

## Project Introduction

**Universal Learning pattern of Beginners** (Oyelere et. al, 2017):



Novice programmers face problems in introductory computer science courses, to remember and correctly apply the programming essentials: **Concepts, Syntax and Logic.** (Robins et al., 2003)

**Syntax error: Ignoring or forgetting the standard convention.**  
**Semantic error: Incorrect logic(Makes no sense).**

They are likely to concentrate on shallow knowledge and fail to incorporate pertinent knowledge for solving problems. These problems need to be addressed to make sure that the students are learning efficiently and can practise the theoretical concepts, to gain practical experience. Parsons puzzle can be used to solve these problems. Its user interactive and engaging. It helps in implementing theory into practical implementation as it provides an opportunity to test student misconceptions more specifically than code writing. It reduces time and effort of students to get deeper understanding.

Parsons Puzzle are small programming tasks to reconstruct program by selecting and ordering code fragments. It's designed to support learning of syntax and logic by teaching problem solving through algorithmic thinking and visualization. Although designed for programming, it could be used for other procedural problems (mathematical proofs, experimental design, essay structure). (Kumar, 2018)

This project aims to provide a solution for integrating the Parson's Puzzle into MyUni. The objective of this project is to design and develop a universal design of parsons puzzle and implement it into customised H5P, that will transform the process of learning for students.

## Used software and tools



**H5P:** a free and open-source content collaboration framework based on JavaScript. It aims to make it easy for everyone to create, share and reuse interactive HTML5 content. The design of two types of parsons puzzle: Drag and Drop, and Fill in the blanks are implemented as customised H5P functions.



**Drupal:** It is a free and open source web content management framework written in PHP. Drupal provides a back-end framework. Upload the new types of parsons puzzle(customised H5P functions) and content into Drupal.

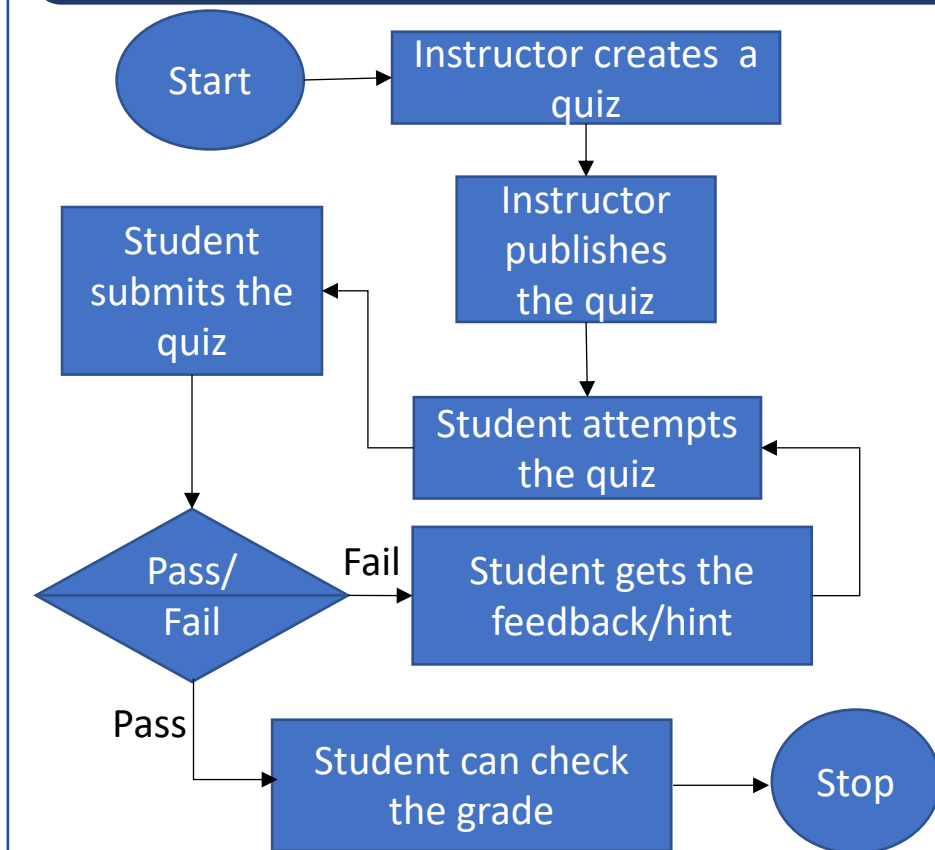


**JavaScript**

## Project Goals

1. Gather information, research and design a universal parsons puzzle to implement it for the subjects where algorithmic thinking is required.
2. Development of environment settings: Integrating H5P into Drupal and MyUni(canvas interface).
3. Implementation of two types of parsons puzzle: Drag and Drop, and Fill in the blanks as customised H5P function.
4. Integrate customised H5P content type - Parsons Puzzle into MyUni.

## Universal Design Key Concepts



**Flow control: Parsons Puzzle implementation**



Instructor interface components for creating a problem

**Predefined syntax rule**

**Expected Actions**

**Hints and Support**

**Tag: difficulty level**

**Grade/Marks**

Instructor can choose to create a quiz. The instructor can choose components required. The predefined syntax rules allow the instructor to create fill in the blanks, comments, indentation and distractors for parsons puzzle. The expected actions help to set the limit of the actions for the students. The hints and support and difficulty level can be decided by the instructor. The instructor can design the marking scheme.



Student interface components

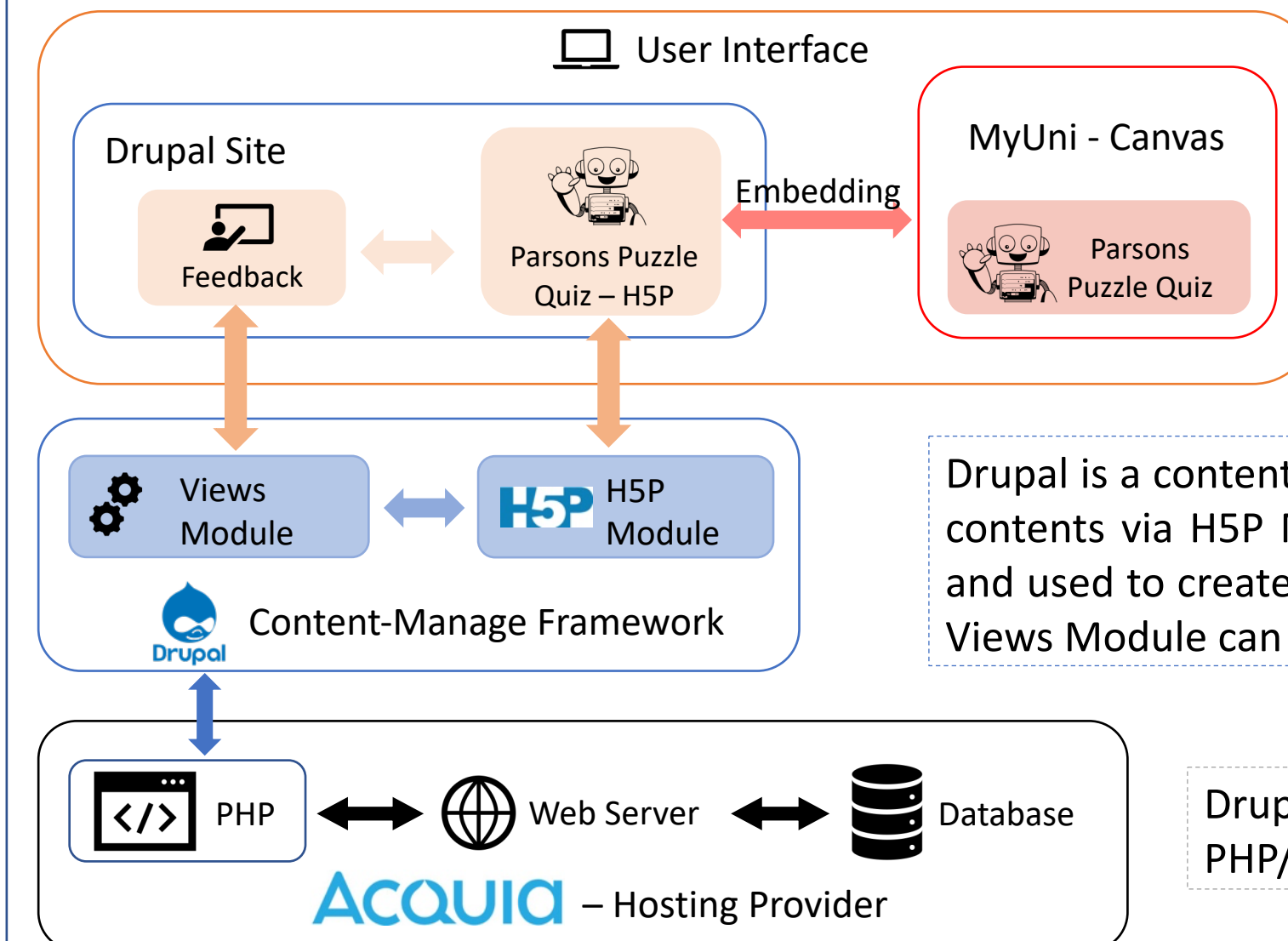
**Attempt History**

**Progress**

Students can track their progress by viewing the upcoming, past, undated problem or test sorted as per the due date. Attempt history will contain the attempt number and the grade for the problem/test.

## Software Architecture

**The goal of the project is full integration with MyUni, but accessing to Canvas instances is not possible within the project timeframe. Integration into Drupal is implemented as a proof of concept.**

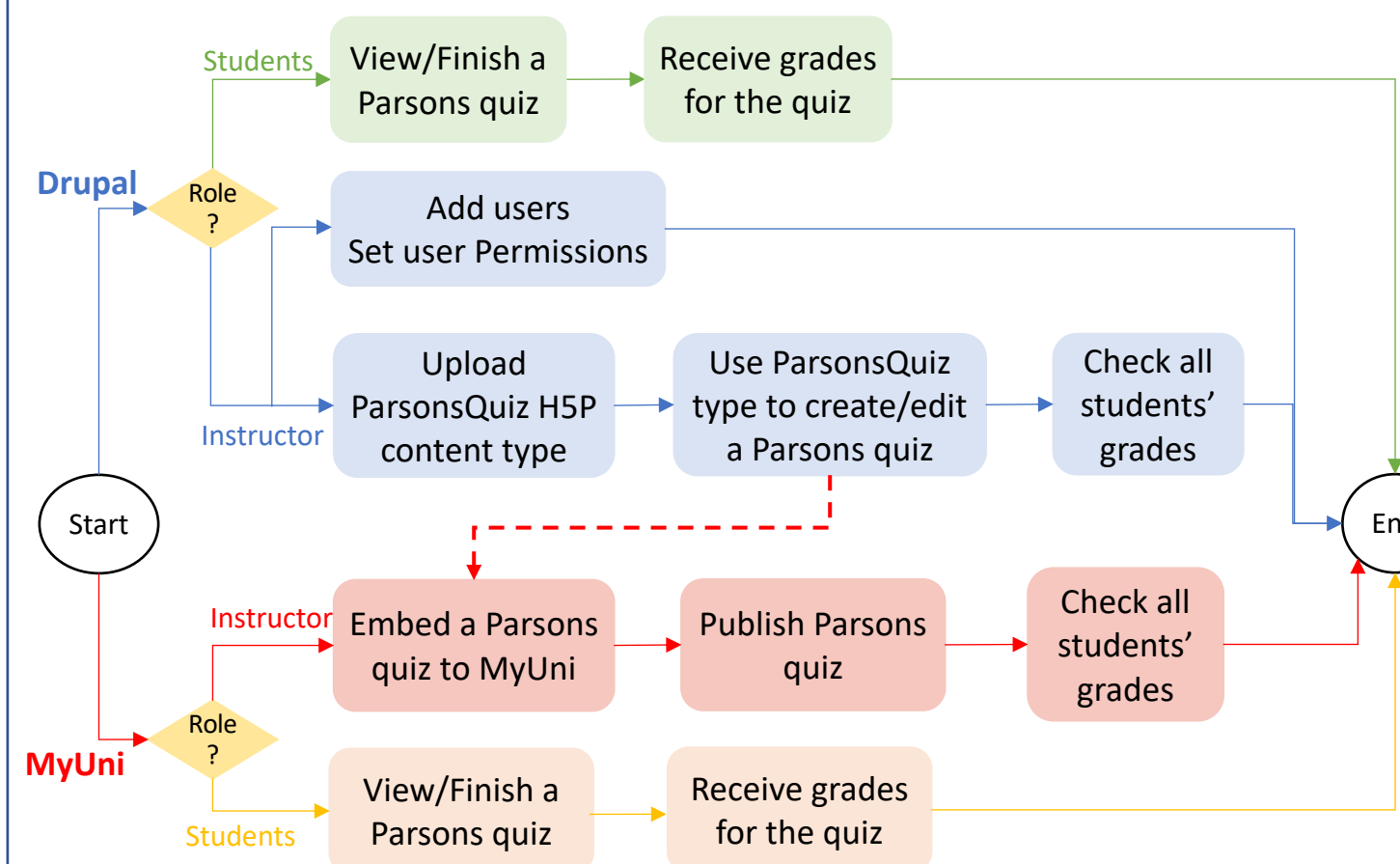


Created H5P content - Parsons Puzzle Quiz can be viewed and finished, and the results can be shown on Drupal website. The Parsons Puzzle Quiz can be embedded into MyUni from Drupal through iFrame, but not fully integrated with MyUni analytics and grades.

Drupal is a content-management framework that can be used to manage H5P contents via H5P Module. A customized H5P content type can be uploaded and used to create/edit interactive contents – Parsons Puzzle Quiz on Drupal. Views Module can analyse results of H5P contents.

Drupal websites runs on hosting provider Aquia which provides PHP/Web Server/Database services.

## Student and Instructor Interaction with Parsons Puzzle



- Instructor can upload the ParsonsQuiz H5P content type to the H5P Libraries on Drupal site.
- Instructor can use the ParsonsQuiz type to create or edit a Parsons quiz.
- Instructor can check the grades from all students.
- Instructor can add users and set user permissions.
- Instructor can embed the Parsons quiz into Canvas and publish it on MyUni.
- Instructor can check students grades on MyUni.

- Students can view/finish the Parson quiz and receive the grade on Drupal site.
- Students can view/finish the Parson quiz and receive the grades on MyUni.

## Achievements

Milestone	Planned Outcome	Actual Outcome
First	Develop the environment setting: Integrate H5P into Drupal.	Same as planned.
First, Final	Research and analyse the design for the universal solution of parsons puzzle.	Same as planned.
First, Final	Create a design of parsons puzzle to be used as a universal solution.	Same as planned.
First, Final	Create customised H5P functions of Drag and Drop, and Fill in the blanks type of parsons puzzle.	Same as planned.
First, Final	Upload and implement the customised H5P functions into Drupal as host.	Same as planned.

## Future Extensions

Data Collection and Analysis

1. Models can be built to analyse the data and generate data of topics which are hard to comprehend for students by taking into account their attempt time, number of attempts, actions and grades. Instructor can use this data to give extra support on the hard topics.
2. Data can be used to monitor student's progression, to keep a check on their performance and to analyse how the parsons puzzle is helping the students to understand the complex topics better.
3. Models can be built to analyse the learning pattern of each student. Instructors can divide the students into different groups based on their different cognitive processing strategies, regulation strategies and learning motivations.

## Conclusion

The project has helped to analyse the importance of parsons puzzle, how to design the universal solution of parsons puzzle, integration of system environment: H5P into Drupal and implementing the customised H5P function and upload it into Drupal. The project has achieved all the basic requirements of the first and the final milestone. The design of the parsons puzzle to be used as a universal solution can be implemented in future, as its too big to be implemented in the give timeframe of 12 weeks and was out of the scope of the project. The data collection and analysis can be done in future, to analyse the hard topics, monitor student progress and understand the learning pattern of students.

## References

1. A. Robins, J. Rountree and N. Rountree, "Learning and teaching programming: A review and discussion," Computer Science Education, vol. 13, pp. 137-172, 2003.
2. S. S. Oyelere, J. Suhonen, T. H. Laine, "Integrating Parson's Programming Puzzles into a game-based mobile learning application", pp. 158-162, 2017.
3. Amruth N. Kumar, "Epplets: A Tool for Solving Parsons Puzzles", pp. 527-532, 2018