AdventureLearn Game Application
Software Requirement Specification

Version 1.2
20/04/2020

Members:
Aloysius Foo Dun Jiat
Farhan Khalifa Ibrahim
Florowski Kamil
Lee Jiho
Ng Jin Han Benedict
Nguyen Duy Khanh
Nicholas Irving Darmadji
Rickson Hu Hong Rui
Sven Tan Wei Jie
Yuen Kim Hwee

Team: NanyangGuys
CZ3003 Software System Analysis and Design, Tutorial Group SSP5

Table of Contents

Revision History

Name	Date	Reason for Change	Version
Yuen Kim Hwee	09/02/2020	Initial SRS	1.0
Benedict	15/03/2020	SRS Update	1.1
Yuen Kim Hwee	20/04/2020	Finalised SRS for Submission	1.2

1. Introduction

1.1 Purpose

The purpose of this document is to present a detailed description of AdventureLearn on the following aspects:

- Purpose of AdventureLearn
- Product Descriptions
- External Interface Requirements
- System Features with Functional Requirements included
- Non-Functional Requirements

1.2 Document Conventions

The following conventions are used in this document.

	Font Type	**Font Size**
Heading 1	Arial	20
Heading 2	Arial	18
Heading 3	Arial	16
Normal Text	Times New Roman	12

1.3 Intended Audience and Reading Suggestions

This document is intended to be read and used by the software developers, project manager, users, and software engineering testers of the application.

Software Developer	Software developers will need to take reference from and update this software requirement specification when making improvements or modifying the application to better comply with the stated functional requirements.

Project Manager	The Project Manager will need to take reference from this software requirement specification to understand the progress of the project and ensure the project is in line with the time requirements.
Users (Students and Teachers)	Users will need to take reference from this software requirement specification to understand the application's functions and limitations.
Software Engineering Testers	Testers will need to take reference from this software requirements specification in order to prepare optimal test cases to verify the functionality of the application based on the requirements specified.

1.4 Product Scope

AdventureLearn is a social game on Android mobile devices that aims to gamify and socialize teaching and learning of math courses. The goal is to increase Students' learning interests and interactions, thus enhancing their effectiveness and efficiency in learning.

1.5 References

IEEE Template for System Requirement Specification Documents:
https://goo.gl/nsUFwy

2. Overall Description

2.1 Product Perspective

AdventureLearn was developed as an attempt to introduce a social game on mobile devices to gamify and socialize teaching and learning of math courses. Students can learn and compete with each other via playing the game, and Teachers can assess the mastery of the course via Summary Reports.

2.2 Product Functions

The main functions of the product are:

Student

- Login with Google Play or Facebook account
- Choose Character Avatar
- Select/Play Campaign Levels
- Create/Edit/Play Custom Levels
- Create/Edit/Play Assignments
- View Leaderboard

Teacher

- Login with Google Play or Facebook account
- Create/Edit Assignments
- Publish Assignments
- View Summary Report

Detailed information on what each product function is about and how they work can be found in the System Features section (Section 4) of this document and in the Use Case Model document respectively.

2.3 User Classes and Characteristics

Student	Students are users who are using the application as a learning platform by completing Campaign Levels and Assignments. Each Campaign Level and Assignment contains questions that are meant to challenge Students' understanding of a Math concept.

	Additionally, Students can also create their own Custom Levels to challenge their peers. Students must have an Android device and are proficient at using it.
Teacher	Teachers are users who are using the application to create Assignments. Teachers are expected to understand all the Math related concepts taught in the scope of the module. Teachers are able to view a summary report that shows their class performance reports in the Assignments. In addition, Teachers are also able to view individual Students' performance.

2.4 Operating Environment

- Android operating system Version 8 and above
- Dependencies
    - facebook-android-SDK: 5.0.0.
    - google.android.gms:play-services-games: 19.0.0
- Database
    - Google Cloud SQL

2.5 Assumptions and Dependencies

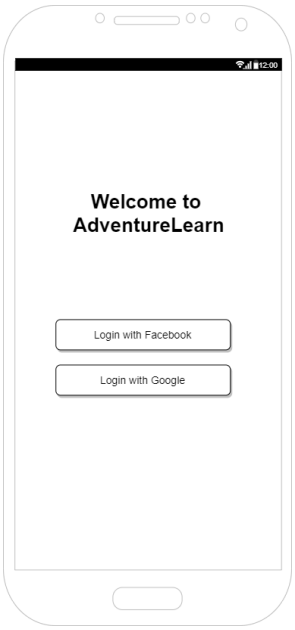
The following describes the assumptions made during the operation of the application.

- There will be no service interruptions in the online database
- Users have no Internet connection issues.
- Users are sufficiently proficient in English.

3. External Interface Requirements

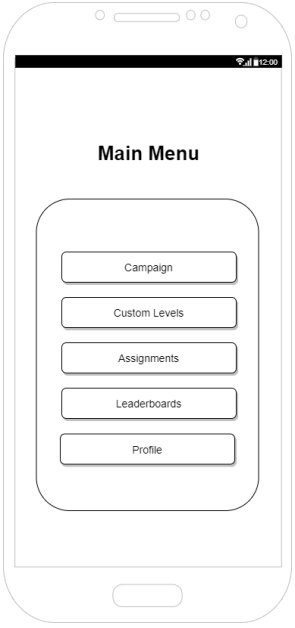
3.1 User Interfaces

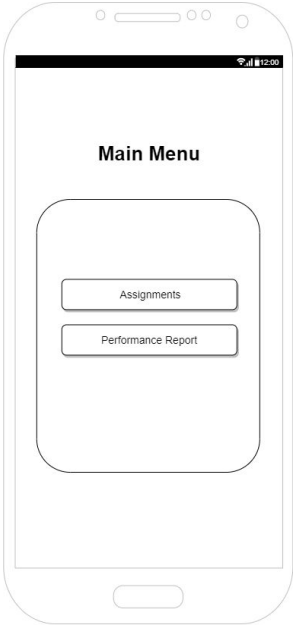
This Section describes the UI of the main functions with sample screens. The UI designs shown here are just sketches to help illustrate the descriptions better.



Login Screen

Users can login through either their Facebook account or GooglePlay account.





Main Menu

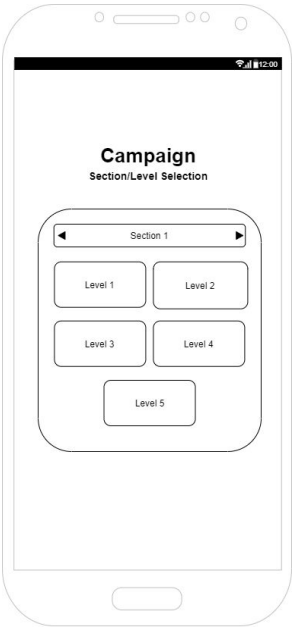
Main functionalities of the application are accessed here.

Left image

Student's Main Menu page, what Students see when they first login.

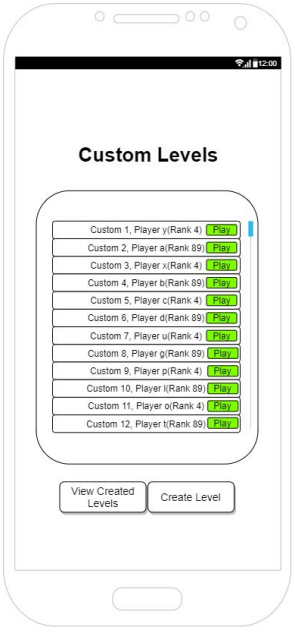
Right image

Teacher's Main Menu page, what Teachers see when they first login.



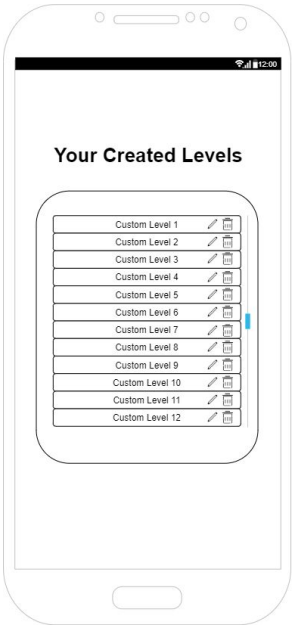
Campaign

Each World corresponds to a topic in Math, and each Section corresponds to a sub-topic and contains the related questions.



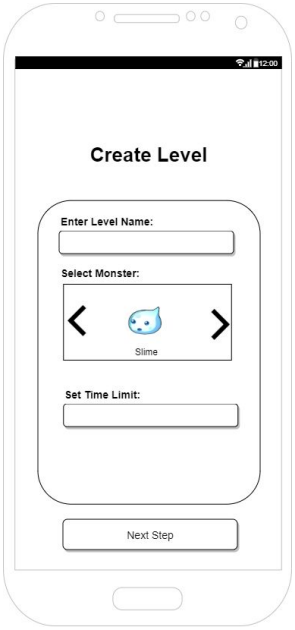
Custom Levels (Scrollable)

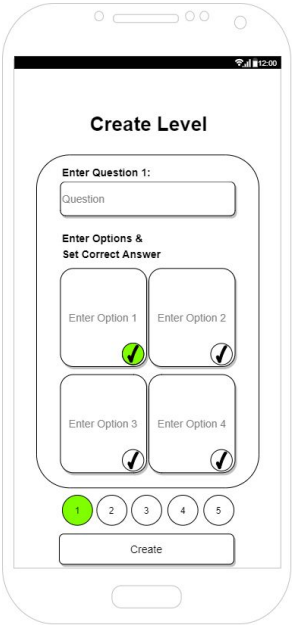
Custom Levels created by Students can be accessed here. In addition, Students can view a list of Custom Levels created by all students. In addition, they may also choose to view Custom Levels created by himself/herself or create a new Custom Level.



View Created Levels (Scrollable)

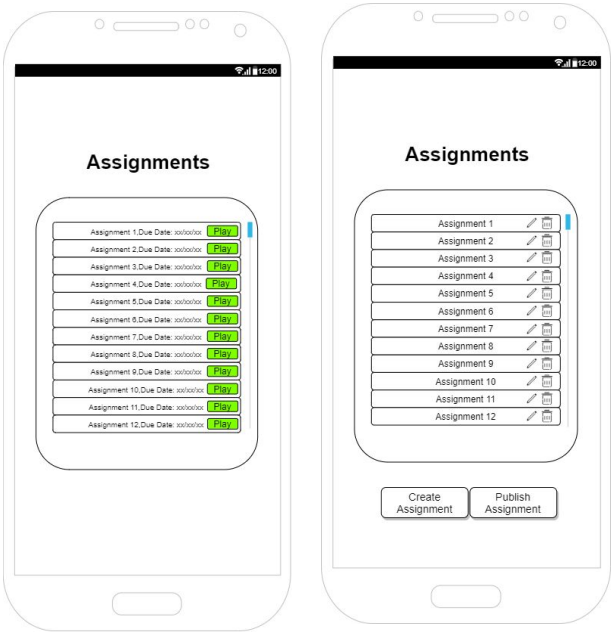
Students can edit or delete their Custom Levels here.





Create Level/Assignment

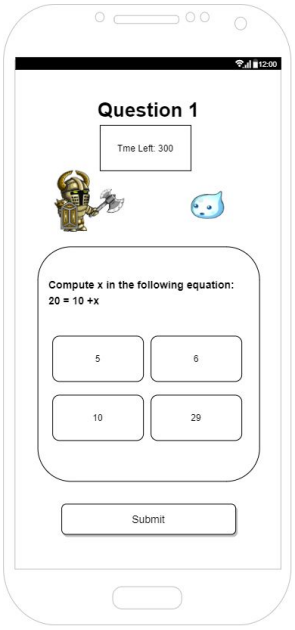
When Students are creating a Custom Level or when Teachers are creating an Assignment, a template is provided.



Assignments (Scrollable)
Assignments created and published by Teachers can be accessed here.

Left image
Student's Assignments page, what Students see when they click on the “Assignments” button.

Right image
Teacher’s Assignments page, what Teachers see when they click on the “Assignments” button.



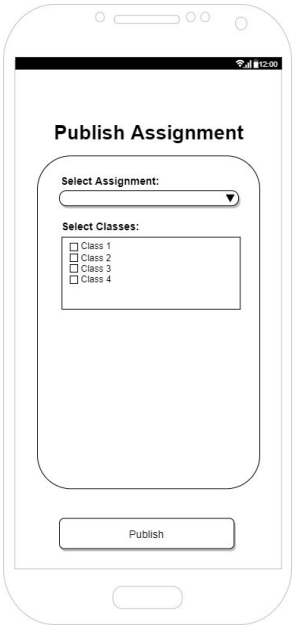
Play Level (Gameplay)
Each Level has a time limit displayed at the top which starts counting down upon entry to the Level. The Student’s sprite and Level’s sprite will launch attacks at each other depending on whether the question is answered correctly.

Leaderboard

The ranks and scores of all Students can be accessed here.

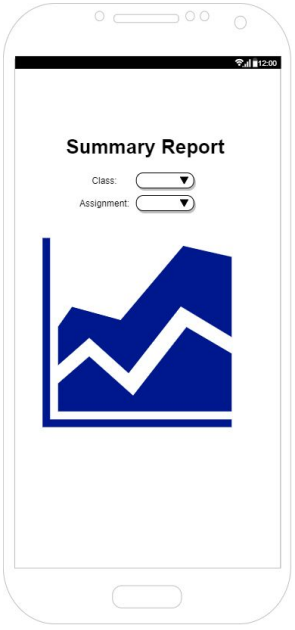
Profile

Students can view their general information here and change their characters.



Publish Assignment

Teachers can publish Assignments to class through this page by selecting the class and Assignment.



Summary Report

Teachers can view a summary report of the Assignment and Campaign scores of different classes.

3.2 Hardware Interfaces

- Android devices

3.3 Software Interfaces

- Operating system required: Android 8 and above.
- Godot and C# for program structure.
- DBeaver as database server

4. System Features

4.1 Login

4.1.1 Description and Priority

Users can login with their Facebook/Twitter/Gmail account.

Priority: High

4.1.2 Stimulus/Response Sequences

Stimulus	Response
The user logins with a valid Facebook/GooglePlay account.	The application's Main Menu is displayed.
The user logins with an invalid Facebook/GooglePlay account.	The Facebook/GooglePlay API will handle the invalid login.

4.1.3 Functional Requirements

1. Students and Teachers must login to the system before the main functionalities can be accessed.
    1.1. Students and Teachers must be able to login through several platforms.
        1.1.1. Students and Teachers must be able to login with his/her Facebook account.
            1.1.1.1. The Facebook API must validate that the login credentials are valid.
        1.1.2. Students and Teachers must be able to login with his/her GooglePlay account.
            1.1.2.1. The GooglePlayAPI must validate that the login credentials are valid.
    1.2. The system must display an error message if the login credentials are invalid.

4.2 Select Game Character

4.2.1 Description and Priority

Different characters can be chosen, each having a unique ability.

Priority: Medium

4.2.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on “Profile” on the Main Menu.	The Profile page is displayed.
The Student clicks on “Change Character” on the Profile page.	The system will display the Character Selection page.
The Student selects one of the available Characters and clicks on the “Enter” button.	The system updates the Student’s chosen Character in the database.

4.2.3 Functional Requirements

1. The system must allow the Student to change characters.
2. The system must provide 4 different characters, each having a unique ability.
   - **2.1.** The first character will have the ability to increase the remaining time by 10 seconds.
   - **2.2.** The second character will have the ability to negate the penalty of answering a question wrongly once.
   - **2.3.** The third character will have the ability to skip to the next question with a 50% chance.
   - **2.4.** The fourth character will have the ability to remove an incorrect answer option to a question.

4.3 Gameplay

4.3.1 Description and Priority

The game consists of a series of Worlds to be explored, each representing different topics in Math. Subsequent Worlds cannot be accessed unless the preceding Worlds have been cleared.
Each World consists of several Sections, each representing sub-topics of the corresponding main topic. Subsequent Sections cannot be accessed unless the preceding Sections have been cleared.
Each Section consists of several Levels, each containing questions related to the sub-topic. The difficulty of the questions increases in each subsequent Level. Subsequent Levels cannot be accessed unless the preceding Levels have been cleared.

Priority: High

4.3.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on “Campaign” on the Main Menu.	The Campaign World Selection page is displayed. This page displays the available Worlds.
The Student selects a World.	The Campaign Section/Level Selection page is displayed. This page displays the Levels available in the corresponding Section.
The Student selects a Section.	The corresponding Levels are displayed.
The Student selects a Level.	The Gameplay page is displayed. This page displays the questions of the selected Level, and the Student can start answering them.
The Student wins the Level.	A score is computed and stored in the database. A popup menu will be displayed which consists of a “You Win” message, a replay button, a play next Level button, and a return-to-menu button.

The Student fails the Level.	A popup menu will be displayed which consists of a "You Lose" message, a replay button and a return-to-menu button.

4.3.3 Functional Requirements

1. The system must provide a series of Worlds for the Students to explore.
- **1.1.** Each World must represent the different topics in Math: Addition/Subtraction, Multiplication/Division, and Comparison.
  - **1.1.1.** To unlock the next World, all the Sections in the preceding Worlds must be completed.
- **1.2.** Each World in the game must have several Sections, each representing the sub-topics of each phase from basic ones to advanced ones.
  - **1.2.1.** To unlock the next Section, all the levels in the preceding Sections must be completed.
- **1.3.** Each Section must have several Levels, each containing questions related to the corresponding sub-topics.
  - **1.3.1.** Each Level is harder than the preceding Levels.
  - **1.3.2.** For each Level, the Student must correctly answer the 5 questions correctly within a time limit.
    - **1.3.2.1.** Every question must be in MCQ format with 4 options.
    - **1.3.2.2.** Each time a question is answered correctly, the next question must be displayed.
    - **1.3.2.3.** Each time a question is answered wrongly, the remaining time will decrease by 10 seconds.
    - **1.3.2.4.** The Student must be able to use his/her character's unique ability.
  - **1.3.3.** When the level has ended, the system must display a popup menu.
    - **1.3.3.1.** Based on the remaining time, the system will compute a score and award a certain number of stars.
      - **1.3.3.1.1.** The formula for computing score: $\left(\frac{timeRemaining}{timeLimit}\right) * 100$
      - **1.3.3.1.2.** For $score = 0$, no stars shall be awarded.
      - **1.3.3.1.3.** For $1 \leq score \leq 50$, 1 star shall be awarded.
      - **1.3.3.1.4.** For $51 \leq score \leq 70$, 2 stars shall be awarded.
      - **1.3.3.1.5.** For $71 \leq score \leq 100$, 3 stars shall be awarded.
    - **1.3.3.2.** If the Student has won, the popup menu will display a "You Win" message and the number of stars awarded.

1.3.3.3. If the Student has lost, the popup menu will display a "You Lose" message and the number of stars awarded.

4.4 Leaderboard

4.4.1 Description and Priority

To keep Students engaged, a Leaderboard is used to display the rank and total points attained by each Student.

Priority: Medium

4.4.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on "Leaderboard" on the Main Menu.	The Leaderboard page is displayed. By default, the Leaderboard will display the total scores across all the Worlds and rank them in descending order.
To view the ranks and total score for individual Worlds, the Student can click on the dropdown list and select a World.	The Leaderboard display is updated accordingly.

4.4.3 Functional Requirements

1. The system must have a Leaderboard.
    1.1. Format for displaying must be: Rank | Name | Score
    1.2. Ranking must be based on the Students' score.
    1.3. Students must be able to view every Student's rank and score for individual Worlds and across all the Worlds.
        1.3.1. Score must be displayed in numerical characters.
        1.3.2. Rank must be displayed in numerical characters.

4.5 View/Play Custom Level

4.5.1 Description and Priority

Students can view a list of Custom Levels created by all the Students and play them.

Priority: High

4.5.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on "Custom Levels" on the Main Menu.	The Custom Levels page is displayed. This page displays all the Custom Levels created by Students.
To play a Custom Level, the Student clicks on the "Play" button beside the corresponding Custom Level.	The Gameplay page is displayed. This page displays the questions of the selected Custom Level, and the Student can start answering them.
The Student wins the Custom Level.	A score is computed and stored in the database. A popup menu will be displayed which consists of a "You Win" message, a replay button and a return-to-menu button.
The Student fails the Custom Level.	A popup menu will be displayed which consists of a "You Lose" message, a replay button and a return-to-menu button.

4.5.3 Function Requirements

1. The system must be able to display all the available Custom Levels on the Custom Levels page.
  1.1. The Custom Levels page must be scrollable.
2. The Student must be able to challenge a Custom Level.
3. For each Custom Level, the Student must correctly answer the 5 questions correctly within the set time limit.
  3.1. Every question must be in MCQ format with 4 options.
  3.2. Each time a question is answered correctly, the next question must be displayed.

3.3. Each time a question is answered wrongly, the remaining time will decrease by 10 seconds.

3.4. The Student must be able to use his/her character's unique ability.

4. When the level has ended, the system must display a popup menu.

4.1. Based on the remaining time, the system will compute a score and award a certain number of stars.

4.1.1. The formula for computing score: $\left(\frac{timeRemaining}{timeLimit}\right) * 100$

4.1.2. For $score = 0$, no stars shall be awarded.

4.1.3. For $1 \leq score \leq 50$, 1 star shall be awarded.

4.1.4. For $51 \leq score \leq 70$, 2 stars shall be awarded.

4.1.5. For $71 \leq score \leq 100$, 3 stars shall be awarded.

4.2. If the Student has won, the popup menu will display a "You Win" message and the number of stars awarded.

4.3. If the Student has lost, the popup menu will display a "You Lose" message and the number of stars awarded.

4.6 Create Custom Level

4.6.1 Description and Priority

Students can create Custom Levels.

Priority: High

4.6.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on “Create Level” on the Custom Levels page.	The Level Creation page is displayed. This page displays a template for creating a level.
The Student fills up the template and clicks on the “Create” button.	The system validates the user inputs. If all the input fields are valid, the Custom Level is successfully created, else display error messages and direct the Student to where the error is.

4.6.3 Functional Requirements

1. Students must be able to create Custom Levels.

1.1. A template must be provided to help Students create a Custom Level.

1.1.1. The template consists of 2 phases: Set-Level-Parameters and Set-Questions.

1.1.1.1. In Set-Level-Parameters phase, Students shall set the Custom Level Name, Monster, and Time Limit.

1.1.1.2. In the Set-Questions phase, Students shall set the 5 questions and options for each question.

1.1.1.3. The system must validate each user input.

1.1.1.3.1. In the Set-Level-Parameters phase, the system shall ensure that the Student does not create a new Custom Level with the same Custom Level name as the Custom Levels created by himself/herself.

1.1.1.3.2. In the Set-Questions phase, the system shall ensure that there are no duplicate options for the same question.

1.2. The message “Custom Level successfully created” must be displayed after a Custom Level has been created.

4.7 Edit/Delete Custom Level

4.7.1 Description and Priority

Students can edit or delete Custom Levels created by himself/herself.

Priority: Medium

4.7.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on “View Created Levels” on the Custom Levels page.	The View Created Levels page is displayed. This page displays a list of custom levels created by the Student with edit and delete buttons beside each of them.
The Student clicks on the edit button beside one of the Custom Levels on the View Created Levels page.	The Edit Level page is displayed. This page displays the same template as the Level Creation page but the template is instantiated with the selected Custom Level. [Identical to Level Creation page, where the same template will be used and the same validations will be done]
The Student clicks on the delete button beside one of the Custom Levels on the View Created Levels page.	A delete confirmation will be displayed. If the Student clicks yes, the corresponding Custom Level will be deleted.

4.7.3 Functional Requirements

1. Students must be able to edit Custom Levels created by himself/herself..
  1.1. The message “Custom Level successfully edited” must be displayed after a Custom Level has been edited.
2. Students must be able to delete Custom Levels created by himself/herself..
  2.1. A system must ask the Student for confirmation before deleting a Custom Level.

4.8 View/Play Published Assignment

4.8.1 Description and Priority

Students can view a list of Assignments created and published by Teachers and play them.

Priority: High

4.8.2 Stimulus/Response Sequences

Stimulus	Response
The Student clicks on “Assignments” on the Main Menu page.	The Student's Assignments page is displayed. This page displays a list of Assignments created and published by the Teachers.
To play an Assignment, the Student clicks on the “Play” button beside the corresponding Assignment on the Student's Assignments page.	The Gameplay page is displayed. This page displays the questions of the selected Assignment, and the Student can start answering them.
The Student wins the Assignment.	A score is computed and stored in the database. A popup menu will be displayed which consists of a “You Win” message, a replay button and a return-to-menu button.
The Student fails the Assignment.	A popup menu will be displayed which consists of a “You Lose” message, a replay button and a return-to-menu button.

4.8.3 Functional Requirements

1. On the Published Assignment page, the system must be able to display the Assignments that are published to the Student’s class.
   1.1. The Assignment page must be scrollable.
2. The Student must be able to challenge an Assignment.
3. For each Assignment, the Student must correctly answer the 5 questions correctly within the set time limit.
   3.1. Every question must be in MCQ format with 4 options.

3.2. Each time a question is answered correctly, the next question must be displayed.

3.3. Each time a question is answered wrongly, the remaining time will decrease by 10 seconds.

3.4. The Student must be able to use his/her character's unique ability.

4. When the level has ended, the system must display a popup menu.

4.1. Based on the remaining time, the system will compute a score and award a certain number of stars.

4.1.1. The formula for computing score: $\left(\frac{timeRemaining}{timeLimit}\right) * 100$

4.1.2. For $score = 0$, no stars shall be awarded.

4.1.3. For $1 \leq score \leq 50$, 1 star shall be awarded.

4.1.4. For $51 \leq score \leq 70$, 2 stars shall be awarded.

4.1.5. For $71 \leq score \leq 100$, 3 stars shall be awarded.

4.2. If the Student has won, the popup menu will display a "You Win" message and the number of stars awarded.

4.3. If the Student has lost, the popup menu will display a "You Lose" message and the number of stars awarded.

4.9 View/Edit/Delete Assignment

4.9.1 Description and Priority

Teachers can only view a list of Assignments created by himself/herself.

Priority: High

4.9.2 Stimulus/Response Sequences

The Teacher clicks on "Assignments" on the Main Menu page.	The Teacher's Assignments page is displayed. This page displays a list of Assignments created by the Teacher with edit and delete buttons beside each of them.
The Teacher clicks on the edit button beside one of the Assignments on the Teacher's Assignments page.	The Edit Assignment page is displayed. This page displays the same template as the Level Creation page but the template is instantiated with the selected Assignment. [Identical to Level Creation page, where the same template will be used and the same validations will be done]
The Teacher clicks on the delete button beside one of the Assignments on the Teacher's Assignments page.	A delete confirmation will be displayed. If the Teacher clicks yes, the corresponding Assignment will be deleted.

4.9.3 Functional Requirements

1. On the Assignment page, the system must be able to display the Assignments created by himself/herself.
2. Teachers must be able to edit Assignments created by himself/herself.
   - 2.1. The message "Assignment successfully edited" must be displayed after an Assignment has been edited.
3. Teachers must be able to delete an Assignment created by himself/herself.
   - 3.1. A system must ask the Teacher for confirmation before deleting an Assignment.

4.10 Create Assignment

4.10.1 Description and Priority

Teachers can create Assignments.

Priority: High

4.10.2 Stimulus/Response Sequences

Stimulus	Response
The Teacher clicks on “Create Assignment” on the Assignment page.	The Assignment Creation page is displayed. This page displays a template for creating an Assignment. This template is identical to the template in the Level Creation page.
The Teacher fills up the template and clicks on the “Create” button.	The system validates the user inputs. If all the input fields are valid, the Assignment is successfully created, else display error messages and direct the Teacher to where the error is.

4.10.3 Functional Requirements

1. Teachers must be able to create Assignments.

1.1. A template must be provided to help Teachers create an Assignment.

1.1.1. The template consists of 2 phases: Set-Assignment-Parameters and Set-Questions.

1.1.1.1. In Set-Assignment-Parameters phase, Teachers shall set the Assignment Name, Monster, and Time Limit.

1.1.1.2. In the Set-Questions phase, Teachers shall set the 5 questions and options for each question.

1.1.1.3. The system must validate each user input.

1.1.1.3.1. In the Set-Assignment-Parameters phase, the system shall ensure that the Teacher does not create a new Assignment with the same Assignment name as the Assignments created by himself/herself.

1.1.1.3.2. In the Set-Questions phase, the system shall ensure that there are no duplicate options for the same question.

1.2. The message “Assignment successfully created” must be displayed after an Assignment has been created.

4.11 Publish Assignment

4.11.1 Description and Priority

Teachers can publish Assignments created by himself/herself to their own Classes.

Priority: High

4.11.2 Stimulus/Response Sequences

Stimulus	Response
The Teacher clicks on “Publish Assignment” on the Assignment page.	The Publish Assignment page is displayed, where the Teacher is required to specify which Assignment to publish and which Class to publish the Assignment to.
The Teacher clicks on the “Publish” button.	Assignment is successfully published.

4.11.3 Functional Requirements

1. Teachers must be able to publish Assignments created by himself/herself.
    1.1. The Teacher must be able to select an Assignment from a list to publish.
        1.1.1. The list is scrollable and must contain all the Assignments created by the Teacher.
    1.2. The Teacher must be able set a due date for the Assignment.
        1.2.1. 3 dropdown lists for Day/Month/Year respectively must be provided for the Teacher to enter the due date.
    1.3. The Teacher must be able to select Classes from a list to publish the selected Assignment to.
        1.3.1. The list must contain all the Classes that belong to the Teacher.
        1.3.2. The list must contain all the Classes that the selected Assignment has yet to be published to.

4.12 Summary Report

4.12.1 Description and Priority

Teachers can view the Summary Report which shows the Students' performance in Campaign Worlds and Assignments.
The system analyzes the Students' playing history, and plots a line graph.

Priority: Medium

4.12.2 Stimulus/Response Sequences

Stimulus	Response
The Teacher clicks on "Performance Report" on the Teacher's Main Menu page.	The Summary Report page is displayed, where there are a few parameters which the Teacher can set to view different types of Summary Reports.

4.12.3 Functional Requirements

1. The Teacher must be able to view the Summary Report for Assignment.
    1.1. The Summary Report must be in the form of a line graph.
        1.1.1. The line graph plot must be Assignment score against Assignment Name.
    1.2. The Teacher must be able to view the Summary Report for individual Students.
    1.3. The Teacher must be able to view the Summary Report for average score across all Assignments.
2. The Teacher must be able to view the Summary Report for Campaign.
    2.1. The Summary Report must be in the form of a line graph.
    2.2. The Teacher must be able to View the Summary Report for individual Students in a selected World and Section.
    2.3. The Teacher must be able to View the Summary Report for average score in a selected World and Section.
    2.4. The Teacher must be able to View the Summary Report for average score across all Worlds.

5. Other Non-Functional Requirements

5.1 Performance Requirements

- The system must support at least 100 unique Student accounts
- The response time for processing Student's answer selection must be below 0.1 second

5.2 Safety Requirements

No safety requirements have been identified.

5.3 Security Requirements

- Student-sensitive data should be stored using and encrypted with an algorithm of equal strength to AES

5.4 Software Quality Attributes

- Usability
    - The application must be able to support English language.
    - The interface of the application must not have more than 10 interactive buttons at any screen.
- Flexibility
    - To support future expansions and inclusion of new features, the application must adopt an architecture that allows such changes to be easily incorporated.
- Maintainability
    - The application functionalities are distinctly separated within each subsystem, any updates and changes made to the subsystems will not affect other subsystems.
- Reliability
    - The application must not crash at any point in time at all.
- Reusability
    - The software components of the application can be reused for the teaching of another subject/course.

5.4 Data Integrity

- We use SQL database to make sure a clear relationship between entities and prevent conflicts between them

6. Other Requirements

Appendix A: Glossary

Data Dictionary

Students	Students refer to users who are playing the game for educational purposes.
Teachers	Teachers refer to users who are able to create and publish Assignments. In addition, they are also able to access the performance reports of the Students' performance to assess Students' mastery of the topic.
Users	Users refer to both Students and Teachers.
Classes	Class refers to a particular group of Students. Classes are created by System Administrators.
Score	Metric displayed to represent the Student's proficiency in a Level. It is computed using the formula: $\left(\frac{timeRemaining}{timeLimit}\right) * 100$
Stars	Stars represent the score range that the Student is in. For $1 \leq score \leq 50$, 1 star shall be awarded. For $51 \leq score \leq 70$, 2 stars shall be awarded. For $71 \leq score \leq 100$, 3 stars shall be awarded.
World	A World is a collection of 5 Sections. Each World represents a topic in Math.
Section	A Section is a collection of 5 Levels. Each Section represents a sub-topic of a corresponding topic.
Campaign Level	A Campaign Level is a collection of 5 questions related to the sub-topic of the Section. Each Level has a set time limit.
Campaign	Refers to the collection of World, Section, and Levels
Question	A MCQ question with 4 options.

Levels	This term is used to represent a subset of {Campaign Levels, Custom Levels, Assignments}
Custom Levels	Levels created by Students.
Assignments	Special Levels created by Teachers.
Monster	A Monster is a sprite in the application which will represent the Level
Character	A Character is a sprite in the application which will represent the Student when challenging Campaign Levels, Custom Levels, and Assignments. Each Character has a special ability that can be used once during the challenge.
Student's Main Menu page (Students only)	This page contains buttons for accessing the main functionalities of the application for Students.
Teacher's Main Menu page (Teachers only)	This page contains buttons for accessing the main functionalities of the application for Teachers.
Student's Assignments page (Students only)	This page contains a list of Assignments published to the Class which a Student belongs to. The Student can then proceed to play the Assignments found on this page before the due date.
Teacher’s Assignments page (Teachers only)	This page contains a list of Assignments created by the Teacher himself/herself. On this page, Teachers can create new Assignments, edit/delete existing Assignments, or publish them to Classes.
Profile page (Students only)	This page displays the Student’s general information: Name, rank, Campaign score, and chosen Character.
Character Selection page (Students only)	This page contains the available Characters for selection. Students can change their chosen Character here.
Campaign World Selection page (Students only)	This page displays all the Worlds. Worlds that a Student has yet to unlock will be greyed out, i.e. it cannot be accessed by that Student until he/she has met the requirements (Clearing all Levels in all the Sections in the preceding World(s)).
Campaign Section/Level Selection page	This page displays the Levels in the corresponding Section. Worlds that a Student has yet to unlock will be locked, i.e. it cannot be accessed by that Student until he/she has met the requirements

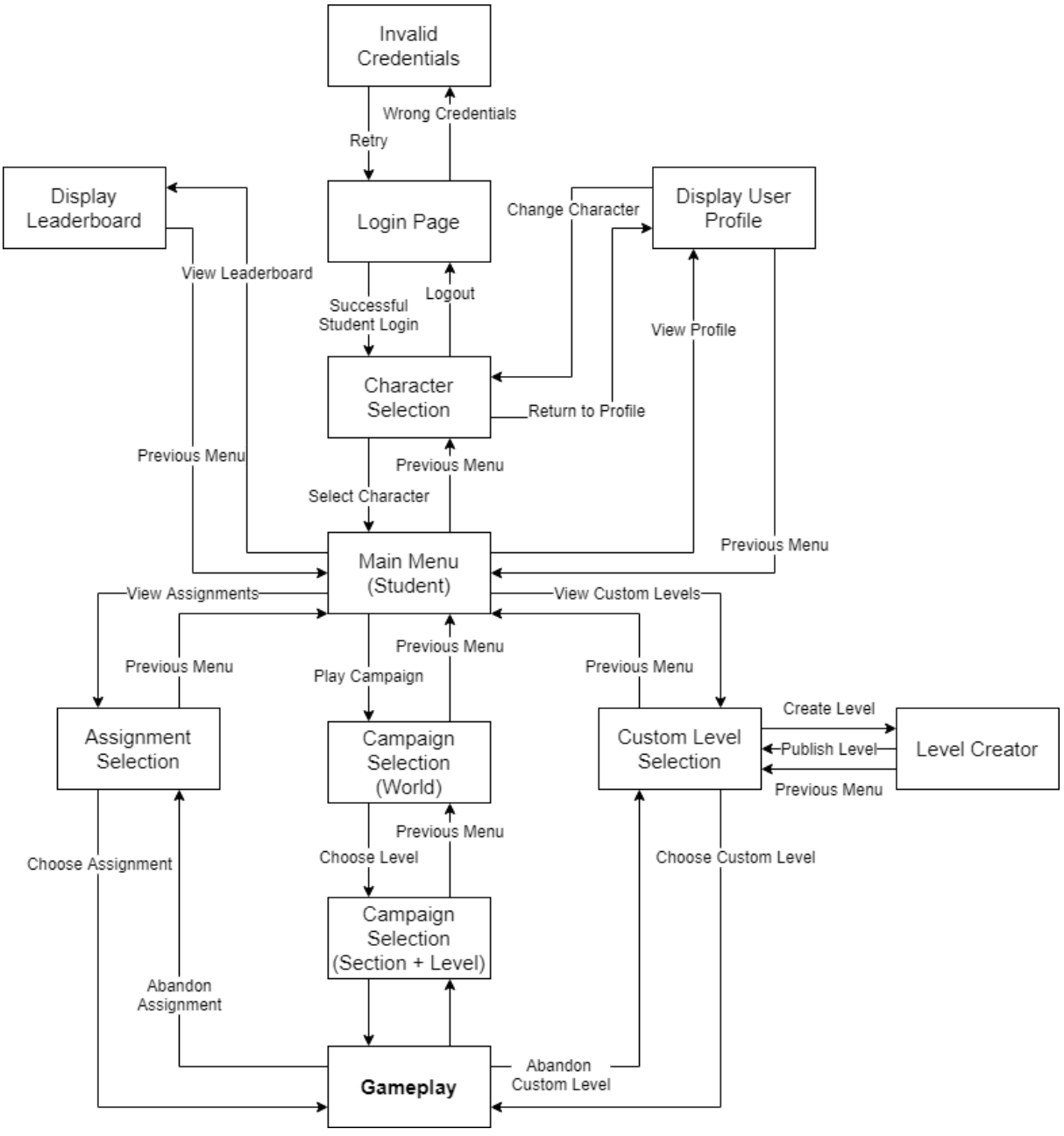
(Students only)	(Clearing all preceding Levels in the preceding Sections).
Gameplay page (Students only)	This page displays the Questions of the corresponding Level. Questions are displayed 1 by 1, and the next Question will only be displayed when the current Question has been answered correctly. Incorrect answers will result in a minus 10 seconds penalty from the remaining time, and when the remaining time reaches 0 before the Student can answer all the Questions, the Student loses. A popup menu will be displayed to show the Students how many stars they have gotten when the Level ends.
Leaderboard page (Students only)	This page displays a scrollable list containing all the Students arranged by their ranks which are determined by their score.
Custom Levels page (Students only)	This page displays a scrollable list of Custom Levels created by all the Students. Students can play the Custom Levels by clicking on the "Play" button.
Level Creation page (Students only)	This page displays a template for creating a Level. The template must be fully instantiated before a Level can be created successfully. The following validations will be performed on the user inputs: - Check if the Level Name is duplicated for the same user - Check if the options for a Question are duplicated Whenever an error is found during the validation, the system will direct the user to the location of the error.
View Created Levels page (Students only)	This page displays a scrollable list of Custom Levels created by the Student himself/herself. For each of the displayed Custom Levels, there is an Edit button and a Delete button which the Student can click to execute the said functions.
Edit Level page (Students only)	This page displays the same template as Level Creation page but is instantiated by the corresponding Level selected. The user can then make the changes he/she wants, and the system will perform validations before updating the database. Whenever an error is found during the validation, the system will direct the user to the location of the error.
Assignment Creation page (Teachers only)	Very similar to the Level Creation page, just that everything within is called Assignment instead of Level.
Edit Assignment page	Very similar to the Edit Level page, just that everything within is called Assignment instead of Level.

(Teachers only)	
Publish Assignment page (Teachers only)	This page allows the Teachers to select an Assignment to publish to his/her selected Classes.
Summary Report page (Teachers only)	This page allows the Teachers to view the performance reports to see how well Students are doing in their Assignments and Campaign.
Login page	This page allows the users to choose Facebook login or GooglePlay login.
Adjust Volume page	This page allows the Student to adjust the volume of background music and sound effects.
Credits page	This page allows users to view the credits for the assets used in this application.

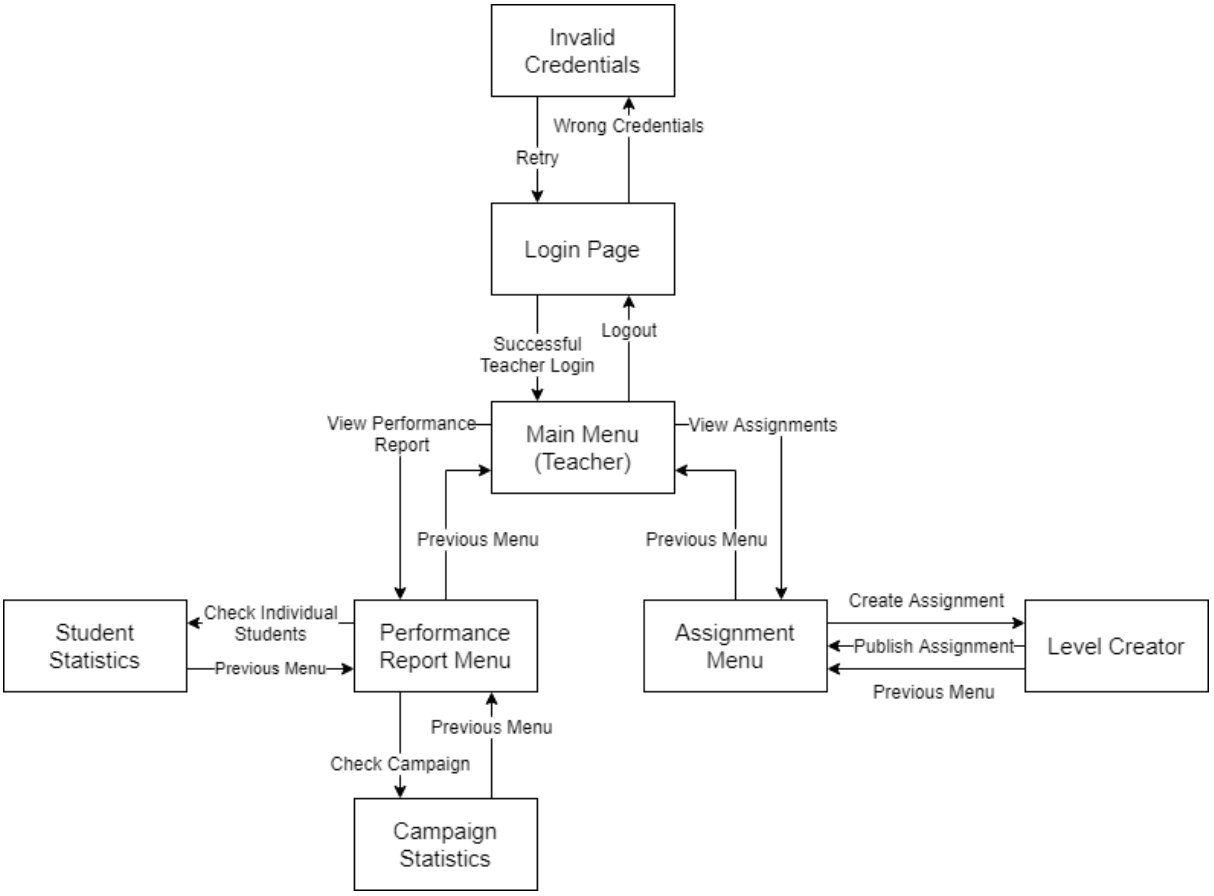
Appendix B: Analysis Models

Dialog Map

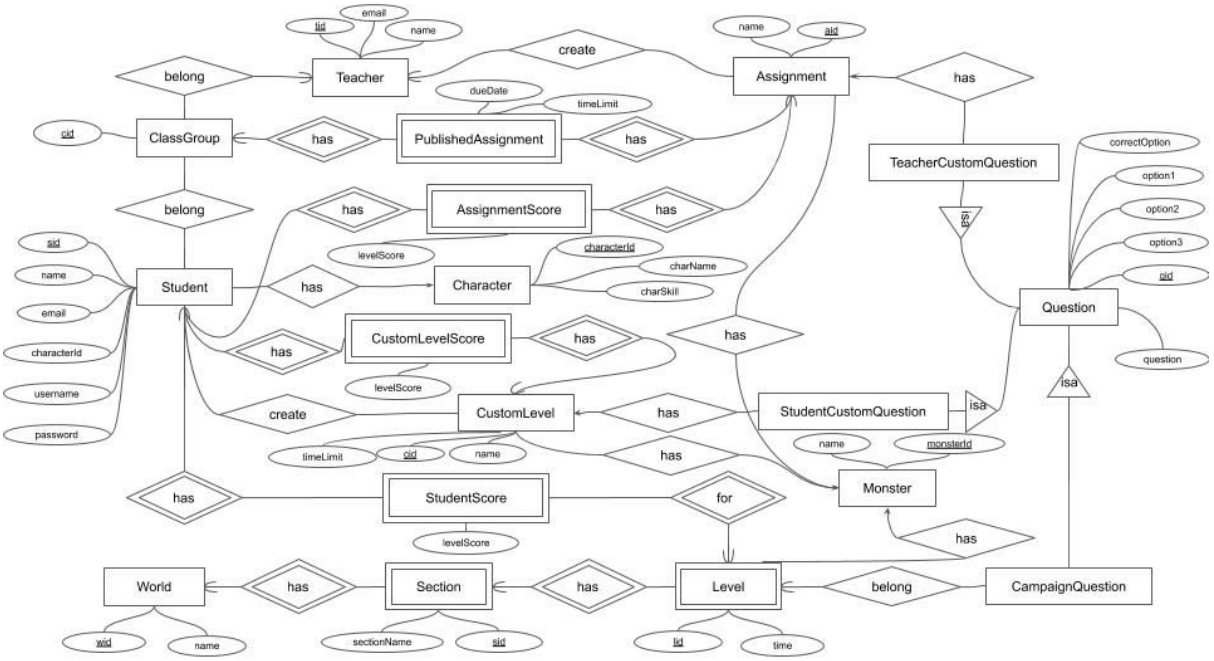
Student:



Teacher:

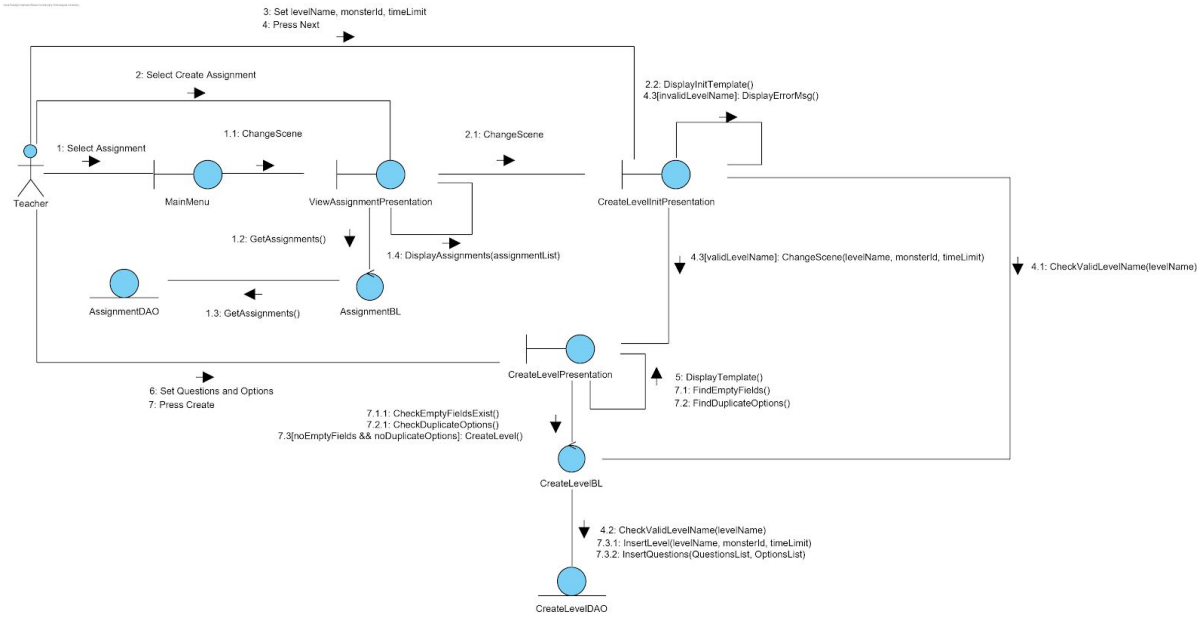

Invalid Credentials
Wrong Credentials
Retry
Login Page
Logout
Successful Teacher Login
View Performance Report
Main Menu (Teacher)
View Assignments
Previous Menu
Previous Menu
Student Statistics
Check Individual Students
Previous Menu
Performance Report Menu
Assignment Menu
Create Assignment
Publish Assignment
Level Creator
Previous Menu
Previous Menu
Check Campaign
Campaign Statistics

ER Diagram

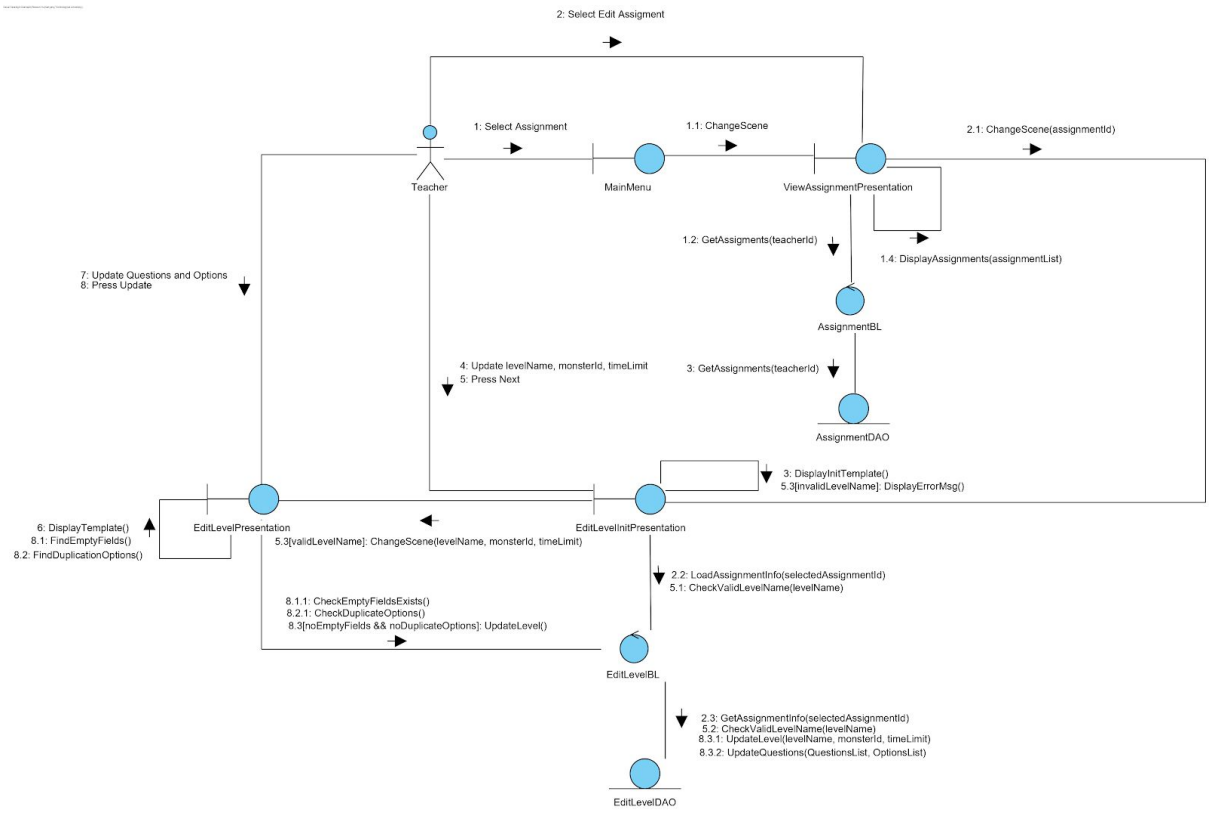

email
lid
name
Teacher
create
belong
name
aid
Assignment
has
dueDate
timeLimit
cid
ClassGroup
has
PublishedAssignment
has
TeacherCustomQuestion
correctOption
option1
option2
option3
qid
belong
has
AssignmentScore
has
isa
sid
name
email
characterId
username
password
Student
has
Character
levelScore
characterId
charName
charSkill
Question
question
has
CustomLevelScore
has
has
levelScore
isa
create
CustomLevel
has
StudentCustomQuestion
name
monsterId
timeLimit
cid
name
has
has
StudentScore
for
Monster
levelScore
has
World
has
Section
has
Level
belong
CampaignQuestion
wid
name
sectionName
sid
lid
time

Communication Diagram (Teachers)

Create level:

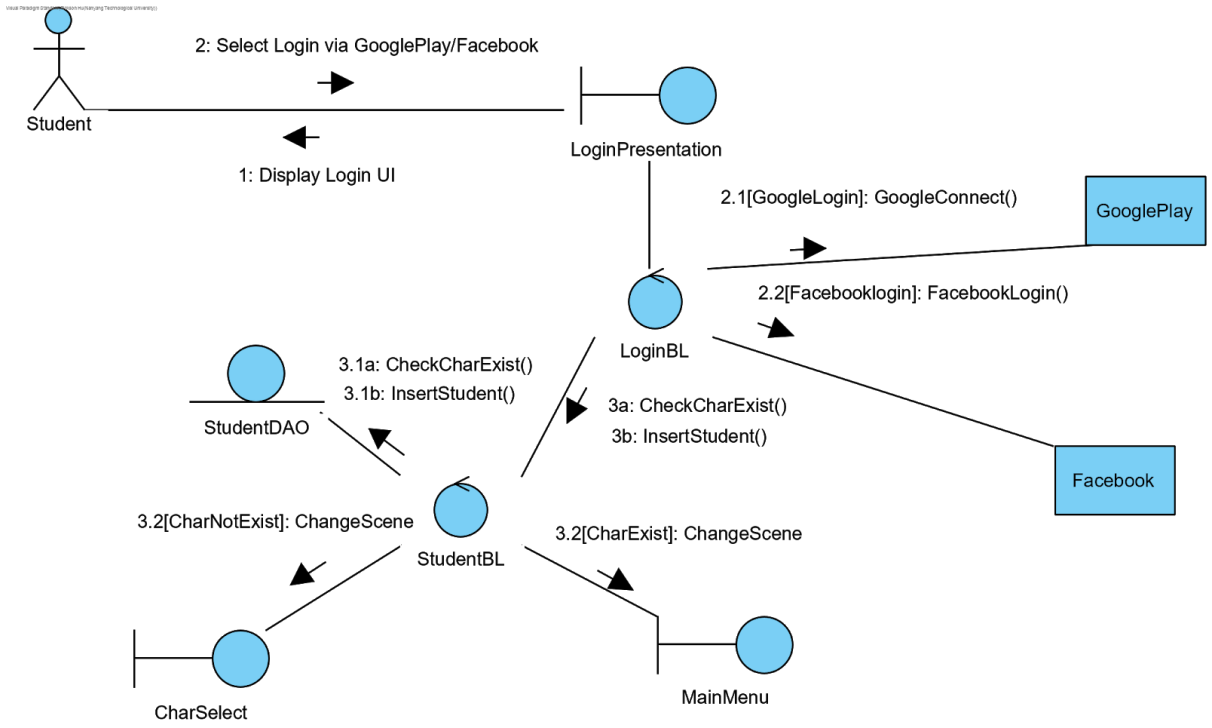


Edit level:

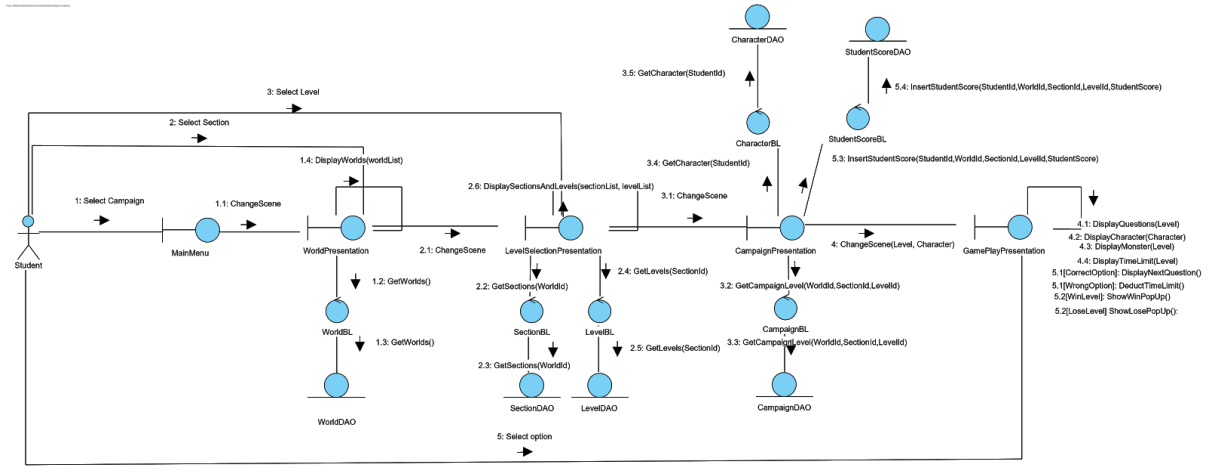


Communication Diagrams for Students

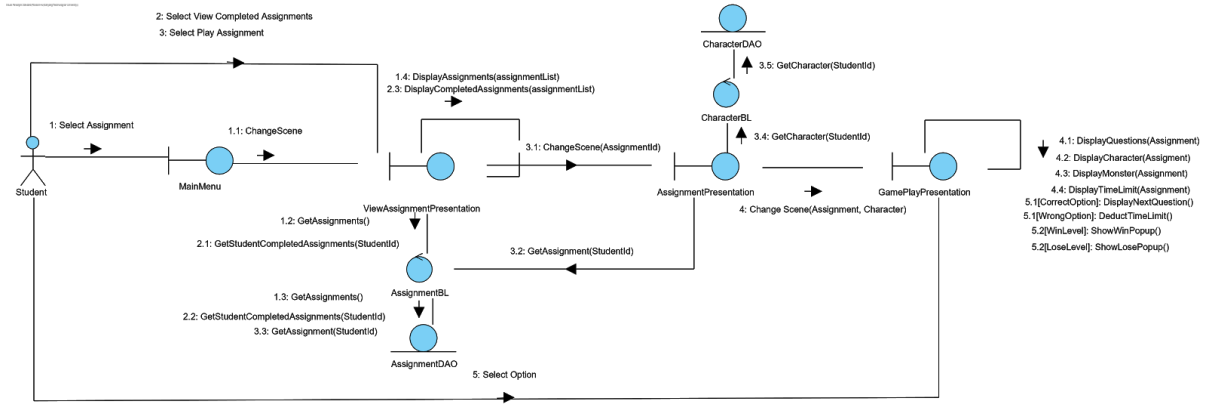
Login:



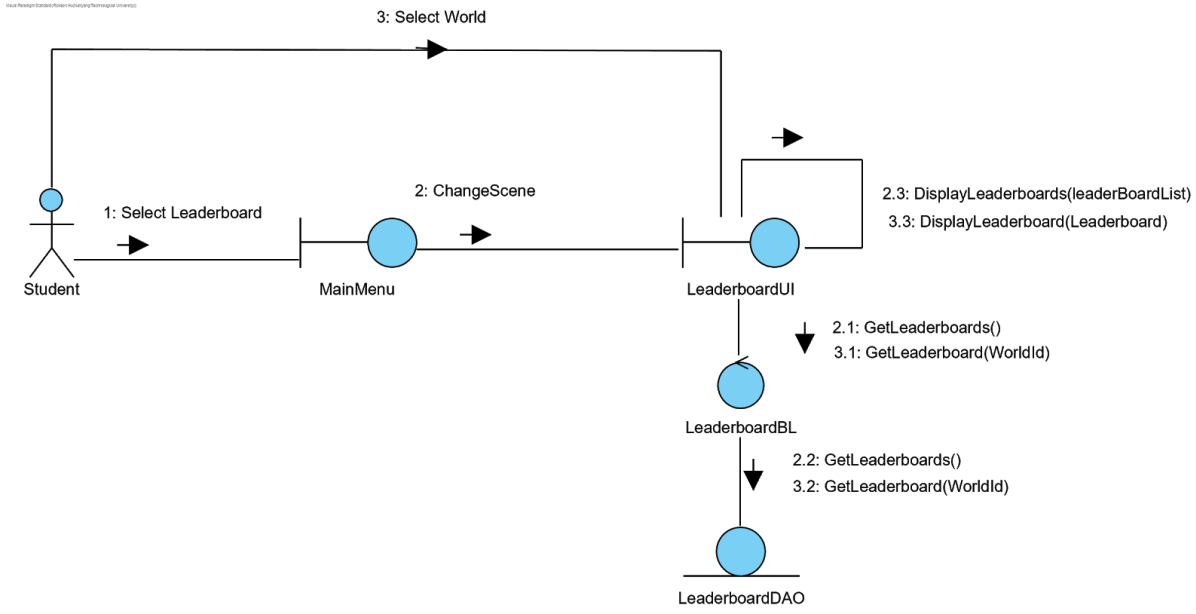
Campaign:



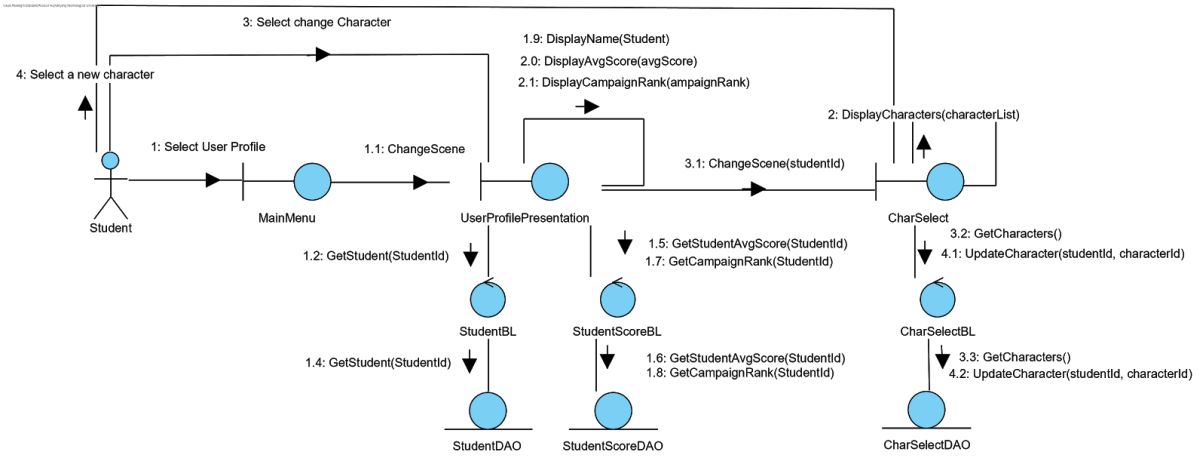
Assignment:



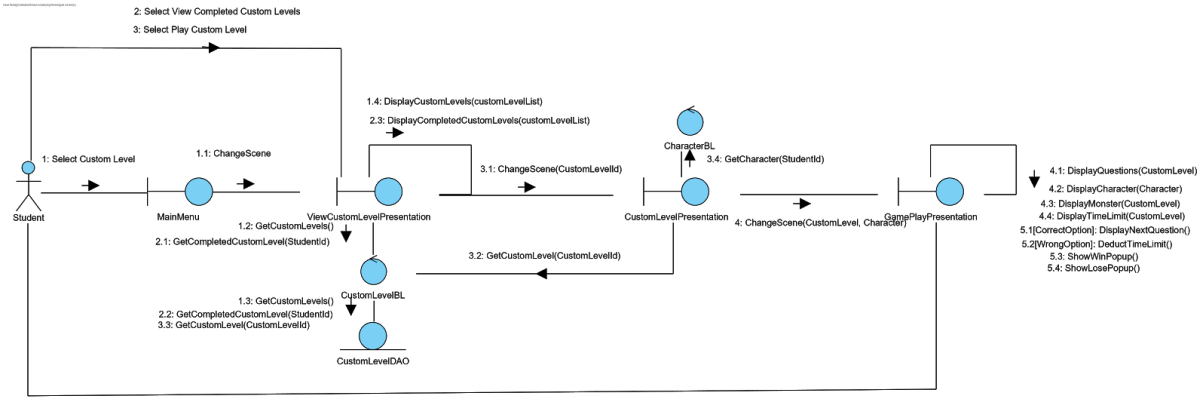
Leaderboard:



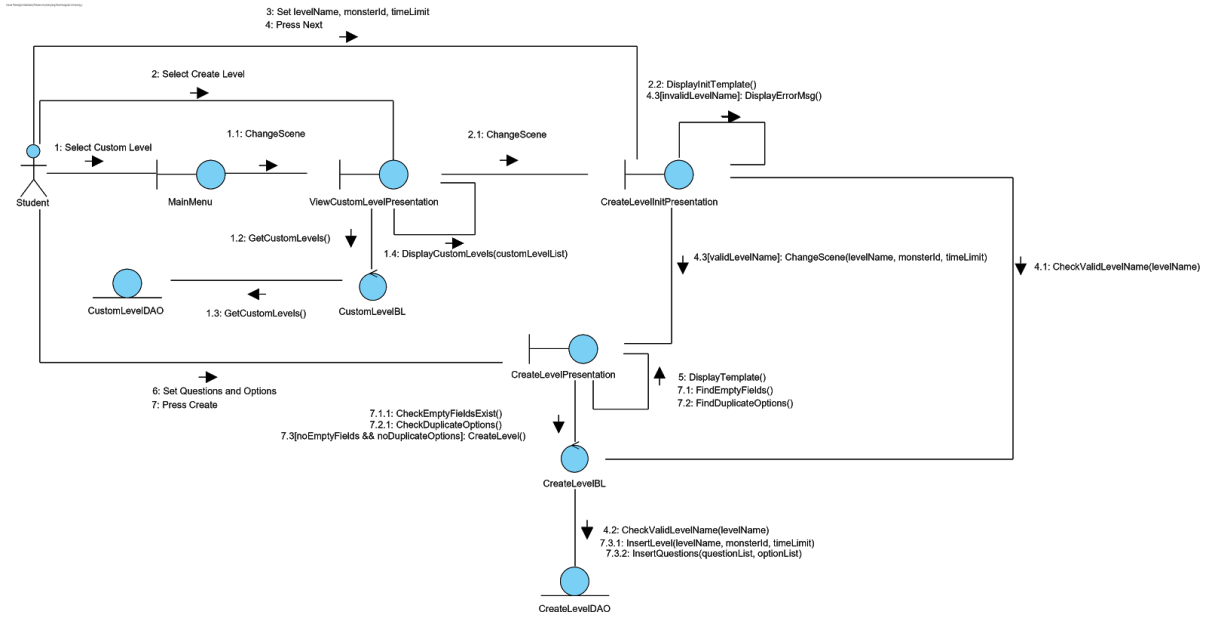
User Profile:



Custom Level:



Create level:



Edit level: