CLARKSON UNIVERSITY

Thesis Title

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The undersigned have examined the thesis entitled

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Abstract

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Contents

Chapter 1

Introduction

1.1 Motivation

The Science and Technology Entry Program (STEP), a program under the New York State Education Department (NYSED), published a set of priorities that it wanted to see solutions proposed for when determining which institutions it would award funding to. Paraphrased, these priorities are for institutions to provide programs and services to improve:

1. The recruitment and retention of male participants;

2. The recruitment and retention of Hispanic/Latino and American Indian participants;

3. Eighth grade students' NYS Math and Science Assessment examination scores [2].

Additionally, STEP created a set of service and data requirements that funding recipients must provide. The underlying themes of the requirements are that there should be increased collaboration between the awarded institution, the local educators, students, and parents as well as providing students with assistance in gaining skills needed to succeed in learning and pursuing STEM (Science, Technology, Engineering, and Mathematics) fields [2].

Data published in numerous studies [**?**, **?**] show that American 8th grade students perform consistently below those in many other countries around the world. School Districts

in Northern New York can substantiate the STEP priorities and requirements. NYS Mathematics test data from 2010 revealed that 56% of the school districts in St. Lawrence County had below average proficiency levels for 8th grade [**?**]. At the Salmon River School District, where there is a majority American Indian demographic, 54% of students scored below acceptable proficiency levels on the 8th Mathematics assessment [4]. It is clear that STEP identified these troubling facts and is now pushing institutes of higher education to try to solve these issues.

IMPETUS (Integrated Mathematics and Physics for Entry To Undergraduate STEM), for Career Success is the result of collaboration between St.Lawrence-Lewis County BOCES, the STEM Partnership, and Clarkson University. Its primary goal is to improve and increase opportunities for underrepresented minorities and students from economically disadvantaged rural areas to realize their potential for college entry as STEM majors and for eventual career success in technically oriented professions.

Traditionally, this collaboration has been accomplished via in-person meetings between various combinations of the relevant parties. St. Lawrence County is the largest county by area in not only Northern New York, but in the whole state, yet has a population density of only $41/\text{mi.}^2$, whereas the state average is $355/\text{mi.}^2$. Combined, these circumstances do not create an environment suited towards an efficient and effective exchange of information [4].

IMPETUS has proposed the creation of a Web-based Collaborative Environment that will satisfy the STEP criteria by combining different technologies into a unified solution while increasing the convenience and accessibility of collaboration. Students who are in need of assistance, when meeting in-person is not possible, will be able to engage in web-based cooperative learning with Clarkson University students. Educators will be able to survey and receive feedback from targets regardless of their location and parents will have access to their children's data.

In 2008, the National Science Foundation (NSF) created a Cyberlearning Task Force that was charged with, amongst other objectives, determining what the key research topics were surrounding cyberlearning [1]. In a subsequent NSF publication, it was determined that one of these topics should be collecting, analyzing, and managing data about how individuals use a given cyberlearning system [3].

Due to STEP's data logging requirement and the fact that the NSF has deemed cyberlearning data collection to be an area of research interest, the IMPETUS Web-based Collaborative Environment (IWCE) will collect an extensive amount of data about not only the individuals using it, but also how they are using it.

1.2 Research Objectives

Todo: Come up with research objectives.

Previous content was not comprised of objectives at all, they were goals. They also were not goals of this paper, but rather goals of the web-based environment. As such, they were moved the Chapter 2.

1.3 Methodology

Creating the IMPETUS Web-based Collaborative Environment will be done following a modified waterfall model of software engineering: Requirements, Design, Implementation, and Verification; the modification being that feedback will be readily incorporated into the phases allowing progress to go "up" the waterfall. Being that there is only one developer on the the project, it is the most basic model to follow.

As modules becomes ready for Verification, usability tests will be done to get feedback on their usefulness and design. This will require the creation of surveys and the user studies

gauge how effective the interface is at allowing a user to accomplish goals.

Chapter 2

Software Requirements

2.1 Overview

As established in section 1.1, the primary motivations behind the creation of IWCE are the need for increased collaboration and the need for data logging. Since IWCE will be targeted at a variety of user class, it follows that each will be permitted access to a different set of features. This means that, while an increase in collaboration is an overall goal for all user classes, specific collaborative goals vary based on how much access each class has to IWCE:

- All users should have read access to announcements and an event calendar.
- All users should have access to an internal messaging system for one-to-one and one-to-many communication.
- All users should be able to answer surveys that are available to them.
- Students should be able to answer quizzes that are available to them.
- Students should have access to an availability schedule for teaching assistants.
- Students should have access to external educational resources.
- Teaching assistants should be able to create their own availability schedule.

- Teaching assistants should be able to create quizzes and surveys.
- Teachers should be able to create announcements and events for the calendar.

The next set of goals correspond to data logging. There is the possibility of some conceptual overlap between whether a goal is collaborative or data logging related, so the line has been drawn at whether or not the collaborative aspect is simply incidental to having to log data. If that is the case, then the goal will categorized under data logging.

- Parents should have access to their children's data.
- Students should have access to their own data.
- Teaching assistants should have access to the students that they are assisting.
- Teachers should be able to be able to view reports for the students that are available to them.
- Teachers should be able to edit data for the students that are available to them.
- Administrators should be able to create and access the entities by which data is stored.
- Administrators should be able to access user tracking data.

In the above list, there are two terms which need some elaboration: "data" and "entities". "Data" is defined as all personal information, survey results, and quiz results for the user it is in reference to, whereas "entities" are the core objects that provide the basis for all relationships in the user data. These entities will be explained in chapter 3.

2.1.1 Features

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2.1.2 User Classes

Anonymous, Parent, Student, Teaching Assistant, Teacher, Administrator. Explain hierarchy of roles.

2.1.3 Operating Environment

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2.2 System Features

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2.2.1 User Tracking

Description

Action/Response Sequence

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Khan Academy

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hello world

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Reasoning

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4.2 Surveys

4.3 Reports

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Chapter 5

Summary and Conclusions

5.1 Conclusions

5.2 Future Work

Bibliography

[1] Christine L. Borgman, Hal Abelson, Lee Dirks, Roberta Johnson, Kenneth R. Koedinger, Marcia C. Linn, Clifford A. Lynch, Diana G. Oblinger, Roy D. Pea, Katie Salen, Marshall S. Smith, Alex Szalay, and NSF Task Force on Cyberlearning. Fostering Learning in the Networked World: The Cyberlearning Opportunity and Challenge. Report, National Science Foundation, 08 2008.

[2] New York State Education Department. STEP Operations Manual. Website, 2011. `http://www.highered.nysed.gov/kiap/step/`.

[3] National Science Foundation. Cyberlearning: Transforming Education Cyberlearning, 09 2011. Solicitation 11-587.

[4] Clarkson University. Northern New York Partnership for Rural Integration of Science and Mathematics, 2010.

Appendix A

User Manual

Appendix B

Administrator Manual