1 PROPOSAL

Date: September 30, 2012
To: Sheri Hronek, ENGL3980 Students
From: Wes Turner
Subject: Assignment 3: Report Outline

Please accept this proposal which presents the Approach, Detailed Report Outline, Budget/Costs, Time line, and References List for the proposed report on self-directed learning with online resources.

Contents

2 Approach

2.1 problem statement

According to the Fact Sheet accompanying the President's Council of Advisors on Science and Technology (PCAST) February 2012 report entitled *Engage to Excel: Producing One Million Additional College Graduates With Degrees in Science, Technology, Engineering, and Mathematics* [29]:

> "Fewer than 40 percent of students who enter college intending to major in a STEM field complete college with a STEM degree today."

The American economy needs more candidates with knowledge of Science, Technology, Engineering, and Mathematics.

If "fewer than 40% of students who enter college intending to major in a STEM field complete college with a STEM degree", there seems to be an indication of a motivation or incentivization challenge: if demand is greater than supply, what about the producers or the environment is preventing equilibrium?

More concisely, how can students learn that self-directed learning with online resources will improve their quality of life?

This report will discuss challenges, opportunities, and strategies for encouraging self-directed learning with online resources.

Through this analysis of challenges, opportunities, and strategies, the report will address how students can learn using empirically validated teaching practices from discovery-based online resources in order to transform themselves into forward-thinking, mathematically capable stakeholders in the community.

2.2 scope of work

The scope of this project includes primary and secondary research activities, a report budget and time line, a written report, and a subsequent presentation. I will be fleshing out the detailed report outline with supporting research and citations in order to address the challenges, opportunities, and strategies for self-directed online learning.

The report assumes that producing more STEM field candidates is an absolute good.

The report does not intend to solve for:

- Mental health screening
- Daycare
- Enforced socialization

2.3 identification of the audience

The audience is a lay audience. The audience will have some prior knowledge of computer and web skills, as well as some experience with traditional education. The audience may be curious about online learning but working with an organization that is slowly adapting to an online environment. If the report is successful, the audience will be left with an interest in pursuing self-directed learning with online resources. The audience will also include a professor teaching technical writing.

2.4 qualifications

- I am not a doctor.
- I am not a lawyer.

- I am not a trained educator.
- I do have experience with training peer groups.
- I have worked in web design and web development for over 10 years.
- I have experience as a student in compulsory and undergraduate education.
- I have been treated like a widget on an assembly line
- I have been treated against an inconsistent criteria rubric
- I have suffered through wasteful required courses that I feel have conditioned me to accept process waste that someone should be working to eliminate
- I have learned that learning to satisfy another's path can be unfulfilling
- I have learned that everyone needs to eat, drink, and sleep
- I have taken more than 5 courses for credit online
- With online resources, on my own, I have learned to:
    - Create websites with HTML, CSS, and Javascript
    - Write code in various programming languages
    - Edit video
    - Interpret stories and metaphorical language
    - Pass math class
- I am familiar with the PCAST Engage to Excel report regarding undergraduate STEM education

2.5 work plan

I will stick to the research schedule and research budget included in the assignment 02 memo, as well as the report Time line and report Budget/costs included in this proposal in order to deliver the report drafts, final report, and final presentation, for free.

3 Detailed Report Outline

3.1 Introduction

> "I have never let my schooling interfere with my education."
>
> Mark Twain

3.1.1 Aquariums and Cave Diving

If self-directed learning with online resources is like cave diving, traditional classroom-based schooling is like an underwater aquarium tunnel.

3.1.2 Undergraduate STEM Graduates

According to the Fact Sheet accompanying the President's Council of Advisors on Science and Technology (PCAST) February 2012 report entitled *Engage to Excel: Producing One Million Additional College Graduates With Degrees in Science, Technology, Engineering, and Mathematics* [29]:

> "Fewer than 40 percent of students who enter college intending to major in a STEM field complete college with a STEM degree today."

More than 60% of students who walk into the traditional classroom-based aquarium school tunnel turn around and walk out. As an aquarium, this is a problem.

The PCAST Engage to Excel Report [29] identifies five overarching recommendations that it believes can achieve the goal of producing one million additional college graduates with Degrees in Science, Technology, Engineering, and Mathematics:

> (1) catalyze widespread adoption of empirically validated teaching practices;
> (2) advocate and provide support for replacing standard laboratory courses with discovery-based research courses;
> (3) launch a national experiment in postsecondary mathematics education to address the mathematics-preparation gap;
> (4) encourage partnerships among stakeholders to diversify pathways to STEM careers; and
> (5) create a Presidential Council on STEM Education with leadership from the academic and business communities to provide strategic leadership for transformative and sustainable change in STEM undergraduate education.

3.1.3 Goals

This report will discuss challenges, opportunities, and strategies for encouraging self-directed learning with online resources and along the way will address how students can (1) learn using empirically validated teaching practices from (2) discovery-based online resources in order to (3) transform themselves into forward-thinking, mathematically capable (4) stakeholders in their community.

3.1.4 History

How did we get here?

In the 6th century BC -- around 2600 years ago -- the Greek philosophers to whom the western world owes much debt did not attend compulsory education. Abundant resource availability allowed the Greeks

to pursue courses of study and learning through various "schools" of tutorship. At the time, there were not quite so many students to teach. In the Peripatetic school, students would walk alongside lecturers like Aristotle and learn through verbal instruction. Scribes would enscribe knowledge and wisdom into future-proof stone tablets that persist and survive to this day.

Through the Middle Ages, master craftsmen would provide food and shelter to apprentices, or proteges, who learned skilled trades and arts. Philosophy and science - in the form of alchemy - persisted through the calligraphy of monastic sects.

Then, in the 19th century CE -- around 200 years ago -- compulsory education developed in response to newfound abilities to communicate knowledge and differences of opinion through manually leaded printing presses. [34]

The 20th century saw the widespread adoption of advances like telephones, radios, televisions, and the internet; allowing social sciences to shape education systems towards mass production modes of standardized education. An individual with an undergraduate or post-graduate degree was all but assured a good job.

Now, in the 21st century CE, knowledge creation and assimilation are accelerating through widespread adoption of online web media technologies like HTML, digital audio, digital video, and YouTube. Public libraries are being supplanted by online reference collections and online expert communities. Educators are continuing to develop and adopt new technologies.

Today, an undergraduate degree is a minimum requirement for, but not a guarantee of a good job. A STEM degree is nearly a guarantee of a good job.

3.2 Challenges

As indicated by the PCAST Engage to Excel Report [29], the demand for knowledgeable STEM field careers is greater than the supply.

Too many people are entering the STEM underwater aquarium tunnel, turning around, and walking out.

There exist primary infrastructure systems that no-one will know how to maintain.

3.2.1 Resource Constraints

This planet suffers from many top-down resource constraints. More locally, teachers' salaries are low and the costs of learning materials are high.

3.2.1.1 Teacher Salaries

In America today, teachers' salaries are very insubstantial. [35] Teaching assistants' salaries are even less substantial. [36]

3.2.1.2 Learning Materials

Learning materials cost time to research, write, and evaluate; and money to bind and distribute.

Because marginal cost of distribution through an online network is zero, anyone with a computer and internet connection can publish.

This presents a challenge for students and educators seeking to learn "true" knowledge and wisdom.

3.2.2 Employer Acceptance

Entrepreneurs have been learning and applying self-motivatedly since the beginning of time.

Employer requirements are driving the growth in the degree and certification granting institution markets.

Employers are looking for qualified candidates with the capability and motivation to acquire and apply new skill sets to compete in a knowledge-driven economy.

While many employers are already leveraging internal online training efforts, self-directed online learning presents a number of challenges for employees and employers.

3.2.2.1 Verification

How can a hiring manager be sure that they're getting what they intend to pay for?

To an employer, a degree indicates that a candidate has the background knowledge and ability to do the job.

Online degrees and online certifications do not yet hold the status of university degrees.

This may be because online courses suffer from the same types of verification problems presented by online polls.

Technical industries are working to solve the verification challenge by requiring in-person proctored certification exams.

Online learning markets are developing standardized badges [56] and completion verification letters as corollaries to certificates.

3.2.3 Incentivization

From an unofficial interview with a group of Fortune 100 executives, one response to online learning was "We hire people for advanced degrees. Why would someone learn online if they aren't going to receive a degree or credit hours for their efforts?"

From an unofficial interview with a hiring manager at a Fortune 100 technology company, one response to online learning was "Where can I find people who are demonstrating their desire to continue to stay up to date within their current or future fields of expertise?"

Both views reflect incentivization challenges for students and employers.

3.2.3.1 Human Motivation

"How do we force people to learn?" may be asking the wrong question.

A different question might be: "How do people learn that learning will improve their lives?"

People want to help themselves and others for various reasons.

Pioneers in positive psychology, such as Abraham Maslow, indicate that people strive to achieve basic needs like food, water, and shelter as well as group needs like belongingness and esteem, and eventually pursue self-actualization.

Both primitive and social survival needs are conditioned and reinforced by positive and negative experiences.

Primitive needs are conditioned and reinforced with a "carrot and stick" approach: do this and be gratified with these rewards: shelter, food, water, healthcare.

Social needs like belongingness and esteem are reinforced by peer and authority acceptance.

And then there is what some people refer to as a "higher" need for self-actualization: to achieve mastery for oneself as part of the whole.

3.2.3.2 Why?

For teachers and STEM professionals who have spent years learning and pursuing advanced education degrees in order to do what they want to do, "Why would I want to learn Science, Technology, Engineering, or Math" may seem like a non-question.

But for a student, the grading structure may be perceived as arbitrary in relation to their values: "what does an A in math class have to do with my ability to get the latest game, shirt, or peer acceptance?."

"We must get good grades in order to get good jobs in order to live comfortable lives."

Freakonomics [32] addresses one scenario in which students are rewarded for good grades with money. The authors' findings are inconclusive; they seem to ask an implicit question: "by adding a component of instant gratification -- money -- how do students learn about long-term gratification?".

Different types of people enjoy different things, but you would be hard-pressed to find a teacher who would respond with anything less than satisfaction when a student says "I like learning."

From the beginning, self-directed learning requires a lifetime learner to develop a positive reward-response cycle for themself.

3.2.4 Learning Assessments

Key Performance Indicators, or KPIs, are metrics by which the success of an operation can be measured. Usually, KPIs are quantitative, empirical numbers on a scale with a low end and a high end. Usually, KPIs are scaled to a bell or similar curve. [37]

PCAST Recommendation #1.

3.2.4.1 Self Evaluation

Self evaluation is a primary avenue through which self-directed learners learn to motivate and evaluate themselves and their level of mastery.

Learning journals in a TIL -- or "Today I Learned" -- format can be valuable tools for developing a map of progress. [39]

Without a guide, a guru, a sensei, or a peer group to support these evaluations, narcissism may negatively reflect in the student's work.

Nobody cave dives alone.

3.2.4.2 Instructor Evaluations

Instructor Evaluation -- or "grading" -- is the traditional method for evaluating student progress. Instructor Evaluations can create a dependent relationship that may or may not be productive in helping self-motivated individuals to develop skills and strategies for building knowledge.

With personal instructor evaluations, the student learns to depend on another person as an indicator of their self worth. [40]

Some students embrace this positive/negative relationship, while others sadly reject it -- and school -- altogether.

This is challenge in that the dependent relationship that does not deliver acceptance may negatively condition the student to dislike learning, reading, and particular subject areas -- like STEM -- in general.

3.2.4.3 Standard-Normal Testing

While educational institutions and employers have been fond of traditional Standard-Normal aptitude tests like the ACT and SAT, their applicability and correlation to skills-acquisition measures have been questioned. [41]

As an internalized metaphor, "leave no-one behind" may indicate a different intention than "everyone going forward". How do you handle outliers? [42]

3.2.4.4 Voting Choice Theory

Voting Choice Theory is the foundation of a democratic system of government. Voting Choice Theory indicates that a "swarm" of self-directed individuals drawing from a diverse base of knowledge, skills, and wisdom is greater than the sum of its parts. [33]

While Peer and Community Evaluations may require extra effort, a sustained connection with a peer group is a good thing.

Community review processes in place at quality journals can be viewed through the lens of voting choice theory. ibid. ~50% of medical journal articles are unreproducible ... standardized terminology for experimental controls ... RDF provenance

PCAST Recommendation #4 [29]

3.2.4.5 Essay Qualification & Quantification

Flesh-Kincaid readability is one of a number of metrics for measuring prose reports for syllabic complexity. [43] Flesh-Kincaid readability thresholds are in place for some government agencies and financial contracts. While automated metrics for essay evaluation may correlate to syllabic complexity, many automated language metrics fall far short of measuring actual compositional acuity.

At web-scale, essay quantification through automated metrics are not sufficient for producing capable communicators. [44]

3.2.4.6 Applied STEM: Computer Science / Engineering

Computer Science and Engineering are fields where STEM knowledge and theory are constantly applied.

Efforts at automated design review in the computer science and engineering fields include Test Driven Development, Automated Model Verification, and quantitative metrics like cycles required and input/output. [45]

Software development concepts like user time and system time can be used to evaluate design complexity. Design complexity measures the amount of resources required to achieve specifications. [46]

The concept of 'elegance' in design and engineering refers to the concision with which a design accomplishes design goals. Like essay evaluation, elegance is very much a subjective measure of mastery.

3.3 Opportunities

Self Directed Learning with Online Resources creates value by helping individuals to develop themselves into self-motivated components of a greater system. Like any business undertaking, this value can and should be measured in terms of both direct and indirect returns.

3.3.1 Direct Returns

The agility afforded by developing an interest in and capability for learning online creates direct returns for learners in the form of knowledge and skills acquisition.

An individual or an employee with the desire to learn and better themselves is an employee that would be hired at many institutions looking for created, motivated professionals. [47]

3.3.2 Indirect Returns / "Externalities"

The Indirect Returns of producing Self-Directed Learners may be considered "externalities" because of the difficulties inherent in a monetary valuation of a knowledge network.

3.3.2.1 Network Effects

Metcalf's law is a law from the telecommunications industry that says that the value of a telecommunications network is proportional to the square of the number connected users; which is to say that the network effects of investing in graphs of knowledge and expertise are exponential. [48]

3.3.2.2 Goodwill

The goodwill created in the market by altruistic participants is difficult to quantify. Anecdotally, I am forever indebted to the professors and institutions that have offered their knowledge and wisdom for free. [49]

3.3.2.3 Knowledge Economy

More self-directed learners learning more on their own leads to more talent creating more more creative applications of technology and ever more value-creating efficient, sustainable business plans.

3.4 Strategies

3.4.1 Channels

3.4.1.1 Static Documents

Static documents are traditional textual products like Books and Readings.

3.4.1.2 Video

Online video is a very engaging market for knowledge delivery. [50] Most online course offerings include video lectures as a primary component. [30]

3.4.1.3 Q&A : Question and Answer Forums

Question and answer forums in the style of http://StackExchange.com allow class sizes to reach web scale with hundreds or thousands of people in a course. This is a new take on the Socractic method of dialectical reasoning. Experts are ranked by the swarm. [51]

3.4.1.4 Chat : Realtime Web Chat

Realtime web chat allows users in the same time frame to interact one- to-one or one-to-many in a peer based fashion.

3.4.2 Implementations

[30]

3.4.2.1 OpenCourseware, Coursera, EdX

While people had been sharing information online for many years, OpenCourseware - largely supported by MIT - is a leading example of sharing curriculum and instruction materials in a structured format. [52]

Free online learning providers like Coursera [53] and EdX [54] offer instructional materials, course-based learning communities, and online learning assessments.

3.4.2.2 University Online Offerings

Most colleges and universities are offering at least a few online classes. [30]

3.4.2.3 Comparison Scheme for Collaborative Technology

Groupware: Design, Implementation, and Use [31] by Briggs, et.al, presented in the month of September of the year 2008 in Omaha, NE, presents a scheme for comparing collaboration technology solutions.

- Core Functionality
    - Jointly Authored Pages
    - Stream
    - Information Access

- Access Controls
- Content
- Actions
- Synchronicity
- Identifiability
- Relationships
- Persistence

3.4.3 Lab Exercises

PCAST Recommendations #2, #3 [29]

3.4.3.1 CodeCademy

As a model for online lab-based larning, CodeCademy offers lab-style learning tracks focusing on various programming skills with automated grading. [55]

3.4.3.2 Math-based web game design

It is possible to teach multiple competencies through project-based learning. For example, students could create a client-side web-based game in HTML5 and Javascript where points are scored by completing the square of a triangle.

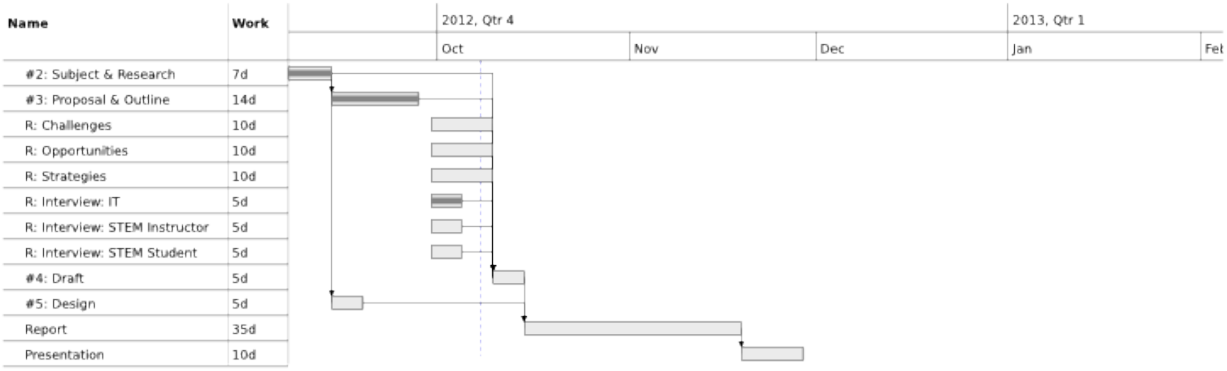
3.5 Conclusion

Question for instructor: If this is not a position paper, what should the conclusion of the analysis look like? "So that's that"? .. this is not a position paper .. this is not a research paper .. this is an analysis of Self-Directed Learning with Online Resources .. what is an analysis without a conclusion

4 Budget/costs

Item	Cost
Paper	$10.00
Ink Cartridges	$30.00
Index Cards	$5.00
Mileage (50 mi @ $0.555/mi)	$27.75
Parking (UNO Library)	$5.00
Time (70 hrs @ $35/hr)	$2,450
Total	**$2,527.75**

5 Time line



WBS	Name	Start	Finish	Work	Duration	Slack	Cost	Assigned to	% Complete
1	#2: Subject & Research	Sep 7	Sep 13	7d	7d	12d	0		100
2	#3: Proposal & Outline	Sep 13	Sep 27	14d	14d	12d	0		100
3	R: Challenges	Sep 30	Oct 9	10d	10d		0		0
4	R: Opportunities	Sep 30	Oct 9	10d	10d		0		0
5	R: Strategies	Sep 30	Oct 9	10d	10d		0		0
6	R: Interview: IT	Sep 30	Oct 4	5d	5d	5d	0		100
7	R: Interview: STEM Instructor	Sep 30	Oct 4	5d	5d	5d	0		0
8	R: Interview: STEM Student	Sep 30	Oct 4	5d	5d	5d	0		0
9	#4: Draft	Oct 9	Oct 14	5d	5d		0		0
10	#5: Design	Sep 13	Sep 18	5d	5d	26d	0		0
11	Report	Oct 14	Nov 18	35d	35d		0		0
12	Presentation	Nov 18	Nov 28	10d	10d		0		0

6 References

29(1, 2, 3, 4, 5, 6) **President's Council of Advisors on Science and Technology.** Engage to Excel: Producing One Million Additional College Graduates With Degrees in Science, Technology, Engineering, And Mathematics, February 2012.

30(1, 2, 3) **Means, B., Yukie Toyama, B. A., Murphy, Robert, Bakia, M., & Jones, K.** (2010). Evaluation of Evidence-based Practices in Online Learning. Evaluation. Retrieved from http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

31 **Briggs, Robert O., Pedro Antunes, Gert-Jan de Vreede, and Aaron S. Read.** Groupware: Design, Implementation, and Use: 14th International Workshop, CRIWG 2008, Omaha, NE, USA, Sept. 14-18, 2008, Revised Selected Papers. Springer, 2009. [p.308]

32 Freakonomics: TODO

33 "Trust the swarm"

34 http://www.johntaylorgatto.com/chapters/7c.htm

35 DOL: Teachers' salaries

36 Un(der)paid GTA

37 **Shum, S. B., & Ferguson, R. (2012). Social Learning Analytics.** Journal of Educational Technology & Society, 15(3), 3–26.

38 **Stein, Z. (2012, August 13). Learning Analytics and the Learning Sciences.** Retrieved September 16, 2012, from http://www.educause.edu/node/267647

39 Education Journaling

40 Instructor Dependence

41 Predictive Value of Standard-Normal Testing

42 Organizational controls

43 Fleisch-Kincaid

44 Standard Error of automated essay metrics

45 Next-gen development practices TDD

46 (cross-applicability of) Software Development metrics

47 interview

48 Metcalf's law

49 interview

50 online video market growth

51 Q&A

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