Widening Access to Virtual Educational Scenarios

562463-EPP-1-2015-1-UK-EPPKA2-KA

D2.1 Development Plan

Deliverable number	D.2.1
Delivery date	Oct 2016
Status	Final
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Funded by the
Erasmus+ Programme
of the European Union

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1. INTRODUCTION

This document represents a development plan for the technical developments that will take place as part of WP2 of the WAVES project. It will identify the key development tasks to be undertaken, describing the systematic process by which these were agreed. It will summarise the key development principles, and the intended technologies and systems to be targeted and used.

The target audience for the document is primarily a technical one, as the key goal for the document is to provide guidance to project team working on implementing developments as part of WP2.

2. IDENTIFYING DEVELOPMENT GOALS

A structured process for identifying the key development goals was undertaken, building upon the Needs Analysis in WP1. This approach was based around the concepts used in Unified Modelling Language (UML) in order to identify the key actors, and initially represent the key use cases for the system. Subsequently, these use cases were further developed into optimal workflows that will describe the tasks that users of Virtual Scenarios commonly wish to achieve and the manner in which they would ideally be able to do so.

These workflows will form the basis of the development work outlined in subsequent sections of the plan, with the goal of achieving these optimal workflows within the exemplars developed by the project.

2.1. **Exemplar End User Scenarios**

Members of the project team who are representative of end users in both the academic and corporate environments were asked to describe typical tasks that they would like to achieve using VS systems, and describe an idealised way in which they would work to complete these tasks that would minimise complexity, time and effort.

The following table details the exemplar end user scenarios that project team members described:

Scenario/ Task – Short Description	Details	Diagram (See Appendix 1)
Learner registered at an academic institution uses a VS	I am a learner registered at an academic institution on a conventional academic programme. I am digitally literate but without specialised technical knowledge. As a learner I would like to have all my learning under one platform so as to reduce the number of different accounts and systems I have to log	Use Case Diagram 1

	into. I would like to be able to log into my institutional VLE and be able to see any Virtual Scenarios in the relevant areas with the rest of my learning content. When I choose to access a scenario I would like to be able to do so without having to enter any other usernames or passwords. Having finished a scenario, I would like to be able to access and see any scores or reports from the scenario integrated with any other information about me on the LMS/VLE.	
Learner registered on a MOOC uses a VS	I am a learner registered on a MOOC, without any affiliation to an academic institution. I am digitally literate but without specialised technical knowledge. As a learner I only have access to the MOOC platform, so my learning must all be accessible through that platform. I would like to be able to access the Virtual Scenario from within the structure of my MOOC course. When I choose to access a scenario it should blend seamlessly with the rest of my course, and I have no logins to other systems. Having finished a scenario, I would like to be able to access any scores or reports from the scenario integrated with any other information about me on the MOOC platform.	Use Case Diagram 2
Learner registered on a Corporate LMS	I am an employee of a corporation. In order to do my job I have to complete some online training. I am digitally literate but without specialised technical knowledge. As a learner I would like to have all my learning under one platform to reduce the number of different accounts and systems I have to log into. I would like to be able to log into my institutional VLE or corporate LMS and be able to see any Virtual Scenarios in the relevant areas with the rest of my learning content. When I choose to access a scenario I would like to be able to do so without having to enter any other usernames or passwords. Having finished a scenario, I would like to be able to access see any scores or reports from the scenario integrated with any other information about me on the LMS/VLE. I would like to have the option to revisit completed scenarios and review their contents in order to refresh my memory.	Use Case Diagram 3
Educator	I am a teacher who wishes to prepare scenarios for a series of	Use Case

creating tutorials for exploring competency	tutorial sessions with my students. I particularly need features of interactivity so that I can use the scenarios for demonstration of decision-making in their competency based training. I am not very technically competent, but I am able to access the programme through our institutional learning environment, which is reasonably easy to use and from where I will start creating my case or edit my existing cases. I have several groups, with different requirements and I can re-use and re-personalize the scenario for different uses. When delivering the tutorial I will access the case myself using the web in the tutorial session.	Diagram 4
Educator creating online scenarios for supplementary learning	I am a teacher who needs to deliver some online learning scenarios for independent learning. The students are not marked on these scenarios, but it is important that i receive notification they have accessed them. I am not very technically competent, but I am able to access the program through our institutional learning environment, and it is reasonably easy to use. The scenarios are shared with the students,and they can access them easily from their learning environment and I can quickly give the entire group access without the need for students to have separate usernames and passwords.	Use Case Diagram 5
Educator creating online scenarios for formative assessment	I am a teacher who needs to deliver some online learning scenarios for training in management skills . I am not very technically competent, but I am able to access the programme through our institutional learning environment, and it is reasonably easy to use. When I have completed editing my case I want to be able to easily share it with my learners using tools that I am familiar with (i.e. the VLE, and not computer code) so that they can access it from within their VLE, without them needing a separate login, and I would like it to show up in the context of the rest of their learning activities within the VLE. The scenarios are shared with the students, and i can quickly give the entire group access without the need for students to have separate usernames and passwords. These scenarios are intended for formative assessment, and the results of that assessments will be logged in the student portfolio. The agreed principle of these formative assessments is that teachers are aware they have been done, but are not automatically aware of the scores, and appear in the area of	Use Case Diagram 6

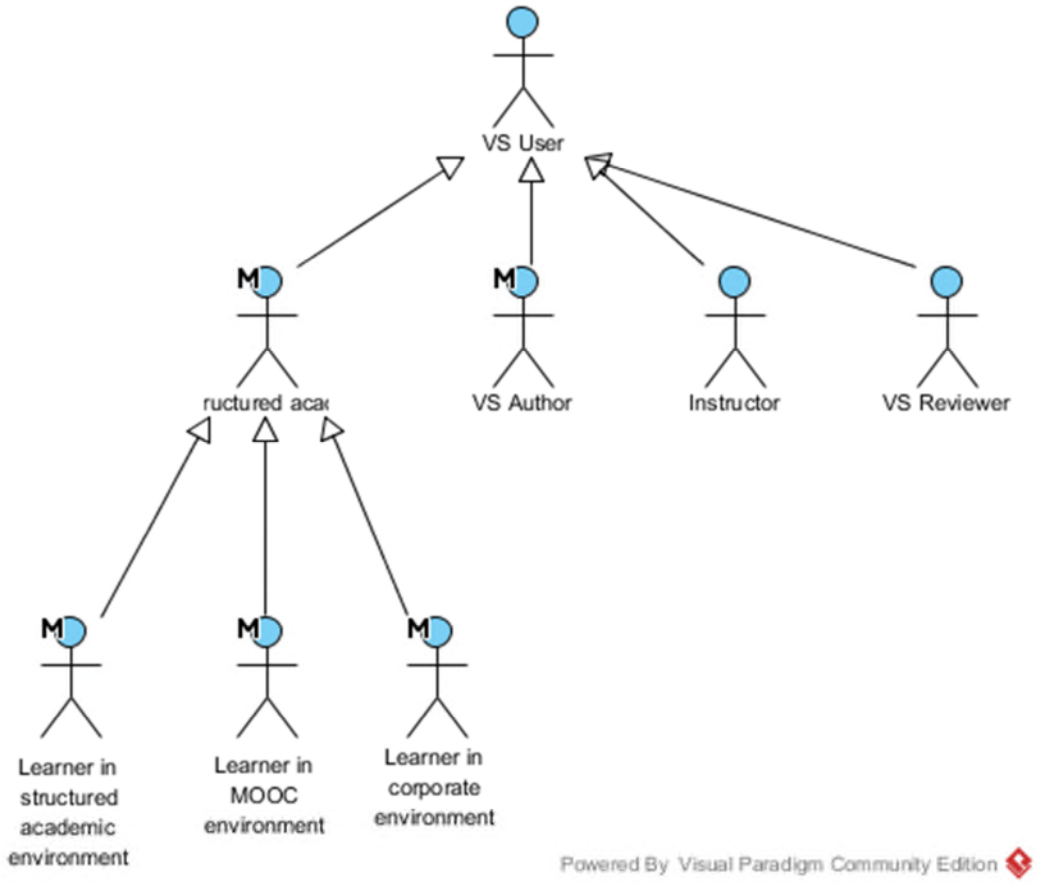
	the VLE or the e-portfolio/gradebook which is private to students.	
Educator delivering online scenarios for summative assessment	I am a teacher who needs to deliver some online learning scenarios for assessment of competency. Mostly these are used in computer classroom settings under conventional exam conditions, but occasionally we use independent learning settings. I am not very technically competent, but I am able to access the programme through our institutional learning environment, and it is reasonably easy to use. The scenarios are shared with the students, and i can quickly give the entire group access without the need for students to have separate usernames and passwords. I would like to be easily able to see at a glance the key information about my classes' use of the Virtual scenario that I created. In particular I would like to be able to log into the VS system using the credentials I used to create the case, and to be able to see how many students accessed the scenario. These scenarios are intended for summative assessment, and the results of that assessments will be logged in the student portfolio or gradebook. I would like to see who completed the scenario, as well as information about how long they spent on each page in my scenario, and what choices were made. I would like to see this information both collectively for a group of students, and if necessary on an individual basis.	Use Case Diagram 7
Subject Matter Expert updating the content of existing scenarios	I am a subject matter expert within our company. There have been some small changes to the subject and I would like to be able to update the existing online scenarios to reflect these changes. I am not that technically competent but I can access the programme through our company's learning management system. From there I can make the changes to the relevant scenario. All the changes are tracked so we know learners are doing the updated training and we have a record for compliance purposes.	Use case Diagram 8
Subject Matter Expert reviewing new content for a scenario	I am a subject matter expert and I have been asked to review some new scenario based training that will be delivered via our company's learning management system. I am not technically competent but all I need do is access the programme via the LMS and locate the new scenario (at the moment only a handful of named individuals can see it). I can then preview the content as a learner but also pause it and move backwards	Use Case Diagram 9

	and forwards at will. There are text boxes where I can add my comments.	
Instructional Designer creating online scenario for a new process	I am an instructional designer working in a large company and I have been approached by one of our internal clients who would like me to design, develop and deliver scenario based training for a process that is being introduced into the business. Learners need to be aware of the consequences if they do not follow the process correctly. I can access the programme via our company's learning management system. From there I can open a template scenario already branded with our company's identity and, using a logical workflow, create an interactive scenario which can be published and assigned to the relevant learners. During the development process I can send out review versions to specific individuals for comment and then collate the feedback to produce the final module. There is no requirement for assessment but we do need to have a record that learners have completed the training so that we have evidence that our employees understand the new process.	Use Case Diagram 10
Instructional Designer creating an online scenario for a new system	I am an instructional designer/developer in a large corporation. A new system has been introduced and I am designing and developing the online training for the system. It is a relatively complex system and users will need to make decisions at certain points as they input data. I am technically competent, experienced in various rapid authoring tools as well as some hard coding. I can access the programme via our Learning Management System and add in screenshots from the actual system with hotspots to create interactivity, as if the learner is using the system. During the development process I can send out review versions to specific individuals for comment and then then collate the feedback to produce the final module. There are a series of scored exercises throughout the scenario. The learner must attain at least 80% in order to complete the training. No record of their actual score is retained and they will be able to retake the training until they achieve the required score. Once they have completed the training they will be given access to the new system, the system owner having received an alert from the LMS.	Use Case Diagram 11

Trainer using online scenarios for supplementary learning	I am a trainer in a large corporation delivering training face-to-face and online. I use a range of scenarios during the sessions and I would like to find them in a bank of scenarios, modify them accordingly and then deliver via a browser either through a projector in the classroom or via our chosen webinar software.	Use Case Diagram 12
Author without access to a VS system	I am an educator who wishes to create VS resources, but my organisation does not have access to a VS system currently, so there is nothing integrated into my VLE. I have identified a system that I wish to use, so I would like to be able to log on to that directly, and share my VS with my students in the form of a link, without them needing an account.	Use Case Diagram 13

2.2. **Identified Actors**

Based upon the scenarios documented above, we have identified the following actors relevant to the project that need to be considered:



Actor	Definition
VS user	can access virtual scenarios
Learner	learns from virtual scenarios
Educator	introduces virtual scenarios in teaching
VS Author	creates or modifies virtual scenarios
VS Reviewer	evaluates virtual scenarios
Instructor	views learner marks and grades from virtual scenarios

Note: Roles can be combined (one physical user can play more than one role in a VS system)

2.3. **Prioritised Use Cases**

For each of the scenarios listed in section 2.1, a use case diagram was generated to represent the interactions with the systems described. These use case diagrams are provided in Appendix 1.

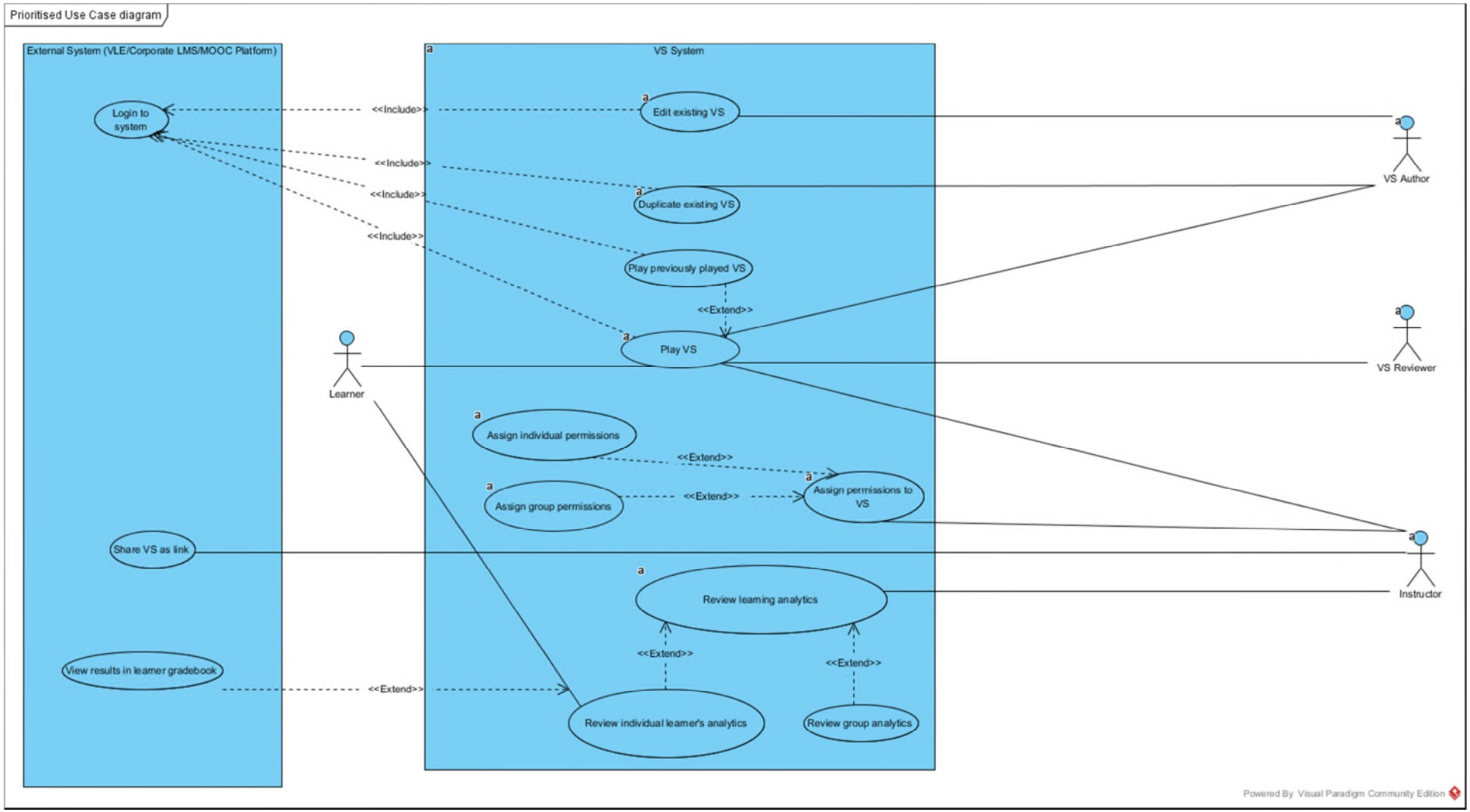
Based upon the scope of the project, and the outcomes from the Needs Analysis it is clear that not all the use cases identified can be addressed, and that the project development has to target selected prioritised use cases.

The goals of the project are to make VS more accessible to users (both learners and educators, in both academic and corporate environments). It is not within the scope to develop additional functionality for VS content and system, but instead to enable easier access to the resources and the data that is generated by the resources. To this end, we will prioritise developments on those use cases which fit this description. Chiefly:

- Those use cases which rely on integration of systems, including single-sign on access for both learners and educators, in a way that is transparent to end users.
- Those use cases that make data more easily accessible, more flexible, and more useful, including by making data portable and enabling transfer to other end-user focused systems.
- Those use cases which are generalisable to multiple contexts and systems i.e. those which do not depend upon features specific to one system and that cannot be replicated by the same or similar means in another system.

We will not prioritise those use cases which involve extending the functionality of existing systems, or which cannot be used by the wider community.

To this end, we have taken the use case diagrams in appendix 1, and used them to generate a unified use case diagram below which describes only those use cases prioritised for the project. This unified diagram more clearly separates the roles of different actors within the system, and in places combines specific use cases from different diagrams as one generalised use case in the single model.

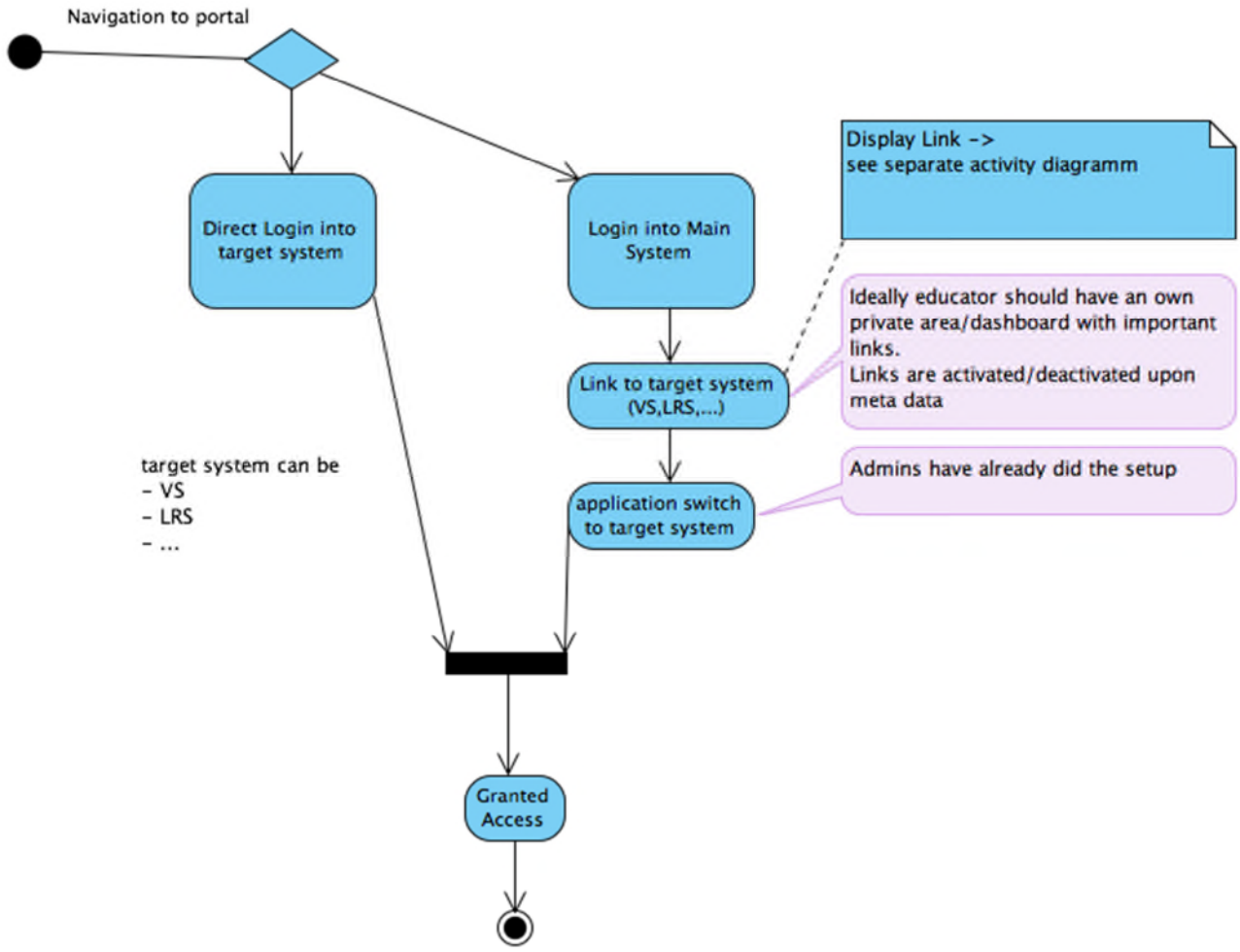

Prioritised Use Case diagram
External System (VLE/Corporate LMS/MOOC Platform)
VS System
Login to system
Edit existing VS
Duplicate existing VS
Play previously played VS
Play VS
Assign individual permissions
Assign group permissions
Assign permissions to VS
Share VS as link
Review learning analytics
View results in learner gradebook
Review individual learner's analytics
Review group analytics
<<Include>>
<<Include>>
<<Include>>
<<Include>>
<<Extend>>
<<Extend>>
<<Extend>>
<<Extend>>
<<Extend>>
<<Extend>>
Learner
VS Author
VS Reviewer
Instructor
Powered By Visual Paradigm Community Edition

3. ACTIVITIES/WORKFLOWS/SEQUENCES

In this chapter we present the key prioritised use cases for WAVES as UML activity diagrams.

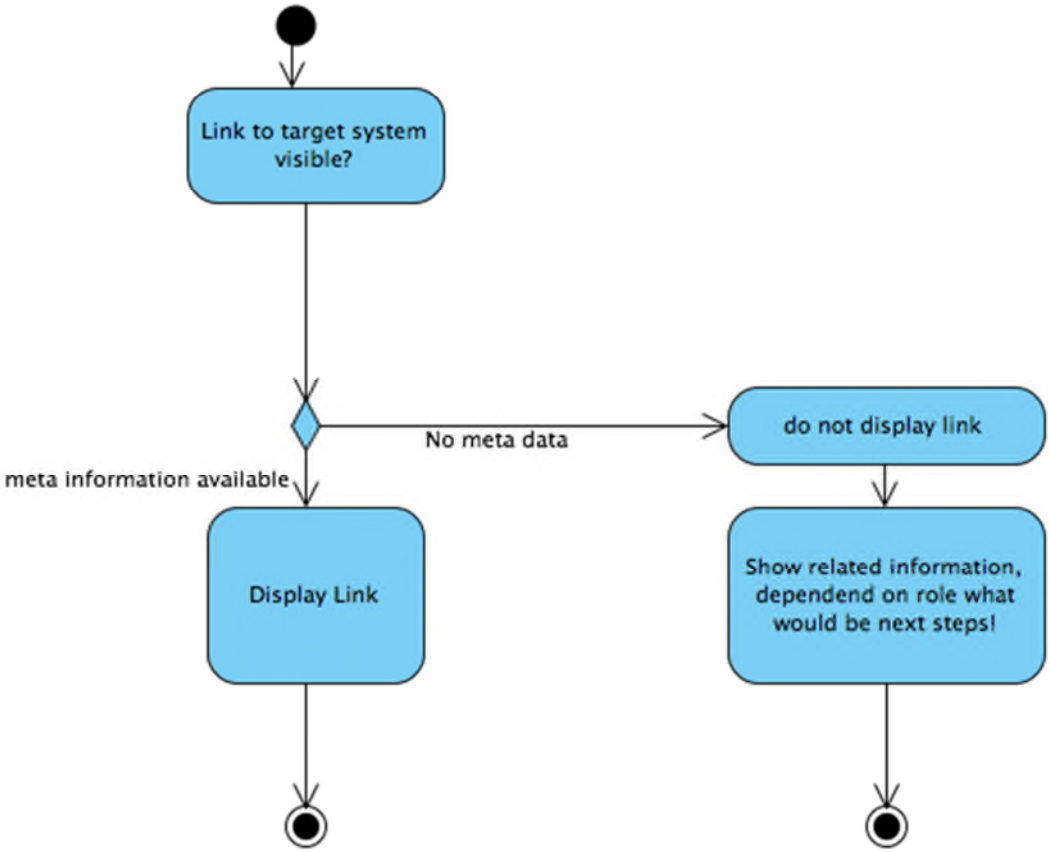
3.1. Activity Diagram 1 – Logging Into The VS System

This diagram shows the login into a targeted “subsystems” (VS, LRS or more) directly or through an institutional portal.



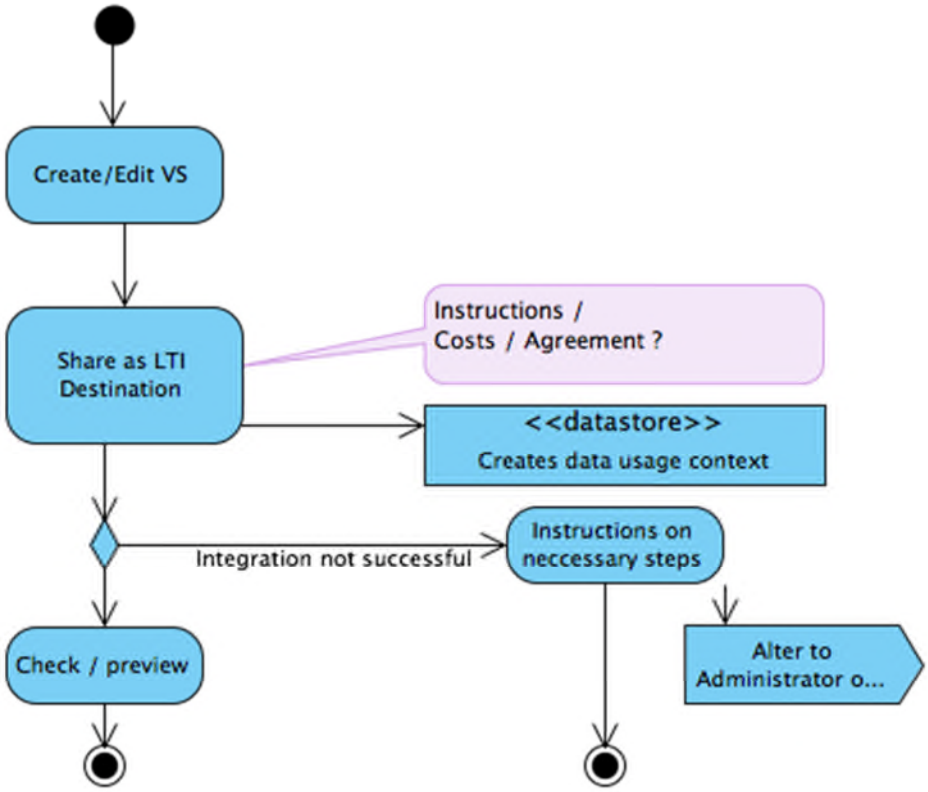
3.2. Activity Diagram 2 – Displaying Link To VS In External Eystem

This diagram covers activity “Link to target system” of 3.1.



3.3. **Activity Diagram 3 – Creating/Sharing A Case**

The following activity diagram shows edit and sharing a case exemplar as LTI linking in another system.



3.4. **Accessing Learner Analytics**

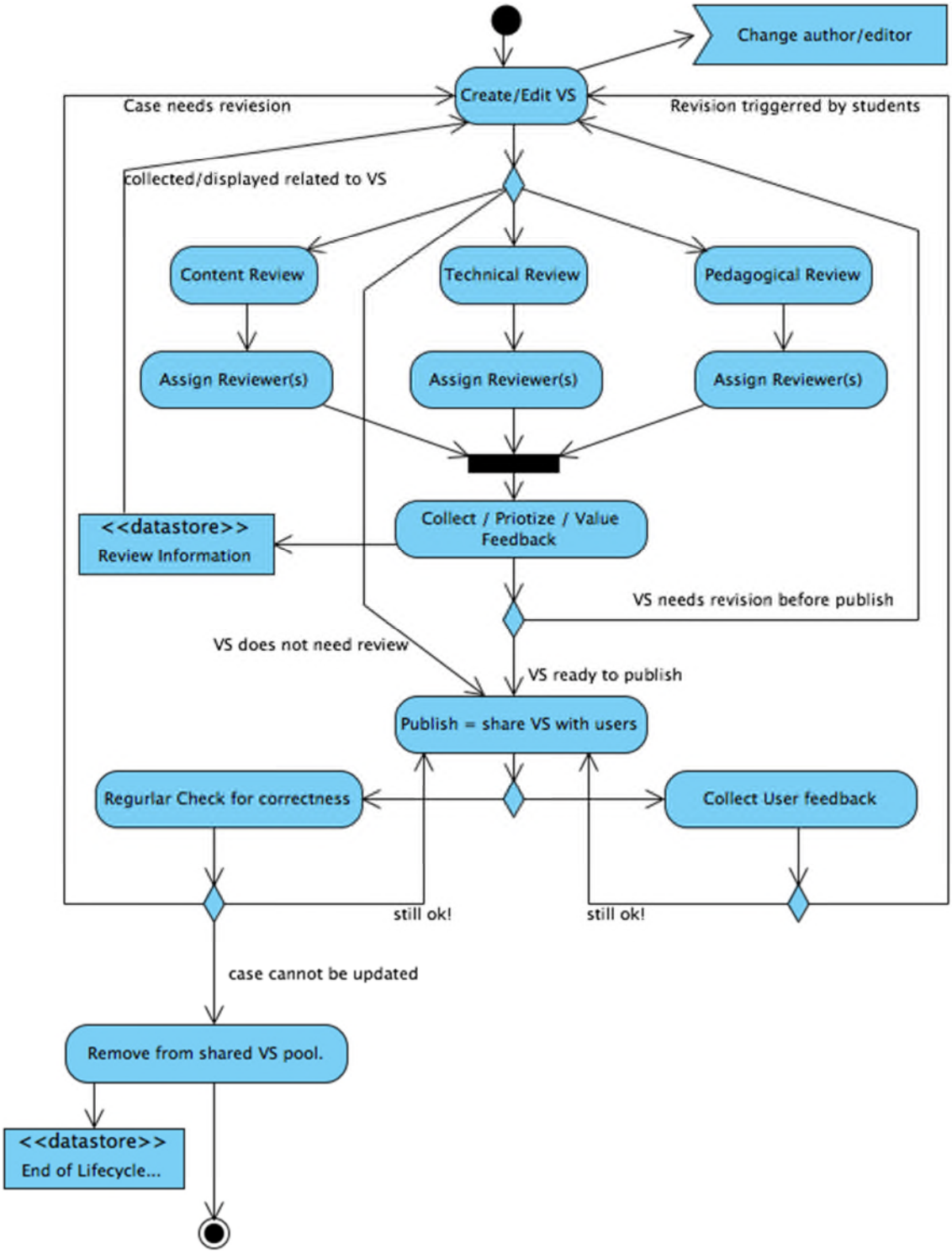
For the access of different reporting types we actually don't see the need of a activity diagram, as this is more about selection and a good navigation. From the use case we identified 3 main reports relevant for educators:

- Search and display data of a specific student
- Search for data of a specific VS
- Search for a specific "context", e.g. a specific group/cohort of students. The organization of cohorts might be different between organizations and the curriculum structure. If we assume virtual scenarios are also shared between institutions, it's not enough to collect just the usage data per VS, but also in context to the students related to an educator. The different groups of students add a context to the usage data.
- Additional reporting may be included or exists already in the VS Systems.

The variant of access this data through an LRS is more a navigation issue than a real workflow. An institution should document whether and which information is collected in an LRS and guide the educators to the right place to make sure institutional policies are fulfilled. At least from educator point of view with an LRS he/she gets all she needs at one place and does not have to decide him-/herself where to go for what. This may require meta information on the portal side where the educator usually get into the distributed learning environment.

3.5. **Activity Diagram 5 – Review & Update**

The following activity diagram represent a common structure of a lifecycle of a VS used in projects. The implementation of tools around this lifecycle is beyond the scope of WAVES, but may be realized as a side effect of other necessary changes within the WAVES project, so we keep this within the development plan as a guideline.



3.6. **Prerequisites**

The presented scenarios can be overall divided into 2 main paths:

1. User is from an institution which has already an established relationship with the VS Systems used: established can mean the following: self-installed and integrated, ASP with agreement and integrated
2. User is self-exploring, so e.g, has his institutional environment with a privately created test/demo/full account at an ASP VS Service.

Scenario 1 can be handled obviously easier, as we have more control. Clear institutional individual workflows can be established on request, educator can be guided, VS providers do not have control necessarily over the main used LMS, institutional portal though. Downside is that by this top down approach, the relationship has to be already in place, so trying out a new VS system not yet used at the institution is not covered.

Scenario 2 is tricky though, as e.g. the proposed integration method LTI needs some preparation, e.g. exchange of keys to work. So as a best practice we recommend all systems to have an easy way to share content even if only preliminary in a easy way for non tech savvy persons, but also have clear guidelines what to do. The easy way to share should be implemented in OL3 and CASUS as mentioned also in activity diagram 3.2.

Very similar to auth related integration will be xAPI: Clear documentation is needed, but should not be part of the job of an educator, so project will focus on guidelines and implementations for administration tech person preparing the work for educators.

4. DEVELOPMENT METHODOLOGY AND KEY PRINCIPLES

In software projects, there are various development methodologies, each one with its own pros and cons. We'll use the Agile[1] development methodology, as the most suitable for our purpose. Some of the principles of the Agile methodology are: active user involvement is imperative, the team is empowered to make decisions, the requirements are evolved but the timescale is fixed, the team will focus on frequent delivery of code, and the development will be in a small, incremental releases.

The development work will be co-ordinated by the Work Package lead, through the Technical Reference group which is chaired by the project co-ordinators. Leads are assigned for each of the deliverables and these leads will be responsible for monitoring progress and meeting deadlines for completion on these deliverables. Deliverable leads will be able to assign tasks to all project partners as part of the work on their deliverables.

[1] "Manifesto for Agile Software Development." Manifesto for Agile Software Development. N.p., n.d. Web. 21 Oct. 2016.

The code will be hosted at the Github, in one or more public repositories under the project's name. The Github will be used also as a version control system and issue tracker. The members of the project will be the collaborators and the repository will be open to community contributions through pull requests.

The internal documents of the consortium during the development will be available online, on the project website and in the Google Docs repository of the project. The Google Docs will act also as a version control system. Comments, chat and other online collaboration tools will be used as well.

Technical documentation and guidelines, in their final format, will also be available in the Github repository (in a markdown language format), using Github pages and/or wiki.

Primary principles

- All code, guidelines, documents etc whenever is possible will be open source and free available. MIT licence will be the basic license whenever is possible
- Be as open as we can, bring together diverse ideas and share work with the community

Principles taken from Needs Analysis

- All features should be developed with usability, user experience and accessibility in mind
- Technologies used should be modern and future proofed.

5. PROPOSED TECHNOLOGIES AND SYSTEMS USED

Identified standards to be used

- Learning Tools Interoperability (LTI) - for embedding and integrating content
- Experience API (xAPI) - for collecting and sharing learner experience data and

Analytics. The project has already established close contact to the xAPI working group, so results as VP/VS xAPI profiles will be included into the development within WP2. Actual verb for xAPI can be found at http://xapi.vocab.pub/datasets/virtual-patient/

- MedBiquitous Virtual Patient (ANSI/MEDBIQ VP.10.1-2010) - for describing VS content. The project will engage with MedBiquitous to develop the standard and improve its versatility for use in integrated systems.
- openSAML - for common/shared authentication. Existing implementations such as Shibboleth will be used, with single sign-on being desirable.

This list of standards represents a provisional guide. Other standards will be used where development needs allow, but all standards used will be reviewed against the project's requirements for suitability and compatibility with existing systems.

Platforms to be addressed

- VS platforms - OpenLabyrinth 3.x and Casus
- Virtual Learning Environments/Learning Management Systems - Moodle
- MOOC platforms - Open edX, FutureLearn
- LRS platform Learning locker, grassblade, Scorm Cloud and other considerations

6. DEVELOPMENT PLAN MILESTONES

The tasks are categorised and ordered first by the WP3 Deliverable due date:

- D2.4 report Jun 2017
  Exemplars of interfaces and implementations of integrating VS into learning delivery platforms will be developed. The exemplar systems used will be Casus and OL3, which are representative of the diverse nature of VS systems. The exemplars will be accessible, described and documented in general terms so that the approach can be mirrored for other VS systems. The experience will be captured, evaluated and quality assured using WP4 and WP5.

- D2.2 software Jan 2018
  Based upon the End-user specification and requirements identified in WP1, recommended modifications will be developed for the authoring interfaces in Casus and OL3 as exemplar systems. The aim for these modifications will be to improve the usability of the systems for educators wishing to create VS content. This will include the consideration of language issues, making sure that the VS and LMS systems can be easily adapted to the requirements concerning languages identified in WP1. An agreed set of heuristics will be used to monitor conformance to the specification.

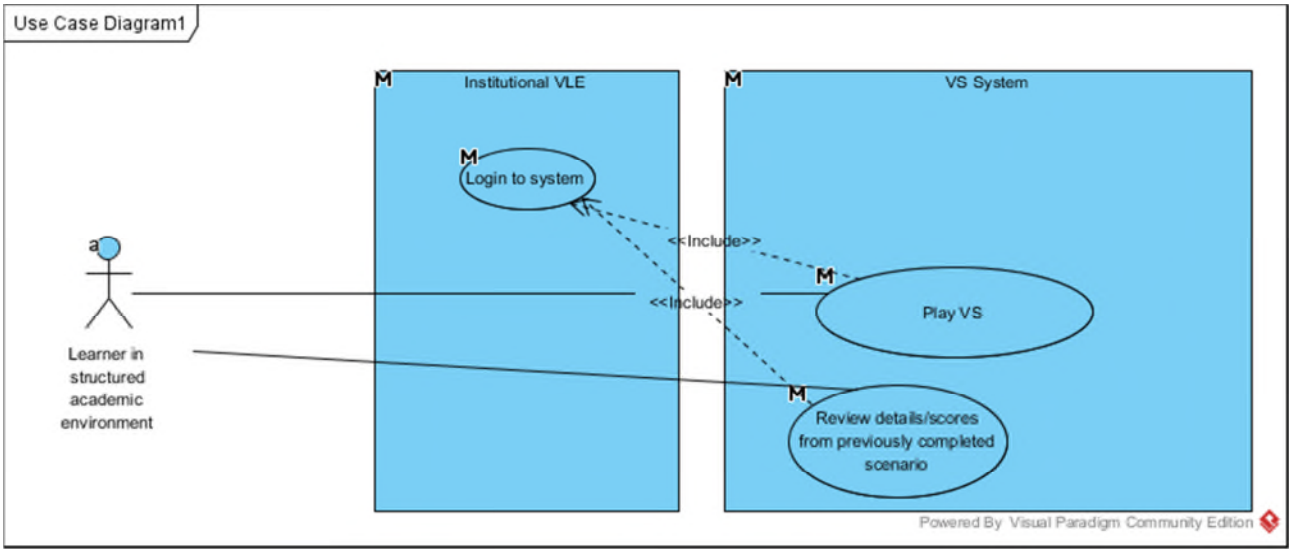
  Development will be completed according to the development plan D2.1 and it is intended that any lessons or best-practice experiences will be captured (WP5) for wider application to other systems, dissemination (WP7) and distribution as part of the knowledge toolkit in WP3.

- D2.3 software Dec 2018
  APIs and extensions will be developed for integrating VS technology and systems into learning platforms (institutional LMSs and MOOC platforms). The software will be developed according to the technical and end user specification details in WP1, and an agreed set of heuristics will be used to monitor adherence to the specifications as a quality assurance measure. The integration mechanisms will include possible functions such as display, authentication and data interchange, and will be generally applicable to other VS systems available to the wider community. Depending on the outcomes of WP4 and 5, any required changes will be implemented on an iterative basis.

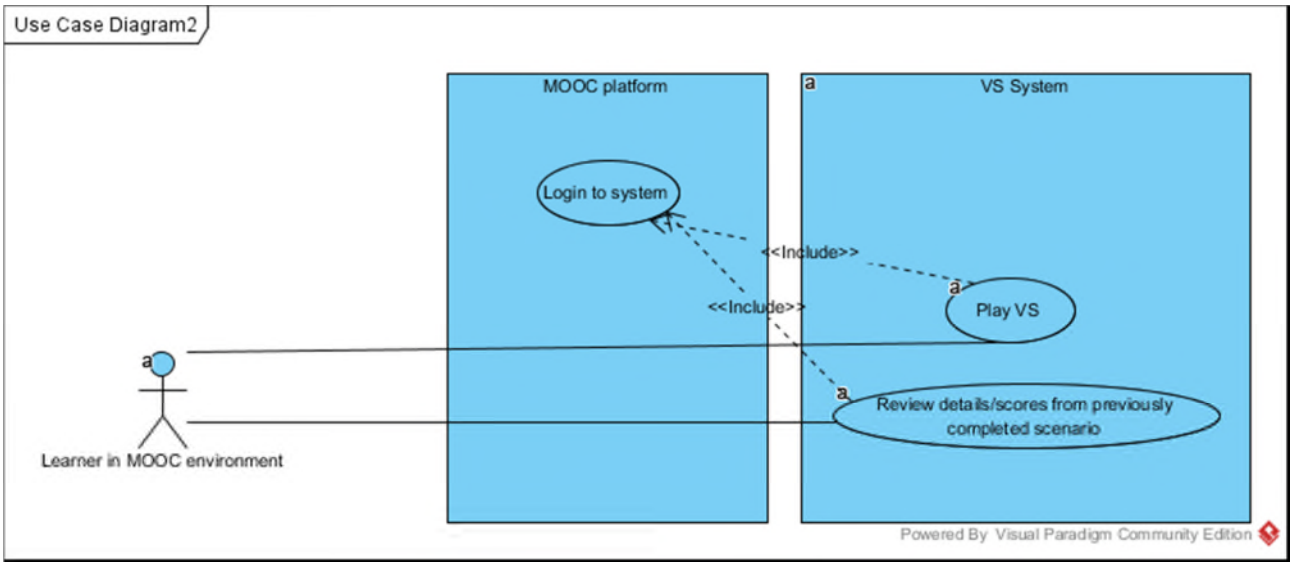
Del.	Task / Milestone	Schedule
D2.4	Use Cases for 2.4 defined and accepted by the group - Diagrams	Dec 2016
D2.4	1st draft for Workflow Mockups defined by accepted workflows / users	Mar 2017
D2.4	Tests (UX + x) with Mockups	Apr 2017
D2.4	Report - Exemplar Implementations for OL3, CASUS	Jun 2017
D2.2	Each system OL3 and CASUS defines changes as outcome of D1.2. to be integrated and quality measures for evaluating the changes until Jan 2017	Jan 2017
D2.2	Each system can perform own testing on further modification based on own test in the time frame	Jan 2018
D2.2	Changes implemented until scheduled date (Sep 2017)	Sep 2017
D2.2	Evaluation and monitoring	Nov 2017
D2.2	Software - final Deliverable	Jan 2018
D2.3	LTI Implementation based on Mockups created in 2.1	Jan 2018
D2.3	Mockups for integration of xAPI into platform	Sep 2017
D2.3	xAPI integration	Apr 2018
D2.3	Definition of exemplar LRS(s)	Dec 2017
D2.3	Testing interoperability of records created from OL3 and CASUS	Jun 2018
D2.3	Refinements and Changes based on evaluation and monitoring	Sep 2018
D2.3	Final Deliverable D2.3	Dec 2018

7. APPENDIX 1 – USE CASE DIAGRAMS

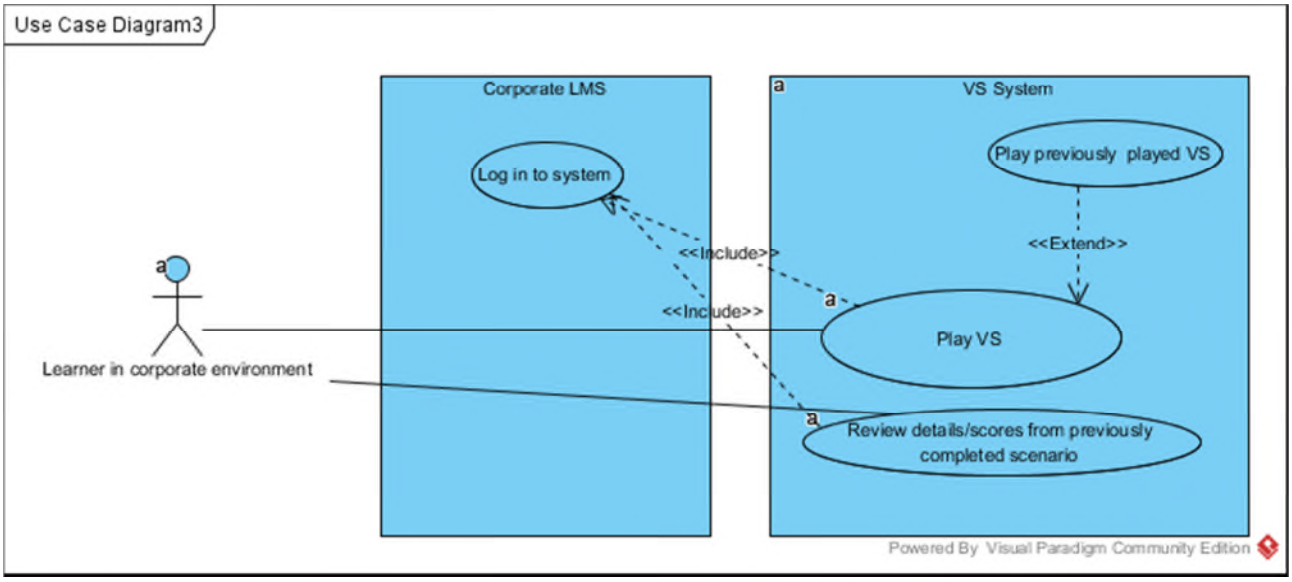
7.1. Use Case Diagram 1



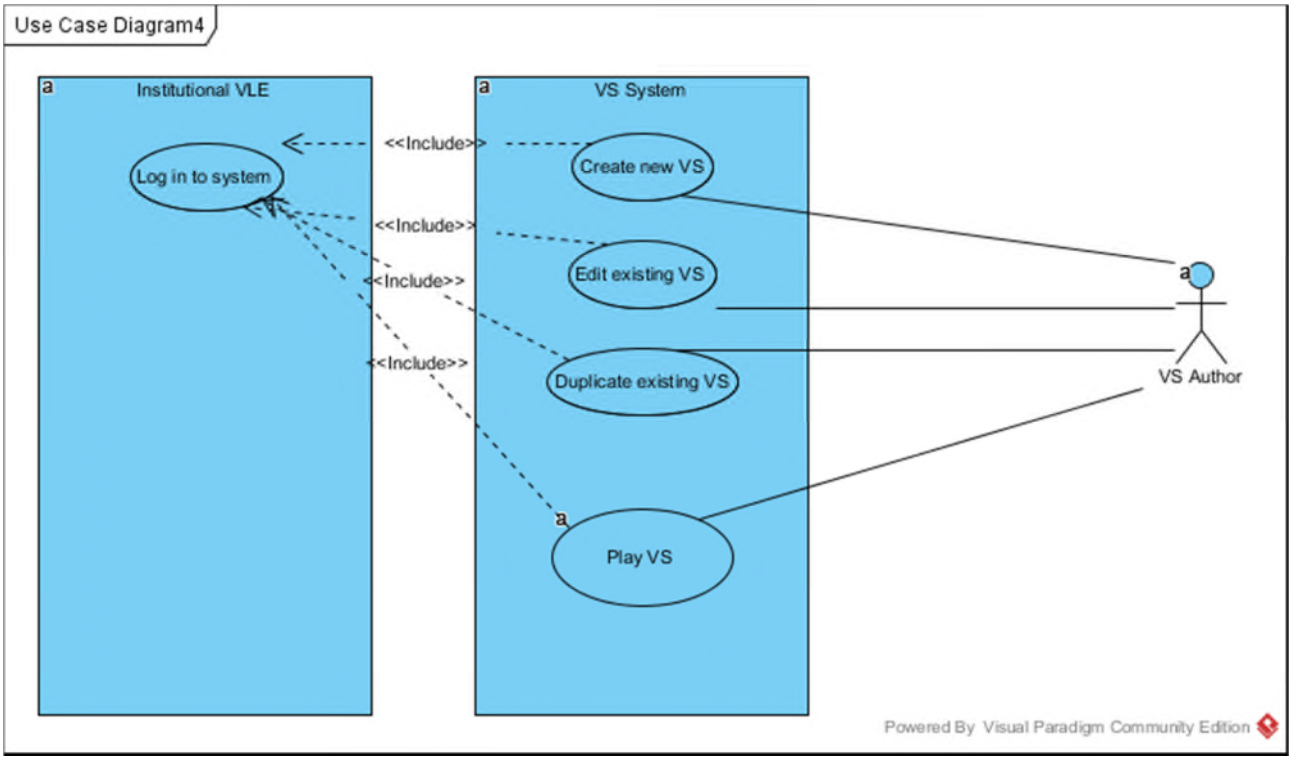
7.2. Use Case Diagram 2



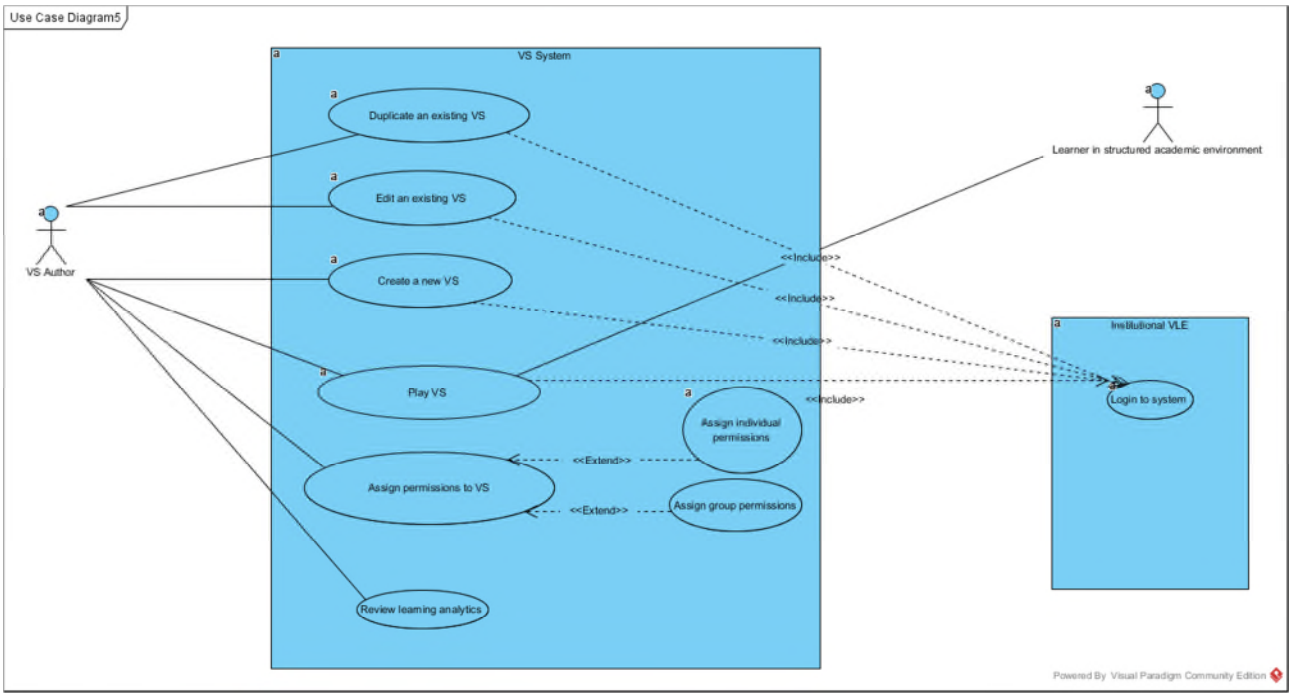
7.3. **Use Case Diagram 3**



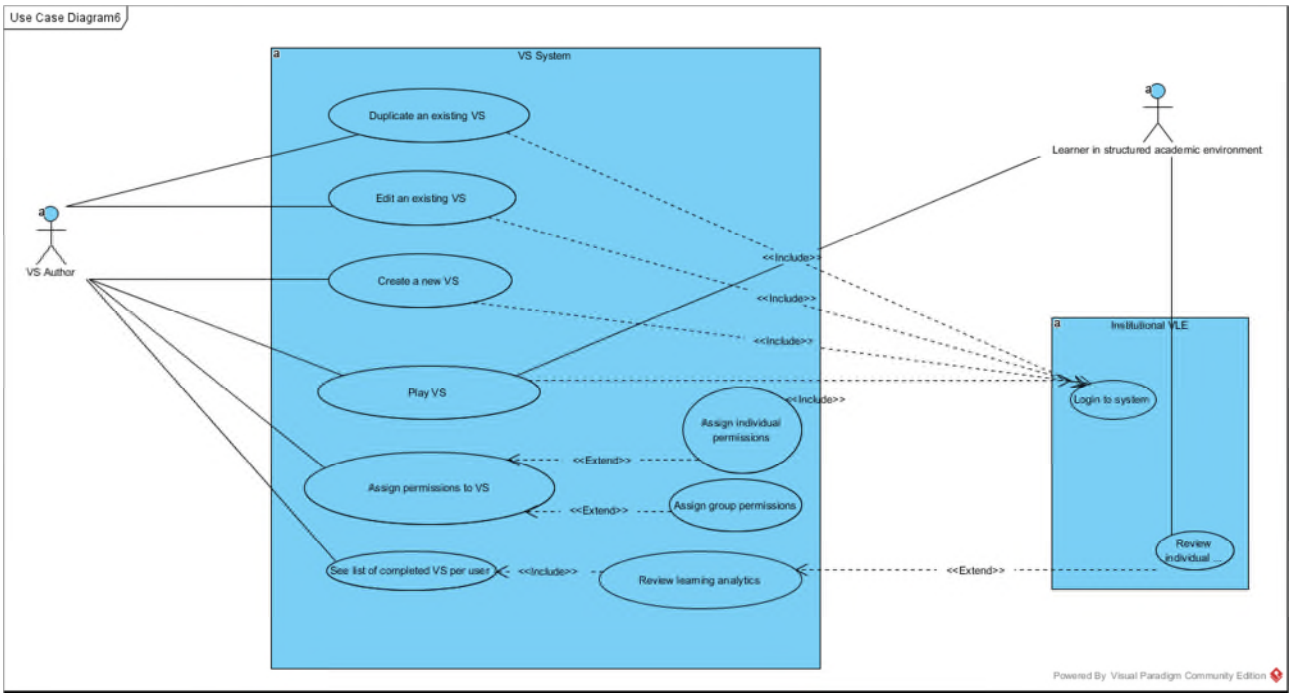
7.3.1. **Use Case Diagram 4**



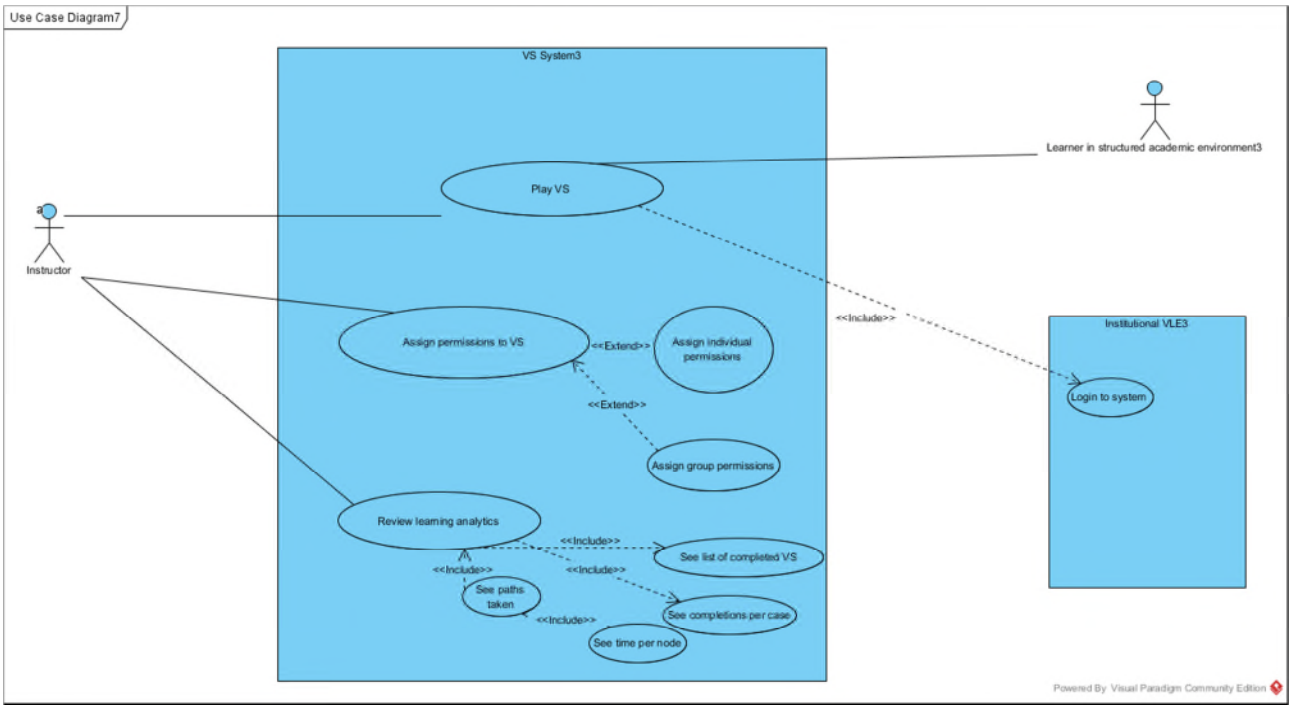
7.3.2. Use Case Diagram 5



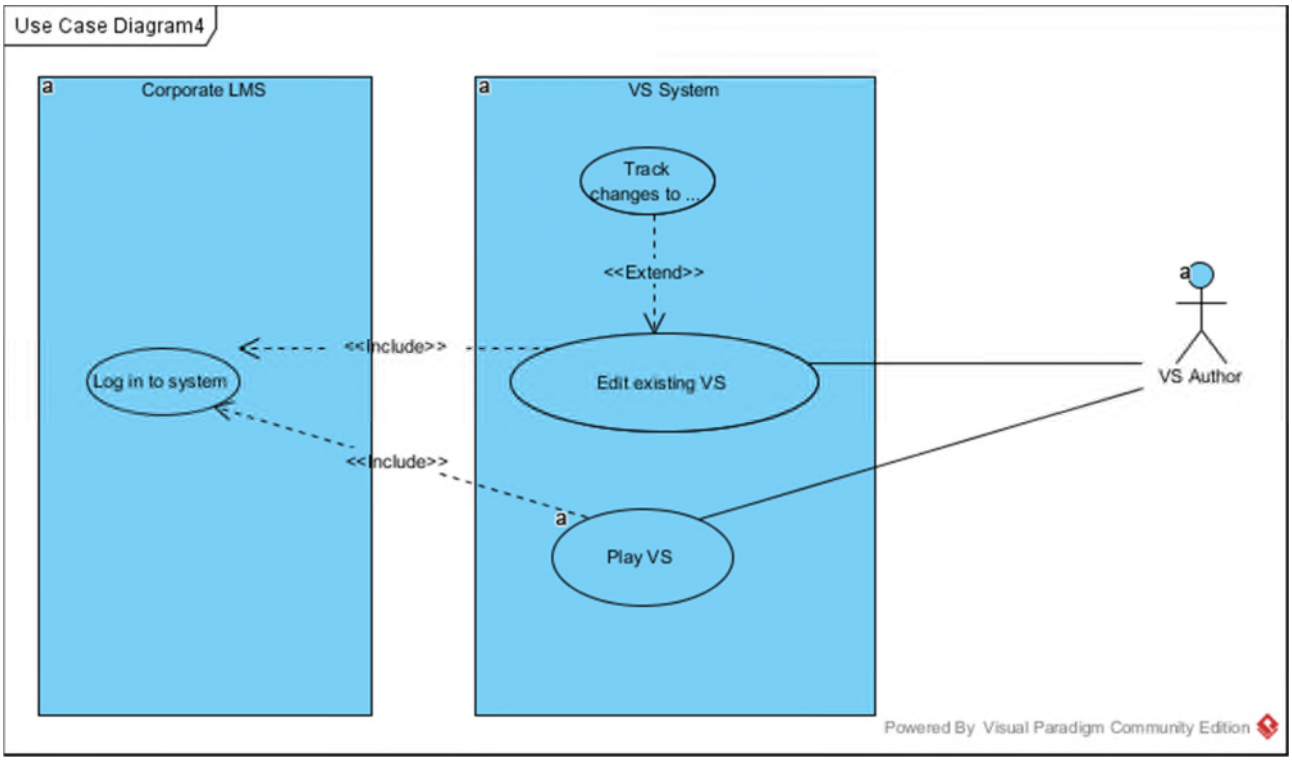
7.3.3. Use Case Diagram 6



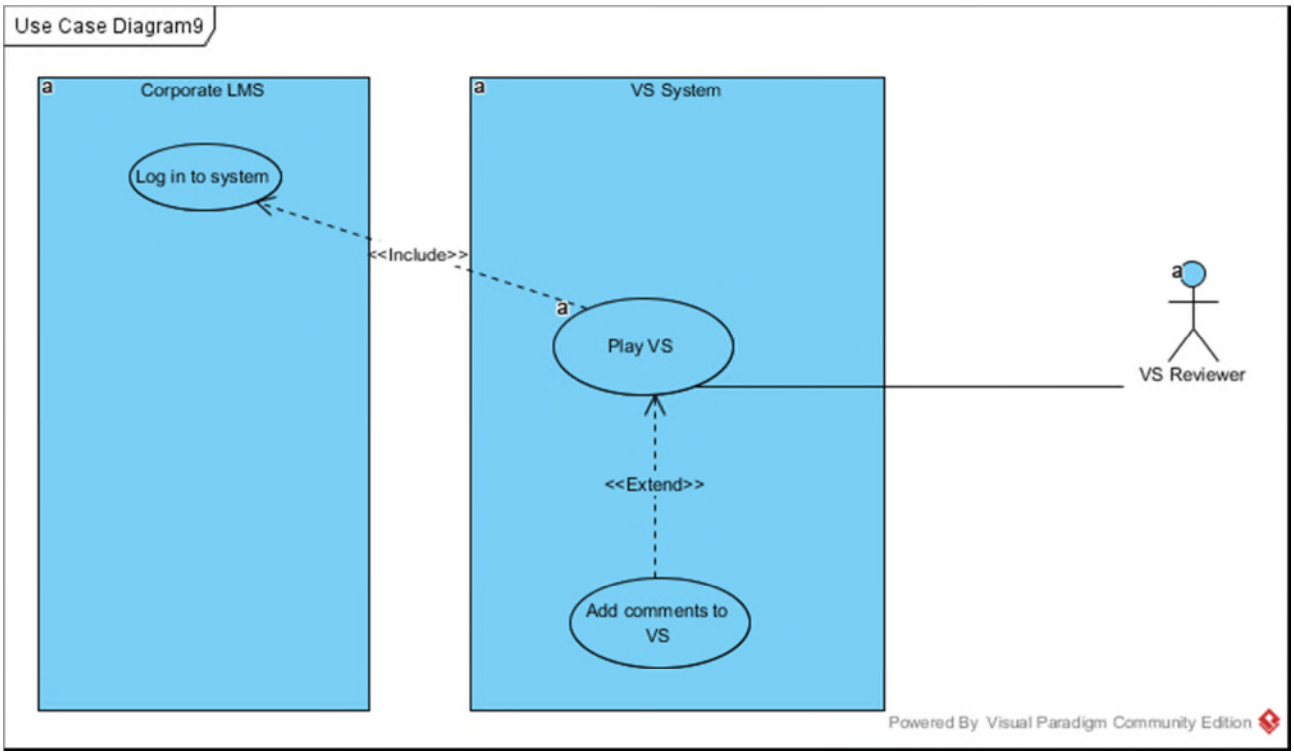
7.3.4. Use Case Diagram 7



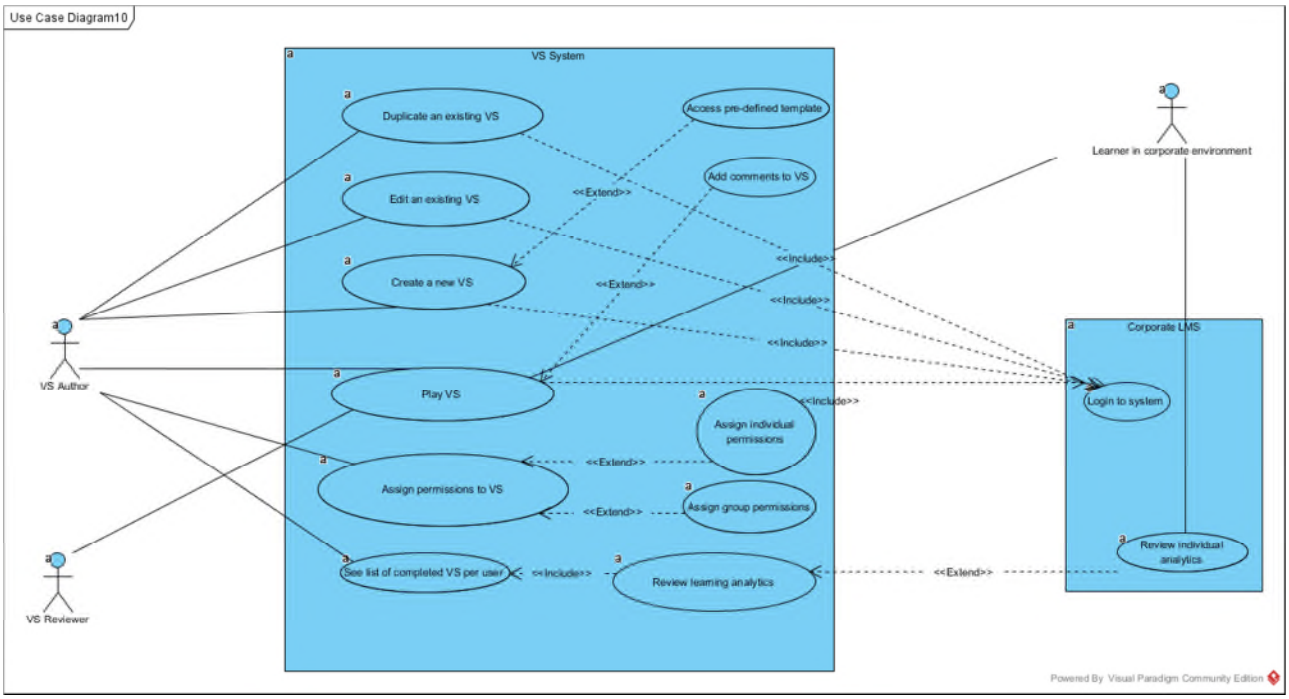
7.3.5. Use Case Diagram 8



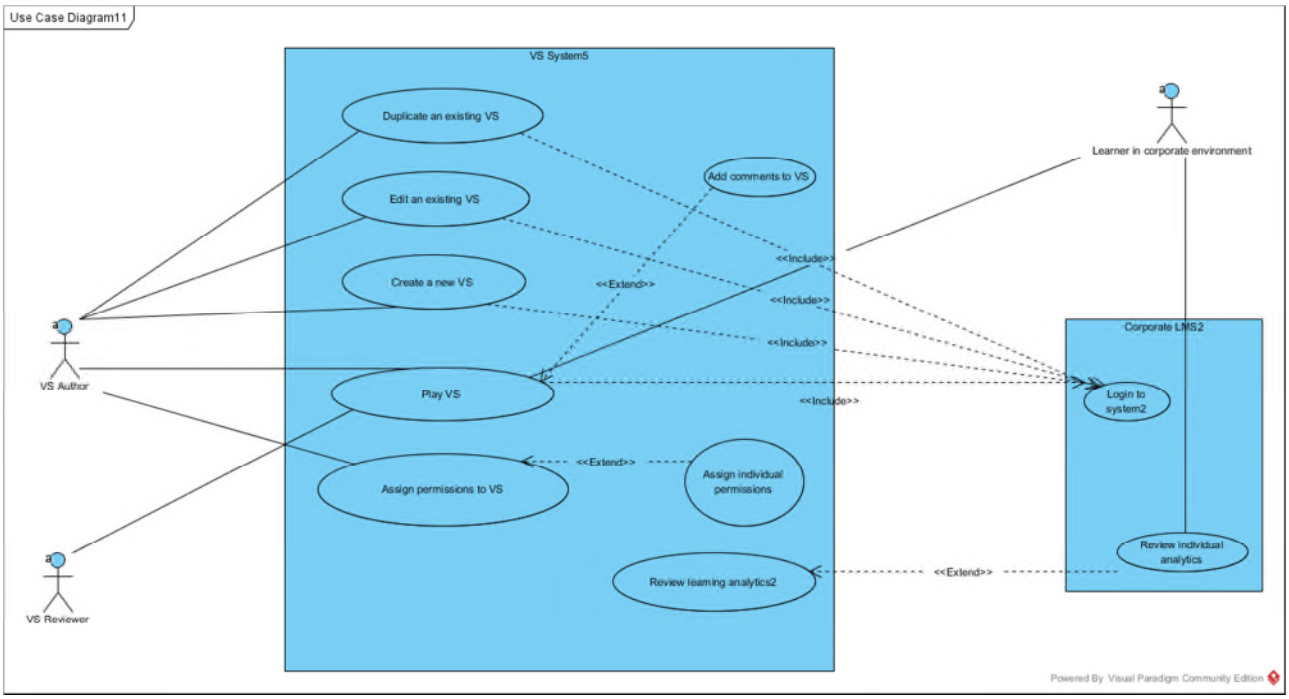
7.3.6. Use Case Diagram 9



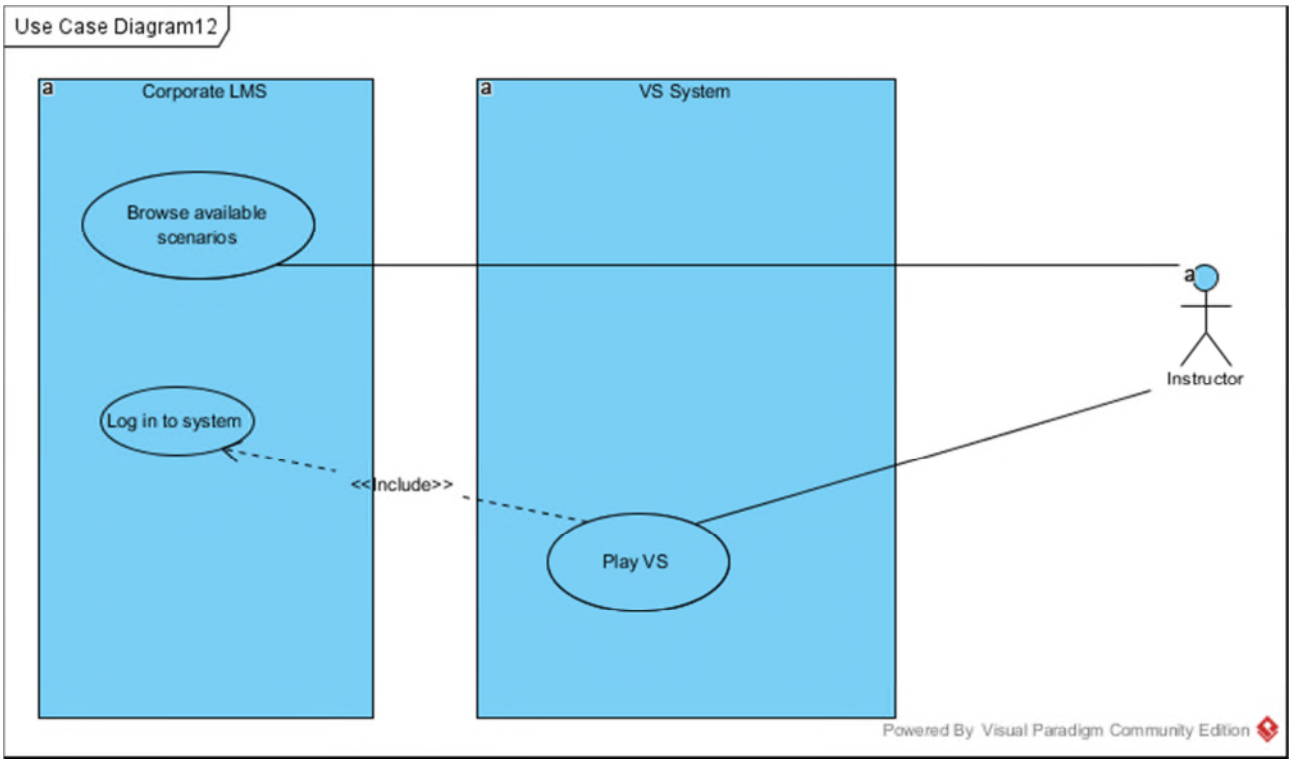
7.3.7. Use Case Diagram 10



7.3.8. Use Case Diagram 11



7.3.9. Use Case Diagram 12



7.4. **Use Case Diagram 13**