Portfolio and assessment system for Work-Based Learning students

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Abstract

A Work Based Learning degree offers its students the chance to work in an actual workplace, carrying out real-life working tasks, while studying to obtain their degree of third level higher education. This type of degree helps students acquire precious knowledge combining both university courses and working experience. In order to blend these two in an efficient way, WBL students would need to submit artefacts and evidence of their efforts in the workplace, so that the academic supervisors could assess them. The goal of this project is the development of an application that would allow the students to upload this type of proof and provide access to both academics and work managers to review it. The implementation of this system requires research into similar learning platforms and other WBL cases and in-depth analysis of the requirements. After its materialization, the WBL application is evaluated and conclusions are drawn regarding its usefulness and performance.

Education Use Consent

I hereby give my permission for this project to be shown to other University of Glasgow students and to be distributed in an electronic form.

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Acknowledgements

We would like to take this opportunity to thank everyone who contributed directly or indirectly to this project. We would like to specifically thank our Supervisor for this project, Joseph Maguire, who guided us successfully with his advice and feedback for completing this semester-long task. Moreover, we would like to thank all the people who agreed to be interviewed by our team. In detail, the interview with the academic, whose team is responsible for creating a Work Based Learning degree for the University of Glasgow, was very enlightening for our system's requirements understanding. In addition, the students we interviewed offered us a great insight on how does Work Based Learning operates and provided us with important feedback while evaluating our application.

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Chapter 1 Introduction

1.1 The Problem

Work-Based Learning (WBL) is a new scheme that introduces to students "real-life experiences".. and motivates them to apply .. "academic and technical knowledge in the workplace" (Brown, 2003). Essentially, the scheme ensures that the students who wish to study at university, not only gain purely academic skills but additionally develop abilities which can help them work in the industry.

Usually, the concept of the Work Based Learning is that the students would not only spend their time at the university, but they would also work in a professional environment, completing practical tasks. This is a great idea, in theory, however, it is essential to remember that while the students are working for a company, their main goal is to obtain a degree, which is granted by the university. For this reason, WBL degrees should ensure there is a balance between the student's university and workplace. Yet, maintaining this balance reserves several obstacles.

1.1.1 Communication Gap

The main challenge of Work Based Learning lies on the fact that there is not any unified platform that can offer a communication link among all the involved parties which are the students, the university and the workplace (Greenfield and Stevens, 2018). So far, Work Based Learning degrees are based on traditional communication tools, such as e-mails, hard copy reports and face-to-face interaction (See Section 2.4). These specific means are used so that both the university and the workplace of the student can collaborate and align their strategies, so that the students will benefit the most, by completing this degree.

1.1.2 Ununified Assessment

Another problem that is encountered in many Work Based Learning degrees these days, is the lack of an established assessment system followed both by the universities and the workplaces (Greenfield and Stevens, 2018). Nowadays, in many WBL cases, students seek to accomplish both their academic and working responsibilities. However, due to the fact there is not a fundamental assessment strategy being applied (See Section 2.4), the efforts of the students are not completely reflected their supervisors. Respectively, for the same reason, students do not get appropriate feedback, thus, they are not able to adapt their academic and work performance based on their supervisors' guidelines.

1.1.3 Privacy Issues

Last but not least, another major concern of Work Based Learning is the privacy matters regarding the information being shared through the students. In several cases, students are asked, by their academic supervisors, to write reports, describing their tasks and achievements in the workplace. Although this can be considered a common assessment practice in Work Based Learning, it withholds

the risk of revealing valuable information, that a company would not want to expose.

1.2 Aims and Objectives

In order to tackle the above challenges, our team decided to develop Bridge, a web application that would be used as a platform that students, academic supervisors, and work managers could access for the purposes of a Work Based Learning degree. The main objectives of this platform are described below:

1.2.1 Link Among Parties

The first reason why the development team considered a web application to be more appropriate for our purpose, would be the fact that it can offer a common platform that every interested party would have access to. Our aim is to implement a system that would provide access to the students and to both their academic and workplace supervisors from anywhere, anytime. This system would be the main tool of communication between all the involved parties by granting a shared space where the three parties of a Work Based Learning degree would express their requests, point out any problems and ask questions.

1.2.2 Assessment Strategy Foundation

Another major goal of Bridge is to set the basis for a unified assessment strategy for Work Based Learning degrees in third level higher education. Our web application will be a platform where the students will be requested to upload specific files that sum up their tasks and performance in the workplace on an arranged basis. The students will be assessed based on their uploads and also, they will receive feedback depending on the content quality of these files. This way, students will be assessed using a uniformed strategy that ensures a high level of assessment quality, equality of assessment among students, and valuable feedback.

1.2.3 File Approval

Lastly, Bridge will act as a filter layer for the files that students upload. In our try to minimise the risk of private information sharing, our application will provide the work managers the chance to review the files students upload, and judge if they contain information that should not be shared with other parties, such as the universities.

1.3 Dissertation Structure

The dissertation is comprised of eight chapters. Chapter 1 is the Introduction where we analyse the main challenges of Work Based Learning, and we point out our goals in solving these problems. Chapter 2 contains the Literature Review, where the team collects all the necessary information about Work Based Learning in general, but also about some real-life WBL cases. Additionally, we conduct a survey about several existing software solutions and we present the types of assessment in Work Based Learning. Chapter 3 is the Requirements Analysis. Based on our requirements capture interview and our Literature

Review we analyse our application' s requirements and then we prioritize and categorise them. Moreover, we exhibit diagrams that help in explaining our requirements more sufficiently. Chapter 4 is about our Design Interface and we implemented our website prototype. Chapter 5 discusses the actual implementation of our software system. More specifically, we demonstrate the tools we used for creating the application and determine how we developed each requirement of our platform. Chapter 6 is called Evaluation and it explains our testing strategy and also the user evaluation methods we used to evaluate our web application. Chapter 7 is where we draw our conclusion and talk about our future work. Chapter 8 is the final part of our dissertation, where we write about the contributions made for this project, and the people who made them.

Chapter 2 Literature Review

The purpose of this project is to develop an application that will be a common platform for all the Work Based Learning parties, meaning the students, their academic supervisors, and their work managers. Using Bridge, the students would be able to upload specific artefacts reflecting their work in the industry, their work managers would approve these artefacts if they satisfied their requirements, and the academic supervisors would assess the students' performance based on the content of these artefacts. In order to develop such an application, two things are required. Firstly, an understanding of what type of evidence is expected from the student to provide the university and secondly, a comparison with existing applications which could do a similar task. Hence, the development team undertook some research to see if there are any existing methods to track the efforts of the students while they are working for the purposes of the Work Based Learning degree.

2.1 Survey of Concepts

The overall aim of this project is to essentially develop a new Work Based Learning tool, however, in order to deliver such an application, the development team needs to gain a true understanding of what exactly Work Based Learning is and observe real-life examples, in order to understand how similar WBL degrees work.

2.1.1 What is Work Based Learning?

Essentially Work-based Learning (WBL) is a concept that equips students with work experience by offering them a real-life environment that allows them to apply and develop their academic and technical skills (Brown, 2003). It is a scheme that bridges the gap between the industry and the university ensuring that after their graduation, students already have the required skills to work in the industry. This idea is highlighted by Lemanski, Mewis, and Overton who stated:

"Work-based learning is the term being used to describe a class of university programmes that brings together universities and work organizations to create new learning opportunities in workplaces." (Lemanski, Mewis and Overton, 2018)

What the development team needs to understand is that there many different types of Work Based Learning. These are highlighted in the table below. (Hamilton, Stephen F., and Mary Agnes Hamilton, 1997)

Name	**Description**
Internship	This type of work based learning is when the Student is working for an employer over a set time period and is set supervised tasks with the aim of helping the organisation.
School-Based Enterprise	This example is when the school/university creates a simulated working environment and invites the students to manage or work in certain areas of the imaginary business.
Job Shadowing	This is a short-term experience where the university would introduce the student to an employee who works for an organisation, the student's role is to watch the employee in order to gain an idea of the duties which they may be expected to perform in the future.
Industry Field Trip	This is when the University plans a trip to an organisation. This type of work-based learning can be described as a tour of a typical organisation which the student is expected to work in after they obtain their degree.

2.2 Work Based Learning Degree

Bridge is implemented in order to serve the smooth operation of Work Based Learning degrees in third level higher education. The type of WBL that our platform will support will be the Internship. Students who undertake a Work Based Learning degree, will be also working in the industry throughout the duration of the degree. During their internship, the students will be requested to complete several tasks in their workplace, and based on their performance on these tasks, they are going to be assessed by their academic supervisors. A major difference between a WBL degree and a regular degree is that the students are not only evaluated on their academic performance but also on their efficiency in their workplace. In many cases, the internship of the students in WBL degrees is graded as an academic course. Our application is being created to aid this specific type of Work Based Learning degrees.

2.3 Types of Assessment

As a result of researching Work-Based Learning, one thing has become evidently clear; "Learning that occurs in the workplace is difficult to capture" (Manthorpe,

2012) To help minimize this issue there is a range of different assessment techniques that can be used, a few examples have been outlined below:

1. Project Work Approach (Manthorpe, 2012)
   - In this type of assessment, students are set a project which they have to complete while working in industry
   - This project could be set by the company or the university
   - The students are graded based on how successfully they complete the project

2. Reflective Assessment (Manthorpe, 2012)
   - Students are required to reflect on what they have learnt, this is usually completed in a weekly journal.
   - The journal can be reviewed by the assessor on a weekly basis. It allows them to overview what the student has accomplished in the week.
   - Provides the student a summary about what they have achieved so far and allows them to reflect on it, by improving their weak spots and correcting their mistakes.

3. Portfolio Evidence Approach (Manthorpe, 2012)
   - The students are required to create a Portfolio containing different tasks they have completed and present it to their assessors.
   - The assessors are able to review the work which has been completed by the students.
   - Extremely beneficial for the students since many employers require that the applicants should present a portfolio when they are applying for jobs.

4. Peer Review (Woolf and Yorke, 2010)
   - The students are assigned by their academic supervisor to review the work of their peers.
   - The system gives access to the student to review the artefacts of other students and allows them to grade and comment their work.

These types of assessment are widely used among universities and academic assessors for the purposes of grading in a degree. The same applies for Work Based Learning degrees. For this reason, our team thought it was essential that our implemented system would integrate these specific types of assessment. More specifically, in our efforts to establish a unified assessment strategy through our application, we arrived at the conclusion that a student should be able to upload journals, reports and various files for assessment. The journals are included in the Reflective Assessment. They should summarize the tasks and the responsibilities a student takes up over a week. The reports which are part of the Reflective assessment as well, are more detailed than the journals since they should be uploaded by the student once or twice in the semester and they should offer a complete overview about the student's workplace experience. Except for journals and reports, the students may have to upload a project or a portfolio of projects and assignments that they completed during their practice in their workplace. As a result, the Project Work and Portfolio Evidence Approaches are crucial assessment types for our WBL platform. By uploading this kind of files, the students can be thoroughly assessed by their academic supervisors, who can get a full understanding of what the students have learned and gained from his

work experience. However, these projects must not contain any sensitive or valuable information about the business the student works for. Similarly, privacy issues are the main reason our team decided not to integrate the Peer Review assessment type in our WBL system. In detail, following the indication that we were given by interviewing one of the team members responsible for creating a Work Based Learning degree for the University of Glasgow, during the requirements capture interview, Peer Review would require non-disclosure agreements to be signed by all the students who would participate in the reviewing process, we excluded this specific assessment approach since it has been proven impractical.

2.4 Work Based Learning Cases

In order for the development team to create their own Work-Based Learning tool, it would be useful to research existing WBL schemes and investigate the methods in which they organise the communication between the private organisations and the university. As part of the project, the development team has interviewed three students with the intention to understand how their university manages the unique way in which these students are taught, inside and outside of the university. Below we present these three Work Based Learning Cases.

2.4.1 Heron Bros

In Northern Ireland, a company called Heron Bros has a similar scheme to Work Based Learning already in place. The scheme allows students who are interested in working in the construction sector, gain experience while completing a degree in Quantity Surveying. As part of this project, the research team had the opportunity to interview one of the students who took part in this scheme. The student who is currently doing the course described to the development team his personal experiences by outlining his daily tasks.

The student highlighted the structure of the scheme. More specifically, he would work for Heron Bros 3 days a week and spend the rest of his time working on his degree responsibilities at the local university. The university provided the student a supervisor who had frequent communication with the company. His main responsibility was to ensure that the student's work was correctly assessed and that the student was properly graded. The students had to keep a written journal which outlined the tasks/objectives they were assigned during the week. Also, in the journal, the students had to explain how they completed these tasks and provide relevant evidence.

The student stressed that their manager always requested to view their journal before giving it to the university. This check was done to certify that the information that was being shared with third parties was not of extreme importance. Once it was reviewed, the journal was sent via e-mail to the student's supervisor.

2.4.2 Ulster University Recruit

Across the UK, it is common practice for students to take a Sandwich/placement year. During that year, the student works in a professional environment which is

related to his subject area. For example, a Computing Science student could work in a software development company. The aim of this scheme is to help students develop skills which they would only learn in the industry and which could not be taught by the university. The student's work, during his placement, is assessed by both the employer and the university.

Usually, the university provides a list of requirements which the student must fulfill while working in his workplace. Examples of such key requirements are: *Independence* (the ability of the student to work alone) and *Teamwork* (the ability of the student to work as part of the team) (see Appendix A). Before the placement commences, the employers agree that they would provide the student with the opportunity to meet all of these requirements. For example, they would assure that the student would not work individually, so he could develop his teamwork skills.

Students at Ulster University who are on placement year are required by the university to complete the following tasks:

- Keep a journal of tasks which they have completed each week
- Hold two meetings with their university supervisor
- Write a final summary report outlining what they have learnt

To help the students follow these requirements, the university has provided them the Recruit System. This system contains many aspects that support both the student and the university manage during the placements.

Firstly, the system allows students to submit their weekly journal and at the same time, allows the supervisor to view these submissions and gain an understanding of what the students do on a daily basis. It was common practice for the student's manager to review these journals before being uploaded to the university's system in order to check if any sensitive information was presented. However, the actual system did not include a function to support this. The main functionality of the system can be seen in Appendix A.

In addition to the journals, the student was assessed by two planned meetings with his supervisor. While preparing for each meeting, the student was required to upload a document summarising what he did over the past few months. This gave the supervisor a brief reminder of what the student has been doing before the meeting. The summary was a doc. file which was required to be uploaded to the Recruit System. After the meeting was completed, the supervisor would provide feedback again via a doc. file, by uploading it to the Recruit System. This way the student would have access to valuable advice and he could reflect his future efforts based on this.

2.4.3 Ulster University's Art School

While researching Work Based Learning schemes, it was pointed out to the software development team, that it may be essential for the implemented system to support portfolio management. In light of this, the team contacted students from the Ulster University School of Art, supposing that these students would use a unified system, so they could be assessed based on their portfolio. Unfortunately, after speaking to a few of the students it became clear that no unique system was applied to support this functionality.

If a student was required to create an assessed portfolio one of two approaches was used: the portfolio would either be printed out and physically handed to an assessor or the student would take pictures of the portfolio and save the pictures in a PDF file and upload the PDF to a Learning Management System like Blackboard or Moodle.

2.5 Survey of Existing Solutions

After conducting a research on the concept of Work Based Learning, analysing the types of assessment that could be used in a WBL degree and presenting several WBL cases, we arrived at the conclusion that the one type of software systems that could support the needs of a Work Based Learning degree and give valuable solutions is Learning Management Systems.

Learning Management Systems (LMS) are software applications used for their course administration tools and their pedagogical functions that allow online access to multiple users (Coates, James, and Baldwin, 2005). More specifically, LMS help organizations manage training events, learning courses and programs, providing accessibility, automation and useful features for organizing and tracking documents, deadlines, and results (Foreman, 2017).

Based on these features the team believes that some elements would be similar to their final product. Since Learning Management Systems are well suited for organizations that aim to offer training and education programs to employees or students (Foreman, 2017), we reached to the decision that a Work Based Learning application should use a Learning Management System as a foundation.

Some of the most popular Learning Management Systems are presented in the sections below. The objective of this analysis is to demonstrate the main functions of these learning platforms, point out their advantages and then make a comparison with the team's Work Based Learning application.

2.5.1 Moodle

Moodle is an open source learning management system. It gives to the users the ability to develop and customize their own learning platform. Moodle is very popular amongst universities, as it offers all the basic features of a learning management system (user personalization, repository for academic files, calendar, grading, messaging system). The advantages of this Learning Management System is that it supports many different languages, it is relatively easy to use and it is designed in a way that promotes both learning and teaching offering a 'set of learner-centric tools' (Docs.moodle.org, 2018).

2.5.2 Blackboard

Blackboard is a learning management system that suits both academic and business organisations because it adapts in different learning scenarios. Essentially, the web platform provides a centralised hub for lecturers to upload their materials to support students taking their course. Lecturers can also set assignments on Blackboard that can be used as custom requirements for the student to follow, as well as providing an upload section to allow students to

deliver their attempt of the assignments. Finally, lecturers can view these attempts and provide feedback, as well as grade the assignment. Additionally, Blackboard provides a Group Management feature where the assessor can categorize learners by different metrics (skill level, skills gaps, department, etc.) This Learning Management System is a great instructor-led training tool, which also promotes online education supported by basic LMS features including course management, individual portfolio, configurable settings, community system. (Blackboard, 2018).

2.5.3 iSpringLearn

iSpringLearn is a cloud LMS software that lets the user upload courses and quizzes, invite learners and monitor their learning progress. This Learning Management System offers unlimited storage space. iSpringLearn provides many essential tools such as calendar, live training, workshops, webinars and group management. What makes this learning platform unique is various features such as a gamification system including points, badges, and leaderboards, a reporting section where the user uploads reports on a frequent basis and learning paths creation which allows users to get a step by step overview of their learning responsibilities (Ispringsolutions.com, 2018).

2.5.4 Comparison

The Learning Management Systems analysed above are very popular among universities and they are used for a lot of educational programmes and degrees worldwide (Shine, 2017). These systems offer a platform to both students and academics to upload course-related documents. Hence, they assist the students to keep track of their responsibilities and also fulfill them and they aid the lecturers in assessing the work the students delivered. These functionalities, combined with features such as a calendar with coursework deadlines, a messaging system and, other learning tools, integrated into an easily accessible and user-friendly system can really improve the educational experience of students and the work of the academic assessors.

The team was assigned with a project of creating a Work Based Learning system for the purpose of a WBL degree equivalent to a third level higher education degree. The operations of this system are based on the foundations of a Learning Management System like the above. However, it is developed in order to suit the needs of a Work Based Learning degree.

The name of the team's application is '**Bridge**' because it bridges the gap between the university and the workplace of the student. The basic advantage of Bridge over the rest Learning Management Systems is that it offers access to both the university and the companies which are associated with the students, whereas LMS, although they are built to support learning in general, they do not offer a three-way communication like Bridge. Our application is a platform that provides a unified assessment strategy. In detail, the students are supposed to upload certain artefacts, which, after they are approved by the work manager, they are available to the academic supervisor for grading. Moreover, by using Bridge, the student has the chance to receive feedback from both parties. Bridge delivers a common platform, where students can read the feedback from both the academic supervisors and the work managers and modify their work based on

them. In other words, Bridge promotes a multi-side interaction among the involved parties.

Additionally, Bridge works as a way of information filter between the university and the companies. More specifically, the work managers are allowed to oversee what information the student shares with the university. Through Bridge, the work managers have the opportunity to validate this kind of sensitive data, which is available to the academics only after their approval. As a result, Bridge gives an extra layer of valuable data protection, compared to the common LMS.

Lastly, Bridge's functions and design are implemented in a way to aid a degree of Work Based Learning. Due to the unified assessment strategy our system promotes, it is not necessary for its administrators to modify the submissions of the students. The majority of the Learning Management Systems are customizable platforms, that rely heavily on the supervisors to complete additional actions. Our system's design is already implemented to match the needs of a Work Based Learning case.

2.6 Summary of Literature Review

By conducting our Literature Survey, we arrived at several valuable conclusions. First of all, we were introduced to the term 'Work Based Learning' and we fully understood the concept of such a scheme and also the way that a Work Based Learning degree would function. Additionally, we reviewed the main types of assessment that could be used for the purposes of this specific degree and we discussed which of them are integrated into our platform. Moreover, we examined some real-life Work Based Learning cases. These cases made us more familiarised with the concept of Work Based Learning and the currently used assessment types and they outlined, even more, the necessity of a system that would serve the causes of such a degree. Making the assumption that this degree would require a Learning Management platform, we analysed the most popular Learning Management Systems in the market. Based on this analysis, we pointed out our application's main advantages over these systems by comparing the features of each platform. Based on that comparison and also on the previous research, we are now able to capture the requirements of the application, we are planning to implement.

Chapter 3 Requirements Analysis

This chapter is dedicated to the analysis of our project's requirements. In the following sections, the team describes the methodology that was used for the requirements capture, categorizes the requirements according to their significance for our WBL application and the problems that it solves and presents diagrams that provide a more detailed aspect in our system's architecture.

3.1 Interview with Client

In order to capture the requirements of our application, we arranged an interview with a possible client. The team got in touch with a member of a team which is responsible for implementing and organizing a Work Based Learning degree offered at the School of Computing Science of the University of Glasgow. According to our project's supervisor, Joseph McGuire, who helped us set up the interview, extracting information about the requirements is crucial for the development of the application and the interviewee was the right person to help our team achieve that.

3.1.1 Interview Preparation

Our team prepared a set of questions focusing on requirements and information capture which were essential for the progress of our project. The interview questions were separated into three different sections. The first section contained questions to help us learn basic facts about our stakeholder and his role in the team which is in charge of creating the Work Based Learning degree. The objective of the second part of the interview template was to identify possible challenges in implementing this WBL degree and possible issues that our team would encounter while developing this WBL tool application. Finally, the third section of the interview helped us understand in a deeper level the user environment of our application and basically clarify the requirements needed to create this system.

3.1.2 University of Glasgow Work Based Learning Degree

The interview provided us both general and specific details about the structure of the Work Based Learning degree that the client and his team want to create and, simultaneously, precious information about the requirements necessary to develop our application that will play a significant role in the degree's operation.

The interviewee pointed out that the Work Based Learning degree is a work in progress and it is set to be ready next September. This degree, which has a four-year duration, it will have the form of a graduate apprenticeship and all the courses of this program are brand new which means that they build this degree from scratch aiming in satisfying all the specific needs that a Work Based Learning degree demands. More specifically, the degree will offer the students a separate WBL course, besides the regular courses. The goals of this course will be to monitor the students' progress in their workplace and give them the knowledge and directives to adapt to the needs of the business world. The student will be graded both for their performance on and off the campus. Their grade will be evaluated by the assessors of the Work Based Learning program. The total amount of the students in the program will be 44 students who will be divided into 3 groups and each group will be assessed by one advisor.

3.1.3 Assessment Strategy

During the WBL program and with the use of our web application the students are expected to upload various artefacts which will be reviewed by their workplace and assessed by the university. These artefacts will be weekly

journals, reports and various files that will present the students' progress and responsibilities of their apprenticeship. The business that employs the student will assign a mentor, a team leader and a work buddy to support the student adjust to the new working environment, learn the basic responsibilities and achieve the goals that are set. These roles can also be appointed to only one person who will have to view the student's work, send him reminders for his tasks and approve his work. In the case of the weekly journals, the interviewee informed us that approval is optional.

After the reviewing process from the workplace, students' efforts are assessed by their advisors. The assessors will grade the artefacts that the students uploaded and they will grade them according to standard criteria. Our team suggested to the client a peer review system for the assessment of the students' performance and asked him if that would be an efficient assessment type. The interviewee was attracted by our proposal, however, he expressed his skepticism that this kind of technique would lead to problems concerning privacy issues and non-disclosure agreements among the businesses, the university, and the students.

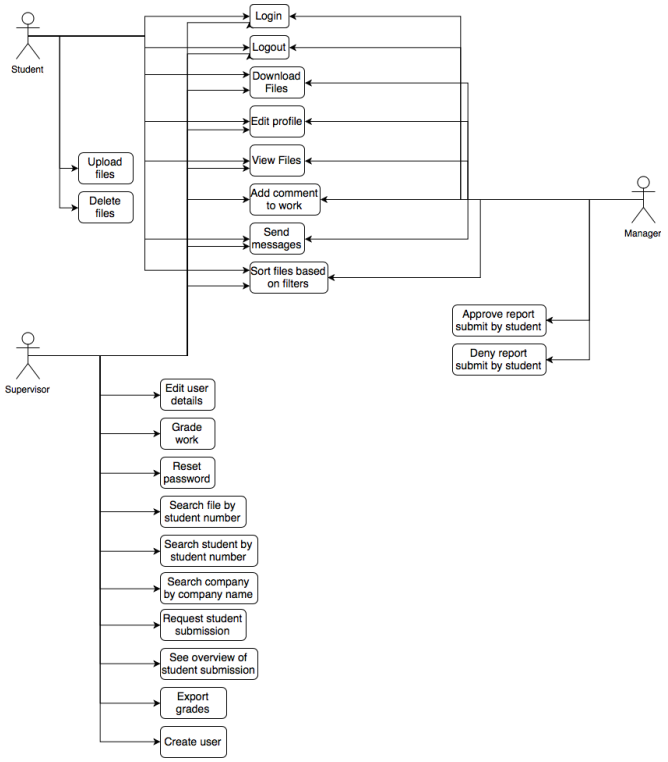
Overall, the interview was crucially important for our project and its future progress. The interviewee is a significant contributor to our application since he and his team are responsible for creating a Work Based Learning degree for the University of Glasgow and more specifically for the School of Computing Science. Interviewing him gave us a richer understanding of the program and the requirements needed to develop a WBL application that will work as a tool for all the stakeholders of this degree.

3.2 Software Methodology

Before setting our application's requirements, in order to improve the overall quality of the project, as a team, we have decided that it is essential that we select the correct Software Development Life-Cycle (SDLC) methodology. Choosing an appropriate model will ensure that there is a structure to follow while working on the project and that there are clear achievable objectives which can be met as time goes on. There is a range of different methodologies to choose from, however, due to the fact that this is the first major development task that the current software development team has undertaken together, and due to the limited available resources, the Waterfall Methodology has been chosen. Its linear-sequential model, along with its prevention of overlapping sequences will ensure that every stage of the life cycle will be completed in detail. Additionally, the process is extremely well documented and has proven to be successful in the past with detailed instructions describing the deliverables of each stage. While working on a software project, one must take into consideration the Triple Constraints, as outlined by Margaret Rouse: "The triple constraint is the combination of the three most significant restrictions on any project: scope, schedule, and cost." (Rouse, 2018). Using the Waterfall Methodology will greatly assist the Software team in tackling the Triple Constraints, due to the step-like approach within the Waterfall model allows the project to be split into intervals allowing the entire development team can focus on each section of the project together ensuring that it is given the attention that it deserves.

3.3 Use Case Diagram

In the first stage, we need to create three use cases, namely the student, the supervisor, and the manager. These three users have their own unique functions and also shared functions.
For example, all three users can log in and log out of the system, modify passwords, upload, edit, browse and delete files, send messages and sort the uploaded files.
Supervisor's unique functions are grading students' reports, querying students' files according to their names or school numbers, requesting file submission, viewing student's grade overview, exporting grades and sending a notification when a user is created.
The common functions of the Academic Supervisor and the Work Manager are to add comments and download the files students uploaded. Finally, the unique functions of the work manager are both approving and denying the report that the student has submitted. These functions are drawn as a use case diagram, as shown below.



3.4 Requirements Prioritization

Once all of the potential requirements of the system were confirmed, the development team decided to consider the Triple Constraints. Due to the fact that there are only 4 developers, a small budget and only weeks to complete the project, it is essential that the requirements were filtered in order to ensure that the overall scope of the project was possible to achieve. The team decided to use the MoSCoW approach, as outlined by ToolsHero.com. In order to assist development teams in the development process, requirements should be prioritised. "There are several tools available to make prioritisation easier. The

MoSCoW method is one them" (ToolsHero.com, 2018). Below, the requirements are prioritised based on four main categories:

Must Have

- The application should have a login system ensuring that only authorised users have access to.
- Once logged in, users should be able to log out.
- Users should be presented with a different screen according to their user type.
- Users should be able to send messages to each other.
- Students should be able to upload weekly journals, files, and reports.
- Students should be able to see the grades of the work they have submitted.
- Students should be able to filter through the files that they have uploaded.
- Students should be able to message the Academic Supervisor or the Work Manager via the application.
- The Work Manager should be able to review the files which the student has uploaded before they are sent to the Academic Supervisor.
- The Academic Supervisor should be able to view files uploaded by the student and that have been approved by the Work Manager. Files that are awaiting approval should appear in a list, once approved they should be moved to a different list.
- The Academic Supervisor should be able to add grades and feedback to the files which have been approved.

Should Have

- Users should be able to sort data based on filters.
- Students should be able to view past journals.
- Students should be able to view the status of the files which they upload:
    - Awaiting Approval- The journal has been submitted and is up to the Work Manager to either approve or disapprove the file.
    - Approved- The Work Manager has approved the file, which is sent to the academic Supervisor to grade the file.
    - Denied- The Work Manager has denied the file.
    - Reviewed- The Academic Supervisor has graded the file.
- Students should be able to view the feedback of both the Work Manager and Academic Supervisor, based on the work that they have submitted.
- The Work Manager should be able to approve or deny files which have been uploaded by the student. Files that are awaiting approval should appear in a list, once approved they should be moved to a different list.
- The Academic Supervisor should be able to search through data based on several properties.
- The Academic Supervisor should be able to send a request to the students reminding them about their file submission.
- The Academic Supervisor should be able to view an overview of the student's submissions.
- The Academic Supervisor should be able to edit student details.

Could Have

- Students should be able to remove a file if the file is still in the Awaiting Approval status.
- The Work Manager should be able to add comments/ feedback to files which have been uploaded by the student.
- The Work Manager should be able to download all files which are awaiting Approval.
- The Academic Supervisor should have access to all files which have been graded. This list can be searched using the Student's Name or Student's ID Number.
- The Academic Supervisor should be able to manage a GUI for Group management for the Students.
- The Academic Supervisor should be able to export student's grades.
- The Academic Supervisor should be able to create a user and send a notification email when a user is created.

Would Like to Have

- The system should be accessed through mobile devices.
- Students should be able to receive reminders if they are required to upload a weekly journal.
- Students should be able to receive notifications when their submission has been modified.
- The Work Manager should be able to receive notifications when a new file is awaiting approval.
- The Work Manager should be able to mark attendance of the students.
- The Academic Supervisor should be able to upload lecture slide material for the student's academic studies.

3.5 Non-Functional Requirements

As the team has decided to follow the waterfall methodology it is essential that we correctly define the requirements since the requirements capture is the foundation of our model. In this section, the requirements of the system will be laid out in detail. These were split will be split into 2 categories, functional and non-functional requirements. The difference between functional and non-functional requirements are highlighted by reqtest.com which states:

"Simply put, the difference is that non-functional requirements describe how the system works, while functional requirements describe what the system should do." (reqtest.com, 2017).

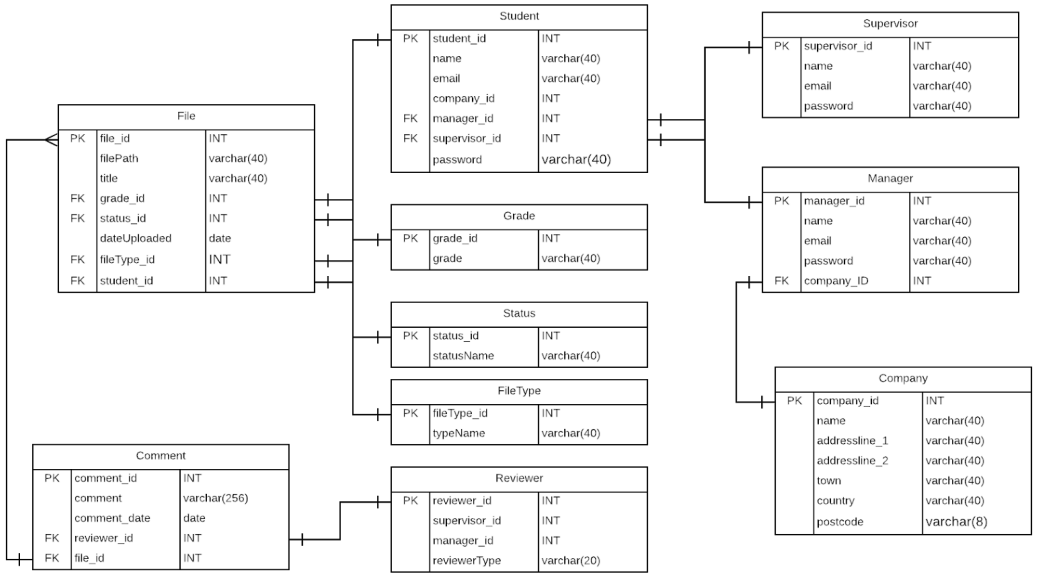
In order to gain an understanding of what the non-functional requirements, note the definition provided by reqtest.com:

"non-functional requirement is that it essentially specifies how the system should behave" (reqtest.com, 2017). More specifically, Bridge should satisfy the following non-functional requirements:

Requirement	Description
Availability	Bridge should be available to the users at all times, with at least an uptime of 99%
Reliability	Users should be able to rely on the application. In order to do this, the application should function without any serious errors which would result in a system failure.
Usability	Learning to use the system should not have a steep learning curve. There will be documentation at the request of the user, however, the design of the front end should indicate to the user how to access certain features of the site.
Confidentiality	The information that the system stores should be kept securely, ensuring that an unauthorized user does not have access to it.

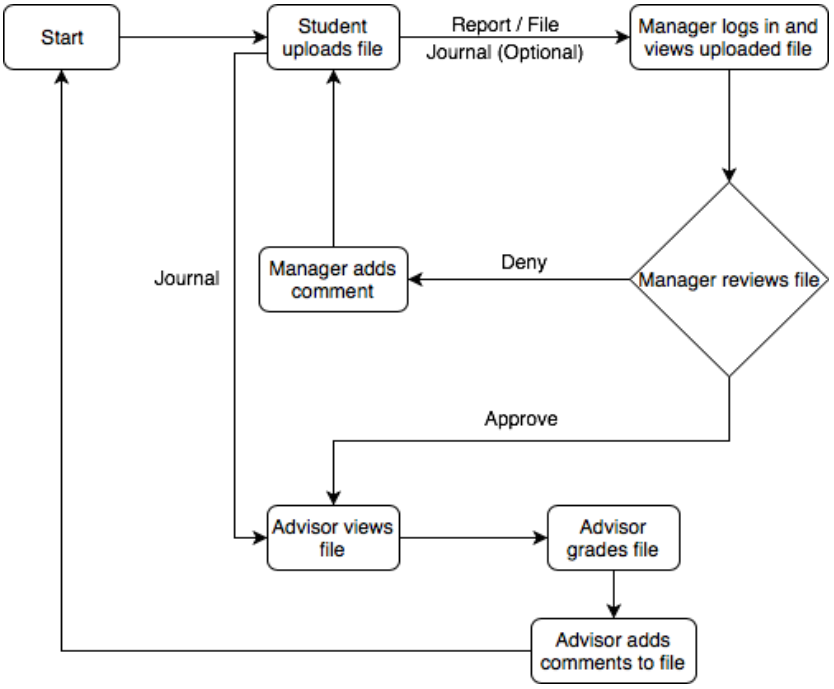
3.6 Entity Relationship Diagram

The overall structure of the database used by the project is presented in the diagram above. Every table has a primary key (PK) and it may also have foreign keys (FK) which reference fields in other tables. These relationships are represented on the diagram by the lines between the tables. For example, in the Student table the manager_id and supervisor_id reference primary keys in the Manager and Supervisor tables respectively, and each student may only have one manager and one supervisor, therefore the relationship between these tables is 1-to-1.



3.7 File lifecycle

The diagram below illustrates the lifecycle of a file within the system. The first stage in the lifecycle of a file within the system is the upload performed by the student. The uploaded file shows up on the manager's dashboard who has to either approve or reject the file. This step is optional for journals but it is mandatory for every other type of file. In case the manager denies the file, he would add some comments in order to help the student understand why the file was not approved. Then, the student would have to re-upload the file. If the manager approves the file, then it would be passed on to the academic advisor, who would have to grade it. Optionally, the advisor might add comments to the file giving feedback to the student, explaining if the requirements were followed.



Chapter 4 Interface Design

Since the requirements of our system have been laid out in detail, the development team decided to create a wireframe of the system, using a tool called Moqups. This acts as a simple prototype creator, allowing the team to quickly visualize how the potential system would work. After creating several designs for our application, and asking several people for their opinion about their appearance, we ended up with our prototype for Bridge. Below, we present each screen of our Interface Design mockup prototype.

4.1 Mockup Screens

4.1.1 Login Screen

This is the first screen which will be displayed to all 3 users, each user will enter their login details in order to be granted access to their part of the application (See Appendix B).

4.1.2 Student - Upload Screen

On the Upload screen, the students can choose what type of file they want to upload, as well as decide whether or not they want to add any comments for their upload. The file may be uploaded either via drag and drop or by clicking the browse button (See Appendix B).

4.1.3 Student - View Work Screen

This screen allows the students to see all of the work that they have uploaded to the system. Here, the students can see the status of every file. If they click on a file that has been Approved, Denied or Reviewed they can view the comments which were left by the Academic Supervisor or the Work Manager. On this page, the students can see the grades of the files, which the supervisor has reviewed (See Appendix B).

4.1.4 Profile Screen

On the Profile page, the user can see various personal information such as Student ID, company name, manager, etc. However, the information presented on this screen varies depending on the user type that accesses it (See Appendix B).

4.1.5 Academic Supervisor - Review Screen

This is the main page for the Academic Supervisor. It presents all the files uploaded by the students and are approved by the work manager. These files need to be graded by the Academic Supervisor. For each file, the assessors can click on the Review button and that will allow them to add a grade and a comment to the file. Once the grade has been submitted, it will be removed from this screen (See Appendix B).

4.1.6 Academic Supervisor - View Work Screen

On this screen, the Academic Supervisor can see all the work which has already been graded. The supervisors can use the search bar at the top to search for files uploaded by a certain student.

4.1.7 Work Manager - Review Screen

On this screen, the Work Manager can see all the files which their assigned student has uploaded and need to be approved before being sent to the university's supervisor. The Work Manager can click the Review button in order to either approve or deny the file, as well as adding a comment to justify their decision.

4.1.8 Work Manager - View Work Screen

On this page, the Work Manager can view that past work of the students that work in his workplace. The files shown on this screen are already approved or denied by the Work Manager and if they are reviewed by the students' Academic Supervisor, the file status will be 'Reviewed'. Moreover, the Work Manager can download the uploaded files and review them again after the first evaluation.

Chapter 5 Implementation

5.1 Tools Used

5.1.1 Programming Languages

PHP

PHP is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML (Php.net, 2018). In our project PHP was used to implement the server-side logic as well as to interact with the MySQL database.

HTML

HTML is the most widely used language to write web pages. It is mainly used to define the structure of a webpage and is generally used together with CSS and JavaScript (www.tutorialspoint.com, 2018). In our project, it is the main programming language we used for building the web pages.

JavaScript

JavaScript is a scripting or programming language that is used to implement complex operations on web pages especially when it comes to the front-end (MDN Web Docs, 2018). On the Bridge website, it is used to hide or show menus and to dynamically manipulate classes and attributes.

MySQLi

MySQLi is a Relational SQL database management system. MySQLi is used inside the PHP programming language to give an interface with MySQL databases. It works by performing queries (which are stored as PHP Strings) on the database and then retrieving the results in PHP objects (arrays, dictionaries, etc.) (www.tutorialspoint.com, 2018).

CSS

CSS is a language that describes the style of an HTML document. It describes how HTML elements should be displayed (W3schools.com, 2018).

Bootstrap

Bootstrap is an open source toolkit for developing with HTML, CSS, and JS (Getbootstrap.com, 2018). The development team used this toolkit for building

the User Interface of Bridge.

5.1.2 Text Editors

Atom
Atom is a text editor that the majority of our team used to write the code for the website implementation.

Sublime Text
Sublime Text is a tool similar to Atom. It was used by only one team member for code writing purposes.

5.1.3 Web Hosting

1&1
1&1 is a Web Hosting service that our team selected for creating Bridge. Besides Web Hosting, 1&1 offered us a Domain, multiple email addresses and, a database.

5.1.4 FTP Clients

WinSCP
WinSCP is an open source free SFTP client, FTP client, WebDAV client, S3 client and SCP client for Windows. Its main function is file transfer between a local and a remote computer (Winscp.net, 2018). WinSCP was used so that the team could transfer files to our server.

FileZilla
FileZilla is another FTP solution similar to WinSCP that was used for the same reason.

5.1.5 Design Tools

Photoshop
Photoshop is a graphic design software that our team primarily used to create and edit images such as Bridge Logo or the background of the Login Page.

Lucidchart
Lucidchart is a diagramming solution software. Every diagram of this dissertation was created by using this tool.

Moqups
A streamlined web app that helps you create and collaborate in real-time on wireframes, mockups, diagrams, and prototypes (Moqups.com, 2018). We used the specific tool to create our website design prototype.

5.2 Database Development

One of the firstly completed aspects of the project was the database. The database was built using the 1&1's control panel. Essentially, once an account was set up with 1&1, the development team had the ability to request for a database using the 1&1 online tool. A screenshot displaying the database creation using phpMyAdmin is presented in Appendix C. Once the database has been connected, the team worked on creating the database tables. As an ER diagram of the tables was first created by using Lucidchart tool, this meant that the process was simplistic due to Lucidcharts' feature to convert the entire ER diagram into simple SQL queries. The generated SQL queries (see Appendix C) were pasted to an SQL session, which automatically created all the tables.

5.3 General Functionalities

5.3.1 Log In

When users try to access the system, the first screen which they will see is the login page which simply requests for a username and password. Once the user has entered the requested information and hits the submit button, the information is posted to the file called loginproccess.php. In this file the information entered via the user is saved as PHP variables, then a Select statement is performed where everything is selected from these tables. If Username equals the username entered by the user, then the script confirms if the password entered matches this user. If they both match then the user is given access to the system. However, if either the username and password do not match, then the user is displayed with an error message saying, "Invalid Credentials" and is not granted access to the system. See Appendix D for sample code.

5.3.2 Log Out

When the user clicks on the Log Out button a GET request is performed with an additional "logout = true" parameter. If this parameter is set, then the webpage redirects to the logoutProcess.php script which clears all the session variables and then destroys the current session. The user is then redirected to the login page.

5.3.3 Edit Profile

The container element of the profile image has an onclick method attached which displays the modal menu used to edit the profile for the current user. The overlay effect is generated through the CSS file. In the Edit Profile menu, the user can change his name, his email address as well as his password. When the user presses the submit button a PHP script is called which performs an UPDATE query on the database in order to change the user details.

5.3.4 Download Files

When the webpage is loaded an archive is created which contains all the files listed on that webpage. As the information for each file is read from the database and inserted into the table, the file path is also extracted which is then used to add the file into the archive. The Download All button links to the path of this archive which is downloaded when the user clicks the button.

5.3.5 Filter Files

All the users of the application are able to filter the displayed files based on the file type. Above the Files List, there are four different buttons. Each one of them displays a different file type title: All, Journal, Report, File. By clicking one of these buttons a GET request is sent and the Files List is modified based on the fileType_id. That way the Files List can show only the Journals, the Reports or the various Files respectively.

5.3.6 Send Messages

Another functionality, all the users are able to use through Bridge, is the Message Sending feature. In detail, by clicking on the Send Message option in the sidebar, an HTML modal appears. This modal contains a drop-down list with the available receivers of the message and a Text Area. In the case a student wants to send a message, they can select either the academic supervisor, the work manager or both of them to receive the message. Next, he writes the message inside the Text Area and clicks on the Send Message Button. The message is then sent via email from our system's email address to the email address of the receiver(s).

5.4 Student Functionalities

5.4.1 Upload Files

When the student presses the upload button, a modal appears containing a form which is prompting the user to enter information about the file they wish to upload. They can select an option from the radio buttons to represent the file type, the user must also enter a title and select the file which they wish to upload. This form posts the information to the upload.php script which performs the upload to the server to the user's personal directory and also writes the file into the database along with information such as the user who uploaded the file as well as the date when the file was uploaded.

5.4.2 Delete Files

The Student User is also allowed to delete a file he uploaded. The user is able to delete a file by pressing the delete button. However, a file can only be deleted by the student user if the file has not been reviewed by the Work Manager or the Supervisor. Meaning only files which are in the 'Awaiting Approval' status may be deleted.

5.5 Academic Supervisor Functionalities

5.5.1 Grade & Comment Submissions

The major functionality the Academic Supervisor has is grading and (optionally) commenting on the students' uploads. Being in the Review section, the supervisor can click on the Comment Icon of a file that he wants to grade. By clicking this icon, the showComment Javascript function is called. This function sends a POST request that passes the Id of the file to the supervisorReview.php. Then, through this php. file, the file, its grade (if set) and the Reviewer Id are being fetched using SQL queries. Also, an HTML modal shows up. This modal contains a Drop Down List with all the possible grades stored in our database and a Text Area for writing comments. After the supervisor selects a grade for the reviewed file and writes a comment, he can save these changes by clicking the Submit Button. Additionally, the supervisor can do the same functionality from the View Work section, where he is given the chance to edit the Grade and the Comment of the file, but this time through the supervisorPastComments.php which also fetches the comment of the reviewed file.

5.5.2 Search Files

The supervisor has the possibility to search for files, companies or students using the search bar provided at the top of each table. The text input has the tableSearch() function attached to it which is called every time the user presses a button. The JavaScript function gets the text from the text input, converts it to uppercase. It then retrieves the rows from the table and iterates through all of them comparing the input from the search box to the first item on each row. The rows that match are displayed while the ones that don't have their "display" attribute set to "none".

5.5.4 Manage Students

The supervisor via the Manage Students section of the website has the power to see all of their advisees as well as reviewing averages for each file submissions. This is done via a select statement from the Student table, which collects all of the students that are being advised by the current Advisor. This select statement also collects the Student_ID attribute which can be used to obtain an average from the file table which contains all of the files and grades of each of the files. This information is outputted to the table giving the supervisor the ability to review the progress of each of their students.

5.5.5 View Student Card

From the Manage Students section, the supervisor also has the power to request files to be submitted by the student. He does this by selecting to view details about that student which makes a POST request with the student ID to the studentCard.php file. From there, he can navigate to the grades tab which will show the average grade for each file type. The information is queried from the Files table in the database using the student ID as well as the file type. This is only done for files with a status of 4 which means that they have been graded.

5.5.6 Request Submission

In order to request a submission, the first steps are similar to the ones for the grade overview. When the user gets to the Grades tab, they can click on the request icon from the corresponding file type. This action passes on the student ID to the requestFile.php file through another POST request. This is done through an AJAX function. Once this has done that they can press the Send Request button which submits the form with the message and the ID to the requeste-mail.php file. This sends an email to the student with the message specified earlier. The student ID is used here in order to retrieve the student name and the student ID from the database.

5.5.7 Export Grades

When the administrator selects the Manage Students tab he has the option to export the information presented in the table in either PDF or CSV format. This is done through the use of an external JavaScript library called JSPDF. The PDF button has an onclick function attached to it that calls the HTMLtoPDF function defined in the JSPDF library.

The administrator can also choose to export the data as CSV. This is achieved through the use of 2 JavaScript functions: exportTableToCSV and download CSV. The first one takes the data from the HTML table and puts it into a CSV file while the second one generates a download link to download the HTML table into a CSV file.

5.5.8 Create New Student User

When the supervisor presses the New Student button a modal menu appears, which contains a form prompting the supervisor to enter the details of the new user. These details are: student name, student ID, company, e-mail address. When the supervisor presses the Submit button, the newStudent PHP script is called which inserts the information into the database. The script does a series of checks such as if the user does not already exist in the database and if the company is valid. After that, an email is sent to the user to confirm the registration.

5.5.9 Create New Manager User

In addition, to create new Students, the supervisor can also create a new Company/ New Manager. To do this the supervisor should select the New Company button from the Manager Companies section of the site. This will make a modal appear which is prompting the user to enter details in relation to the company, however, they must also include information in relation to the Manager who is working at the company. When the form is complete the data is inserted into the database.

5.5.10 Edit User Details

The supervisor is also able to change details for a certain student. He can do that from the Manage Students panel by clicking on the icon on the right-hand side of the table. This brings up a modal menu which contains 4 text fields where the

supervisor can change the current details for the student. Once the user selects the confirm button, this data is updated in the database.

5.6 Work Manager Functionalities

5.6.1 Approve / Deny Uploads & Comment

The main functionality of the Work Manager is Approving or Denying the uploads of the students. In the Review section, the manager can see all the files with status 'Awaiting Approval'. Clicking on the Comment Icon button, the showComment JavaScript function is called. Through this function, the Id of the file to be approved/denied is passed to the managerApproval.php. This file is responsible for finding the file based on its Id and fetching any existing comments it has via SQL queries. Then, it displays an HTML modal with two Radio Buttons (Approve & Deny) and a Text Area. The Work Manager can click one of the Radio Buttons and write a comment in the Text Area, and by clicking submit the Status and the Comment properties of the file will be saved. The same functionality can be operated in the Work View section where the Manager can edit the comment he already made.

Chapter 6 Evaluation

6.1 Testing Strategy

Within any application, testing is a crucial stage as it helps ensure that the finalised project is free of errors. Any bugs or problems found by the user decreases the software's credibility and usability resulting in an application which is never used.

"Functionality testing is performed to verify that a software application performs and functions correctly according to design specifications" (istqbexamcertification.com, 2018).

There are many different types of testing, however, the following tests were performed to the Bridge Application:

- Browser Compatibility Testing
- Application Testing

6.1.1 Browser Compatibility Testing

In order to complete the testing phase of the project an online tool called Cross Browsing Testing was used, this tool allows the development team to test the web system through a range of different browsers and devices allowing a quick assessment to be made in relation to its compatibility with any other devices or browsers in addition to Chrome. (Chrome was the primary browser which the web system was developed on). All of the application tests mentioned in the section above were tested within the Cross Browsing Testing tool, allowing for

the system to be tested in a variety of platforms in order to review what platforms are the finished web system supported by.

6.1.2 Application Testing

Within this section various parts of the system will be tested; each set of tests have been grouped via the part of the application in which they relate to. The test results of each section are stored in a table which has the Test Description, this is what the test actually was, the Pass Criteria, which represents the parameters which must be met in order for the system to pass the test, and finally the browsers in which the test was performed on, Chrome, Firefox, Safari, and Opera. In Appendix E, most of the test cases are shown.

6.2 User Evaluation

6.2.1 Evaluation Methods

In order to allow users to evaluate Bridge, we decided that interviewing people with previous Work Based Learning experience would be the optimal solution. As we stated in the first Chapter of this paper, we aim to solve the problems that currently constrain Work Based Learning. Finding out if we managed to tackle these problems, would require the opinion of users who already had Work Based Learning experience and possibly used similar platforms to Bridge. Our team also considered using various User Evaluation methods, such as Questionnaires, Think Alouds and Talking Points because that way we would gather more results since these tests are easily shared to more participants who can answer them more easily compared to an Interview. However, we came to an agreement, that these answers would not be informative enough and that they would not help us draw any valuable conclusions.

6.2.2 Participants

As we mentioned above, the participants of our evaluating interviews were people who had completed a Work Based Learning internship in the past. Hence, we interviewed three different students that satisfied this requirement. Ideally, we would also like to interview professors and work managers who participated or participate in the WBL scheme since they are equally important users of Bridge. However, the limited available time we had, did not allow us to get in contact with these types of users.

6.2.3 Procedure

Having already conducted several interviews, our team was able to carry out the same procedure with ease. Firstly, our team prepared the interview questions. The first part of the interview would contain questions that would extract information about our participants and about their previous experience with Work Based Learning. The objective of the first part of the interview is to obtain precious details that we could compare with our solution. The second part of the interview presupposes that our interviewees have already tested Bridge and they are able to answer questions about its usability and the solutions it offers. This is the most crucial part of the interview since it can grant us extremely valuable feedback and it can let us know if we succeeded in our goals. The third and final

part of the interview gives the participants the chance to express their overall opinion about Bridge and suggest improvements or additions that could be implemented in the future.

6.3 Ethics

Since our system's evaluation required the participation of other people, we had to make sure that our evaluation method complied with the Ethics Checklist (see Appendix E) that it was provided to us with the assignment of our project. Additionally, the User Evaluation Interview we used to obtain our results, contained an introduction and a debriefing script (see Appendix D), underlining the aim of this interview and reassuring the participants about any concerns they could have during the interview procedure.

6.4 Results

Our team interviewed three different students (two undergraduate students and one postgraduate student), who have completed a placement year (internship) during their studies. The two undergraduate students are studying Computer Science and they just completed their one-year internship last year, while the postgraduate student had his placement year two years ago during his Civil Engineering undergraduate studies. Although these three interviewees had different Work Based Learning experience, the answers we received from them were similar.

More specifically, all of the interviewees were satisfied by their internship since they all felt that they could efficiently communicate with both their universities and their workplace, they had a clear understanding of their expected tasks, and they were assessed fairly and correctly by the university.

Moreover, after testing Bridge and its functionalities they gave their opinion regarding the usability of the platform and the efficiency of its features. In detail, all the students gave a positive response when they were asked if they would use Bridge as a tool for their internship. In addition, they believe that the system was significantly intuitive and easy to use. Being aware of the website's functionalities, the interviewees informed us that would effectively support the communication among the students, the university and their workplaces, pointing out that this three-way communication was difficult in several cases throughout the placement year. Answering the question about whether Bridge would boost the quality of the academic supervisor's assessment, the students agreed since they think that the inclusion of the Work Manager approval and the fact that all the students would upload the same type of files on Bridge would aid and improve the assessment of the supervisors. Lastly, the interviewees believe that Bridge would prevent cases of private information leaks since the Work Manager approval process ensures that the students do not send any sensitive files to third parties such as the universities.

In the last part of the interview, the students offered us their overall opinion about Bridge and how it can be improved. The participants gave us extremely positive feedback about our platform and its usability. Additionally, they specifically underlined the fact the Message functionality was extremely useful and significantly fast. On the other hand, they identified that the application

should be more mobile-friendly since the design interface does not adapt well to smaller screens and they indicated some minor design changes they would like to see (buttons, colors, interaction).

Chapter 7 Conclusion

7.1 Conclusions

Work Based Learning is an extremely useful concept that allows students to combine academic and technical skills and knowledge during their studies. Our team identified three major challenges during a Work Based Learning scheme. These problems lie in the communication among the associated parties of WBL, the assessment strategy followed and the privacy risks involved. Our team took up this project in order to tackle these obstacles and, for this reason, we implemented Bridge. Bridge is a website specifically designed to support Work Based Learning cases universities can provide. Our team created this platform based on the requirements we set and developed these functionalities that we believed they would solve the addressed problems. After testing the application and evaluating it based on the interviews we conducted, with some experienced WBL students, we arrived at some valuable conclusions.

Overall, Bridge is an intuitive and easily used application that serves effectively the purposes of Work Based Learning. Although we noticed that the way Work Based Learning is planned nowadays offers satisfying results to the students, it was made clear to us that the lack of a communication link, a unified assessment strategy and, privacy protection is the main concern in this type of scheme. Based on our feedback, we were suggested that Bridge was developed towards the right direction and that it is a system that could be used by students, universities and private businesses as their main WBL tool since it confronts these problems effectively.

7.2 Future Work

Bridge is a fully implemented system that can serve the purposes of Work Based Learning degrees. However, our platform has space for future improvements or additions.

7.2.1 Future Implementation Stages

The fact that the time our team had for implementing this project was limited, means that there are many features that can be enhanced or developed so that our application reaches its full potential. As a first next step, our team would create a version of Bridge for mobile phones. This would make the application constantly available and more easily accessible to all its users, providing even better communication among the interested parties. This three-way communication can also be promoted with a more effective message team. Currently, the users can interact with each other via comments or e-mail messages. An in-app message system would be a significant improvement for Bridge. The users could communicate through a group chat including a student and the assigned supervisors. This message system would make the

communication faster, more practical and more personal. This means that we would achieve more effective communication among the users, which is one of the system's objectives. Last but not least, we could upgrade some of the already existing Bridge's functionalities. More specifically, currently, in the case a Work Manager denies a student's upload, the student has to re-upload a new artefact. A modification our team could make would be to allow the student to edit the denied file by using the application. That would save time for the users and improve the User Experience in general.

7.2.2 Future Evaluation Stages

For a further and more accurate evaluation of our application, it would be extremely useful, if our team arranged interviews with Academic Supervisors or Work Managers who have experience with Work Based Learning. Since these two types of users are equally important as a student, interviewing both parties would give us extremely valuable feedback. Based on this feedback we would be able to understand if our application accomplishes the set goals and whether there is a need for changes.

Chapter 8 Contributions

Our team consisted of four members: Alexandru Sever Craciun, Charalampos Konstantinidis, Enda McVey and Han Chen. Each one of us put a great effort so that this project will come into completion. More specifically, Enda McVey was responsible for implementing the largest part of our website since he was the most familiar with the selected programming language (PHP), Charalampos Konstantinidis was the one who brought together the dissertation and Alex Craciun was the linking piece who played an important role in completing the product and the dissertation respectively. Despite, their roles all the team members contributed significantly in all the aspects of this project such as the interface design, the documentation and the evaluation of the application.

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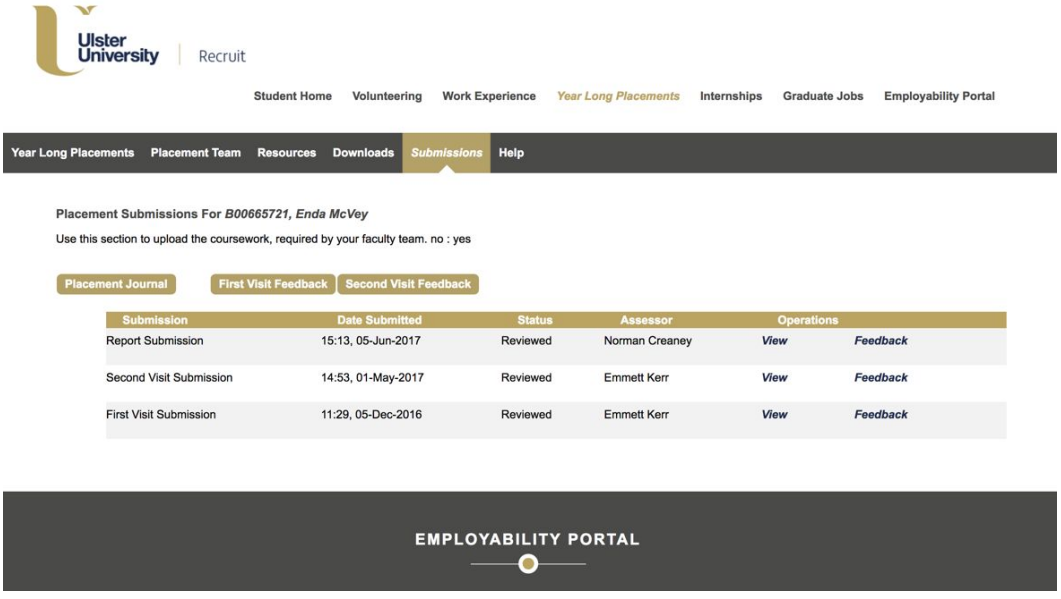
Appendix A Ulster University Recruit

Placement Competencies:

Below is a list of attributes which students at Ulster University are expected to show during their placement year.

	Competency	
1	**Independence**	Student demonstrates appropriate independence and self-reliance in carrying out their duties. This might include making appropriate use of sources help and support.
2	**Flexibility**	Student demonstrates appropriate flexibility in carrying out their duties. This might include transitioning from student life; responding appropriately to changing needs, work patterns, deadlines, etc.
3	**Timekeeping**	Student has an appropriate and satisfactory record of attendance and timekeeping.
4	**Teamwork**	Student is an effective team member and has good working relationships with colleagues/clients/customers.
5	**Interpersonal Skills**	Student demonstrates effective communication & interpersonal skills. This might include: speaking, listening, presenting, writing, use of telephone & email, informing, instructing, training, persuading, demonstrating, etc.
6	**Self-awareness**	Student has appropriate awareness of the extent and limits of their own professional competence. This might include: taking appropriate initiative, asking for help, identifying training needs, responding appropriately to performance feedback, etc.
7	**Organisation & planning**	Student demonstrates effective planning in managing tasks This might include seeing tasks through to their conclusion, making effective use of own time, avoiding unnecessary work, etc.
8	**Health & Safety Awareness**	Student is aware of relevant health & safety issues and, where necessary, adopts appropriate work practices. Must complete H&S checklist to achieve this.
9	**Social & Professional Awareness**	Student is aware of relevant professional social, legal & ethical issues and responsibilities. This might include awareness of: relevant legislation, impact of organisation's actions on people and the environment, organisation's policy on social responsibility, professional body codes, etc.
10	**Technical Expertise**	Student demonstrates appropriate expertise appropriate to the job and their course of study.

Ulster University Recruit System:

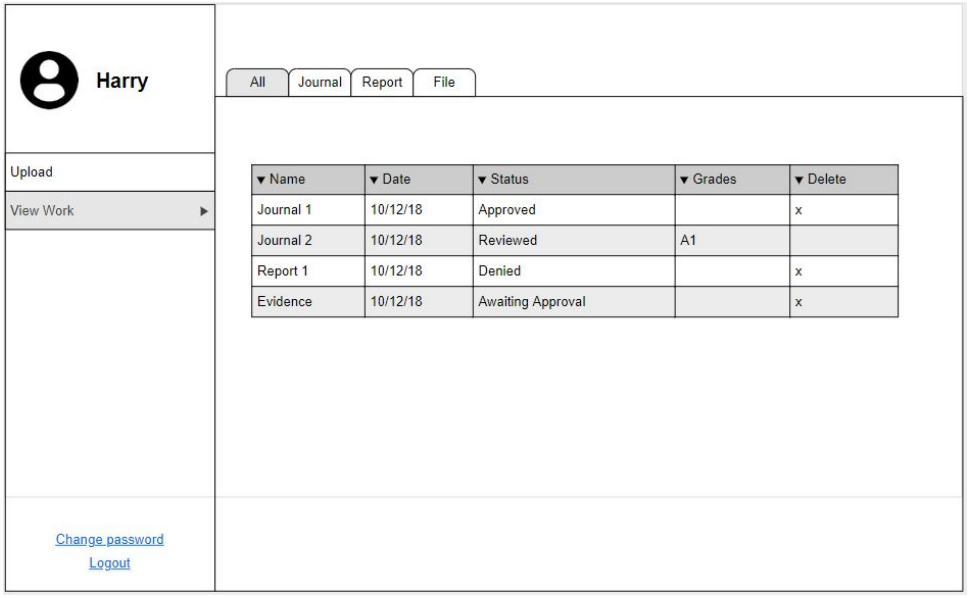


Appendix B Wireframe

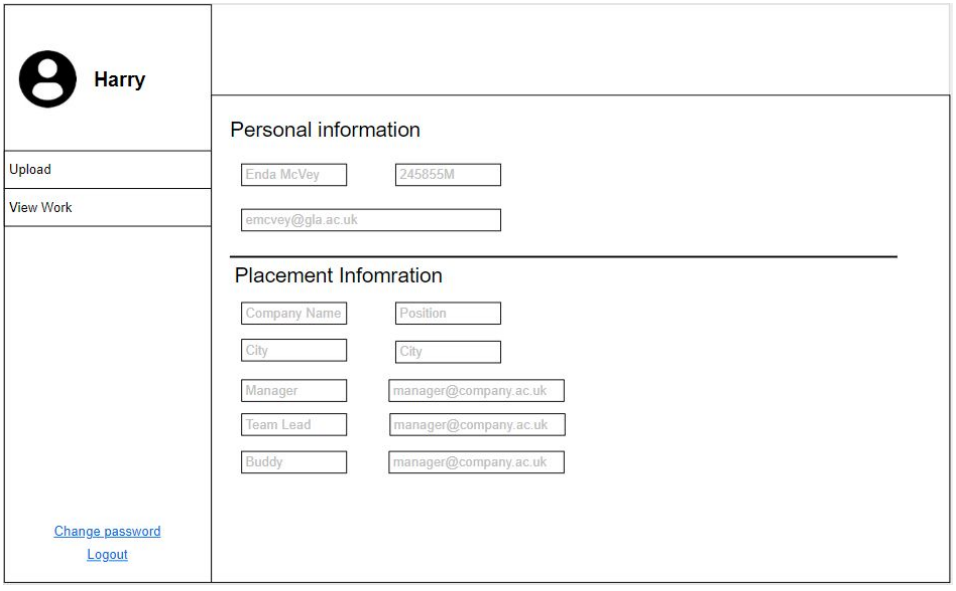
Login Screen:

Student - Upload Screen:

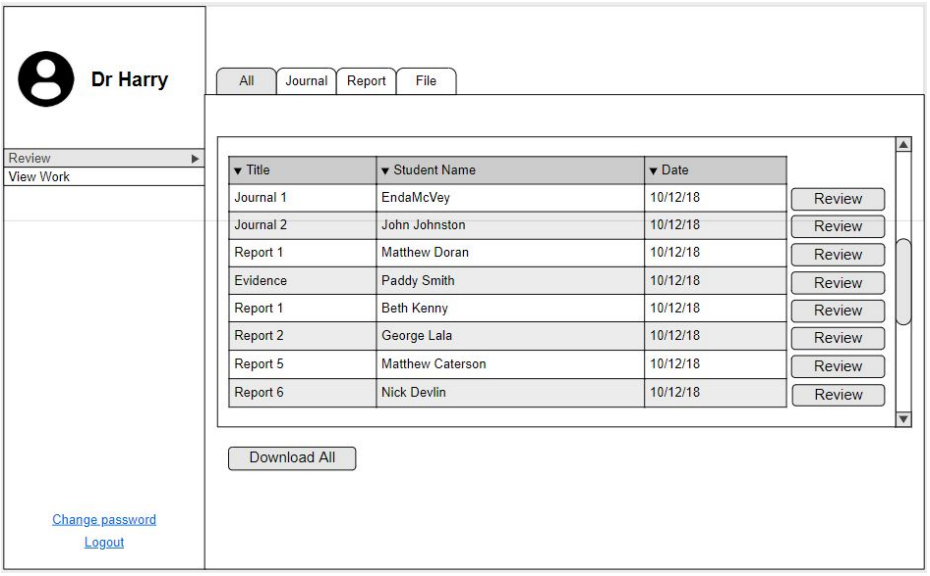
Student - View Work Screen:



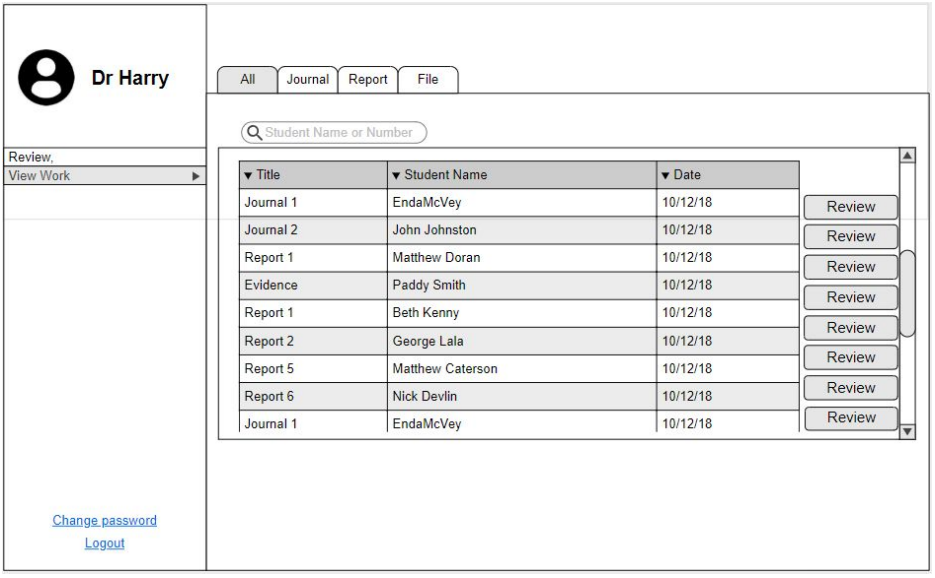
Profile Screen:



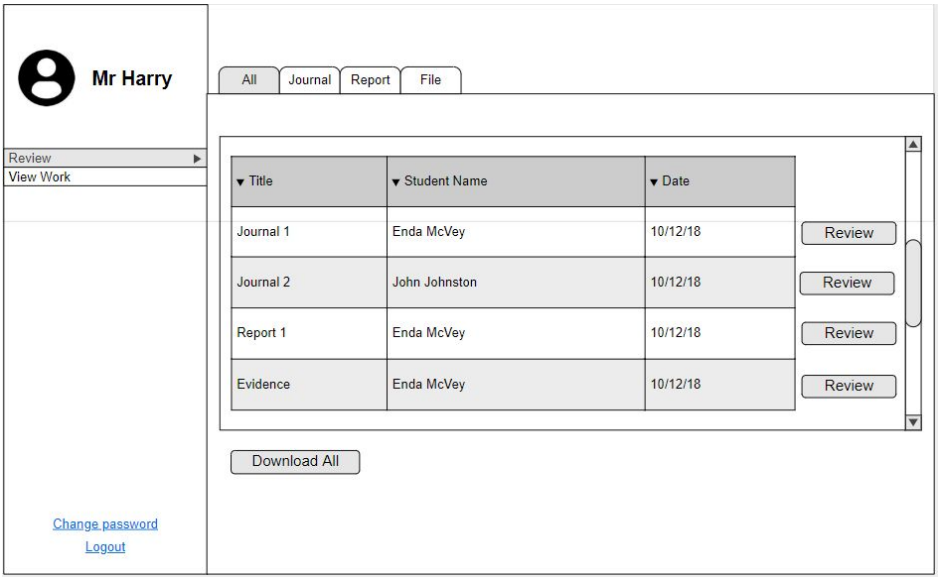
Academic Supervisor - Review Screen:



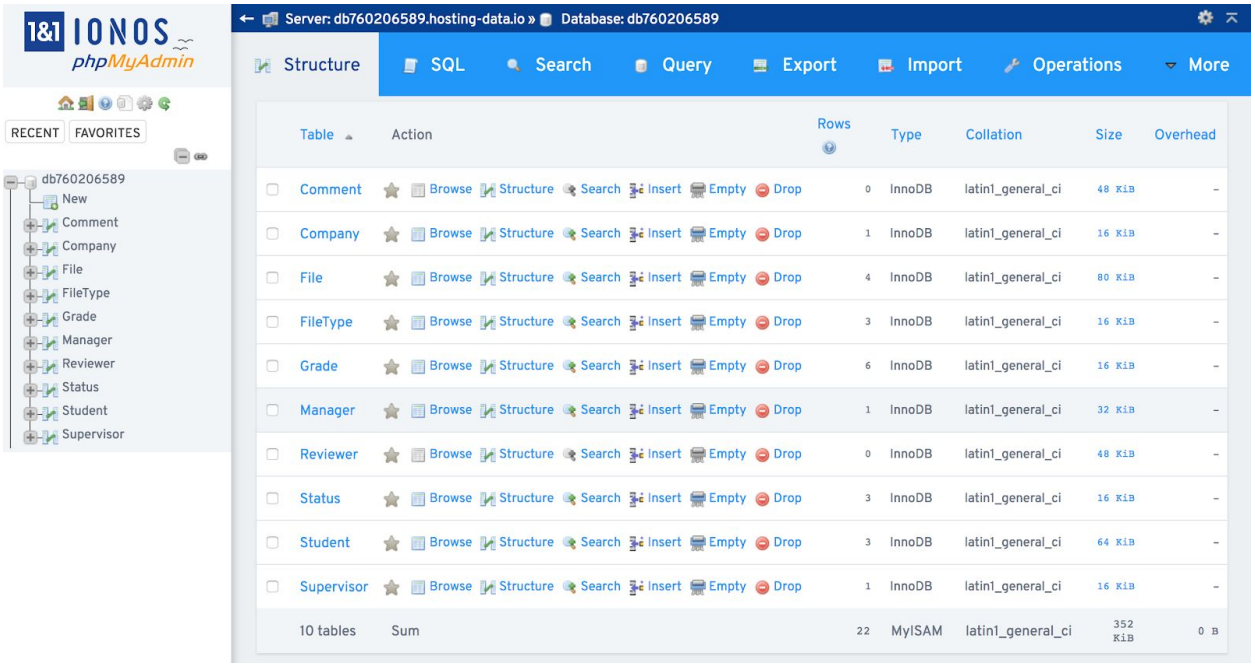
Academic Supervisor - View Work Screen:



Work Manager - Review Screen:



Appendix C Database Development




```
CREATE TABLE `Comment` (
  `comment_id` INT,
  `comment` varchar(256),
  `comment_date` date,
  `reviewer_id` INT,
  `file_id` INT,
  PRIMARY KEY (`comment_id`),
  KEY `FK` (`reviewer_id`, `file_id`)
);

CREATE TABLE `Company` (
  `company_id` INT,
  `name` varchar(40),
  `addressline_1` varchar(40),
  `addressline_2` varchar(40),
  `town` varchar(40),
  `country` varchar(40),
  `postcode` varchar(8),
  PRIMARY KEY (`company_id`)
);
```

```php
<?php
$host_name = 'db760206589.hosting-data.io';
$database = 'db760206589';
$user_name = 'dbo760206589';
$password = 'Project08!';

// Create connection
$conn = new mysqli($host_name, $user_name, $password, $database);


// Check connection
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}else {

}

?>
```

Appendix D Implementation Screenshots

Log In:

```
if($Username==$formUser){
  if($Password==$formPass){
    $userType = "student";
    //Need to declare session informations
    $_SESSION['Username']=$Username;
    $_SESSION['Password']=$Password;
    $_SESSION['UserID']=$UserID;
    $_SESSION['UserType']=$userType;
    $_SESSION['Fullname']=$FullName;
   $fail= "NOFail";
```

Log Out:

```
session_start();

session_unset();
session_destroy();
```

```
<label>Name<input type='text' id='name' name='name' class='form-control' size='20' value='<?php echo $studentName ; ?>' ></label><br>
<label>Password<input type='password' id='password' name='password' class='form-control' size='20' value=<?php echo $studentPassword;?> ></label>

<label>e-mail<input type='text' id='email' name='email' class='form-control' size='30' value=<?php echo $studentemail;?> ></label><br><br>
label><input type='submit' id='submit' name='submit' class='form-control' size='20'><br></label><br></center>
```

Edit Profile:

```
$name = $_POST['name'];
$password = $_POST['password'];
$email = $_POST['email'];

$sql= "UPDATE Student set name = '$name', password='$password', email='$email'  where student_id= '$UserID'";
$result = $conn->query($sql);
```

Filter Files:

```
<div class="w3-section w3-bottombar w3-padding-16">
  <span class="w3-margin-right">Filter:</span>
  <a href="student.php?" class="w3-button w3-white" id="all"> <i class="far fa-folder-open w3-margin-right"></i>All</a>
  <a href="student.php?filetype=2" class="w3-button w3-white" id="Report"><i class="fas fa-envelope-open-text w3-margin-right"></i>Report</a>
  <a href="student.php?filetype=1" class="w3-button w3-white w3-hide-small" id="Journal"><i class="fas fa-book w3-margin-right"></i>Journal</a
  <a href="student.php?filetype=3" class="w3-button w3-white w3-hide-small" id="File"><i class="far fa-file w3-margin-right"></i>File</a>
</div>
```

```php
if (isset($_GET["filetype"]))
{
  $filetype= $_GET["filetype"];
  $sql1 = "select * from File where student_id =$UserID and fileType_id = '$filetype'";
  $result = $conn->query($sql1);
}else{
  $sql1 = "select * from File where student_id =$UserID";
  $result = $conn->query($sql1);
}//else

if (isset($_GET["success"]))
{
  if($_GET["success"]== 10)
  {
      echo "<script>document.getElementById('editProfile').style.display='block';</script>";
  }elseif($_GET["success"]== 20)
  {

    echo "<script>document.getElementById('id01').style.display='block';</script>";
  }
}//isSet
```

Send Messages:

```php
<div id='SendMessage' class='modal'>
<form class='modal-content animate' action='../Process/StudentSendMessage.php' method='post' enctype="multipart/form-data">
  <span onclick='document.getElementById("SendMessage").style.display="none"' class='close' title='Close Modal'>x</span>

  <center>  <h2>Send Message</h2></center>
    <br>
    <center>
      <label><select name= 'Reciever' id ='Reciever' class='form-control' required >
        <option><?php echo $manageremail?><option>
        <option><?php echo $Supervisoremail?><option>
          <option value= '<?php echo $manageremail?>,<?php echo $Supervisoremail?>'>All<option> </select></label><br><br>
  <label><textarea class='form-control' name='comments' id='comments' size='50' rows='10' cols='50' > </textarea>
  <br> </label>
<center>  <input type='submit' name='submit' id='submit' class = 'form-control' size ='20' value='Send Message' ></center>
<center>
```

```php
include '../db_connect.php';
session_start();
$UserID=$_SESSION["UserID"];
$Name=$_SESSION["Fullname"];

$Reciewer = $_POST['Reciever'];
$comments= $_POST['comments'];
//send e-mail to user
//Used a e-mail template from: https://support
$to = $Reciewer;
$subject = " Bridge Message Notification";
$from="bridgesystem@bridge.com";
$message =" <html>
```

```php
$headers = "MIME-Version: 1.0\r\n";
$headers .= "Content-type: text/html; charset=iso-8859-1\r\n";
$headers .= "From:" . $from;

if (mail($to, 'Bridge Message Notification', $message,  $headers))
{
```

Upload Files:

```
if ($uploadOk == 0) {
    header("Location: ../student_Upload.php?success=0");
// if everything is ok, try to upload file
} else {
    if (move_uploaded_file($_FILES["fileToUpload"]["tmp_name"], $target_file)) {
        header("Location: ../student.php?success=0");
    } else {
        header("Location: ../student.php?success=0");
    }//else
}//else
```

Delete Files:

```
$FilePath =substr($target_file, 30);
$query5 = "INSERT INTO File (filePath, title, status_id, dateUploaded, fileType_id, student_id)
VALUES ('$FilePath', '$FileTitle','3','$dateUploaded','$fileType_id','$UserID')";
$result = mysqli_query($conn, $query5);
```

Grade & Comment Submissions:

```
            //reviewer is not in Reviewer Table
            $query5 = "INSERT INTO Reviewer (supervisor_id, reviewer_type)
            VALUES ('$UserID' , 'Supervisor')";
            $result = mysqli_query($conn, $query5);
          }//else
        } while ($reviewer == "False");

        //add comment to Comment Table
        $query2 = "INSERT INTO Comment (comment, reviewer_id, file_id, comment_date)
        VALUES ('$comments', '$reviewer_id', '$id','$comment_date')";
        $result2 = mysqli_query($conn, $query2);

        //update file status

          $query3 = "UPDATE File  set status_id= 4, grade_id= $grade_id where file_id= $id";
          $result3 = mysqli_query($conn, $query3);

          header("Location: ../supervisor.php?Success=1");
```

Search Files:

```
//Used the following guide for the search feacture https:
function tableSearch() {
var input, filter, table, tr, td, i, txtValue;
input = document.getElementById("myInput");
filter = input.value.toUpperCase();
table = document.getElementById("table");
tr = table.getElementsByTagName("tr");
for (i = 0; i < tr.length; i++) {
  td = tr[i].getElementsByTagName("td")[0];
  if (td) {
    txtValue = td.textContent || td.innerText;
    if (txtValue.toUpperCase().indexOf(filter) > -1) {
      tr[i].style.display = "";
    } else {
      tr[i].style.display = "none";
```

Manage Students:

```
//Journal Average
$sql = "SELECT avg(grade_id) from File where fileType_id =1 and status_id=4 and student_id = $student_
$resultJournalAverage = $conn->query($sql);
while($row = mysqli_fetch_array($resultJournalAverage))
{
  $resultJournalAverage=$row["avg(grade_id)"];
  $resultJournalAverage= round($resultJournalAverage);
}//JournalAverage
```

Appendix E Test Cases

Login Page:

Test Description	Pass Criteria	Chrome	Firefox	Safari	Opera
Login using correct details	Should be given access	Pass	Pass	Pass	Pass
Login using wrong Username but correct password	Error Message presented on screen	Pass	Pass	Pass	Pass
Login using correct username but wrong password	Error Message presented on screen	Pass	Pass	Pass	Pass
Login with empty form	Error Message presented on screen	Pass	Pass	Pass	Pass

Student Page:

Test Description	Pass Criteria	Chrome	Firefox	Safari	Opera
Upload Journal	Upload Successful	Pass	Pass	Pass	Pass
Upload Report	Upload Successful	Pass	Pass	Pass	Pass
Upload File	Upload Successful	Pass	Pass	Pass	Pass
Delete File (without comment)	Delete Successful	Pass	Pass	Pass	Pass
Delete File (with comment)	Error Message presented on screen	Pass	Pass	Pass	Pass
Download All Files	Download zip. file containing all files	Pass	Pass	Pass	Pass

Send Message to one User	An e-mail containing a message is sent to the selected user	Pass	Pass	Pass	Pass
Send Message to All	An e-mail containing a message is sent to all the users	Pass	Pass	Pass	Pass
Logout	Redirect to Login Page	Pass	Pass	Pass	Pass

Work Manager Page:

Test Description	Pass Criteria	Chrome	Firefox	Safari	Opera
Approve File without leaving Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Deny File without leaving Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Approve File with Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Deny File with Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Download All Files while in View Work	Download zip. file containing all files in View Work section	Pass	Pass	Pass	Pass
Download All Files while in Review	Download zip. file containing all files in Review section	Pass	Pass	Pass	Pass
Send Message to one User	An e-mail containing a message is sent to the selected user	Pass	Pass	Pass	Pass

Send Message to All	An e-mail containing a message is sent to all the users	Pass	Pass	Pass	Pass
Logout	Redirect to Login Page	Pass	Pass	Pass	Pass

Academic Supervisor Page:

Test Description	Pass Criteria	Chrome	Firefox	Safari	Opera
Grade File without leaving Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Grade File with Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Edit File's Grade	Changes saved successfully	Pass	Pass	Pass	Pass
Edit File's Comment	Changes saved successfully	Pass	Pass	Pass	Pass
Download All Files while in View Work	Download zip. file containing all files in View Work section	Pass	Pass	Pass	Pass
Download All Files while in Review	Download zip. file containing all files in Review section	Pass	Pass	Pass	Pass
Create New Student User	New User is successfully created	Pass	Pass	Pass	Pass
Create New Student User without filling all the details	Error Message appears	Pass	Pass	Pass	Pass
Export Grades in PDF File	Grade Overview is downloaded as a pdf. file	Pass	Pass	Pass	Pass

Export Grades in CSV File	Grade Overview is downloaded as a csv. file	Pass	Pass	Pass	Pass
Edit Student's Details	Changes are successfully saved	Pass	Pass	Pass	Pass
Request Submission of Journal	An e-mail is sent to the student requesting the submission of a Journal	Pass	Pass	Pass	Pass
Request Submission of Report	An e-mail is sent to the student requesting the submission of a Report	Pass	Pass	Pass	Pass
Request Submission of File	An e-mail is sent to the student requesting the submission of a File	Pass	Pass	Pass	Pass
Reset Student's Password	An e-mail is sent to the student containing the reset password.	Pass	Pass	Pass	Pass
Create New Work Manager User	New User is successfully created	Pass	Pass	Pass	Pass
Create New Work Manager User without filling all the details	Error Message appears	Pass	Pass	Pass	Pass
Export Students in PDF File	Students Overview is downloaded as a pdf. file	Pass	Pass	Pass	Pass
Export Students in CSV File	Students Overview is downloaded as a csv. file	Pass	Pass	Pass	Pass
Edit Work Manager's Details	Changes are successfully saved	Pass	Pass	Pass	Pass

Reset Work Manager's Password	An e-mail is sent to the work manager containing the reset password.	Pass	Pass	Pass	Pass
Send Message to one User	An e-mail containing a message is sent to the selected user	Pass	Pass	Pass	Pass
Send Message to All	An e-mail containing a message is sent to all the users	Pass	Pass	Pass	Pass
Logout	Redirect to Login Page	Pass	Pass	Pass	Pass

Appendix F Ethics

Ethics Checklist:

School of Computing Science
University of Glasgow

Ethics checklist for 3rd year, 4th year, MSci, MRes, and taught MSc projects

This form is only applicable for projects that use other people ('participants') for the collection of information, typically in getting comments about a system or a system design, getting information about how a system could be used, or evaluating a working system.

If no other people have been involved in the collection of information, then you do not need to complete this form.

If your evaluation does not comply with any one or more of the points below, please submit an ethics approval form to the Department Ethics Committee.

If your evaluation does comply with all the points below, please sign this form and submit it with your project.

---

1. Participants were not exposed to any risks greater than those encountered in their normal working life.

   Investigators have a responsibility to protect participants from physical and mental harm during the investigation. The risk of harm must be no greater than in ordinary life. Areas of potential risk that require ethical approval include, but are not limited to, investigations that occur outside usual laboratory areas, or that require participant mobility (e.g. walking, running, use of public transport), unusual or repetitive activity or movement, that use sensory deprivation (e.g. ear plugs or blindfolds), bright or flashing lights, loud or disorienting noises, smell, taste, vibration, or force feedback

2. The experimental materials were paper-based, or comprised software running on standard hardware.

   Participants should not be exposed to any risks associated with the use of non-standard equipment: anything other than pen-and-paper, standard PCs, mobile phones, and PDAs is considered non-standard.

3. All participants explicitly stated that they agreed to take part, and that their data could be used in the project.

   If the results of the evaluation are likely to be used beyond the term of the project (for example, the software is to be deployed, or the data is to be published), then signed consent is necessary. A separate consent form should be signed by each participant.

   Otherwise, verbal consent is sufficient, and should be explicitly requested in the introductory script.

4. No incentives were offered to the participants.

   The payment of participants must not be used to induce them to risk harm beyond that which they risk without payment in their normal lifestyle.

5. No information about the evaluation or materials was intentionally withheld from the participants.
   Withholding information or misleading participants is unacceptable if participants are likely to object or show unease when debriefed.

6. No participant was under the age of 16.
   Parental consent is required for participants under the age of 16.

7. No participant has an impairment that may limit their understanding or communication.
   Additional consent is required for participants with impairments.

8. Neither I nor my supervisor is in a position of authority or influence over any of the participants.
   A position of authority or influence over any participant must not be allowed to pressurise participants to take part in, or remain in, any experiment.

9. All participants were informed that they could withdraw at any time.
   All participants have the right to withdraw at any time during the investigation. They should be told this in the introductory script.

10. All participants have been informed of my contact details.
    All participants must be able to contact the investigator after the investigation. They should be given the details of both student and module co-ordinator or supervisor as part of the debriefing.

11. The evaluation was discussed with all the participants at the end of the session, and all participants had the opportunity to ask questions.
    The student must provide the participants with sufficient information in the debriefing to enable them to understand the nature of the investigation.

12. All the data collected from the participants is stored in an anonymous form.
    All participant data (hard-copy and soft-copy) should be stored securely, and in anonymous form.

Project title Portfolio and assessment system for Work-Based Learning stu

Student's Name Charalampos Konstantinidis

Student's Registration Number 2421909

Student's Signature [signature]

Supervisor's Signature [signature]

Date 18/12/2018

Interview:

Work Based Learning Platform Evaluation

"The aim of this interview is to determine if the functionalities of our website solve the addressed problems. Also, through this interview we intent to acquire feedback about the platform's usability and possible suggestions for improvements or additions. In order to obtain these valuable details, we need to interview people who have previously participated in the Work Based Learning concept. The interviewee will browse through the pages of our website and at the same time, a team member will explain to him the major functionalities of Bridge. Then he will be asked specific questions about his WBL experience and our website. The answers of the interviewee will be written down and collected. The interviewee may ask questions throughout the whole process of the interview

which is going to be conducted in a friendly tone.
The interview is not a test of your abilities and knowledge. You are welcome to withdraw from the interview at any time. Do you agree on starting this interview? Do you have any questions before we start?"

User Evaluation Interview

1st part:
What is your occupation?
What is your degree?
Did you participate in Work Based Learning Scenario?
For how long?
During your internship:
Did you communicate with both the university and the work manager? Was it helpful?
Were the demanded tasks from both the university and the workplace clear?
Do you feel you were assessed fairly and correctly by the university?

2nd part:
Would you use Bridge as a tool for your internship?
Do you think it is easy to use?
Do you think it is intuitive?
Do you think it would support communication among you, the university and the workplace?
Do you think it would boost the quality of the academic supervisor's assessment?
Do you think it would prevent any cases of private information leaks?

3rd part:
What is your overall opinion about Bridge?
What can be improved / added?

"The aim of this interview is to determine if the functionalities of our website solve the addressed problems. Also, through this interview we intent to acquire feedback about the platform's usability and possible suggestions for improvements or additions. However, the main goal of this interview was to make clear that our website tackles or has the potential to tackle the major problems of Work Based Learning, as stated in our dissertation.
Do you have any comments or questions about the interview? Please take note of our e-mail addresses and please feel welcome to contact us for further questions or comments. Thank you for your time."