the methodology of peer-review typically adopted for the evaluation of scientific publications.

APPENDIX B. Personas

Name: Arthur.	**Role**: Instructor.
Demographics: 40 years old.	
Knowledge, skill & abilities: Arthur is a professor in Computer Science Department and he is looking for a new form of assessment in order to assess his students in an e-learning activity as part of his course Information Search and Retrieval (ISR). Arthur has been teaching the ISR course for more than five years. This year he added an online learning session to the course curricula and he want to conduct new form of assessment during this online learning activity. Arthur is thinking to apply an e-learning approach that consists of online learning phase and an assessment phase.	
Goals, motives and concerns: Out of this online learning activity Arthur wants to investigate the students' attitudes to modern learning activities, evaluate the student's knowledge acquisition abilities for online learning, and to assess the student's performance in modern learning approaches.	
Usage patterns: Arthur is a permanent user of ALICE. He uses the system as the main resource to manage his courses and to conduct learning activities.	

Name: Alex.	**Role**: Learner.
Demographics: 23 years old.	
Knowledge, skill & abilities: Alex is a student in Computer Science Department and he attending the course Information Search and Retrieval (ISR). Alex is in his first year of his master studies. He does not have any experience with peer-assessment activities.	
Goals, motives and concerns: Assess Alex performance in an e-learning activity that has both online assessment and peer-assessment, investigate his attitude to modern learning activities, and evaluate his knowledge acquisition abilities for online learning.	
Usage patterns: Alex is a permanent user of ALICE. He uses the system as the main resource to follow the learning activities required by his courses.	

Name: Leila.	**Role**: Learner.
Demographics: 23 years old.	
Knowledge, skill & abilities: Leila is a student in Computer Science Department. She is a part- time student and she is in her third year in the bachelor program.	
Goals, motives and concerns: Self-regulated learning, Automatic questions generation for single, multiple-choice questions, and fill in blank questions.	
Usage patterns: Leila is a part-time user of ALICE. She uses the system as the main resource to participate in the courses and to follow the required learning activities.	

Name: Eric.	**Role**: Instructor
Demographics: 38 years old.	
Knowledge, skill & abilities: Eric is an assistant-professor in Computer Science Department. Eric is teaching Software Development for undergraduate students. Eric has been teaching the Software Development course for more than five years. Over the years he identified problems regarding a great variety of student's knowledge and motivation; he also has somehow to deal with different types of students, from inexperienced fulltime students to experienced part time students. This year he is intended to offer blended learning activities and improve the course using the ALICE system. In particular he is interested in having affective and collaborative learning forms. He is also interested in digital storytelling and retelling as an effective way of learning. Moreover, he is interested to continuously evaluate student's performance and knowledge competencies as part of theoretical and practical software development activities.	
Goals, motives and concerns: Affective and Collaborative learning forms; Digital Storytelling and retelling as an effective way of learning; Adaptive and personalized learning; and New forms of assessment.	
Usage patterns: Eric is a permanent user of ALICE. He uses the system as the main resource to manage his courses and to conduct learning activities.	

Name: Dana.	**Role**: Learner
Demographics: 20 years old.	
Knowledge, skill & abilities: Dana is a student in Computer Science Department and she is attending the course Software Development during the summer term. Dana is in her 2nd year of her bachelor program. Dana is very inexperienced in computer science topics and needs continuous guidance during her courses and requires continuous feedback to keep encouraging her to feel confidant during the learning activities. She is not used to work in groups and is anxious to contribute and defend her input within the group. Dana is also interested in having a blended learning course where she can attend face-to-face lectures as well as online learning activities.	
Goals, motives and concerns: To support Dana to be more self-confident through personalized learning activities; to encourage her to be more engaged in collaborative learning activities; and to assess her learning in competencies and performance.	
Usage patterns: Dana is a permanent user of ALICE. She uses the system as the main resource to follow the learning activities required for her courses.	

Name: Sara.	**Role**: Learner
Demographics: 30 years old.	
Knowledge, skill & abilities: Sara is a part-time student in Computer Science Department and she does not have free time to attend the lectures of the course "Software Development". She is interested in having online web-based learning activities so that she can learn any time anywhere she would like to learn. Although online learning would support her time limitations, she had in the past problems to keep motivated and engaged; in the last semester she had quite 2 courses because she felt very isolated and need to be more involved in a learning community.	
Goals, motives and concerns: To support both part-time students as well as distant students with web-based useful learning activities for the course "Software Development".	
Usage patterns: Sara is a permanent user of ALICE. She uses the system to follow her e-learning activities as part of her courses.	

Name: Christoph.	**Role**: Learner
Demographics: 23 years old.	
Knowledge, skill & abilities: Christoph is a student in Computer Science Department. He is a full- time student and he is in the third year of the bachelor program. He is very experienced in computer science topics and he is highly motivated to learn more than average students in his class. Christoph is interested in having self-regulated learning. Moreover, he is interested in improving his meta-cognitive and social skills by working in groups.	
Goals, motives and concerns: Self-regulated learning; Automatic questions generation for single, multiple-choice questions, and fill in blank questions; Collaborative-learning; Storytelling.	
Usage patterns: Christoph is a permanent user of ALICE. He uses the system as the main resource to participate in the courses and to follow the required learning activities. Moreover, to search the ALICE Content Management System (CMS) for further and suitable readings for his learning activities.	

Name: Michael.	**Role**: Learner.
Demographics: 25 years old.	
Knowledge, skill & abilities Michael is a Graduate from the Computer Science Department and he is working for Siemens as an Analyst/Developer. Michael as part of the SW-Development Department, he needs to revise some ideas and techniques that he learnt during his university studies as well as to learn the emergent technologies and techniques in the domain of SW-Development. Michael loves to work in groups, share ideas and learn from peers; he is willing to give advices and share his knowledge but also wants to get feedback from his peers.	
Goals, motives and concerns: To support Michael with personalized material that suits his qualifications and requirements (Life-long learning); and to adapt the instructional as well as the learning content to the industrial requirements. (Among the alumni queries the system can extract the requirements of the industry and the labor market).	
Usage patterns: Dana is an Alumni user of ALICE. He uses the system as the main resource to search for personalized material for his job activities requirements.	

Name: Leopoldo.	**Role**: Teacher
Demographics: 35 years old.	
Knowledge, skill & abilities: Leopoldo is a Teacher of Artificial Intelligence in an open university. He manages two course of Logics, one for the faculty of Computer Science and another for the faculty of Mathematics. He's experienced in ALICE knowledge management features.	
Goals, motives and concerns: Leopoldo already has a Logics ontology for mathematicians that he uses to let ALICE build personalized courses basing on it. Given that topics for computer scientists are slightly different, the ontology and some learning resources must be modified in order to take into account also the new context where courses have to be generated.	
Usage patterns: Leopoldo is an experienced user of ALICE. He currently uses ALICE advanced features to provide personalised courses to his students.	

Name: Marcovaldo.	**Role**: Learner.
Demographics: 24 years old.	
Knowledge, skill & abilities: Marcovaldo is a student in Physics that is preparing his examination on mechanics. He must still fill some gap mainly about collisions.	
Goals, motives and concerns: Marcovaldo needs to acquire practice in exercising on inelastic collisions. A so specific course is not included in the ALICE course catalogue: only a course on Mechanics and a comprehensive course on Physics are available but they are expensive and cover many unnecessary or already known topics.	
Usage patterns: Marcovaldo is an occasional user of ALICE. He uses the system to complement what he learns through University courses.	

Name: Francesco	**Role**: Learner
Demographics: 16 years old. He lives in a place at high risk of earthquakes.	
Knowledge, skill & abilities: Francesco has a lot of experience of earthquakes. He has participated in training courses and managed different seismic events. He has good skills about communication, computer and concerning the use of specific iDevice for the fun	
Goals, motives and concerns: Francesco needs to acquire some specific knowledge in earthquakes environment : knowledge of rules and behaviors to adopt in an emergency situation; knowledge of safeguards to prevent or mitigate threats to himself and others.	
Usage patterns: Francesco is an occasional user of ALICE. He uses the system as a complementary learning method to the traditional activity developed in the class.	

Name: John	**Role**: Schoolchild
Demographics: UK Key Stage 3 age threshold (11-14)	
Knowledge, skill & abilities: Interested in games for entertainment purposes; limited knowledge of best practice in an evacuation and apathy towards learning it.	
Goals, motives and concerns: Competitive game player, little motivation to learn evacuation procedures.	
Usage patterns: Willing to play entertaining games during leisure time and outside of school hours via the Internet. Also has access to PCs via a computer lab at school, and regular lessons. Limited exposure to real world evacuation drills and simulations.	

Name: Elena.	**Role**: Learner
Demographics: 30 years old.	
Knowledge, skill & abilities: Elena is a student in Computer Science and has to participate in a small virtual group (4-5 members) to carry out a software project at a distance. She has experience in computer programming, however the project sets high level requirements and needs that demand intensive collaboration during the whole quarter.	
Goals, motives and concerns: Elena may not have previous experience in collaborating with other people, especially at a distance. She will certainly need important guidance and support by her teacher who should be able to monitor individual and group work throughout the experience. The tutor disposes of a variety of collaborative strategies, methods and tools to support and enhance collaboration, debate and information exchange among peers so as to lead them to complete the required project successfully. Each group should be able to choose an adequate subset of the given collaborative strategies and build their own collaboration strategy that best suits the group's dynamics, interests, and goals. The tutor should provide a well-structured project with suitable learning activities, well defined tasks, as well as rules and procedures that group members have to follow in order to accomplish the project.	
Usage patterns: Elena is a permanent user of ALICE. She uses the system as the main resource to develop the project she has been assigned to.	

Name: Anna.	**Role**: Learner
Demographics: 21 years old.	
Knowledge, skill & abilities: Anna is a student in Computer Science Department and has to participate in a collaborative learning activity (discussion) within a group of 5 members as part of a Software Engineering course.	
Goals, motives and concerns: Anna may not have previous experience in online collaboration within a group. She has to participate within a group in a discussion learning activity where her performance will be assessed. The course instructor suggests a peer-assessment procedure to assess the performance group members as well as the overall performance of the group. Different groups should be able to start the discussion activity. Each group members has to peer-assess the posts from the same group members. A set of tutors are assigned to assess the posts within the discussions. The tutors' assessments will be used as reference evaluations and the learners peer-assessments will be compared to them. Each group member will receive a feedback of her/his posts as well as responds compared with other peers and tutors' responds. The instructor may provide Collaborative Complex Learning Resource (CC-LR) contains Virtualized Collaborative Session (VCS) in order to help the learners to learn from previous discussions.	
Usage patterns: Anna is a permanent user of ALICE. She uses the system as the main resource to participate in the collaborative learning activities that have been assigned to her.	