Rationale Paper for a Master of Educational Technology at Boise State University

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INTRODUCTION

The Master of Educational Technology (MET) program at Boise State University aligns to the five standards established by the Association for Education Communications and Technology (AECT): content knowledge, content pedagogy, learning environments, professional knowledge and skills, and research. Below each standard, I have listed the indicators used by the AECT with the artifacts that demonstrate my mastery of that indicator.

STANDARD 1: CONTENT KNOWLEDGE

Indicator 1: Creating

Candidates demonstrate the ability to create instructional materials and learning environments using a variety of systems approaches. (Januszewski & Molenda, 2008, p. 81)

EDTECH 532: Contextual Transposition Lesson Plan: Aperture Science Portal Energy Analyzer

In this lesson, students are asked to apply their knowledge of conservation of energy to analyze the behavior of objects in the popular game *Portal 2*. Students begin by making observations in selected levels and using their observations to create energy bar charts, an important visual representation in physics (Van Heuvelen & Zou, 2001). Students must then engage in scientific argumentation by applying their observations to justify whether or not portals, a key game mechanic, obey the law of conservation of energy. Finally, students must use their knowledge to create their own levels that demonstrate an understanding of conservation of energy.

While I have not yet been able to use this lesson with students, this project gave me insight into the resources available to support the use of commercial games in education. During my background reading on *Portal 2*, I discovered STEAM for SCHOOLS, a program that provides a free version of games like *Portal 2* to schools for educational use. This moved developing my lesson from a purely academic exercise to something I can actually implement and expand upon. Working on this project also gave me my first exposure to *Portal 2*'s level builder, an impressive tool that is both extremely easy to use and very flexible. This provides students with opportunities to experiment with a broad range of conditions and variables, a feature that is considered crucial to educational simulations (Wieman & Perkins, 2006). Discovering that games like *Portal 2* are accessible to schools and contain features valuable to science education has opened the door for commercial games to come into my classroom.

Indicator 2: Using

Candidates demonstrate the ability to select and use technological resources and processes to support student learning and to enhance their pedagogy. (Januszewski & Molenda, 2008, p. 141)

EDTECH 521: Asynchronous Lesson: Bending Light

In this lesson, I used technology in several ways to support best practices in science. The lesson is an exploration of the refraction of light based on principles of discovery learning. One of the crucial tools in this lesson is a PhET simulation that uses conceptual enhancements to make apparent aspects of the phenomena that are normally hidden in the lab (Snir, Smith, & Grosslight, 1993). For example, the simulation provides a representation of light waves as they travel from one medium to another, allowing students to see changes in the speed and wavelength of the light, rather than relying on an instructor to provide the information.

I also used technology to incorporate structures for immediate feedback and mastery learning into this lesson. Several pages in the lesson require a password that can be obtained by mastering a previous stage of the lesson. For example, during the phase titled "The Formula," students are asked to determine a value for the index of refraction of a mystery material within a simulation. The value for that index then serves as the password to access the next phase of the lesson. This provides students with immediate feedback on their performance. In addition, since the site does not record or limit the number of attempts, the stakes for each attempt are very low, allowing students to make and correct mistakes as many times as necessary. According to Wormeli (2006), the use of low-stakes formative assessments with timely feedback has dramatic positive impacts on student learning (p. 28).

Indicator 3: Assessing/Evaluating

Candidates demonstrate the ability to assess and evaluate the effective integration of appropriate technologies and instructional materials.

EDTECH 505: Evaluation Project: Evaluation of Desmos for Use in Physical Science Courses

At the time I took EDTECH 505, my building was preparing to rollout a bring your own device (BYOD) policy. In anticipation of the policy, I was beginning to experiment with web-based graphing tools for use in my classroom, so the final project for EDTECH 505 provided an excellent opportunity to examine in-depth Desmos, one of the tools I was considering. This project provided valuable insight into the strengths and weaknesses of Desmos, as well as a clearer picture of my students' impressions of the tool. On an assessment of linear motion, a topic where Desmos was an important piece of my instruction, student scores rose an average of 34.5% from the pre-test to the post-test. In addition, while only 19 out of 112 students scored above mastery on the pre-test, every student achieved mastery on the post-test. On an attitudinal survey, students were generally positive towards Desmos, but expressed some confusion on how to perform important functions in Desmos. By combining student feedback with my observations from lessons using Desmos, I was able to provide resources targeting my students' confusion, including screencasts posted to my website, and additional instruction targeting specific student difficulties. As a result, students became more comfortable using Desmos and their focus could shift to interpreting the data they put into Desmos.

Indicator 4: Managing

Candidates demonstrate the ability to effectively manage people, processes, physical infrastructures, and financial resources to achieve predetermined goals. (Januszewski & Molenda, 2008, p. 178)

EDTECH 501: Technology Use Planning Overview

In this blog post, I critiqued the National Education Technology Plan and See's (1992) take on key features of a district technology plan and examined specific strengths and weaknesses of technology planning within my own district. While I was not directly involved in most of the decisions I discussed in the post, it demonstrates my ability to analyze characteristics of effective planning and decision-making. I have also applied the thinking I demonstrate in this post to make effective decisions within my district. When the 9th grade science teachers received a grant to purchase technology as part of a STEM integration initiative, the initial focus was on what decisions would allow us to purchase the greatest quantity of devices. By bringing up See's (1992) point that technology decisions should focus on application, I was able to switch the conversation to which devices would introduce the most new functionality to our classrooms, leading to a dramatically different decision than seemed likely at the start of the conversation.

Indicator 5: Ethics

Candidates demonstrate the contemporary professional ethics of the field as defined and developed by the Association for Educational Communications and Technology. (Januszewski & Molenda, 2008, p. 284)

EDTECH 502: Netiquette Page

In this project, I created a page of netiquette guidelines using the language of the "Titan Way," the framework for positive behavior interventions used in my building. According to Palloff and Pratt (2007), “...they key to successful online learning is the formation of an effective learning community…” (loc. 348) and establishing clear expectations for interaction is an important foundation for community-building. I have used this site and other materials to teach my students how to engage in positive, effective communication when we use online environments.

EDTECH 501: Digital Divide Presentation

For this presentation, I explored the definition of the digital divide, a gap in access to digital technologies, and how it has impacted the district where I work. I also proposed some solutions to reduce the impact of the digital divide. The research I conducted for this presentation made me more aware of how the use of technology in the classroom can exacerbate issues of inequality and gave me ideas on how to improve equity within my classroom. In the presentation, I identified classroom-level interventions, such as explicitly teaching digital skills like effective search techniques and instruction on the use of common software, that I make a conscious effort to implement in my classroom.

STANDARD 2: CONTENT PEDAGOGY

Indicator 1: Creating

Candidates apply content pedagogy to create appropriate applications of processes and technologies to improve learning and performance outcomes. (Januszewski & Molenda, 2008, p. 1)

EDTECH 521: Asynchronous Lesson: Bending Light

In this online lesson, students use a simulation to explore concepts related to refraction before receiving any direct instruction. This structure is based on principles of discovery learning, in which students explore a concept before the teacher provides any more background than absolutely necessary (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011, p. 5). Once students have established a conceptual foundation, students use the simulation again to determine a relationship between the incident angle, the material, and the refracted angle before being provided with the accepted version of the formula.

Throughout the lesson, students post to discussion forums to collaborate with their peers. This allows students to discuss and refine ideas while they are developing the knowledge, as well as to create social bonds within the course (Palloff & Pratt, 2007, loc. 2846).

When I adapted this lesson for use in my face-to-face classroom, I was extremely pleased with the results. During the initial exploration, students easily recognized key features of refraction using only the simulation and a few guiding questions. In subsequent lessons, students readily applied principles discovered during the exploration to analyze new situations. These experiences reinforced the value of discovery learning pedagogies in the physics classroom.

Indicator 2: Using

Candidates implement appropriate educational technologies and processes based on appropriate content pedagogy. (Januszewski & Molenda, 2008, p. 141)

EDTECH 532: Contextual Transposition Lesson Plan: Aperture Science Portal Energy Analyzer

In this lesson, students apply conservation of energy to analyze several levels in the commercial game *Portal 2* before using the game's level builder to create levels that demonstrate an understanding of conservation of energy. This lesson would provide a good fit for the model deployment phase of the Modeling Instruction approach (Jackson, Dukerich, & Hestenes, 2008). In this phase of instruction, students apply a model they have already developed to analyze situations and solve problems in order to reinforce key understandings. An important piece of a successful deployment phase is providing students with engaging situations to apply the model to. Many students naturally try apply their physics knowledge to determine whether a game they play is realistic, so a popular game like *Portal 2* can take advantage of questions students are already asking to provide that engaging situation. The approach I took with *Portal 2* can easily be expanded to use other games, ideally ones that my students have found, to take advantage of my students' natural curiosity.

Indicator 3: Assessing/Evaluating

Candidates demonstrate an inquiry process that assesses the adequacy of learning and evaluates the instruction and implementation of educational technologies and processes (Januszewski & Molenda, 2008, p. 116-117) grounded in reflective practice.

EDTECH 523: Blended Physics Course: Electricity Evaluation Plan

An important component of my EDTECH 523 project to develop a blended physics course was to develop a research-based evaluation plan to determine whether the instruction was achieving the desired outcomes. One of the key components of this plan is the Determining and Interpreting Resistive Electric Circuits Concepts Test (DIRECT) developed by Engelhardt (1997). As a validated assessment, there are published baselines for the expected gains on the assessment for students at various levels, including high school. By comparing gains made by students enrolled in the blended course to established baselines for high school students, it should be possible to draw conclusions about whether the online course is providing effective delivery of the intended content. In addition, since the DIRECT specifically targets common misconceptions, the results will provide insight into the misconceptions students retain at the end of the course, which can then guide future improvements to the course. As we consider offering a primarily online section of physics as a solution to declining enrollment, tools such as the DIRECT will be crucial in demonstrating that online instruction can be an effective way to deliver a physics course.

Indicator 4: Managing

Candidates manage appropriate technological processes and resources to provide supportive learning communities, create flexible and diverse learning environments, and develop and demonstrate appropriate content pedagogy. (Januszewski & Molenda, 2008, p. 175-193)

EDTECH 523: Blended Physics Course: Electricity Video Summary

Blended Physics Course: Electricity Schoology Site

***Username:* Tartan**

***Password:* Titan**

***School:* Tartan High School (55128)**

In this project, I developed a one-trimester physics course that would take place primarily online within the Schoology learning management system. This required me to consider how the tools available on Schoology could be used to effectively manage processes key to the course.

This course relies heavily on on active learning approaches. According to Palloff and Pratt (2007), the online learning environment “cannot be passive” (loc. 371) while Wieman (2014) shows that active learning strategies consistently lead to higher outcomes when compared to traditional direct instruction, even going so far as to call lecture “the pedagogical equivalent of bloodletting” (p. 8320). Since collaboration is a key feature of active learning (Palloff & Pratt, 2007), my first step was to use technology to manage the development of the collaborative, supportive learning environment crucial to the course’s success. In Module 0, I used Schoology’s threaded discussion tool to provide forums for a community-building activity and for collaboratively developing a set of class norms. This sets the stage for ongoing collaboration as students share their thinking and challenge the ideas of their classmates in order to develop knowledge in a social-constructivist setting (Duit & Treagust, 1998).

I also had to consider how I would use technology to manage the learning itself. A key feature of this course are open-ended, flexible activities prior to direct instruction that provide students the opportunity to engage in the scientific process and develop scientific reasoning skills (Lawson, 2001). This approach to learning is a complex process that can be difficult to manage even with the immediate interactions and nonverbal cues available when the teacher and student are in the same room, so it was critical that I consider how to manage this process remotely. The first step was having students sign up for a lab partner in Module 0, ensuring each student will have a peer to discuss ideas and questions with as they work through the material. Students also post to discussion forums at least once during each content-oriented module, providing me an opportunity to monitor my students' thinking and provide correction as necessary.

Since this course is structured on principles of discovery learning, it will be important that students not have access to the direct instruction until after they have completed and discussed the activities involved in constructing the target knowledge (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011, p. 5). While the version of the course currently has all items completely visible, during implementation, I will make use of Schoology's options to set visibility on specific elements to hide direct instruction until students have completed other portions of each module.

Indicator 5: Ethics

Candidates design and select media, technology, and processes that emphasize the diversity of our society as a multicultural community. (Januszewski & Molenda, 2008, p. 296)

EDTECH 541: Social Networking Project: Egg Lander Challenge

In this lesson, large teams split into smaller groups to work on different aspects of a larger engineering design challenge. Throughout the project, teams use social networking tools to communicate across groups. The school I work in is seeing a growing range of cultures represented among our student population, and many students find it more comfortable to establish relationships with students from a different culture in online settings than by communicating face-to-face. This can be leveraged to place students in teams with students from dramatically different cultural backgrounds from their own, giving them the opportunity to collaborate on a complex challenge in a relatively safe space. While my district blocks most social media sites on school networks, making it difficult to implement this project as written, it pushed me to consider how I can use the tools we have available to produce similar benefits. A wiki page or comments on a Google Site may be able to provide a similarly informal setting where students can interact similar to how they would on social media. Providing students with opportunities to bridge cultural gaps and develop relationships in one of these low-risk settings should translate to more effective collaboration when students are face-to-face and encourage a more positive classroom climate.

STANDARD 3: LEARNING ENVIRONMENTS

Indicator 1: Creating

Candidates create instructional design products based on learning principles and research-based best practices. (Januszewski & Molenda, 2008, pp. 8, 243-245, 246)

EDTECH 542: Eggheads Design Challenge

This unit on Newton's Laws, built around an engineering design challenge, draws influence from two main sources. First, it aligns to the eight essential elements of project-based learning as described by Larmer and Mergendoller (2012). Second, the unit aligns to the Framework for Quality K-12 Engineering Education developed by Moore et al. (2014). The unit begins with an authentic problem connected to issues in their community, which provides immediate engagement and motivation for the following study of Newton's Laws. Students then move through the engineering design process identified in the frameworks by designing, building, and testing two iterations of a cargo carrier for hazardous waste, which also fits with items from the eight essential elements including the need for in-depth inquiry and opportunities for critique and revision.

Indicator 2: Using

Candidates make professionally sound decisions in selecting appropriate processes and resources to provide optimal conditions for learning (Januszewski & Molenda, 2008, pp. 122, 169) based on principles, theories, and effective practices. (Januszewski & Molenda, 2008, pp. 8-9, 168-169, 246)

EDTECH 521: Asynchronous Lesson: Bending Light

Arons (1996) promotes the idea that students should explore and develop a concept before encountering new vocabulary to describe it. To incorporate this idea into my asynchronous lesson on refraction, I borrowed an idea from Kremer (2014) and had students begin by using the Arabic version of a simulation from PhET. When I delivered a version of this lesson to my students, the Arabic simulation allowed them to develop a rich, thorough understanding of refraction and created a need for vocabulary that made the phrase “index of refraction” much less imposing.

It is also important to recognize that learning, especially when steeped in constructivism, is a deeply social process (Duit & Treagust, 1998). Throughout this lesson, I ask students to participate in discussion forums where they must articulate their ideas and challenge the thinking of others. This process is very much central to the practice of science, but also provides students with the opportunity to come together as a community (Palloff & Pratt, 2007).

Indicator 3: Assessing/Evaluating

Candidates use multiple assessment strategies (p. 53) to collect data for informing decisions to improve instructional practice, learner outcomes, and the learning environment. (Januszewski & Molenda, 2008, p. 5-6)

EDTECH 505: Evaluation Project: Evaluation of Desmos for Use in Physical Science Courses

As mentioned previously, for EDTECH 505, I evaluated a web-based graphing tool called Desmos. This evaluation included several data sources. First, I analyzed the results of a common assessment on linear motion. Desmos was a central tool in teaching the content included on this assessment, so I was able to determine whether students were mastering the desired content while using Desmos. Second, I used classroom observations of students working with Desmos during lab activities. This allowed me to see what struggles students had while using the tool and to adapt my instruction accordingly. While students did fairly well using the tool, I have started incorporating explicit instruction on selecting an appropriate range to display when I have a lesson using Desmos since that was a particular struggle for students. Finally, I asked students who had used Desmos to complete an anonymous survey. This gave me a clearer insight into their perspectives on the tool. After reviewing the surveys, I added short video walkthroughs to my website and added more instruction on the tool during lessons when I wanted students to use Desmos.

EDTECH 523: Blended Physics Course: Electricity Evaluation Plan

When it came time to develop an evaluation plan for the online course I developed in EDTECH 523, it was only natural to lean on many of the skills I had learned in EDTECH 505. Boulmetis and Dutwin (2005) repeatedly emphasize the importance of having someone unconnected to the project involved in the evaluation, so I recruited a colleague from another district to rate the course for alignment to the Minnesota Science Standards and the Next Generation Science Standards. Bangert and Rice (2009) discuss the importance of including student perceptions in any evaluation of a course, so I included Bangert's Student Evaluation of Online Teaching Effectiveness (SEOTE) in the evaluation plan. Finally, to determine whether students actually learn the target material, I included the Determining and Interpreting Resistive Electric Circuits Concepts Test (DIRECT) developed by Engelhardt (1997). Combined, these varied data sources should provide a clear picture of the strengths and weaknesses of the course.

Indicator 4: Managing

Candidates establish mechanisms (Januszewski & Molenda, 2008, p. 190) for maintaining the technology infrastructure (Januszewski & Molenda, 2008, p. 234) to improve learning and performance. (Januszewski & Molenda, 2008, p. 238)

EDTECH 501: School Evaluation Summary

In this project, I used the Maturity Model Benchmarks survey developed by Sibley and Kimball (1998) to evaluate, in detail, the level of technology integration in the school where I work. The survey included benchmarks for administrative technology use, curricular integration, support, connectivity, and innovation with several indicators for each benchmark. At the time, I gave the school an overall score of islands of technology integration, a term that indicates a moderate degree of integration. Based on these results I proposed several steps the school could take to improve technology integration, such as improving student access through a bring your own device (BYOD) program, upgrading classroom wi-fi access to allow more students to connect simultaneously, and improving the quality of professional development related to technology, including dedicated time to develop materials utilizing the available classroom technology.

My district happened to hire an outside consulting company to evaluate our technology integration and provide recommendations at the same time as I was working on this project. Based on the portions of the report released to staff, the consultants and I came to very similar conclusions and provided comparable recommendations. In the time since these reports were completed, my school has taken steps to follow many of these recommendations. In particular, our wi-fi network has been restructured to increase the number of devices which can connect to a given access point and to allow additional bandwidth. We also rolled out a formal BYOD policy this spring and have seen significant changes in the professional development around technology. Several professional development days have included work sessions where teachers are given time to work with a given technology tool with a teacher skilled in that tool available to provide support. As a result, many teachers have been using classroom technology more frequently and more effectively.

Indicator 5: Ethics

Candidates foster a learning environment in which ethics guide practice that promotes health, safety, best practice (Januszewski & Molenda, 2008, p. 246), and respect for copyright, Fair Use, and appropriate open access to resources. (Januszewski & Molenda, 2008, p. 3)

EDTECH 502: Copyright Scavenger Hunt

In this project, I created a web-based scavenger hunt for students to explore issues related to plagiarism and fair use. In order to create the activity, I had to refine my own understanding of these issues, especially how to define plagiarism, and explore a variety of resources for helping students to understand copyright. I integrated much of what I learned creating this activity into the introductory materials for a research project in my 9th grade physical science course. Many of my students copy text, rather than paraphrase, especially when the material is technical, with little understanding that they are committing plagiarism. As part of the introduction to the project, I now have students complete portions of the copyright scavenger hunt and examine some of the resources I found especially useful in creating the activity. As a result, I now see significantly more of my students paraphrasing and quoting sources appropriately.

EDTECH 541: Interactive Presentation: Magnetism

This is the only assignment I had to re-do during my time in this program. In my own practice, when looking for images to use in a presentation, I typically used a Google image search to locate those marked free to use, and inserted them into my slides without attribution.

When working on this assignment, I did the same thing and assumed I was covered under fair use. After a conversation with my instructor, I studied the Creative Commons attribution system and revised my presentation accordingly. Armed with this knowledge, I now ensure that any images I use are either under public domain or are attributed properly, even if I am merely using the image in my classroom.

Indicator 6: Diversity of Learners

Candidates foster a learning community that empowers learners with diverse backgrounds, characteristics, and abilities. (Januszewski & Molenda, 2008, p. 10)

EDTECH 541: Adaptive & Assistive Technologies Project

For this project, I examined technological supports for students with a range of needs, including gifted students, at risk students, and students with cognitive, physical, or sensory difficulties. By exploring recommended strategies for using assistive technologies, especially those already available in my building, I have been able to make more effective use of these technologies and strategies in my classroom. For example, this project gave me the opportunity to carefully examine the supports built into the online textbook used in one of my courses. Shortly after, I had my first experience with a student with a vision impairment that interferes with reading. Thanks to this project, I was able to provide this student with instruction on how to access the audio version of the textbook as well as several features that helped this student to keep their place while following the audio.

STANDARD 4: PROFESSIONAL KNOWLEDGE AND SKILLS

Indicator 1: Collaborative Practice

Candidates collaborate with their peers and subject matter experts to analyze learners, develop and design instruction, and evaluate its impact on learners.

EDTECH 542: Eggheads Design Challenge

During the semester I was enrolled in EDTECH 542, I was also participating in a grant through the University of Minnesota in which teachers collaborated to develop effective STEM integration curriculum. The frameworks for effective STEM integration developed by the Moore et al. (2014) has significant overlap with the principles of effective project-based learning, so I worked on the same curriculum in both settings. As part of my participation in the grant, I worked with Angela Meyerson, a science teacher from a neighboring district, and Lisa Ortmann, a University of Minnesota graduate student, to develop the curriculum. Each of us brought different areas of expertise to the curriculum development, which truly enhanced the final product. My knowledge of educational technology and data analysis guided ways we integrated math and technology into our unit. Meyerson is skilled at engaging a wide range of students and creating a truly collaborative classroom environment, which informed the ways we structured group work in the project. Ortmann studied literacy in STEM education for her dissertation and provided valuable insights on how to approach vocabulary development during the unit. Because Meyerson and Ortmann brought perspectives, experiences, and knowledge different from mine, they could answer questions I never even thought to ask and push me to look at aspects of our curriculum in ways that never would have occurred to me. This experience made it possible for me to bring pieces of their expertise to other areas of my work and demonstrated how valuable it is to collaborate with someone new.

EDTECH 523: Blended Physics Course: Electricity Preliminary Evaluation

In EDTECH 523, I completed a semester-long project to develop a physics course that would take place primarily within Schoology. As part of that process, I worked with a colleague willing to serve as a subject matter expert to evaluate the materials for alignment to key content standards as well as science practices. Boulmetis and Dutwin (2005) emphasize than an evaluator completing this type of assessment should be otherwise uninvolved in the project, allowing them to remain objective. With this in mind, I approached a colleague who had not been involved in developing any of the materials and who would not be affected by the presence of an online physics course in my building. Her objective, dispassionate perspective made it possible to have valuable conversations regarding the strengths and weaknesses of the materials, resulting in important improvements to the overall course.

Indicator 2: Leadership

Candidates lead their peers in designing and implementing technology-supported learning.

EDTECH 542: Eggheads Design Challenge

Shortly before I took EDTECH 542, the 9th grade science teachers in my district received a directive to make engineering a more significant part of our curriculum. When the course began, project-based learning immediately struck me as a powerful vehicle for not only teaching engineering, but linking it to science content. For my project, I built a unit on Newton's Laws around an engineering design challenge for my 9th grade physical science course. At the end of the summer, I shared my project at a curriculum writing session, which lead to every physical science teacher implementing a version of the project. As a result of teaching this unit, several teachers used certain technologies, such as cell phone video or digital probeware, in their classrooms for the first time. On the basis of this project, my district collaborated with the University of Minnesota to create a STEM integration coach position in which I will be supporting other teachers interested in bringing all four branches of STEM to their classrooms.

Professional Artifact: Google Drive Professional Development Session

In the spring of 2015, my building implemented a bring your own device (BYOD) policy. An important part of this program has been providing professional development around technology to members of the staff. As part of this process, I was asked to lead a session on facilitating student collaboration in Google Drive.

Indicator 3: Reflection on Practice

Candidates analyze and interpret data and artifacts and reflect on the effectiveness of the design, development and implementation of technology-supported instruction and learning to enhance their professional growth.

EDTECH 503: Instructional Design Project: Video Analysis in Engineering Design Evaluation

In this project, I designed several hours of instruction to introduce students to using Vernier Video Physics, a data collection app for the iPad, for evaluating the products of an engineering design challenge in a 9th grade physical science course. As part of this process, I conducted a needs analysis as recommended by Smith and Ragan (2005). The primary component was a student survey with three main sections: prior knowledge of Newton's Laws, prior experience with video analysis, and general aptitude with technology. I had students currently enrolled in physical science complete the survey at the point in the course where the engineering design challenge would be placed. The results of the survey provided several important insights. First, student responses on a section covering prior knowledge of Newton's Laws illuminated some important gaps in existing instruction, leading to revisions in the existing curriculum. The section of the survey specific to video analysis skills revealed students lacked some skills that had not previously been considered, such as the ability to read timestamps on a video frame and the ability to interpret a negative velocity. I use these results to guide changes to the curriculum prior to and during students' first use of Vernier Video Physics, which prevented these issues when the materials were implemented.

Indicator 4: Assessing/Evaluating

Candidates design and implement assessment and evaluation plans that align with learning goals and instructional activities.

EDTECH 523: Blended Physics Course: Electricity Evaluation Plan

As I began the development of my online course for EDTECH 523, a crucial goal was to emphasize the practices of science and conceptual understandings, which supports students in developing crucial skills such as critical thinking and communication (Jackson, Dukerich, & Hestenes, 2008). With this in mind, I set out to develop an evaluation plan that reflected that goal. I was able to identify standards from within the Minnesota K-12 academic standards (2009) that address the scientific process and developed a rubric for a subject matter expert to evaluate how well the course design met these goals. In addition, I examined the Next Generation Science Standards (2013), and discovered they identify eight practices of science. I used these practices to develop a second rubric for the subject matter expert to evaluate the course.

Indicator 5: Ethics

Candidates demonstrate ethical behavior within the applicable cultural context during all aspects of their work and with respect for the diversity of learners in each setting.

EDTECH 501: Digital Divide Presentation

In this presentation, I researched the inequalities connected to the digital divide and strategies for addressing this challenge in the public schools. As part of this, I examined specific demographic groups in my school's attendance area that are less likely to have access to computers or an internet connection in their homes. I also developed recommendations for addressing these issues that could be applied at the classroom, district, and school level. In my practice, I have worked to apply classroom level interventions in order to ensure equitable opportunities for all of my students. For example, I have shifted to assigning very limited homework, especially homework that explicitly requires an internet connection, because this project reinforced that many of my students do not have the necessary resources in their homes.

EDTECH 541: Adaptive & Assistive Technologies Project

For this project, I studied recommended best practices for supporting students with additional needs and compiled a list of possible strategies for using technology to provide a support to students with diverse learning needs. Thanks to the knowledge I gained from this project, I have been able to offer new suggestions when working with students, parents, and special education teachers to identify appropriate supports for a student. As a result, I am able to provide students with a much wider range of needs with appropriate, personalized support in their learning.

STANDARD 5: RESEARCH

Indicator 1: Theoretical Foundations

Candidates demonstrate foundational knowledge of the contribution of research to the past and current theory of educational communications and technology. (Januszewski & Molenda, 2008, p. 242)

EDTECH 504: Synthesis Paper: Computer Simulations in Assisted Discovery Learning

In this formal library research paper, I explored the role that simulations can play in providing scaffolding to effective discovery learning, synthesizing skills and knowledge developed in several earlier assignments. In one of the first assignments of the semester, I wrote a brief overview of the theory of discovery learning, including a look at the historical development of the theory. In a later assignment, I examined research specifically on the use of simulations within discovery learning. For the synthesis paper, I combined what I gained in these two earlier assignments to explore the ways simulations can address specific challenges within discovery learning.

Indicator 2: Method

Candidates apply research methodologies to solve problems and enhance practice. (Januszewski & Molenda, 2008, p. 243)

EDTECH 501: Research in Educational Technology

For this annotated bibliography, I began by selecting an area of instruction that I felt needed improvement. Specifically, time and available lab materials limit the size and complexity of circuits that students can experiment with, so I was interested in using simulations to improve my instruction over electric circuits. I examined some research on the effectiveness of simulations as a substitute or supplement to more traditional lab activities, especially as relates to electric circuits. This allowed me to identify some key features of a good simulation, such as conceptual enhancements (Snir, Smith, & Grosslight, 1993) and a wide range of options for experimentation (Wieman & Perkins, 2006). Based on this knowledge, I developed lessons for both my 9th grade physical science and 12th grade physics courses utilizing a specific circuit kit simulation. As a result, I have seen students demonstrate a much broader understanding of electric circuits than I had previously seen. The knowledge I gained from this research later influenced my use of simulations in a blended physics course on electricity developed for EDTECH 523.

Professional Artifact: Analysis of Physics Enrollment Demographics & Trends

As a member of my school's AVID site team, I have been involved in efforts to promote equity in advanced courses. This motivated me to apply what I have learned about basic research methodologies to examine equity issues in my own classroom during the 2014-2015 school year. Each trimester, I complied the demographics (self-identified race and gender) of students enrolled in honors-level physics and compared these results to the overall demographics of the school's senior class. This allowed me to identify not only groups that are underrepresented in the course, but groups with a low retention rate once enrolled in the course. This knowledge has made it possible to identify interventions to better support underrepresented students, such as providing more interactive resources on the course website and utilizing a one-way texting service to communicate with students and parents.

Indicator 3: Assessing/Evaluating

Candidates apply formal inquiry strategies in assessing and evaluating processes and resources for learning and performance. (Januszewski & Molenda, 2008, p. 203)

EDTECH 505: Evaluation Project: Evaluation of Desmos for Use in Physical Science Courses

In this project to evaluate the use of a web-based graphing tool, I followed the evaluation cycle laid out in Boulemtis and Dutwin's (2005) *The ABCs of Evaluation* and conducted a formal examination of the effectiveness of Desmos. As part of this evaluation, I analyzed the results of a district-wide common assessment covering a unit where Desmos was used heavily to determine whether students made acceptable gains in content knowledge. While the assessment gains were promising, with the number of students achieving mastery rising from 19 out of 112 on the pre-test to 112 out of 112 on the post-test, in an attitudinal survey included in the evaluation, students expressed attitudes only slightly positive towards the tool and, in open-ended questions at the end of the survey, several students made comments suggesting a need for more instruction on the use of Desmos. As a result of this project, I was able to add resources to my course website and provide additional in-class instruction relating to the use of Desmos to address the issues I saw in the evaluation.

Indicator 4: Ethics

*Candidates conduct research and practice using accepted professional (Januszewski & Molenda, 2008, p. 296) and institutional (*Januszewski & Molenda, 2008, *p. 297) guidelines and procedures.*

EDTECH 504: Synthesis Paper: Computer Simulations in Assisted Discovery Learning

In this paper, I applied guidelines established by the American Psychological Association to examine existing research on effective scaffolds for discovery learning and the ways in which computer-based simulations can be used to provide those scaffolds. I applied the knowledge I gained by writing this paper to my own classroom practice by implementing scaffolds that had particularly strong basis in research. For example, Reid, Zhang, and Chen (2003) found that providing students with cues related to good experimental design lead to increased student learning, so I placed similar cues on my course website along with links to any simulations and conducted class discussions to review those principles before students began explorations. Manlove, Lazonder, and Jong (2006) saw significant benefits when providing students with a large goal subdivided into smaller goals. Again, I used my course website to provide students with these supports even whether or not the simulation they were using included this particular support.

CONCLUSION

My time pursuing a Master of Educational Technology (MET) at Boise State University has been an opportunity to critically examine my practice and grow as an educator. In particular, I have studied how to use technology to make classrooms more student-centered, especially through effective STEM integration. This learning has been reflected in shifts to an emphasis on discovery learning in my classroom and engineering design challenges that require students to go beyond building something and truly apply their science knowledge. As a result, I have been given opportunities to lead professional development sessions on technology integration and to take on the role of a STEM integration coach during the coming school year. The MET program has not only provided me with the skills and knowledge to fulfill these roles, but to continue my learning and growth in the future.

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