Utilizing Adult Learning Theory in Online Classrooms

A Major Qualifying Project
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Abstract

This project's purpose is to gather data to inform the creation of an online classroom for STEM teachers utilizing the adult learning theory method. This is an important topic because the enhanced education of the teaching force helps to improve the quality of education received at the K-12 level. The goal of this project will be to understand what makes a successful online classroom experience for K-12 STEM educators, and ultimately create a prototype online module. To accomplish this goal, I will learn how to create, distribute, and analyze a survey, conduct interviews of online instructors, and utilize this knowledge to create a prototype.

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Introduction

Teachers currently have to go through obtaining Professional Development Points (PDP) in order to recertify every 5 years in their primary area they teach in. To do this, educators have to take university classes in some fashion to keep themselves up to date in their field. This means that teachers have to spend their time wisely looking for opportunities to gain PDPs through course credit while trying to prepare for their own classes. Classes currently are more focused on a typical university student coming out of high school or graduate level classes for student's right out of college. Although the content may be useful to know in order to heighten the teacher's repertoire of the subject matter, these classes will rarely teach effective ways to bring the information into the classroom immediately. This project hopes to emphasize the untapped potential of online classrooms that can be tailored specifically for teachers that will accommodate their needs, and improve the education in the classes they teach.

In creating a classroom that is conducive with an adult audience of STEM teachers, it is important to take into account the extent to which we utilize andragogy. The concepts of andragogy have taken shape over around a century. How we facilitate adult learning and the specifics surrounding that have been refined and adapted over that century. Understanding the progression of andragogic practices will help to focus on which aspects of andragogic practices that we wish to utilize in the final product and see where arguments for specific practices are dismantled.

Goals of the MQP Project

The major goal of this project is to be able to gather enough information concerning online classrooms with STEM teachers to be able to create a prototype classroom as an example for future work. I want to be able to learn why teachers decide to pursue online education, why teachers want to further their education, and how online classrooms have been successful. By learning this information, it will allow me to make an educated assertion as to what aspects of an online classroom are essential when creating a STEM teacher only environment. To accomplish this goal of creating an online classroom for STEM teachers the following actions need to be taken. The first is that I will be reading literature to understand the Adult Learning Theory and how it is applied in a generic way before being able to apply it to a very specific situation. I also need to be able to create a robust survey tool in order to gather data concerning STEM teachers, which also entails learning how to pretest and analyze surveys in order to critique and refine my own survey. The survey is the optimal method for obtaining this information as it is cheap, efficient, and can be administered remotely which allows me to reach potential teachers that are outside of the Worcester area. With my limited resources for this project, a survey makes the most sense as a data collection method. I also need to conduct interviews to understand not only what teachers want out of online classroom experiences, but what instructors feel are the most efficient uses of the online space. All this prior information will then allow be to make an informed decision when I create the prototype classroom and attempt to gather feedback on it.

Chapter 1: Literature Review

1.1 Key Points in the History of Knowles' Andragogy

The term andragogy "was first authored by Alexander Kapp (1833), a German high school teacher" (Henschke 2009) who talked about how education extends throughout a person's lifetime. Kapp's main contribution to the term andragogy is arguing that adult education must differ by providing "objective competencies, and, that learning happens not only through teachers, but also through self-reflection and life experience, which makes it more than 'teaching adults' "(Henschke 2009). There must be a higher emphasis in andragogy on the experience being practical to the point where it can be utilized more immediately, and the learner can use their own experience as an enhancer to their education.

The person most commonly associated as the father of andragogy is Malcolm Knowles who created the first definition of andragogy. His main assertion is "that adults learn differently from children" (Henschke 2009) and his book *The Modern Practice of Adult Education: Andragogy vs Pedagogy* popularized this terminology of the word andragogy. By 1970 there were a few well agreed upon assumptions based on Knowles work. The assumptions were that adult learners "are self-directing, their experience is a learning resource, their learning needs are focused on their social roles, their time perspective is one of immediate application" (Henscheke 2009). This set the standards of what defined andragogy and how to differentiate it from pedagogy.

Around 1975 the concept of self-directed learning became the main way to implement the concepts and aspects of andragogy that Knowles had presented. Knowles added to the conversation with "his guidebook for learners and teachers on the topic of Self-Directed Learning. This was the first time that he labeled pedagogical as 'teacher-directed' learning and

andragogy as 'self-directed' learning" (Henschke 2009). He helped make the case that adults need to be the main driving force behind their learning and require self-directed focus to achieve success. The teacher becomes the one that needs to provide content that can excite their thirst for knowledge and education, rather than a motivating force they are a resource to be used. An adult learner will likely also see their peers as resources as well and find other ways to make each experience in the classroom a learning experience.

Further work on andragogy around 1980 came from both Jack Mezirow and Knowles on refining the definition and factors of andragogy. Knowles viewed the difference between pedagogy and andragogy as more of a transformation renaming his original work from "'andragogy vs. pedagogy' to 'from pedagogy to andragogy'. In addition, he added the fifth assumption - adults are motivated more intrinsically than extrinsically" (Henschke 2009). He came to believe that many of the concepts of andragogy can also work for K-12 classrooms and that the difference is not as large as he first imagined. Rather many of the aspects from pedagogy could be adapted to work in an adult learning situation, just as andragogy concepts could be adapted to work in K-12. Mezirow would add to the discussion with the addition of 12 concepts that would aid adults in their ability to self-learn.

By the 1990s, andragogy had gained a small amount of backlash but mostly the complaints and arguments against Knowles theory were due to misunderstandings of its use. It wasn't until 1995 when the first arguments came up that mounted accusations that andragogy had been outdated or needed a new definition or principles. Welton argued that "the fundamental accusations expressed are that because of this perspective, adult education has abandoned its once vital role in fostering democratic social action, is on a shaky foundation, works to the advantage of large-scale organizations, and is conceptually inadequate to serve the interests of

the disenfranchised in North American society." (Henschke 2009) His point is similar to that of many others that andragogy was outdated and the teaching styles it presented created advantages towards actively putting more of the responsibility on the individual in a disenfranchised society rather than the provider of the education.

By 1997, other arguments surfaced to defend the legitimacy of andragogy and of Knowles interpretation of adult education. Marcia Conner argued that "in the information age, the implications of a move from teacher-centered to learner centered education are staggering. Postponing or suppressing this move will slow our ability to learn new technology and gain competitive advantage. She also depicted andragogy's major focus as understanding and adjusting our experiences and beliefs in relationship with the world we face on a daily basis" (Henschke 2009). This was a pretty important point that was raised by Conner because of the rapidly changing world and a teaching system that could be slow to adapt. If people did not have a self-influenced drive for education, they would never be able to determine what is necessary to learn to enhance their lives. The concept of teacher-reliance was something she considered that we eventually lose and start to find ways to learn for ourselves. She argued that andragogic tactics would help those who want to self-learn no matter who they are or what age they were.

D.D. Billington in the year 2000 started to add more to the field of andragogy. He identified a bunch of "key factors relating to andragogy that helped them grow, or if absent made them regress and not grow " (Henschke 2009). These factors included respect in the classroom, recognizing ability and achievement, intellectual freedom, and other aspects that made the learner feel like an equal to the teacher. Billington found that when the material is challenging and the learner is being rewarded for going above and beyond that the people were able to learn far more. Thom Gehring in his studies with people at correctional settings found that some

students are not ready for the concepts introduced in andragogy that affirm that self-learning provides the best results. They were not mature enough to benefit from anything andragogy had to offer. However, those that did mature, "will benefit from having the facilitator apply andragogic principles in their learning activities" (Henschke 2009). Andragogy was being recognized as more specialized and was not able to be applied to every case of adult education. The person needed to have the drive to learn, and the educator needed to provide an environment that complimented that attitude in order for the practices described in andragogy to succeed. Later in the 2000's similar findings from various research would identify key characteristics of successful learners that confirmed Gehring's findings. Characteristics like individualism of the learner, results based learning, and respect of the educator were even further cemented as clear identifiers of good andragogic practices.

1.2 Current Definition of Andragogy

There are currently a two main ways to use the word andragogy today. One definition is that andragogy is "the scholarly approach to the learning of adults. In this connotation andragogy is the science of understanding and supporting lifelong and life wide education of adults" (Reischmann 2004). This definition is a much broader terminology that is used to describe the process of understanding how to support education as people move along into the adult stages of their life. However the United States has a different use of the word andragogy.

The common definition in the USA is that "andragogy in the tradition of Malcolm Knowles, labels a specific theoretical and practical approach, based on humanistic conception of self-directed and autonomous learners and teachers as facilitators of learning." (Reischmann 2004). This definition examines a much more specific direction that andragogy has taken over the years towards looking at self-learning and having teachers be facilitators or support. Unlike

the first definition, this definition of the term andragogy looks at a particularly successful application of andragogy instead of the broader scope of adult learning. This definition is the one I will be referencing throughout this paper as the product of interest is designed for an American audience. Much of the discussion will also come from Knowles' interpretation of andragogy as he is the one credited with providing many of the key foundations for andragogy and continuing to improve his definition into the present.

There are four principles that Knowles applied to adult learning. They are:

1. Adults need to be involved in the planning and evaluation of their instruction.
2. Experience (including mistakes) provides the basis for the learning activities.
3. Adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life.
4. Adult learning is problem-centered rather than content-oriented. (Pappas 2013)

The first principle dictates that adults need to be given more control over their learning and be able to take different routes based on how they will learn the material best. They are given much higher levels of freedom than students that are taught with pedagogical principles. This could be as simple as releasing multiple modules or homework simultaneously and then providing the freedom for the individual to complete the assignments at their own pace. This way the students are able to control their education to higher degrees and that respect for their planning skills and the application of responsibility will enhance their learning experience as adults.

Second, the lessons need to be highly adaptive and discussion focused with a focus on each class' experience on their own. This principle entails that learners should be able to come to each class and bring their own set of thoughts and ideas and have them discussed and engaged as

the primary focus. For a successful application of this principle the instructor needs to be able to hold a strong discussion and let learners lead the way for the class at periods. Doing this promotes self-learning in the learners and sets up the teachers as the support structures fitting straight into andragogical practice.

Third, the immediate applicability of is crucial for adult learners to find importance in what they are learning. Although continuing education can be something of value to many adults as they advance throughout their lives, there are many variables that make furthering their education a tough decision. Adult learners need to be able to enhance their quality of life or apply the knowledge they are learning to something they are already doing. In other stages of life, just the act of learning can be fruitful because there are no other pressures to apply any knowledge gained. Andragogy pinpoints this difference and suggests that where it is possible that the information taught directly corresponds with a real world application.

Finally, creating lessons that revolve around critically solving problems rather than knowing the information are much better suited for adults. Not only does this engage the adult learner more and help them become a better self-learner but it helps show the applicability of the information in the real world if done correctly. Critical thinking shows the highest level of understanding, and with adult learners we can expect that they will frequently enroll in classes not to learn the information but to understand the information. This is what this fourth principle of andragogy entails.

There are also five assumptions of adult learners that differ from child learners that Knowles suggested. These assumptions fit into the four principles of andragogy in different ways. The five assumptions are self-concept, adult learner experience, readiness to learn, orientation to learning, and motivation to learn (Pappas 2013). These five factors that we believe

in andragogical practice will differ play key roles in constructing the four principles. For example, having a strong self-concept and being dependent will play a role in your desire to learn from your mistakes and fully understand material. Orientation to learning directly correlates with the principle of immediate application of knowledge. Instructors that utilize andragogy should assume these five traits about their learners in order to provide them an experience as it provides mature adult learners to get the best possible experience.

1.3 Online Education History

Throughout the time that computers have been available, people have been trying to create educational experiences to utilize technological advances. The course we hope to design in this project will need to take into account many of the growths of online education. The field is extremely new, and commercial success is only possible by making sure to capitalize on the unique benefits provided by the internet. It's important to understand how we got to the point where online education can be marketed and commercially successful by showing its history.

Online education that utilized computers to provide a remote educational experience is something that didn't really pick up steam until around 1990s as the technology for computers advanced to a point where it was commercially feasible to create the courses. The first online program that emerged was in "1989 when the University of Phoenix began using CompuServe, one of the first consumer online services" (Knetnor 2015) This program was something that was more of a convenience service for those already attending University of Phoenix because of how you still needed to be on campus to attend the class. However, by 2002, the market had blown up

with 1.6 million people attending online classes, and the University of Phoenix's enrollment doubled in large part because of its online classes. (Knetnor 2015)

One aspect however that stunted the initial rise of online classrooms was the mismanagement of the medium in online classrooms. "Online education is a different medium for teaching and learning,and therefore requires a different pedagogy"(Knetnor 2015) and this idea was not embraced until around 2010. The educators themselves were more hesitant that learning would be possible without face to face communication. Therefore, most online courses in that period had no unique aspects of them that would make them different experiences from the on-site class. Online classrooms at this point in time merely provided all the class materials online and then assigned the same assignments as the on-site classes they were based around. This lack of enthusiasm for embracing the medium led to the downfall of many online classrooms in the early 2000s. The three things that impacted the closure of many online institutions was "the lack of understanding of this method of teaching, the lack of institutional support, and fear that the quality of education in online environments would suffer" (Knetnor 2015). There is a lot of potential power that can be gained by using online mediums and many people argued that an investment of time and money is needed to thoroughly understand the power of online education. Even today, online education has just recently been being looked at and people are trying to create pedagogy for its use. Most online classrooms still follow failing models of the early 2000s are are seen as inferior for good reason. Online education has the power to be an accessible and powerful way to distribute information better to the on-site method that has been done for around 50 years. People who are far away from the institution or people who don't have as much money will be able to be educated. More specifically for this project,

teachers who don't have the time to come and invest time into physically attending courses can take the time to further their education and enhance the public education they teach.

1.4 Online Pedagogy

Online pedagogy is another aspect to seriously consider when looking at creating an online course for STEM teachers. It can be extremely easy to fall into the trap of creating an online classroom that just provides the resources available to on-site education because there is very little extra work in transitioning a classroom from the on-site type to online. However, this sort of lack of work in creating online classrooms is leading to a lack of quality. A specific online pedagogy needs to be considered because of how there is less face-to-face interaction. Traditional on-site education can rely on around four hours a week of face-to-face time with students where there are opportunities to communicate. This can be remedied in online education by trying some different approaches to teaching the classroom.

Bill Pelz, a psychology professor and award winning online teacher has a few ideas on how to apply online pedagogy that I will discuss. First, he argues that a teacher's job in an online environment is less about distributing the knowledge but about "creating an environment in which a majority of the students gladly learn that which they and [him] deem relevant and salient" (Pelz 2010). The environment of learning is much more important since typical lecture styled college teaching is much less effective when it isn't in person. Pelz is essentially suggesting that teachers set up environment in online education that put students in charge of their education and give them responsibility, especially in adult classes, and respect that empowers students. He believes educators should see themselves as facilitators for creating these environments rather than ways to distribute the information. He states that "A lecture is the best way to get information from the professor's notebook into the student's notebook with passing

through either brain" (Pelz 2010). By actively involving the student more, they are forced to think critically about the information they learn. On online platforms this is arguably easier because of the vast amount of knowledge present on the internet.

Another aspect Pelz suggests is letting students do most of the work in teaching classrooms. Activities such as student led discussions, discussions led by students on online resources, peer assistance, and case studies have tended to provide positive results for Pelz while letting students facilitate learning. (Pelz 2010) With these methods of learning there is a systematic change for how to grade individuals. Grades come down much less to individual assignments but whether a student has made the effort to interact and contribute to discussions in original and relevant ways. Pelz suggests that by cutting down on less assignment grades and highlighting the importance of discussion presence in his grades that students become more invested with material rather than being bogged down by an assignment that is trying to force them to think critically about the information. He accomplishes this by creating a publicly visible rubric for discussion and scoring comments as a points and tallying them up at the end.

Interactivity glues all of Pelz's ideas together and is the major part in his argument towards improving online education. While interactivity in an on-site classroom involves talking and listening, an online classroom looks at interactivity as writing and reading (Pelz 2010). The idea of creating an interactive environment will help make up for the fact that students will have no traditional face-to-face contact with either their peers. The two assignments that Pelz suggests to create heightened levels of interactivity are research proposal projects and collaborative research papers. He suggests that these assignment be given out at the beginning of the class and then be tied into class discussions and built on throughout the class as ways to understand an application of the knowledge taught. He even suggests making it mandatory to cite student

discussions as part of the paper further putting the responsibility on the students to create interesting and deep discussions that can be used later for the term project (Pelz 2010).

Many of these ideas of pushing for more discussion based, student led classrooms are interesting places to take an online classroom. I especially believe that these practices described by Pelz are extremely relevant in the realm of teaching STEM teachers. Teachers will have good grasps of how to create discussions and bounce ideas of each other. It also ties right into andragogy in how most of the responsibility is put on the learner and how respect is immediately given to the learner. This makes this view introduced by Pelz a good fit for an online classroom that will be teaching specifically teachers. The projects that he suggests can also be altered to be built around creating lesson plans over the course of the class or understanding real world applications. The classes will also create more networks between teachers and help spread knowledge around from many different locations.

Chapter 2: The Survey

For the survey there were two main goals that needed to be accomplished. The first was to learn about the respondent, and to understand what considerations were taken into their career choice of a teacher considering the lower pay and high workload. The other goal was to learn why online courses were even considered as a part of a teacher's higher education and what parts of the experience they found useful or necessary. This information will help me to craft an online experience that gets at the core principles of what teachers want out of their education. To start however, I had to make sure that my survey tool was effective and did not have any bias or other factors that would invalidate results, as well as learn how to create such a tool.

An online survey was chosen as the tool of choice in order to obtain results from teachers for a variety of reasons. In order to reach as many teachers as possible I decided to go with a method that allowed me to reach teachers outside of the Worcester area via email or IR code. This cut down on the physical aspect of the survey and allowed for data to be compiled automatically, decreasing the overall strain of compiling results with a team of only one person. Secondly, an online survey created more flexible options for teachers to complete the survey. If the survey was physical it could get lost in paperwork and would need a conscious effort to start and complete. With an online survey, the survey would be very accessible to them and could be taken when they have a small reprieve in their schedule. Giving more flexibility to when the survey can be completed could increase the number of responses and the response rate.

2.1 Methodology

This survey was constructed as a part of PSY340X Survey Design course with the aid of Jackson Perry. Over the class time, Jackson and I were able to utilize the resources and opinions of our classmates in order to create a robust survey tool that could be utilized and gather meaningful data. The following is a review of our joint path and research towards creating the final survey product.

2.1.1 Literature Review

The most important factors that informed our decisions about design came from class and the readings. Most of the questions fell on Likert scales or utilized ranking of potential factors. Both of these techniques are described in Fink's *How to Conduct Surveys*. Likert scales are beneficial because they are easy to use and interpret, and they have been shown to be valid in a

number of settings. Ranking questions are also mentioned in Chapter 2, but we will find that ranking questions might not be the best in our situation.

Surveys for teachers and surveys about online courses are fairly commonplace in literature. Rotsaert et al conducted a survey on teachers about peer assessment and its educational value. Some of their demographic questions helped inform similar survey questions for the project, and their use of Likert-type scales helped validate the decision to do so. Although their topic was a little different, their research was a helpful jumping off point for the project.

2.1.2 Questionnaire Design

We designed the survey to appeal specifically to STEM teachers and to figure out their opinions on the importance of various aspects associated with online classrooms. This meant that we had to refine the jargon to fit terms that would be instantly recognizable to STEM teachers. Additionally, many questions clarify the terms through a quick example such as clarifying that online sharing sites are similar to the widely popular Google Classroom. These details will make the survey more personalized and welcoming to the target demographic.

We also chose to use importance as the main Likert scale because it makes the most sense for understanding the relative value of different features of an online class. The scale was a 5 point scale from Not at all Important to Very Important. Only having 5 ranking levels is something that Fowler says is a reasonable amount of options that people can meaningfully use for rating tasks, which allows for more accurate responses than other scales (Doyle, 2018). Larger scales would create confusion and be interpreted more differently than a 5 point ranking scale. This will eventually allow for results to show which aspects should be most heavily

advertised and provide more accurate results than questions that use language that may be misinterpreted.

The question order was based around asking similar questions together so that respondents could maintain train of thought. We grouped questions concerning their teaching background at the start of the survey in order to tailor further questions later around their answers with logic statements. Similar groupings of different question types proceeded until eventually we reach the demographics at the end of the survey. Chunking the surveys this way with page breaks allows for a very clean delivery where each time the respondent clicks the next arrow to move on they are answering a whole new set of questions that relate to one topic. The demographics being at the end ensures that by the time they reach the end of the survey and are tired of answering questions, they will be on easy and less important responses (Doyle, 2018).

2.1.3 *Implementation and Distribution Plan*

The ideal distribution plan for this survey is extensive and somewhat different than our pre testing phase. The survey is designed for middle and high school teachers in the Worcester area. As such, the sampling frame would be all the middle and high school math, science and computer science teachers in Worcester Public Schools (WPS). Contact information for these people can be easily obtained via the WPS website. After we get both mailing addresses and email for the sampling frame, implementation can begin.

We suggest using a simple random sample on this frame to obtain a sample of about 100 of the 200+ WPS teachers that fall into the desired population. We would begin by sending a mailed letter to everyone in the sample containing information about the survey, a $15 Amazon

gift card and a link to the survey. This would introduce participants to the survey, why it is important and why we chose them specifically. About one week later, we would send an email to the sample containing a link to the survey to reiterate the importance of taking the survey and allow quick and easy access to it. Finally, about two weeks later, a reminder email would be sent containing the link to the survey to anyone who had not yet taken it.

As mentioned in class, the goal for the survey is to optimize response rate. In order to do so, the plan to give multiple chances for completion could help. Additionally, adding the financial incentive of the gift card - specifically before the survey goes out - will usually result in a higher response rate. Finally, by giving the survey out in multiple modes (mail and email), people in the sample are more likely to respond (Doyle, 2018). The plan to use a simple random sample comes from Fink, as this method is the simplest and easiest to draw conclusions from (Fink, 2017). Finally, the larger sample size we selected will hopefully reduce sampling error through the random selection process (Fink, 2017).

2.1.4 *Pretesting Design and Implementation*

We decided to run the pretest in the STEM department of Doherty High School by contacting someone we had previously worked with that was the head of the math department at the school. Then we would supply her the link to the survey and she would distribute the survey for us which we hoped would provide a higher response rate due to her position. This would allow us to remotely reach science and math teachers which are the target demographic for the survey. Even though the sample would be smaller than we would like, the demographic would fit

better than using the SONA sample pool at WPI as most of the questions would be completely irrelevant for any demographic that is not a teacher.

The implementation of the plan worked better than expected. It turned out that we were able to have a cognitive interview with our contact, Renah Razzaq, and that helped to smooth out many smaller wording issues. This in turn helped the implementation of the pre-test for the rest of the respondents. We were lucky to have someone reliable enough to remotely hand out the link to the survey and get results for us. When we did end up getting results they were 100% gathered from the math department which shows the massive effect of Renah's influence on whether people responded or not. We were able to gather 10 responses and enough feedback to change multiple aspects of the survey.

2.1.5 Pretesting Results and Analysis

The first portion of the pretest was a cognitive interview with Mrs. Renah Razzaq, the head of the math department at Doherty Memorial High School in Worcester, MA. The researchers had connections to Mrs. Razzaq from the Teacher Preparation Program at WPI. For about two hours, we walked through a survey draft with Mrs. Razzaq, poring over each question, probing her for her interpretation and suggestions. Her insight was quite helpful. As a result of the interview, we added a question on what types of online classes respondents would be interested in, added examples of online sharing sites to prime response, added "check all that apply" where appropriate, and changed wording of some questions to utilize profession-specific vocabulary.

The second part of the pretest was to distribute the survey to the math department at Doherty through Mrs. Razzaq. The department is made up of 12 teachers, and as of the writing of this report, we have 10 responses. The small sample size reminded us to widen the sampling frame for the actual survey to all STEM teachers in Worcester Public Schools, over 200 teachers. However, preliminary responses from teachers in the pretest look promising. Eighty percent of respondents would consider taking a graduate course or an online course like the planned System Dynamics course. Some other important results are found below.

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	1	2.00	4.00	3.17	0.69	0.47	6

Figure 1: The summary data for the number of online classes respondents had taken.

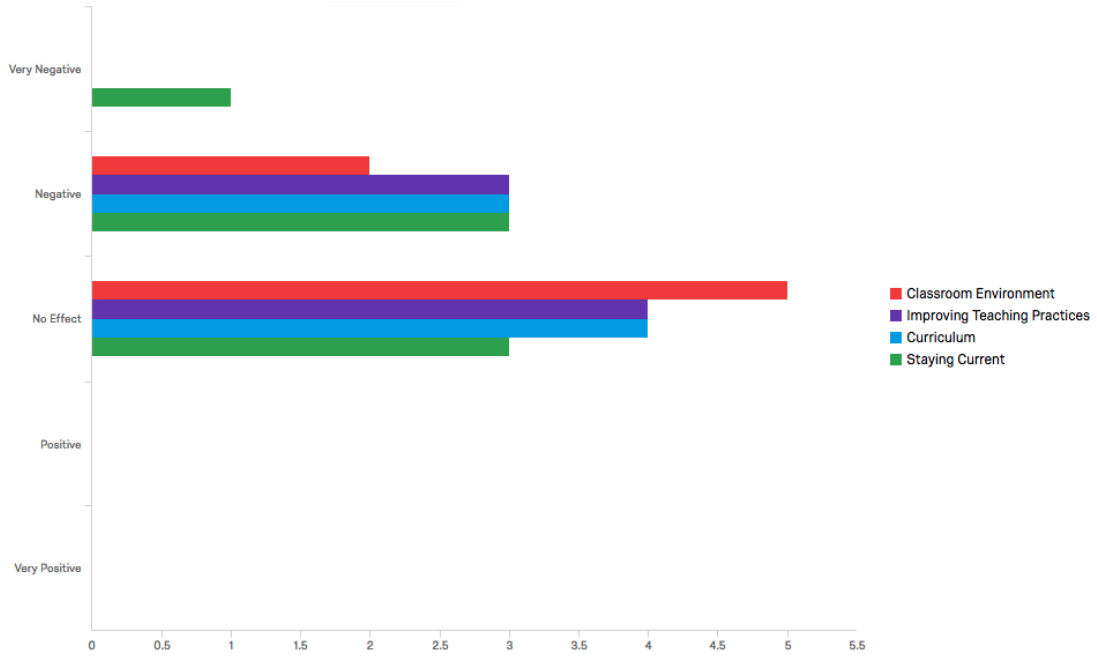

Figure 2: Responses to Question 11, the effect of their most recent online class on certain factors in their classroom. Note that the response scale has been flipped since testing. Most respondents answered "No Effect" or "Positive".

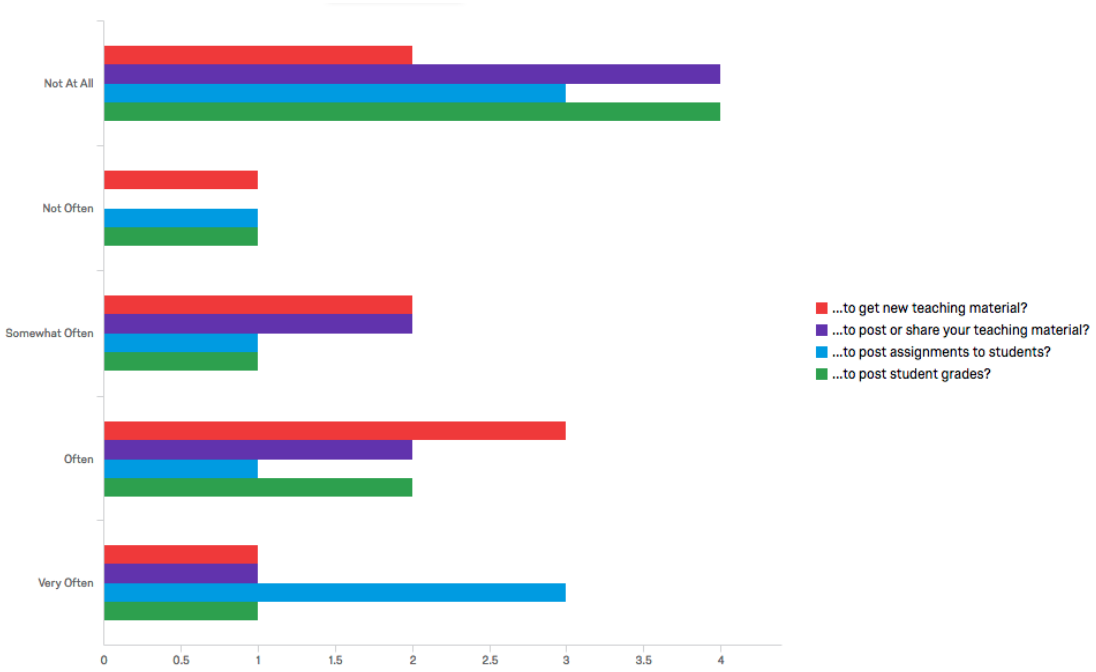

Figure 3: Respondents' use of online sharing sites to carry out activities in their classroom. Distribution is largely spread, so more data point may be needed.

In addition to the main questions, we added various questions about the clarity of the survey, question wording and response scales to get feedback about these aspects from respondents. We received three important points of feedback. One respondent was concerned about anonymity as a result of school and subjects taught questions; these characteristics may be identifying. Therefore, we changed the subjects taught question to a question about which department respondents were in. Secondly, respondents found the ranking questions, 4 and 8, problematic because some responses were non-factors to them. Therefore, instead of asking them

to rank different factors against each other, we had a separate importance scale for each individually. Next, one respondent made an important distinction between online classes taken out of desire and those taken out of requirement. As a result, we added a question about required online classes. Finally, we realized that many of the scales were flipped, namely that some went not important at all to very important and others went in reverse order. Therefore, we switched each to keep consistent throughout the survey.

2.2 Target Audience and Distribution

The target of the survey was K-12 STEM teachers, which made trying to get a large sample size difficult because of the lack of possible subjects. To try and alleviate this issue, the survey was distributed in two separate waves because of the limited population that could be collected from. The first survey was given out to STEM teachers at a teaching convention when they came by the WPI STEM education center booth. The survey was given out with a free commemorative pen from the STEM education center in order to incentivize a response. However, although there was a small gift given to participants in order to hopefully have the teacher return the favor, this survey was given out to 80 teachers but only got 19 responses for a 24% response rate. This was a simple random distribution method which was eventually scrapped as the number of responses and response rate were too low to obtain meaningful results. This method was not very successful, likely because there was very little positive reinforcement to take the survey and there was no way to follow up with any of the teachers who said they would take the survey but did not.

The next time I sent out the survey I chose to do a convenience sample by reaching out to teachers that the STEM education center had contact with, or with teachers from my home school district that qualified. This survey was given out to 60 teachers and 52 responded for a response rate of 87% which is very high. This high response rate was aided by the fact that we could contact the targets multiple times if necessary in order for the surveys to be completed. It was also helpful that many of the teachers were very willing to take the survey because they had either personal connections with either Shari Weaver, one of my advisors, or myself which made the interaction more personal. The only problem with this wave of the survey is that it was done through convenience so there could be some trends that are observed that instead relate to a different variable that is over documented in this sample.

The teachers that ended up being subjects were on average veteran teachers and many of them had taken multiple online classes with the mean ending up at 6.07 online classes per individual. This means that many of the results are based upon experience and multiple different environments rather than one-off experiences that could sway results or give misleading information which is important to note. In addition all teachers who took the survey had at least 6 years of teaching experience under their belt and many had many more years as a teacher completed. This should inform that the findings of this survey reflect the opinions of teachers who have more than likely completed multitudes of classes in order to maintain their licensure and understand the importance of staying up to date in their field.

2.3 Understanding Teacher Interests and Goals

My first goal in utilizing a survey was to understand why teachers wanted to teach in the first place and how they wanted to advance their career through further education. I asked

questioned concerning any non-teaching jobs and the why they would do a different job than teaching. This enables me to view what priorities teachers have in their profession and personal life and correlate that to their wants and priorities in the aspects of their online classroom. I also directed questions at the types of values they prioritize in further education. This type of questions allows me to commit resources in an efficient manner when building my prototype class and creating an assessment on what needs to be addressed in a teacher only learning environment.

2.3.1 How important is each factor when choosing a graduate course?

This is the first question I asked when trying to figure out some of the most important features to factor into the creation of an online classroom. I gave them the features of cost, proximity to home, flexibility, duration of program, school prestige, relevance to career, personal interest, possible pay raise, and needed for professional development. I felt that these choices would help me decide if utility of the course was the most important, whether their career advancement was the most important, or whether it was something they were doing for self-fulfillment

What I found when analyzing the data was that the most important qualities on average to teachers were proximity to their home, flexibility, and cost. These all had a mean score of around 4.30 out of 5 showing that they are rarely unimportant and key factors I should take into account. It shows that one of the major drives to making education succeed is allowing for it to be utilized effectively by the student. This didn't surprise me greatly, because one of the main aspects and selling points of online classrooms is that they can be accessed from anywhere and allow for different levels of flexibility in adult's schedules.

#	Field	Mean	Count
2	Proximity to Home	4.30	43
3	Flexibility	4.28	43
1	Cost	4.26	43
7	Personal Interest	4.16	43
6	Relevance to Career	4.07	43
4	Duration of Program	3.98	42
9	Professional Development	3.63	43
8	Possible Pay Raise	3.47	43
5	School Prestige	2.37	43

Figure 4: Respondent's Mean Score on Important Factors in Graduate Courses

One thing that did surprise me however was that this flexibility and utility outshined possible career development. Professional Development reasons and possible pay raise ranked in last, only more important than the prestige of the institution providing the course, which shows that just the creation of a course catered towards teachers would not be enough. While many respondents did say that those values were very important, they were also much more focused on whether they would enjoy the class and if the class could adapt to their busy schedule. Therefore, I think that creating classes with many interesting topics and modules that will help engage teachers in teaching classrooms will help improve attendance in these sort of programs.

2.3.2 How important was each factor when you took a non-teaching position?

When looking at this question, it was only asked to those who actually had taken up positions in the past that were non-teaching positions. By asking this questions I hoped to understand what factors would draw someone away from teaching to another profession in order to help alleviate those concerns with an online classroom. The results of this question showed that the major reasons for these teachers taking other positions was out of personal interest and

financial benefit. Every other reason was ranked at 1.36 or lower and was not important such as having not attained a license, no teaching positions, or not enough education.

The results of this question make a lot of sense when observing the previous question discussed above. The teachers are most concerned with something that actively engages them and helps to provide additional utility to their lives. In this case the utility comes in the form of a more interesting job or more money to live more comfortably. The best answer to this kind of data to focus heavily on making class information pertinent to a teacher's life. This can take the form of response questions that ask how you could phrase the information in a classroom setting to students or homework that has the teacher create a lesson plan to teach the material to show mastery.

2.4 Understanding Important Qualities of Online Classrooms

Another goal of utilizing my survey was to identify current failings of online classrooms and how current online classrooms are succeeding, and making those aspects favorable to teachers. If a new classroom can capitalize on the current success of the best online classrooms while also evolving through the use of ALT and the shortcomings of similar opportunities, the commercial success of such a classroom is possible.

2.4.1 What Influence did Online Classes have on Aspects of your Teaching Environment?

This question aims to understand what online classes are currently providing successfully to teachers. The options for teaching to provide feedback on are influences on classroom environment, improved teaching practices, curriculum, or staying current. The clearest positive impact of online classes comes from staying current with 80% stating that it was either a positive or very positive influence from taking an online class. Similar data is seen around how

classrooms improve teaching practices with around 72% of participants citing some positive impact. However around 40% of participants also stated that the online classrooms had no effect on their curriculum or their classroom environment. This provides some crucial information in the creation of an online classroom catered towards teachers. If there are many teachers coming out of normal online classes feeling like they can't improve their classroom environment or update their curriculum, than maybe this new class can try to actively change that as part of the class. The ALT states that if the information is more relevant to the learner than they will have an easier time taking in the information. This fits perfectly into classwork and homework that could be designed to empower teachers to teach the new material in their classroom and update their curriculums with new material each year.

2.4.2 How Important are the Following Aspects of an Online Class?

For this question I asked teachers about the different facets of an online class and whether they are important for an overall satisfactory experience or whether it doesn't matter. I queried them about the time commitment, applicability to the classroom, active community of peers, and accessibility of professor, professor expertise, subject material, and the credits the class provides. These features covers most of the crucial aspects that would have to be taken into account when creating and eventually monetizing an online classroom for teachers.

#	Question	Not Important At All		Not Very Important		Somewhat Important		Important		Very Important		Total
1	Time Commitment	0.00%	0	2.44%	1	14.63%	6	36.59%	15	46.34%	19	41
2	Applicable to Your Classroom	4.88%	2	2.44%	1	14.63%	6	31.71%	13	46.34%	19	41
3	Active Community of Peers	7.32%	3	19.51%	8	39.02%	16	21.95%	9	12.20%	5	41
4	Professor is Easily Accessible	4.88%	2	4.88%	2	46.34%	19	24.39%	10	19.51%	8	41
5	Professor Expertise	2.44%	1	4.88%	2	24.39%	10	39.02%	16	29.27%	12	41
6	Subject Material	0.00%	0	0.00%	0	12.50%	5	42.50%	17	45.00%	18	40
7	Credits Towards Degree	19.51%	8	9.76%	4	19.51%	8	17.07%	7	34.15%	14	41

Figure 5: Percentage of Respondents Answers to Important Qualities of Online Classrooms. Based on a Scale from Not Important at All to Very Important

The most important features for online classrooms from teachers were the time commitment, applicability to the classroom and subject material, which were all rated important by around 80% of participants. Both subject material and applicability both target the content of the classroom which indicates that how the class is structured and how the content is presented is critical to the success of the class. The material covered must be altered in ways that make it applicable to the classroom in a teaching scenario and be interesting with many real world applications. This information also has to be explained very succinctly in order to have a classroom with the least time commitment required in order to understand the information. Other techniques like breaking up the lectures into chunks, or creating asynchronous sessions also alleviate some of the time commitment required, which seems to be an important aspect for many teachers.

The other point of interest within this question is how little the community of the class mattered to teachers. Around 30% of respondents said that it was not at all important or not very important, and with 40% responding that it didn't matter. This highlights that many teachers are much more focused on getting the best possible experience for themselves and are not concerned or enjoy having to cater their time to others. This goes back to the point that utility aspects of the classroom seem to be valued very highly, and that working with others is a very high cost activity that requires additional planning that might just not be possible in a teacher's schedule. This would make sense then as to why an active community is not important to teachers. Although many online classrooms suggest an active community with cooperation, it is possible that teachers would not work best in that sort of environment.

2.5 Demographics

During this survey some of the questions tried to find out more information about the respondents in order to understand if any trends could be based off of demographic data. The most notable standouts from this data are that 80% of respondents were from mathematics or science departments and that 62% of respondents were female. Neither of these however seem to be an influencing factor on any of the above questions. The one other key demographic I took was the level of teaching licensure in which 80% of respondents were professional licenses, 15% were initial and 5% were preliminary. This may be a much bigger factor in the experience they had answering the questions and I would look out for changes between teachers with less experience and veterans.

2.6 Key Findings

In summary the survey helped shed light on 3 major components of running a successful online class for STEM teachers. The first factor is that flexibility in the schedule, curriculum, and homework can go a long way to making the experience more enjoyable and can be utilized to make the class more engaging. Making the class able to be experienced in short or long intervals will also increase the possible amount of teachers that would be able to take the class while teaching and not compromise either job.

The second factor is that group work that requires direct coordination between two people should be taken off the table. Teachers clearly have addressed in the data of the survey that they do not care about getting to know their classmates as much and therefore group work would likely be more tedious than enriching. It is possible however, to make asynchronous interactions, such as in discussion boards that could allow for communication while not tying down two people together.

Finally, applicability of the content is critical to a teacher believing the class was worthwhile. To take advantage of this knowledge, which fits nicely into the ALT, we can utilize the fact that all students will have similar professional experiences as a teacher and create relevant problems for them to solve that they can use to enhance their own career. This will make the classes infinitely more valuable than a typical online classroom and enhance the value of the course.

Chapter 3: Interviews

To assess what aspects of online classrooms would be the most effective to implement, an interview was conducted of four different online STEM instructors from WPI. The interview

was 19 questions long in a semi-structured format where interviewees were probed further upon responses that were unique, interesting, or required more investigation to understand. All four interviewees had very similar responses to the questions asked, providing a solid foundation of some core principles to follow when constructing an online classroom due to the consistency of responses. There were four main takeaways that the interviews provided that should be accounted for in the creation of any online classroom.

3.1 Group Work

All four interviewees stated that for the most part group work tended to be more trouble than it was worth and the cons should be heavily considered before utilizing group work. Interviewee one said that "Especially for adults, there can be a substantial disconnect in time availability between partners. There can be jobs, differing time zones, or family life that may cause the group to not be able to communicate effectively, ridding the group work of its purpose." Although a general consensus was reached that group work can be an excellent tool for bringing classmates together, it runs into too many roadblocks. When the goal of online classrooms is to provide flexibility to learning, group work goes counter to that philosophy and design goal. Interviewee four also added that "I have had many classes where group projects have caused several students to drop the class because they could not properly complete the assignment in their group." Therefore, group projects should be only given out if the availability of the students to be able to complete the project in groups is thought out and planned.

3.2 Clarity

Another consensus between interviewees was a necessity for clarity in instructions, whether it be on assignments or in lectures. Interviewee one explained that “Many online instructors create assignments that leave out details by accident. When you create an assignment, a lot of the time you will assume that in class you will be able to answer any questions concerning unclear aspects of the assignment. With online classes this is not the case and can lead to students getting stuck.”

This idea of getting stuck should be avoided and clarity in word choice is crucial on assignments. The main thing to make especially clear is any step that requires some sort of outside software usage or is a step based around setting up the environment to do the assignment. If those sections are not close to word-for-word what needs to happen, the instructor risks some students not understanding how to start an assignment, getting frustrated, and in some cases not finishing the class.

3.3 Chunking Lectures

Another takeaway from the interviews was to break lectures down into easily consumable sections, preferably 15 minutes per section. The reason behind this idea was to make it easier to pick apart a 2 hour lecture a little bit at a time or find the part of the lecture the student is looking for. This specifically helps for creating a STEM teacher online classroom because teachers have extremely limited free times. It would be very difficult to have them sit down for two hours to listen to the whole lecture in one sitting. However, listening to only the first segment for 15 minutes would be a task that could be done in small bits of free time between work.

Additionally, this system allows for excellent integration into homework assignments. Homework assignments can be assigned to different segments of the lecture, so for example

questions 1-3 correspond to the first 15 minutes. This again adds more flexibility to how a student goes about the material and lets the student work at their own pace. The only requirement is that you need to build a lecture that is built around breaking it down in 5-6 chunks. For an online classroom for teachers this aspect in particular is critical in order to maximize the amount of opportunities they have to engage with the material.

3.4 Maximum Class Size

When looking at class size every interview answered with something around 10-12 students as an optimal number. When asked why it was so low the response from Interviewee one was “Feedback is the most critical aspect of communication in an online classroom. It allows you to clear up any misconceptions and touch base with your students to see where they are at. In classes sized 12 or lower, I can effectively give extensive feedback to all my students and help guide them towards success in my class. Any number higher than 12, and the quality of feedback would need to drop in order to grade the assignments on time.”

This response indicates that not only is a small class size preferable but that feedback is critical to the communication between teacher and student. There are not many points in an online classroom, especially an asynchronous one, where the teacher and student can communicate effectively. Assignment feedback is a great touchpoint that can be leveraged effectively in order to help keep everyone on track with the material. These responses showed that quality should come over quantity and that providing meaningful online experiences means taking a little extra care into making feedback meaningful.

Chapter 4: Prototype Classroom

After researching Adult Learning Theory, distributing and analyzing a survey, and conducting an interview, a prototype classroom was constructed via Google Classroom to

demonstrate what an ideal module for a System Dynamics course would look like. The previous feedback and information gained from those activities would be used to construct content that specifically targets STEM teachers and creates a unique experience in the online classroom sphere. Additionally the goal was to then distribute this prototype to a small group of volunteer subjects to provide feedback.

The classroom prototype was built around 2 lectures, each of them clocking in at 2 hours and broken down into six 15 minute segments. These lectures are broken up into either two parts of one concept or completely different trains of thought, allowing for flexibility in how you approach the lectures and the amount of time required to get a substantial section of the work completed.

The assignment also focused on creating a lesson plan for a classroom in order to maintain its pertinence to the learner's life. This was done by asking the learner questions concerning their personal life and then having them be able to explain how policy resistance is pertinent to their example. In this case, because all of the students will be STEM teachers, it is easy to personalize the information and assignment to be relevant.

Figure 6: A representation of what the lecture environment would look like to a student. This in particular is a short 7 minute introduction lecture.

System Dynamics Foundations: Managing Complexity

Professors: Oleg Pavlov and Shari Weaver

HW 1
Policy Resistance and reference modes

Learning Objectives: *This assignment provides an opportunity to practice your understanding of concepts introduced in the first lectures: policy resistance, unintended consequences, and unexpected behavior*

Places in this assignment that are marked with a ✎ symbol require output from you. **Please type your answers below each question**.

✎ Identify an example of policy resistance or unintended consequences from work, personal life or politics. [Policy resistance refers to situations where a policy was put in place, or actions taken, to achieve a desired outcome (i.e., a "goal'), but where an undesirable outcome eventually materialized as a result of unanticipated feedback(s).]

a. **(1 point)** Briefly describe the example. Be sure to identify the goal, the action(s) taken, and the unanticipated reaction.

b. **(1 point)** Draw reference modes for two variables in your example. Make sure to identify clearly these variables. [A reference mode is a sketch of the behavior of one or more key variables over time; it emphasizes the problematic pattern of behavior. Approximate scale information is required for the time-axis, but is optional for the vertical axis.] On your reference mode, please draw lines representing the feared, the hoped-for, and the historic (i.e. until "Now") behaviors. Note that feared and hoped-for curves are drawn after the time "Now." Sketch the graphs in some software package such as MS Word, MS Visio, Paint, Excel. You can also use a graphing app on iPad, or Bamboo sketch pad, etc. – there are many different options that are now available for drawing.

Figure 7: The created homework assignment for the prototype classroom with two main objectives to complete that draw on a learner's ability to reteach the material.

In addition to the assignment and lectures, a discussion board question was asked and students could respond to the post and to each other. This activity on a discussion board helps foster some discussion between peers, lets the instructor understand if people are correctly understanding the material, and isn't intrusive to the student's other time commitments. This relates back to the feedback on the survey where teachers did not care about a community of peers. A discussion board is the least intrusive way to have them interact with others while also

respecting the flexibility they want out of the online classroom. These parts of the prototype made up what was able to be built on the limited resources we had.

4.1 Shortcomings

The prototype classroom started off as a plan to gather lots of feedback as to whether all the feedback gained from research, interviews, and the survey was valid in usage. However, many different factors made it impossible to collect meaningful feedback and the prototype became an amalgamation of all of the research and as a starting point for future research and production rather than as a feedback tool.

To start, because of our limited funding we were unable to utilize any form of advanced learning platform, akin to something like Blackboard. This meant that the project had to utilize the free Google Classroom which had an assortment of issues. The first was that it did not allow many K-12 addresses to be valid student emails and cut the amount of possible subjects by around 60% due to their frustration through troubleshooting. Secondly, was that Google Classroom didn't have a lot of different pages to organize content and it got very constrained into one space which made it more of an information dump than would be desired.

Additionally, because of the scope of the prototype, it was unable to actually test for any concepts that require a teacher presence or time. The prototype is unable to accurately gauge feedback from assignments and how that affects learning, or how students take the time to utilize the fifteen minute chunks. These factors made it difficult to use as a feedback tool and so it was decided that future projects that follow this could utilize the prototype as a starting point.

Chapter 5: Conclusion

This project's scope was to understand how to create an effective online classroom environment for STEM teachers in order to foster better educational experiences that could be transferred into K-12 classrooms. This would allow for the further development of the education system and eventually increase the quality of education in the United States if the practice became widespread. This project utilized surveys, interviews, and research in order to properly inform a decision on the design of such a classroom. Ultimately, the project was able to create a prototype classroom that demonstrates many of the findings of the survey, interviews, and research and provided a baseline for future projects to create and market such a class.

Ultimately the project was limited by the timeframe, manpower, and funding to be able to reach completely conclusive results regarding the design of a STEM teacher online environment. The project was unable to reach a large population of STEM K-12 teachers due to the lack of manpower. Additionally, providing incentives to answer the survey or being able to ask subjects multiple times to complete the survey was impossible because of funding. The project had to rely on personal connections in order to assure high response rates.

Overall, I think the concept of an online classroom for STEM teachers is a concept that still has so much room to improve on. Surveys, interviews, and research suggest that flexibility and accommodating the learner will help increase the effectiveness of learning the material in adults. When applied to STEM teachers, we can focus even more directly on creating content and assignments specifically to bring the content back to the classroom and make the time spent in class and on assignments feel meaningful and important.

There are many factors I would wish to see future projects focus on to further refine the concept of the online STEM teacher learning experience. To start, a project that focused more on what makes a strong assignment would help to round out the research and findings of this project. This project was unable to test or ask any questions concerning assignments and relied on research from common practices in online classrooms. A further study with a test group over multiple lessons could prove fruitful as well. Additionally, someone could also look into how to make this idea profitable as it looks into a niche community that will always need education in some fashion to remain a teacher. All these concepts should be core points for future work into this concept.

If there is anything to remember when looking at STEM teachers as learners against other learners is that they need less external motivation and require more relevance to their lives and require higher levels of accommodation and flexibility than other groups. If those two factors can be accomplished, the online classroom environment created will be much more favorable for STEM teachers and will draw them in over other online or physical classroom experiences.

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Appendix

A. Pretested Survey

Teacher Survey

Start of Block: Past Education

This survey is designed to gauge interest in certain types of graduate courses. Please answer to the best of your ability to provide us with the most accurate information. Your time is greatly appreciated.

Page Break

The following questions will ask you about your past education as well as your interest in further education.

Q1 What is your highest level of education attained?

O High School Diploma (1)

O Some College (2)

O Associate's Degree (3)

O Bachelor's Degree (4)

O Some Graduate School (5)

O Master's Degree (6)

O PhD (7)

Q2 Since your most recent degree, have you worked in a non-teaching position while not teaching?

O Yes (1)

O No (2)

O Prefer Not to Say (3)

Display This Question:

If Since your most recent degree, have you worked in a non-teaching position while not teaching? = Yes

Q3 Since your most recent degree, how many years did you work in a non-teaching position before beginning teaching?

O Less than 2 years (1)

O 2-4 years (2)

O 4-6 years (3)

O 6 or more years (4)

Display This Question:
If Since your most recent degree, have you worked in a non-teaching position while not teaching? = Yes

Q4 Rank the most important reasons you took a non-teaching position?
_____ Financial Benefit (1)
_____ No Teaching Position Available (2)
_____ Had Not Attained License (3)
_____ Had Not Attained Advanced Degree (4)
_____ Personal Interest (5)
_____ Other (6)

Q5 Have you considered taking a graduate course?

O Definitely yes (1)

O Probably yes (2)

O Might or might not (3)

O Probably not (4)

O Definitely not (5)

Q6 Have you considered taking an online course?

O Definitely yes (1)

O Probably yes (2)

O Might or might not (3)

O Probably not (4)

O Definitely not (5)

Q7 What types of classes or Professional Development programs would interest you?

_____
_____
_____
_____
_____

Q8 Rank the most important factors when choosing a graduate course?

_____ Cost (1)
_____ Proximity to Home (2)
_____ Flexibility (3)
_____ Duration of Program (4)
_____ School Prestige (5)
_____ Relevance to Career (6)
_____ Personal Interest (7)
_____ Possible Pay Raise (8)
_____ Professional Development (9)

End of Block: Past Education

Start of Block: Professional Development & Continued Learning

Q9 The following questions will ask you about your professional development progress and also inquire about your experiences with online classrooms in your continued learning.

Q10 Have you taken an online class for a PDP (Professional Development Program)?

O Yes (1)

O No (2)

Q11 How many online class have you taken?

	0	1	2	3	4	5	6	7	8	9	10
1 ()											

Display This Question:
If How many online class have you taken? [1] > 0

Q12 When was the last online class you took?

O Less than a year ago (1)

O 1-2 years ago (2)

O 2-3 years ago (3)

O 3+ years ago (4)

Display This Question:
If How many online class have you taken? [1] > 0

Q13 What was the quality of the most recent online class you took?

	Very Good (1)	Good (2)	Neutral (3)	Poor (4)	Very Poor (5)
Quality (1)	O	O	O	O	O

Q14 Through what graduate program, if any, did you take your most recent online class?

_____

Q15
Through what school, if any, did you take your most recent online class?

_____

Q16 What influence did the online class have on the following aspects of your teaching environment?

	Very Positive (1)	Positive (2)	No Effect (3)	Negative (4)	Very Negative (5)
Classroom Environment (1)	O	O	O	O	O
Improving Teaching Practices (2)	O	O	O	O	O
Curriculum (3)	O	O	O	O	O
Staying Current (4)	O	O	O	O	O

Q17 What reasons influenced your opinion to the above question?

_____
_____
_____
_____
_____

Q18 How important are the following aspects of an online class?

	Very Important (1)	Important (2)	Neutral (3)	Not Important (4)	Not at all important (5)
Time Commitment (1)	O	O	O	O	O
Applicable to Your Classroom (2)	O	O	O	O	O
Active Community of Peers (3)	O	O	O	O	O
Professor is Easily Accessible (4)	O	O	O	O	O
Professor Expertise (5)	O	O	O	O	O
Subject Material (6)	O	O	O	O	O
Credits Towards Degree (7)	O	O	O	O	O

Q19 How often do you use online sharing sites like Google Classroom...

	Very Often (1)	Often (2)	Somewhat Often (3)	Not Often (4)	Not At All (5)
...to get new teaching material? (1)	O	O	O	O	O

...to post or share your teaching material? (2)	O	O	O	O	O
...to post assignments to students? (3)	O	O	O	O	O
...to post student grades? (4)	O	O	O	O	O

End of Block: Professional Development & Continued Learning

Start of Block: Demographic

The following questions will ask you to provide demographic information to help inform the findings of this survey.

Q20 What is your gender?

O Male (1)

O Female (2)

O Other (3)

O Prefer Not to Say (4)

Q21 What is your age?

_____

Q22 For how many years have you been a teacher?

_____

Q23 What is your level of teaching licensure?

O Preliminary (1)

O Initial (2)

O Professional (3)

Q24 What school do you currently teach at?

_____

Q25 How long, in years, have you taught at this school? Do not count any time as a temporary substitute teacher.

_____

Q26 What subjects are you teaching at this school this academic year? Check all that apply.

☐ Algebra (1)

☐ Pre-Algebra (2)

☐ Pre-Calculus (3)

- [ ] Calculus (4)
- [ ] Statistics (5)
- [ ] Computer Science (6)
- [ ] Biology (7)
- [ ] Chemistry (8)
- [ ] Physics (9)
- [ ] Geology (10)
- [ ] Engineering (11)

Q27 What grade levels are you teaching this academic year? Check all that apply.

- [ ] Freshmen (1)
- [ ] Sophomores (2)
- [ ] Juniors (3)
- [ ] Seniors (4)

Q28 Approximately how many students are you teaching this academic year?

O 50 or fewer (1)

O Between 50 and 75 (2)

O Between 75 and 100 (3)

O Between 100 and 125 (4)

O Over 125 (5)

End of Block: Demographic

Start of Block: Block 3

These questions will help us improve the survey. Please respond with any helpful information.

Q29 Were any questions on the survey confusing? If so, describe the question and where your confusion was.

_____
_____
_____
_____
_____

Q30 Were there any questions on the survey where your preferred answer was not given as an option? If so, describe the question and what answer you would have liked to see.

_____
_____
_____
_____
_____

Q31 Were there any questions that could have been asked, but weren't? What questions, if any, would assist researchers in making the best online systems dynamics class?

_____
_____
_____
_____
_____

Q32 Any additional comments or suggestions.

_____
_____
_____
_____
_____

End of Block: Block 3

B. Revised Survey

Teacher Survey

Start of Block: Past Education

This survey is designed to gauge interest in certain types of graduate courses. Please answer to the best of your ability to provide us with the most accurate information. Your time is greatly appreciated.

Page Break

The following questions will ask you about your past education as well as your interest in further education.

Q1 What is your highest level of education attained?

O High School Diploma (1)

O Some College (2)

O Associate's Degree (3)

O Bachelor's Degree (4)

O Some Graduate School (5)

O Master's Degree (6)

O PhD (7)

Q2 Since your most recent degree, have you worked in a non-teaching position while not teaching?

O Yes (1)

O No (2)

O Prefer Not to Say (3)

Display This Question:

If Since your most recent degree, have you worked in a non-teaching position while not teaching? = Yes

Q3 Since your most recent degree, how many years did you work in a non-teaching position before beginning teaching?

O Less than 2 years (1)

O 2-4 years (2)

O 4-6 years (3)

O 6 or more years (4)

Display This Question:

If Since your most recent degree, have you worked in a non-teaching position while not teaching? = Yes

Q4 How important was each factor when you took a non-teaching position?

	Not Important At All (1)	Not Very Important (2)	Somewhat Important (3)	Important (4)	Very Important (5)
Financial Benefit (1)	O	O	O	O	O
No Teaching Position Available (2)	O	O	O	O	O
Had Not Attained License (3)	O	O	O	O	O
Had Not Attained Advanced Degree (4)	O	O	O	O	O
Personal Interest (5)	O	O	O	O	O
Other (6)	O	O	O	O	O
Other (7)	O	O	O	O	O

Q5 Have you considered taking a graduate course?

O Definitely yes (1)

O Probably yes (2)

O Might or might not (3)

O Probably not (4)

O Definitely not (5)

Q6 Have you considered taking an online course?

O Definitely yes (1)

O Probably yes (2)

O Might or might not (3)

O Probably not (4)

O Definitely not (5)

Q7 What types of classes or Professional Development programs would interest you?

_____
_____
_____
_____
_____

Q8 How important is each factor to you when choosing a graduate course?

	Not Important At All (1)	Not Very Important (2)	Somewhat Important (3)	Important (4)	Very Important (5)
Cost (1)	O	O	O	O	O
Proximity to Home (2)	O	O	O	O	O
Flexibility (3)	O	O	O	O	O
Duration of Program (4)	O	O	O	O	O
School Prestige (5)	O	O	O	O	O
Relevance to Career (6)	O	O	O	O	O
Personal Interest (7)	O	O	O	O	O
Possible Pay Raise (8)	O	O	O	O	O
Professional Development (9)	O	O	O	O	O

End of Block: Past Education

Start of Block: Professional Development & Continued Learning

The following questions will ask you about your professional development progress and also inquire about your experiences with online classrooms in your continued learning.

Q9 Have you taken an online class for a PDP (Professional Development Program)?

O Yes (1)

O No (2)

Q10 Have you taken an online class for a required task (ex: ALICE Training)?

O Yes (1)

O No (2)

Q11 How many online classes have you taken?

	0	1	2	3	4	5	6	7	8	9	10
1 ()											

Display This Question:

If How many online classes have you taken? [1] > 0

Q12 When was the last online class you took?

O Less than a year ago (1)

O 1-2 years ago (2)

O 2-3 years ago (3)

O 3+ years ago (4)

Display This Question:
If How many online classes have you taken? [1] > 0

Q13 What was the quality of the most recent online class you took?

	Very Poor (1)	Poor (2)	Neutral (3)	Good (4)	Very Good (5)
Quality (1)	O	O	O	O	O

Q14 Through what graduate program, if any, did you take your most recent online class?

_____

Q15
Through what school, if any, did you take your most recent online class?

_____

Q16 What influence did the online class have on the following aspects of your teaching environment?

	Very Negative (1)	Negative (2)	No Effect (3)	Positive (4)	Very Positive (5)
Classroom Environment (1)	O	O	O	O	O
Improving Teaching Practices (2)	O	O	O	O	O

Curriculum (3)	O	O	O	O	O
Staying Current (4)	O	O	O	O	O

Q17 What reasons influenced your opinion to the above question?

_____
_____
_____
_____
_____

Q18 How important are the following aspects of an online class?

	Not Important At All (1)	Not Very Important (2)	Somewhat Important (3)	Important (4)	Very Important (5)
Time Commitment (1)	O	O	O	O	O
Applicable to Your Classroom (2)	O	O	O	O	O
Active Community of Peers (3)	O	O	O	O	O
Professor is Easily Accessible (4)	O	O	O	O	O
Professor Expertise (5)	O	O	O	O	O

Subject Material (6)	O	O	O	O	O
Credits Towards Degree (7)	O	O	O	O	O

Q19 How often do you use online sharing sites like Google Classroom...

	Not At All (1)	Not Often (2)	Somewhat Often (3)	Often (4)	Very Often (5)
...to get new teaching material? (1)	O	O	O	O	O
...to post or share your teaching material? (2)	O	O	O	O	O
...to post assignments to students? (3)	O	O	O	O	O
...to post student grades? (4)	O	O	O	O	O

End of Block: Professional Development & Continued Learning

Start of Block: Demographic

The following questions will ask you to provide demographic information to help inform the findings of this survey.

Q20 What is your gender?

O Male (1)

O Female (2)

O Other (3)

O Prefer Not to Say (4)

Q21 What is your age?

_____

Q22 For how many years have you been a teacher?

_____

Q23 What is your level of teaching licensure?

O Preliminary (1)

O Initial (2)

O Professional (3)

Q24 What school do you currently teach at?

_____

Q25 How long, in years, have you taught at this school? Do not count any time as a temporary substitute teacher.

_____

Q26 Which academic department(s) are you a part of at your school? Check all that apply.

- ☐ Mathematics (1)
- ☐ Science (2)
- ☐ Engineering (3)
- ☐ Computer Science (4)
- ☐ Other: (13) _____
- ☐ Other: (14) _____

Q27 What grade levels are you teaching this academic year? Check all that apply.

- ☐ Freshmen (1)
- ☐ Sophomores (2)
- ☐ Juniors (3)
- ☐ Seniors (4)

Q28 Approximately how many students are you teaching this academic year?

O 50 or fewer (1)

O Between 50 and 75 (2)

O Between 75 and 100 (3)

O Between 100 and 125 (4)

O Over 125 (5)

End of Block: Demographic

Start of Block: Block 3

Q29 These questions will help us improve the survey. Please respond with any helpful information.

Q30 Were any questions on the survey confusing? If so, describe the question and where your confusion was.

_____
_____
_____
_____
_____

Q31 Were there any questions on the survey where your preferred answer was not given as an option? If so, describe the question and what answer you would have liked to see.

_____
_____
_____
_____
_____

Q32 Were there any questions that could have been asked, but weren't? What questions, if any, would assist researchers in making the best online systems dynamics class?

_____
_____
_____
_____
_____

Q33 Any additional comments or suggestions.

_____
_____
_____
_____
_____

End of Block: Block 3

C. Results of Final Survey Tool

Default Report

Teacher Survey School/Other Results

April 19th 2019, 2:47 am MDT

Q1 - What is your highest level of education attained?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your highest level of education attained?	4.00	7.00	5.70	0.73	0.53	50

#	Answer	%	Count
1	High School Diploma	0.00%	0
2	Some College	0.00%	0
3	Associate's Degree	0.00%	0
4	Bachelor's Degree	12.00%	6
5	Some Graduate School	10.00%	5
6	Master's Degree	74.00%	37
7	PhD	4.00%	2
	Total	100%	50

Q2 - Since your most recent degree, have you worked in a non-teaching position while not teaching?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Since your most recent degree, have you worked in a non-teaching position while not teaching?	1.00	2.00	1.66	0.47	0.22	50

#	Answer	%	Count
1	Yes	34.00%	17
2	No	66.00%	33
3	Prefer Not to Say	0.00%	0
	Total	100%	50

Q3 - Since your most recent degree, how many years did you work in a non-teaching position before beginning teaching?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Since your most recent degree, how many years did you work in a non-teaching position before beginning teaching?	1.00	4.00	2.58	1.32	1.74	12

#	Answer	%	Count
1	Less than 2 years	33.33%	4
2	2-4 years	16.67%	2
3	4-6 years	8.33%	1
4	6 or more years	41.67%	5
	Total	100%	12

Q4 - How important was each factor when you took a non-teaching position?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
5	Personal Interest	1.00	5.00	4.42	1.11	1.24	12
1	Financial Benefit	2.00	5.00	4.08	1.07	1.15	13
6	Other	1.00	5.00	3.00	2.00	4.00	2
3	Had Not Attained License	1.00	5.00	1.36	1.15	1.32	11
2	No Teaching Position Available	1.00	4.00	1.36	0.88	0.78	11

4	Had Not Attained Advanced Degree	1.00	2.00	1.18	0.39	0.15	11
7	Other	1.00	1.00	1.00	0.00	0.00	1

#	Question	Not Important At All		Not Very Important		Somewhat Important		Important		Very Important		Total
1	Financial Benefit	0.00%	0	7.69%	1	30.77%	4	7.69%	1	53.85%	7	13
2	No Teaching Position Available	81.82%	9	9.09%	1	0.00%	0	9.09%	1	0.00%	0	11
3	Had Not Attained License	90.91%	10	0.00%	0	0.00%	0	0.00%	0	9.09%	1	11
4	Had Not Attained Advanced Degree	81.82%	9	18.18%	2	0.00%	0	0.00%	0	0.00%	0	11
5	Personal Interest	8.33%	1	0.00%	0	0.00%	0	25.00%	3	66.67%	8	12
6	Other	50.00%	1	0.00%	0	0.00%	0	0.00%	0	50.00%	1	2
7	Other	100.00%	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0	1

Q5 - Have you considered taking a graduate course?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Have you considered taking a graduate course?	1.00	5.00	2.05	1.31	1.72	43

#	Answer	%	Count
1	Definitely yes	51.16%	22
2	Probably yes	18.60%	8
3	Might or might not	11.63%	5
4	Probably not	11.63%	5
5	Definitely not	6.98%	3
	Total	100%	43

Q6 - Have you considered taking an online course?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Have you considered taking an online course?	1.00	5.00	1.91	1.20	1.43	43

#	Answer	%	Count
1	Definitely yes	51.16%	22
2	Probably yes	25.58%	11
3	Might or might not	11.63%	5
4	Probably not	4.65%	2
5	Definitely not	6.98%	3
	Total	100%	43

Q7 - What types of classes or Professional Development programs would interest you?

What types of classes or Professional Development programs would interest you?
classes without a lot of outside work. Informative Lectures, discussions, activities, and meet ups with professionals.
STEM incorporating inquiry based learning to meet MA standards
Nothing at time to be completely honest
Math Classes for secondary school Technology Teaching Tool Classes for secondary school Best Practices in Math Classes for secondary school

Technology integration in mathematics instruction.

Mathematics courses, both applied and pure mathematics.

I'm a year away from retirement after 30 years of teaching. I've taken enough graduate courses.

Masters in Math

ones that provides things I can bring to classroom

Any PD that includes STEM, wellness (mental and physical), and special education issues

Ones that involve teaching honors math. Classes like Andrew Chen runs...he's a phenomenal teacher!

Content based

Online or nearby graduate level classes in math that are teaching-specific, esp those that are affordable! There is a deficit of these kinds of classes available, yet they are needed for current teachers to recert.

At this point in time, not very many and since retirement, courses in crafts such as pottery and weaving of greater interest than PD.

STEAM

Common planning time with other teachers of like subjects to collaborate and share materials.

classroom management motivating students

Experiential workshops - I want to learn by doing and making. Otherwise, I might as well just read a teaching book.

Education Math

SCIENCE Chemistry

classes sharing hands-on science investigations/experiments

Educational Leadership

I have just recently got my CAGS in administration. I am also currently taking online classes that focus on teaching mathematics. I need to take so many of these courses to get my professional teaching license. Courses that meet the requirements set by the state for my license are always the courses I would be most interested in. The more practical to my everyday teaching they are the more I would like them.

Leadership/ Mansgement

I would want graduate level courses in my content area

Math Classes

Trauma informed teaching practices

Science content-classes based on teaching the new science standards and new techniques to use with the students, student development and psychology, teaching English language learners, teaching special education students

I constantly look for classes and course that are developed with the math teacher in mind. Many PD course are not content specific and therefore they don't offer valuable strategies for teaching in the classroom. This is what is important to me. I have earned my masters degree, took post grad courses for credit and PDPs, and am currently working on my doctorate.

Anything that would add to my teaching. Different technology, methods of presenting, ways to incorporate real life situations into the curriculum.

Anything to do with biology and new ways to teach biology.
science stem coaching adolescent development
Current technology to improve student engagement in science
Interactive courses that provide hands on learning experiences for me to possibly use with my students.
none
Classroom management techniques How to speed up grading

Q8 - How important is each factor to you when choosing a graduate course?

#	Field	Mean	Count
2	Proximity to Home	4.30	43
3	Flexibility	4.28	43
1	Cost	4.26	43
7	Personal Interest	4.16	43
6	Relevance to Career	4.07	43
4	Duration of Program	3.98	42

9	Professional Development	3.63	43
8	Possible Pay Raise	3.47	43
5	School Prestige	2.37	43

#	Question	Not Important At All		Not Very Important		Somewhat Important		Important		Very Important		Total
1	Cost	4.65%	2	2.33%	1	9.30%	4	30.23%	13	53.49%	23	43
2	Proximity to Home	2.33%	1	0.00%	0	6.98%	3	46.51%	20	44.19%	19	43
3	Flexibility	2.33%	1	2.33%	1	9.30%	4	37.21%	16	48.84%	21	43
4	Duration of Program	2.38%	1	4.76%	2	21.43%	9	35.71%	15	35.71%	15	42
5	School Prestige	20.93%	9	32.56%	14	37.21%	16	6.98%	3	2.33%	1	43
6	Relevance to Career	4.65%	2	2.33%	1	18.60%	8	30.23%	13	44.19%	19	43
7	Personal Interest	0.00%	0	4.65%	2	16.28%	7	37.21%	16	41.86%	18	43
8	Possible Pay Raise	13.95%	6	9.30%	4	23.26%	10	23.26%	10	30.23%	13	43

9	Professional Development	9.30%	4	9.30%	4	23.26%	10	25.58%	11	32.56%	14	43

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
2	Proximity to Home	1.00	5.00	4.30	0.79	0.63	43
3	Flexibility	1.00	5.00	4.28	0.90	0.81	43
1	Cost	1.00	5.00	4.26	1.04	1.07	43

Q5 - Have you taken an online class for a PDP (Professional Development Program)?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Have you taken an online class for a PDP (Professional Development Program)?	1.00	2.00	1.23	0.42	0.18	43

#	Answer	%	Count
1	Yes	76.74%	33

2	No	23.26%	10
	Total	100%	43

Q37 - Have you taken an online class for a required task (ex: ALICE Training)?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Have you taken an online class for a required task (ex: ALICE Training)?	1.00	2.00	1.16	0.37	0.14	43

#	Answer	%	Count
1	Yes	83.72%	36
2	No	16.28%	7
	Total	100%	43

Q6 - How many online classes have you taken?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count

1	1	1.00	10.00	6.07	2.98	8.88	42

Q7 - When was the last online class you took?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	When was the last online class you took?	1.00	4.00	1.65	0.96	0.93	40

#	Answer	%	Count
1	Less than a year ago	62.50%	25
2	1-2 years ago	17.50%	7
3	2-3 years ago	12.50%	5
4	3+ years ago	7.50%	3
	Total	100%	40

Q8 - What was the quality of the most recent online class you took?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count

1	Quality	1.00	4.00	1.85	0.73	0.53	40

#	Answer	%	Count
1	Very Good	32.50%	13
2	Good	52.50%	21
3	Neutral	12.50%	5
4	Poor	2.50%	1
5	Very Poor	0.00%	0
	Total	100%	40

Q9 - Through what graduate program, if any, did you take your most recent online class?

Through what graduate program, if any, did you take your most recent online class?
NA
Learner's Edge - earn credits past master's for pay increase
I am presently enrolled in Blended and Personalized Learning offered by Fitchburg State University

M. Ed. C&I Mathematics

Secondary Education

School PD this year ALICE on-line start of the school year.

Umass Lowell

n/a

Merrimack College - Curriculum and Instruction

Master Class on Writing from Malcolm Gladwell

n/a

Educational Administration

Umass Lowell Doctorate in Education STEM

not for a graduate program

N/A

GRADUATE PROGRAM, Worcester State University WSU

Middle School Science MS

I have been taking classes through TeacherStep.com which is accredited through Converse College.

None

Masters in education with a concentration in high school Math

Masters in ed

Lesley Master in Education

University of New England's Educational Doctorate

Learner's Edge

Teachers for a Global Classroom - Fullbright Scholarship program

american museum of natural history science program

SNHU

none

Framingham State University PBTL

Q10 - Through what school, if any, did you take your most recent online class?

Through what school, if any, did you take your most recent online class?

Univeristy of Illinois (Mook) ; great Courses;

Learner's Edge

Not sure ...had a choice of schools to receive credit

Fitchburg State University

Concordia University Portland

Worcester State University

Never.

ALICE training

Umass Lowell

Framingham State University

not a college

Merrimack College - Curriculum and Instruction

CHS

Worcester State

Umass Lowell

it was an internal class through my district

N/A

WTHS

WSU

Lesley Ed

I have been taking classes through TeacherStep.com which is accredited through Converse College.

None

Colorado state

WSU

AIC Framingham state

Lesley

UNE

Augustana University

George Washington University.

credits given thru Framingham state

American Museum of Natural History / Framingham State

Discovery Education or PBS Learning

none

Framingham State University

Q11 - What influence did the online class have on the following aspects of your teaching environment?

#	Question	Very Negative		Negative		No Effect		Positive		Very Positive		Total
1	Classroom Environment	0.00%	0	0.00%	0	37.50%	15	42.50%	17	20.00%	8	40
2	Improving Teaching Practices	0.00%	0	0.00%	0	27.50%	11	50.00%	20	22.50%	9	40
3	Curriculum	0.00%	0	0.00%	0	42.50%	17	32.50%	13	25.00%	10	40
4	Staying Current	0.00%	0	0.00%	0	20.51%	8	46.15%	18	33.33%	13	39

Q12 - What reasons influenced your opinion to the above question?

What reasons influenced your opinion to the above question?

Most graduate programs are not applicable to the High School standards we must implement, but they do improve teacher background knowledge and other externalities.

I enjoy learning new techniques to help my students improve their math skills. This was offered as a course to help students improve their skills.

I've used units and lessons I prepared in my program and have applied philosophies so studied to my pedagogy.

I enjoy teaching and I beleive that if teaching is truly to be consodered a profession, then we need to stay up to date with research in education.

We have fantastic PD at my school.

Experience with the people in my class; weekly comments

I gained perspective from my class, esp in terms of how I structure online components of my own classes. I also feel 100% that you have to put in what you expect to get OUT of any grad level course.

According to current interests.

Exploring a new technology for my classes helps me to communicate and hold students responsible for meeting deadlines

The class did not pertain to my classroom/subject matter

usefulness of class

ALICE

The course was relevant to my interest

good online interaction and culture great sharing of ideas and resources for teaching use of technology in the classroom

I find online classes less effective in my learning. I take them for the flexibility in when I can take the course and the cost being much lower while still meeting the requirements set by the state for my teaching license.

To stay current was the main reason

Content Knowledge

Bettering practice

My online program through Lesley helped me try out new activities in my class and kept me up to date on current information in science.

I thought about the conversations in discussion boards with peers, the weekly conference calls and video chats, and well as the content of the course. Though these activities I have been able to learn and readjust my teaching to improve how i present content to students allowing them better opportunities for learning through improved teacher practices and a more positive environment as there is not as much dread about coming to class. My curriculum was not changes as I must meet, federal, state, and local guidelines- there isn't much room for flexibility and I have always stayed current.

I was given practices and ideas to enhance the curriculum and ways I teach students.

---

new information re: genetic research

The interactions with peers to develop methods to easily transition learned material into classroom experiences for students

---

The course provided relevant material I could use in my course.

It was required by state law for all teachers to take that on-line training course.

It was very fun and applied to teaching, which I have only been doing for ~6 years. So I needed to learn so much and it was very helpful.

Q13 - How important are the following aspects of an online class?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Time Commitment	2.00	5.00	4.27	0.80	0.64	41
2	Applicable to Your Classroom	1.00	5.00	4.12	1.06	1.13	41
3	Active Community of Peers	1.00	5.00	3.12	1.09	1.18	41
4	Professor is Easily Accessible	1.00	5.00	3.49	1.02	1.03	41
5	Professor Expertise	1.00	5.00	3.88	0.97	0.94	41
6	Subject Material	3.00	5.00	4.33	0.69	0.47	40
7	Credits Towards Degree	1.00	5.00	3.37	1.51	2.28	41

#	Question	Not Important At All		Not Very Important		Somewhat Important		Important		Very Important		Total
1	Time Commitment	0.00%	0	2.44%	1	14.63%	6	36.59%	15	46.34%	19	41
2	Applicable to Your Classroom	4.88%	2	2.44%	1	14.63%	6	31.71%	13	46.34%	19	41

3	Active Community of Peers	7.32%	3	19.51%	8	39.02%	16	21.95%	9	12.20%	5	41
4	Professor is Easily Accessible	4.88%	2	4.88%	2	46.34%	19	24.39%	10	19.51%	8	41
5	Professor Expertise	2.44%	1	4.88%	2	24.39%	10	39.02%	16	29.27%	12	41
6	Subject Material	0.00%	0	0.00%	0	12.50%	5	42.50%	17	45.00%	18	40
7	Credits Towards Degree	19.51%	8	9.76%	4	19.51%	8	17.07%	7	34.15%	14	41

Q18 - How often do you use online sharing sites like Google Classroom...

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	...to get new teaching material?	1.00	5.00	3.02	1.39	1.93	41
2	...to post or share your teaching material?	1.00	5.00	3.66	1.44	2.08	41
3	...to post assignments to students?	1.00	5.00	3.71	1.55	2.40	41
4	...to post student grades?	1.00	5.00	3.02	1.92	3.68	41

#	Question	Not At All		Not Often		Somewhat Often		Often		Very Often		Total
1	...to get new teaching material?	12.20%	5	34.15%	14	17.07%	7	12.20%	5	24.39%	10	41
2	...to post or share your teaching material?	9.76%	4	19.51%	8	9.76%	4	17.07%	7	43.90%	18	41
3	...to post assignments to students?	14.63%	6	14.63%	6	7.32%	3	12.20%	5	51.22%	21	41
4	...to post student grades?	46.34%	19	0.00%	0	2.44%	1	7.32%	3	43.90%	18	41

Q19 - What is your gender?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your gender?	1.00	2.00	1.63	0.48	0.23	40

#	Answer	%	Count
1	Male	37.50%	15

2	Female	62.50%	25
3	Other	0.00%	0
4	Prefer Not to Say	0.00%	0
	Total	100%	40

Q20 - What is your age?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your age?	1.00	81.00	46.00	12.78	163.42	38

Q21 - For how many years have you been a teacher?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	For how many years have you been a teacher?	6.00	50.00	18.57	8.89	79.09	40

Q22 - What is your level of teaching licensure?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count

1	What is your level of teaching licensure?	1.00	3.00	2.74	0.54	0.29	39

#	Answer	%	Count
1	Preliminary	5.13%	2
2	Initial	15.38%	6
3	Professional	79.49%	31
	Total	100%	39

Q23 - What school do you currently teach at?

What school do you currently teach at?

CHS
Trottier Middle School
Chelmsford High School
Chelmsford High School
High School

Worcester Technical High School
Wilton community school district. Wilton IA.
Worcester Tech
CHS
Auburn Middle School
Chelmsford high school
Millbury Jr. Sr. High
Chelmsford High
None
CHS
Worcester Technical High School
CHS
Chelmsford High School
WTHS
Worcester Technical High School

Trottier Middle

Chelmsford High School

Just retired

Millbury

Chelmsford High

WTHS

Brookside

Trottier Middle School

Chelmsford High School

Chelmsford High School

Chelmsford High School

Trottier Middle School

Trottier Middle School

Chelmsford High School

Trottier Middle School

Q24 - How long, in years, have you taught at this school? Do not count any time as a temporary substitute teacher.

How long, in years, have you taught at this school? Do not count any time as a temporary substitute teacher.

18
15
5
13
19
12
4
25 years
16
8
7
13
32 years

This is my 4th year.

0
12
17
12
16
11
16
12
15 years
8
32
18
21
18

10
11
8
17
11
18
7
15 years
14
2

Q25 - Which academic department(s) are you a part of at your school? Check all that apply.

#	Answer	%	Count
1	Mathematics	38.10%	16
2	Science	35.71%	15

3	Engineering	9.52%	4
4	Computer Science	2.38%	1
13	Other:	11.90%	5
14	Other:	2.38%	1
	Total	100%	42

Other:

Other: - Text
SPED
English
All subjects
English
All contents

Other:
Other: - Text

Q26 - What grade levels are you teaching this academic year? Check all that apply.

#	Answer	%	Count
1	Freshmen	21.62%	16
2	Sophomores	31.08%	23
3	Juniors	25.68%	19
4	Seniors	21.62%	16
	Total	100%	74

Q27 - Approximately how many students are you teaching this academic year?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Approximately how many students are you teaching this academic year?	1.00	5.00	3.62	1.12	1.26	37

#	Answer	%	Count
1	50 or fewer	8.11%	3

2	Between 50 and 75	2.70%	1
3	Between 75 and 100	32.43%	12
4	Between 100 and 125	32.43%	12
5	Over 125	24.32%	9
	Total	100%	37

D. Human Subject Certificate

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Ethan Marshall** successfully completed the NIH Web-based training course "Protecting Human Research Participants."

Date of Completion: 09/17/2018

Certification Number: 2935746

NIH National Institutes of Health Office of Extramural Research