

# A Social VLE to Promote Student Performance: Specification

Alex Macpherson

October 12, 2016

## Contents

<b>1</b>	<b>Problem Statement</b>	<b>1</b>
<b>2</b>	<b>Project Outline</b>	<b>1</b>
<b>3</b>	<b>Technical Objectives</b>	<b>1</b>
3.1	Primary Objectives . . . . .	2
3.2	Secondary Objectives . . . . .	2
<b>4</b>	<b>Software Development Methodology</b>	<b>3</b>
<b>5</b>	<b>Project Timeline</b>	<b>3</b>
5.1	Research . . . . .	3
5.2	Framework . . . . .	3
5.3	Back End & Security . . . . .	4
5.4	Front End . . . . .	4
5.4.1	User Interface . . . . .	5
5.4.2	Data Representation . . . . .	5
5.5	System Evolution & Testing . . . . .	6
5.6	Reports & Presentations . . . . .	6
5.7	Gantt Chart . . . . .	7
<b>6</b>	<b>Resources</b>	<b>8</b>
<b>7</b>	<b>Further Considerations</b>	<b>8</b>
7.1	Risk Assessment . . . . .	8
7.2	Legal Issues . . . . .	9
7.3	Social Concerns . . . . .	9
7.4	Professional Standards . . . . .	10
7.5	Ethical Considerations . . . . .	10
<b>8</b>	<b>References</b>	<b>11</b>

# 1 Problem Statement

Through numerous studies, it has been consistently found that parental involvement in a student's education significantly improves their performance at school[1][2], yet the modern school system seldom invites such further than termly parent-teacher meetings and student report cards. Further to this, report cards rarely go into more detail than an 'expected' and an 'on-target-for' grade[3], poorly representing the many multi-faceted subjects pupils study. Where a report may state a student is achieving an average grade in Computing, for example, they may actually be scoring highly in more-practical programming modules but struggling with those that are more theoretical. This highlights the importance of data representation with regard to student performance through the course of their modules, allowing more targeted learning and focused revision to aid and improve their studies. Currently, this seldom extends further than a student manually tracking how well they perform across numerous tests and pieces of homework[4] - information which is very easily misplaced or forgotten. Though numerous virtual learning tools exist to this end, few manage to wholly encapsulate the range of other requirements posed by all members of the school body, from students to parents, teachers to governors.

## 2 Project Outline

This document specifies the development of a web-based VLE (Virtual Learning Environment) software, serving primarily as a student performance tracking tool to promote achievement and parental involvement in schools, employing strong UI (User Interface) design and thorough but intuitive data representation techniques to aid targeted learning across a multitude of modules. The software will incorporate a number of other features, including direct messaging between teachers, students and parents, timetables and event calendars, and homework tracking and submission, ultimately aiming to provide an unparalleled academic companion tool of significant educational benefit.

## 3 Technical Objectives

The application has a number of technical objectives it will aim to meet; those which are critical to development are considered primary objectives, where secondary objectives reflect areas which will be expanded upon should time allow.

### 3.1 Primary Objectives

- A browser-based web-application, compliant to all standards defined by HTML5 and CSS3. The application will support Chrome v49+, Safari v9+, IE v11+, Firefox v38+. Older browser versions may work but support will not be guaranteed.
- Intuitive and clean UI design for ease of navigation through the application and simple interfacing between parents, pupils and teachers.
- Easily understood representation of large datasets, reflecting a student's performance in a given module over time.
- Data will have numerous possible mappings, allowing different views of the same set of points (for example, one view of a single student's scores mapped against their expected grades, and another of the scores of all students in a class mapped against one another).
- Class timetable and event calendar for students and teachers.
- Homework setting, tracking, submitting and grading tool, allowing students and teachers to easily see what work is outstanding.
- Direct & instant messaging between students/parents and teachers, with all parties having their own profile pages, listing contact details and other necessary information.

### 3.2 Secondary Objectives

- The web-app will incorporate responsive web design, supporting mobile browsers by decomposing gracefully with size.
- Timetable and calendar will be exportable to PDF and to mobile calendar apps (eg. Google Calendar).
- Whole school overview, mapping large amounts of data at once in a fast and clear manner (for example, the spread of results across a whole student body over a number of years).
- The interface will incorporate additional functionality to improve accessibility for users of all abilities.
- Accompanying mobile application to improve ease of use on mobile devices.

## 4 Software Development Methodology

The development of this application can be divided into a number of smaller subsections, covered in more detail below, each of which will employ a RAD (Rapid Application Development)[5] methodology. Unlike a waterfall model, which requires strictly defined plans for implementation prior to coding, RAD allows for the adaptability and flexibility of specified requirements. This is particularly important for the UI and data representation portions of this project, which may be significantly altered late in development according to user testing and feedback. RAD accommodates this by using prototyping in addition to design specifications, allowing frequent user involvement to better refine the application throughout its development.

## 5 Project Timeline

The core developmental subsections are detailed below, with an overview of the technical tasks involved in each stage as well as a justified time-frame for their respective completion.

### 5.1 Research

As a number of VLEs and academic companion tools already exist on the market, it is important to assess the functionality of competing softwares, identifying both strengths and weaknesses to help distinguish this application from its competitors by avoiding their flaws and improving upon their successes. With a number of the existing tools having very limited scope, it is also likely this application will form a more cohesive singular equivalent to multiple other individually-focused products.

---

Commencement Date: **3<sup>rd</sup> Oct 2016**  
Anticipated Completion Date: **9<sup>th</sup> Oct 2016**  
Absolute Completion Date: **16<sup>th</sup> Oct 2016**

---

### 5.2 Framework

Ruby on Rails is the framework upon which the application will be developed. This has been selected for its emphasis on *Convention over Configuration*, lessening the number of explicit decisions a developer must make while retaining flexibility of coding, and *Don't Repeat Yourself*, storing information

in a single, unambiguous place to significantly reduce repetition of code.[6] Both principles help to lessen the amount of low-level code with which a developer must be concerned, allowing more time and resources to be spent on the actual development of the application. As Ruby is not a familiar language, nor Rails a familiar framework, some time will be set aside to become acquainted with both through intensive self-tutoring.

---

Commencement Date: **3<sup>rd</sup> Oct 2016**  
Anticipated Completion Date: **13<sup>th</sup> Oct 2016**  
Absolute Completion Date: **16<sup>th</sup> Oct 2016**

---

### **5.3 Back End & Security**

Being a data representation and academic companion tool, this web-app requires a well-structured back end in place to support the front end and UI. With large amounts of data requiring storage, the application will rely on a MySQL database for storage, using Rails to manipulate and manage the information parsed to the user-facing front end.

As the data stored and utilised by the application is sensitive personal data, it is important to ensure the database is secure through necessary encryption and that the back end is resilient to malicious attacks through SQL injection and XSS (Cross Site Scripting).

By mid-November, it is intended to have an MVP (Minimum Viable Product) developed, allowing user testing to commence as soon as is feasibly possible. Development will continue in iterations beyond this point, most notably with the UI and data representation techniques, but undoubtedly this will incur some degree of continued implementation with the back end. It is expected that the majority of front-and-back end development will have been completed by the beginning of second term (January 8th).

---

Commencement Date: **17<sup>th</sup> Oct 2016**  
Minimum Viable Product Completion Date: **20<sup>th</sup> Nov 2016**  
Absolute Completion Date: **8<sup>th</sup> Jan 2017**

---

### **5.4 Front End**

Development of the front end will be largely interleaved with that of the back end, implementing both in tandem once the underlying structure of the

system is well-formed. The front end itself is largely divided between two fields of development, the UI and the representation of data. The former is expected to be fully developed by the beginning of the second term, where the latter will be subject to user test-driven evolution through the course of the project, with new system versions being developed regularly through the second term.

#### 5.4.1 User Interface

Being a system intended for use by all members of a school body, it is important that the interface is streamlined to each specific user group - these are identified as *Students*, *Parents*, *Teachers* and *Schools*. For ease of use, the interface is comprised of four (or three, as the student/parent views will not likely differ wildly) sub-interfaces, each encapsulating the functionality required by said user group and employing intuitive design techniques to make the system as simple to use as possible. The design is intended to be current and clean, applying a passive but positive colour palette to accentuate key areas.

It is expected that large portions of the UI will have at least partial functionality by the completion of the MVP, but development will continue beyond this point as feedback from user testing encourages change and improvement.

---

Commencement Date: **24<sup>th</sup> Oct 2016**

Minimum Viable Product Completion Date: **20<sup>th</sup> Nov 2016**

Absolute Completion Date: **8<sup>th</sup> Jan 2017**

---

#### 5.4.2 Data Representation

A large focus of this project is the representation of student performance data using a number of metrics to best reflect and aid a pupil's learning, enabling more focused studies. This is an area which will be largely user test-driven, with feedback helping to sculpt the graphical views which students, parents and teachers respectively find most useful. Where a student may find it preferable to view their performance based on target grades assigned by their tutors, teachers will likely find it useful to view the data of a whole class mapped alongside one another, enabling easy identification of those pupils consistently under-performing as well as those who are attaining higher grades than anticipated and require additional difficulty levels to further their learning. With this in mind, iterative system development will be paramount

to furthering the quality of representation, with new versions being released frequently to improve the usefulness and ease of interpretation of the data.

---

Commencement Date: **7<sup>th</sup> Nov 2016**  
Minimum Viable Product Completion Date: **20<sup>th</sup> Nov 2016**  
System Evolution: **Ongoing Post-MVP Release**

---

## 5.5 System Evolution & Testing

From the release of the MVP (Minimum Viable Product), development, generally pertaining to the front end of the system, will be largely user test-driven. As the project objectives outline '*numerous easily understood representations of large datasets*', it is important to gauge user feedback on existing system versions to ascertain which methods of displaying the data are perceived most useful in order to hone in on the goal of providing a tool of significant academic benefit. Upon completing the MVP, it is intended for new versions to be released frequently with additional functionality, as well as improvements to the UI and representation techniques, with each iteration having a lifespan of between one and - at most - three weeks in order to gather feedback and further develop the software. This process will continue through the majority of the second term, enabling the final versions to be as complete and user-approved as possible.

---

Minimum Viable Product Completion Date: **20<sup>th</sup> Nov 2016**  
System Evolution: **Ongoing Post-MVP Release**  
System Iteration Lifespan: [ **Three Weeks** ]

---

## 5.6 Reports & Presentations

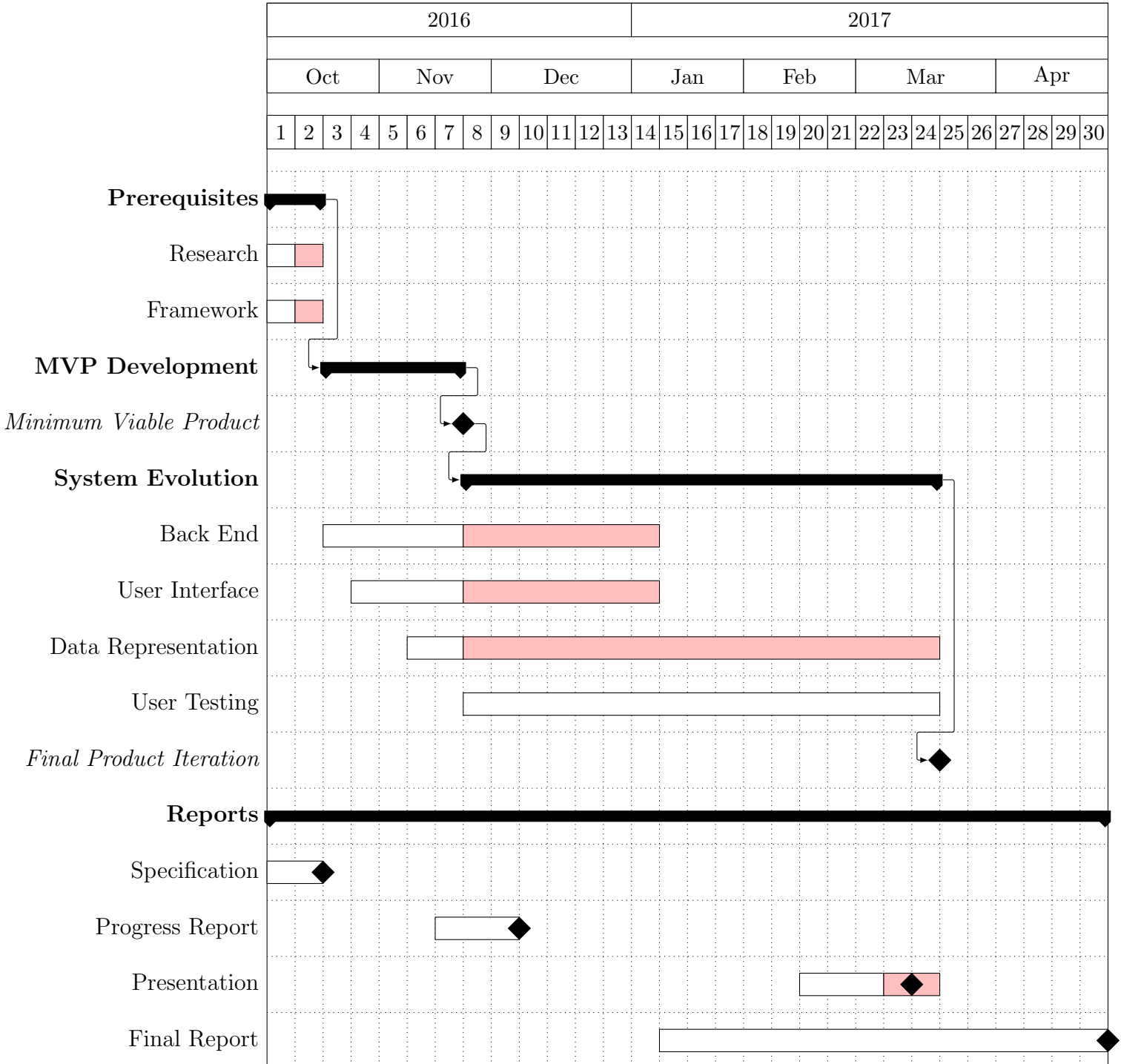
Through the course of the year, a number of reports and presentations must be completed alongside the development of the system. Minutes from supervisor meetings, notes from development and feedback from test-users will be kept in an organised manner to aid the writing of these documents.

---

System Specification: **13<sup>th</sup> Nov 2016**  
Progress Report: **W/C 28<sup>th</sup> Nov 2016**  
Presentation: **W/C 6<sup>th</sup> Mar 2017**  
Final Report: **W/C 24<sup>th</sup> Apr 2017**

---

## 5.7 Gantt Chart





## 6 Resources

The system will be developed using the Ruby on Rails framework, likely incorporating jQuery to ease the coding of various JavaScript elements across the front end.

Being a web-app, a server is required for both implementation and testing. Though currently hosted on a fixed GoDaddy server, as the system expands, it is likely to be migrated to Amazon Cloud Hosting, affording more dynamic scalability as required.

The software will be compliant to all standards defined by HTML5 and CSS3, and will support Chrome v49+, Safari v9+, IE v11+, Firefox v38+.

Git will be used as a version control system, allowing iterations to be stored distinctly from one another as the system evolves through the course of the project.

LaTeX, written using TeXstudio, will be used for all formal documentation through the project.

The majority of coding will be completed on a Novatech laptop; in the unlikely instance it breaks, development will continue from the DCS machines.

## 7 Further Considerations

A system of this manner will undoubtedly encounter a number of risks and issues through the course of its implementation and evolution. Below are listed some of the considerations one must take in order to ensure continued development without risk of the project falling through.

### 7.1 Risk Assessment

Below is a risk matrix containing a number of the risks identified with this project. Each is accompanied by their respective severity and likelihood of occurrence, as well as the mitigating action to be taken in the event such a risk transpires, allowing development to continue largely unhindered.

Risk	Severity	Likelihood	Mitigating Action
Developer falls ill.	Low	10%	Continue any work possible without further risk to health.
MVP not delivered on time.	Moderate	25%	Devote more time to project development to deliver ASAP.
Ruby on Rails is not learned to a sufficient standard.	Moderate	10%	Utilise PHP framework instead, hard-coding pages and style in HTML and CSS.
BSREC Ethics form not approved.	High	1%	Complete user testing on similarly-aged peers rather than children - less effective, but still user testing.
Current server unavailable during testing period.	High	1%	Find alternative server or enact early migration to Amazon Cloud Hosting (more reliable!).

## 7.2 Legal Issues

As the system largely deals with sensitive personal information, it is of utmost importance to ensure the data is stored securely as per the guidelines of the Data Protection Act of 1998.[7] Necessary encryption of all sensitive information will be arranged and no data will be unlawfully shared with third parties.

## 7.3 Social Concerns

Generally speaking, there are very few social concerns beyond the high amount of personal data from students the system may store, though it is likely some persuasion will be required by participating schools to encourage student, parent and teacher uptake of the application.

## **7.4 Professional Standards**

Being a web-application, a number of professional standards must be upheld, including reasonable browser compliance (Chrome v49+, Safari v9+, IE v11+, Firefox v38+) and accessibility features where possible and applicable to enable use by those of all abilities.

As the product nears a commercially-viable state, the issue of fault tolerance will become paramount, with a single server being insufficient to ensure an always-available service. As the system reaches this point, migration from self-hosting to Amazon Cloud Hosting will be important to maintain availability and scalability of the software.

As a number of user-tests will be undertaken, it is also important they are carried out to a professional standard, maintaining a good manner so as not to tarnish the reputation of the product, the developer or the university.

## **7.5 Ethical Considerations**

As a software intended for schools, the majority of user-tests require the involvement of young students and children. As per university regulations, an application to BSREC (Biomedical and Scientific Research Ethics Committee) for Research Ethical Approval will be submitted as soon as possible to ensure the necessary testing may be undertaken.

## 8 References

- [1] S. R. Hara and D. J. Burke, "Parent involvement: The key to improved student achievement," *The School Community Journal*, vol. 8, no. 9-19, 1998.
- [2] N. E. Hill and S. A. Craft, "Parent-school involvement and school performance: Mediated pathways among socioeconomically comparable african american and euro-american families," *Journal of Educational Psychology*, vol. 95, no. 74-83, 2003.
- [3] *Understanding Grades/Levels and Reports.* William Farr C of E Comprehensive School. <http://www.williamfarr.lincs.sch.uk/information/understanding-gradeslevels-and-reports>.
- [4] *How do students find out how well they are doing?* St Saviour's & St Olave's School. <http://www2.sso.southwark.sch.uk/page/?pid=209>.
- [5] J. Martin, *Rapid Application Development*. Macmillan, 1991.
- [6] I. G. Czibula, C. L. Lazar, I. Lazar, S. Motogna, and B. Parv, "Rapid prototyping of service-oriented applications on osgi platform," *2009 Fourth Balkan Conference in Informatics*, 2009.
- [7] *Data Protection Act 1998*. Office of Public Sector Information. <http://www.legislation.gov.uk/ukpga/1998/29/contents>.