I. Title of Project

Integrating STEM Resources into the High School Core Curriculum

II. Curriculum Topics, School Name(s), Number of Educators, Grade Levels

Columbia Public School System, Columbia, Missouri is composed of three campuses: Battle, Hickman, and Rockbridge. These schools are aligned with the Missouri Dept. of Education learning standards (MLS) and are overseen by a supervisor of operations. Each Highschool is managed by a principal, and all three campuses have active PLC groups which meet weekly, within each school and monthly at joint meetings to collaborate on curriculum and instruction objectives. This is the main school system which is the target of this workshop. Teachers from surrounding regions were also invited to attend. This opened up opportunities for teachers to collaborate with private schools, rural state schools to compare and contrast the curriculums, standards, and learning objectives from those respective schools and also to assist one-another in the STEM integration process. Teachers were encouraged to make connections and stay in touch with one-another for long term, sustainable, and continued professional development.

The participants included the following teachers:

Justin Burns, Battle High School, Pre-Calculus

Jake Smith, Battle High School, Algebra 2

Traci Bolda, Hickman High School, Fine Art

Shannon Blakey, Rockbridge High School, Fine Art

Shauna Atkins, Rockbridge High School, Chemistry

Tim Larkin, Fayette High School, Algebra 1 & 2, Geometry, Trigonometry, and Physics

David Larkin, University of Missiouri High School, Biology

Kate Miller, Columbia Montessori School, Middle School, English Language Arts

Victor Soria, Columbia Independent School, High School, Algebra 1 & 2, Geometry, Pre-Calculus, AP Calculus

III. Standards Addressed

The goal of the workshop was to help teachers from any topic area to find new and innovative ways to implement STEM concepts, resources and lessons into their existing lesson plans and curriculums using NGSS, Media Arts, NCSTM, and ITEEA Standards.

These guidelines are designed to emphasize the creative aspects of learning in the classroom. NASA based Engineering design and problem-solving methodologies, technological innovations, and artistic and creative approaches are presented-- with the goal of finding ways to integrate these pedagogical, content-based, and data collection, interpretation and analytical skills practices into the classroom . See Appendix 1 for a complete list of standards and practices presented to participants.

IV. Summary of Project

The objective of the workshop was to help teachers learn more about the philosophy of STEM integration, based on the tenants I have learned through the Endeavor Program coursework, and to introduce participants to the resources and materials available. The goal of the workshop was to help each teacher to take an existing lesson plan (one which is a "favorite") and integrate at least one NGSS Standard & one NASA resource into the LP by the end of the day. The teachers were invited using the following overview/explanation of the purpose of the workshop; this also served as the "hook" for this workshop:

Infusing STEM (Science, Technology, Engineering, and Mathematics) into high school lesson plans can pose a formidable task for teachers, yet it remains an imperative step in the education of students, equipping them with the skills necessary to thrive in an ever-evolving world. Not only does STEM education hone problem-solving abilities, but it also prepares students for careers in fields that are rapidly expanding and in demand.

To integrate STEM concepts seamlessly into existing lesson plans, we will consider the following strategies:

- Commence with familiar territory: Incorporate STEM principles into subjects you already teach. For instance, if teaching biology, present engineering concepts by having students devise and construct a model of a cell.
- Seek collaboration: Collaborate with fellow educators to cross-fertilize STEM concepts. For example, a mathematics teacher can collaborate with a science teacher to instruct a unit on geometry and its practical applications.
- Embrace hands-on involvement: Hands-on activities can effectively engage students in STEM concepts. These activities can vary from simple experiments to complex projects such as robot construction or digital animation creation.
- Leverage technology: Implement technology in the classroom to assist students in visualizing and comprehending STEM concepts and data collection methods. For example, virtual simulations and interactive videos can provide students with a deeper understanding of complex topics, such as genetics, weather patterns or engineering design methodology to solve problems.
- Link STEM to real-world scenarios: Make STEM relevant to students by relating it to real-world situations. For instance, educate students on the impact of climate change on wildlife or how mathematics and science are utilized in everyday life.

In conclusion, infusing STEM methodology into existing lesson plans can prove to be a challenging endeavor, yet it constitutes a wise investment in the future of students. By utilizing these tips and tapping into your creativity, you can bring STEM concepts to life for your students and equip them with the tools necessary to tackle the obstacles of the 21st century.

V. Pre-workshop Survey questions

Teacher Name:

School Name:

School Size:

Curriculum you teach (including topic and grade level):

Do you incorporate formative and summative assessment methods into your daily lesson plans? If so, briefly explain.

Do you incorporate or integrate STEM based learning into your curriculum or lesson plans? If so, briefly explain.

Give an example of one of your favorite topics you present to your students.

Can you list the 3 most important learning standards you feel are necessary for your students to understand by the time they have completed the course you teach?

Do you currently break your students down into smaller groups for guided inquiry discussions as part of your pedagogy and lesson planning? If so, explain the benefits this gives your students.

VI. Brief description of the actual workshop activities

Activities/Agenda: There will be 5 Phases in this workshop. The professional development training will consist of an introduction and overview of effective pedagogical practices which help incorporate STEM integration into current or new lesson plans. Examples of lesson plans will be presented which are designed around the 5E lesson plan template. Collaborative discussion on how it is used in tandem with the NGSS standards, school or district standards, and also NASA resources and data will take place with the group. Small groups will form to collaborate and implement one STEM based topic, NGSS Standards, and NASA data into the existing lesson plans of teachers in attendance. The PD workshop will conclude with a group discussion on what was learned, or what the “takeaways” of the day were.

VII. Brief description of each of the activities in the professional development session

Phase 1. Welcome, Introductions, and explanation of the purpose for the Pre- and Post-Surveys, as well as the follow-up interviews.

I will talk about how I used the Pre-Survey information to determine each attendee's perspective on STEM and what it means to them. Open discussion on how they currently talk about STEM, & how they currently integrate it into their Lesson Plan, if at all. Note: share the "Pushes & Praises" sticky notes with attendees as a motivation for setting a goal of sustainability with STEM integration into the standard routine of school. Suggest setting up a PLC, also.

Phase 2. Presentation of background Information and resources available for STEM Integration.

Introduce methods and resources for integrating STEM-based standards into the lesson plan using the following STANDARDS RESOURCES:

NGSS, MEDIA ARTS, NCSTM, IEEA (See Appendix 1 for complete list).

Briefly introduce the following 4 concepts as the foundation and background information for STEM which are the ultimate goals of this workshop.

Concept 1.
Introduce technology that could be included in their lesson plans.
-Spheros
-3-D Scanners & Printers
-TI-84 Calculators and resources available
-Anything else? (Ask classmates and colleagues to suggest other elements here.)

Concept 2.
Talk about the benefits of coaching and mentoring teachers to help them improve their pedagogy. Suggest Incorporating Guest Speakers and taking Field Trips to visit places where STEM-related professionals are working & doing what they love in a real-world setting.

Concept 3.
Introduce the concepts of Horizontal and Vertical alignment of STEM curriculums, summative and formative assessments to enhance learning, using rubrics for projects and assignments, exit tickets to keep students on use to prepare for tests and quizzes, and incorporating scaffolding pedagogy to better incorporate STEM concepts into the classroom.

Concept 4.
Talk about advocating for STEM in your school system and requesting STLs (Science Teacher Leaders) be put in place to facilitate and assist with this goal. Re-visit the idea of setting up a PLC group to advocate for, facilitate production of new lesson plans, and sustain the emphasis of STEM integrations into the school system.

Phase 3. Presentation of examples of STEM Lesson plans which could work for each teachers' disciplines and backgrounds.

The underlying theme of this phase is to address the following question: How can you better integrate Graphs and Data Modelling into your classroom and lesson plans? The specific answer to this is by using NASA- based resources. Next, review the NASA Cubes, found on the My NASA Data JPL site. If time allows, also look at GIS, which is perfect for STEM and ELA teachers to use as a resource for looking at Geographic and Earth-Science concepts for integration and discussion resources in their lesson plans. Note: this is an amazing resource for promoting STEM literacy and learning for teachers in all science, technology, engineering, and mathematics content areas, as well as for English, Social Studies, and the Arts. NOTE: Be sure to explain that we will be working from the student's perspective and the teachers perspectives during this phase. Explain that by changing your perspective, you will be able to build a fun and cohesive STEM integrated lesson plan. Conclude this phase by setting up break-out groups to develop an outline for your specific STEM lesson plan.

Phase 4. Presentation of your findings and sharing insights with each participant as a collaborative discussion to conclude the workshop.

Each participant will briefly share how they modified their lesson plan. I will discuss & demonstrate examples of an ideal model which incorporates STEM integration into a lesson plan and share ideas on how to advocate for bringing STEM integration into the school system. I will also talk about what an ideal STEM based PLC looks like, which is facilitated using STL's. Conclude this phase with a discussion of what you can do next at your specific location/environment.

Phase 5. Follow-Ups and promotion of sustainable practices.

This phase ultimately will occur after the completion of the workshop. Each attendee will complete a Post-Workshop Survey. I will also attempt to complete as many one-on-one interviews with attendees as possible, and attempt to schedule another workshop with the original attendees, as well as any new teachers and staff members which could be beneficial to advocating for and incorporating STEM concepts into their specific school systems in the future.

VIII. What NASA data & resources did you include in the workshop?

1. NASA EXPRESS AND NASA CONNECT newsletter and curriculum development and lesson plans help:

https://www.nasa.gov/stem/express

2. NASA ENGINEERING DESIGN AND PROBLEM-SOLVING FLOWCHART:

Note: Teachers can pair with an art teacher to help students sketch, draw, construct, and build mock-up designs of the concept they are working on using this flow chart.

https://www.nasa.gov/audience/foreducators/best/edp.html

3. MY NASA DATA LITERACY CUBES:

https://mynasadata.larc.nasa.gov/data-literacy-cubes-graphs-maps-and-data-tables-archived

4. NASA resource for **integrating** creative strategies such as free writing, visual **art**, and theater exercises:

NASA (.gov)
https://astrobiology.nasa.gov › classroom-materials

5. NASA resource for using the elements of art — shape, line, color, texture, value — helping students make sense of images of planets, asteroids, comets and moons.

https://www.nasa.gov/audience/foreducators/science-a-skill-an-art.html

Educator Guide: Art and the Cosmic Connection

6. NASA/JPL resource designed to engage students **in** space-science education by becoming **artist** explorers:

https://www.jpl.nasa.gov/edu/teach/activity/art-the-cosmic-connection/

7. NASA data resources for studying the solar system and beyond!

https://solarsystem.nasa.gov/planet-compare/
https://nssdc.gsfc.nasa.gov/planetary/factsheet/
https://spaceplace.nasa.gov/mars-rovers/en/
https://mars.nasa.gov/all-about-mars/facts/
https://solarsystem.nasa.gov/moons/jupiter-moons/europa/in-depth/#otp_size_and_distance

8. MARS ACTIVITIES. Mars Education Program. Jet Propulsion Laboratory.
Teacher Resources and Classroom Activities:

NASA (.gov)
https://mars.nasa.gov › classroom › pdfs › MSI

9. NASA Wavelength is a collection of resources that incorporate NASA content and have been subject to peer review:

NASA (.gov)
https://science.nasa.gov › learners › wavelength

10. NASA Resources for teaching an integrated elective class introducing students to multidisciplinary content in nature.

https://www.nasa.gov/stem/foreducators/k-12/index.html

11. Learning and Educational Activities and Resources from NASA Science. This link gives teachers a more art-integrated, STEAM environment in their classroom:

https://science.nasa.gov/learners/back-to-school

12. Students will use the NASA Design Squad Template to learn how to create a rocket and launch it at a specific target.

https://www.nasa.gov/pdf/418003main_OTM_Launch_It.pdf

IX. Follow-up Activities & Post-questions Survey List

Follow up activities will be completed in the 5th phase of the workshop plan, as listed in section VIII above. Each teacher will have a unique set of outcomes resulting from their specific background, which aspect of the workshop they collaborated on within their small group, and how the NGSS standards and NASA resources complement their lesson plan. Teachers will be encouraged to continue to stay in communication with each other by setting up PLCs, establishing STL roles in each or their respective schools, and planning to attend this workshop in subsequent semesters to continue enriching specific lesson plans, as well as complete curriculums, with STEM-integrated resources. Post-workshop survey questions are listed below; see also Appendix 2 for the template used to establish future follow-up correspondence and collaboration activities with each individual teacher.

Post-Workshop Survey Questions:

• After the training, how familiar are you with the 5E Lesson Plan?

• Do you feel the NASA resources and Lesson plan templates might help improve your lesson plan?

• What would be your biggest barrier to including NASA resources and NGSS standards in the lesson plan?

• Would you be interested in sitting down for a one-on-one follow-up meeting on how to modify lesson plans?

• After the training, are you familiar with NASA resources and how they could be incorporated for cross-curricular connections in your classroom?

• What is one thing that you can take away from the PD on STEM integration and using NASA resources?

• Do you feel like you are better prepared to advocate or talk about STEM based programs with your administrator?

• Do you feel like you are now better prepared to work as a (STEM Teacher/Leader) STL in your school or district?

• Which topics would you like more information about after attending?

• Do you have access to coaches or mentors who could help you improve your teaching, lesson plans, or help with STEM-based integration into your existing curriculum?

• Do you do any sort of field trips, or do you have guest speakers come in to your classroom?

• Anything else you would like to add?

X. Outcomes. Final Data Collection and Analysis

a. Survey Results/Comments on the content included in the workshop.

The attendants brought their own lesson plans to the workshop to present and use with colleagues and the presenter to incorporate STEM concepts and NGSS, MEDIA ARTS, NCSTM, IEEA, and Missouri Learning Standards into their existing lesson plans. Overall, participants found the workshop to be beneficial as they all were able to leave the day with at least one NASA resource and one NGSS standard, in addition to further integrations using the Media Arts, NCSTM, IEEA, and MLS standards based on the topic of the individual lesson plan. One participant commented: “I enjoyed using the interactive online standards resources as I could easily type my topics and subject areas into the filters and search tools to identify standards which fit into my lesson plan.” Another comment explained: “I was

grateful to have an opportunity to observe my fellow teachers talk about the content areas they were specialists in to get a better understanding of how to incorporate that content into my classroom with STEM integration." There was one particular pairing at the workshop in which an art teacher and a biology teacher were able to collaborate and create integrated lesson plans which will enable students to learn how to shade drawings with pencil, or create texture and 3-D perspectives with ink or brush strokes to draw a more precise and detailed picture of biological plant and animal cells, or fungus, mushrooms, and other macro molecular structures. The two teachers collaborated during the workshop and plan to invite one-another to their respective classrooms to present short lessons on cell biology (in the art classroom) & 3-D drawing and shading (in the biology classroom) as a standard, integrated, practice in subsequent semesters. They also look forward to attending this workshop again in future semesters to deepen their lesson plans and create more next time.

b. Survey Results/Comments on the pedagogy in the project.

The attendants of the workshop generally enjoyed the activities, and everyone was able to leave with a NGSS standard and at least one NASA resource integrated into their lesson plan. One survey said: "I couldn't believe how fast the 90 minutes went by! I was completely enamored with the STEM Connections resources and lesson plans. It was easy to find topics relevant to my lesson plan, and I am already thinking about how to start bringing these concepts into my classroom this semester." Another survey explained: "I have always considered myself to be tech-savvy, but I didn't think about how the NASA resources could help me bring the joy of (using the) technology to my students in more fun and exciting ways. One teacher felt they improved more than just their understanding of STEM concepts: "I enjoyed learning about STEM integration, but I also found three suggestions and examples to be helpful: 1. Focusing on formative assessment to ensure understanding of a teaching concept is happening in real-time in my classroom. 2. Learning the importance of utilizing a rubric and exit tickets to ensure standards are included in lessons. 3. Appreciating the value in participating in PLCs, and being open to the idea of receiving coaching, and mentoring to help improve my skillset and get support when I need it. One of the art teachers explained: "I always felt like I was integrating STEM into my lessons, especially in terms of the camera obscura, but after the workshop, I have a more phenomenal way to talk about it with my students. It was fun to see other teachers from different curriculums (physics & mathematics) share their ideas on talking about this concept with my students when we do pastels." The fun part of this workshop for me as the presenter was to go around to the small groups, after I presented my examples of lesson plans written using the 5E template, to nudge conversations and spark ideas among the participants. Each small group was divided into ELA, math, science, and art to enhance the cross-curricular design dynamics of the workshop agenda. This enabled each participant to talk with a fellow instructor while switching from a teacher hat to a student hat (reference discussion article here). One participant surveyed said: "I liked being able to see another teacher in action, either demonstrating how they lecture about a topic in their class, which I can try in my environment, or working to help another teacher (or even getting help themselves) find NASA resources which are useful to enhance the topics they regularly teach." Participants also commented on the convenience of using the NGSS

standards website to organize cross-cutting concepts into coherent topics and finding NASA resources which lined up to that standard easily. One participant explained: “I thought about how my students should be introduced to real-world concepts, and also develop a better appreciation for science in general, as I give lectures every day, but this workshop showed me a more direct path and plan to make that happen.”

c. Was your professional development successful?

I feel that my professional development was successful because at the conclusion of the 90-minute workshop the attendees were taking their time packing up, and asking questions of their colleagues, exchanging phone numbers and emails, and talking excitedly about making plans to incorporate topics from the workshop into future PLC meetings at their respective schools. The teachers also made specific requests to have access to a google folder containing the links and resources provided during the workshop for future use and reference. Several teachers spoke about the possibility of developing the workshop into a 5-hour seminar, which could be organized and offered once a semester, or annually, if possible. I felt good about the NASA resources and standards referenced; I also had time to discuss and share the provided standards to the participants, and I also felt that the participants will get more specific help as they review the 5E lesson plan templates, as well as the example lesson plans, I provided. I also felt satisfied with the information I provided about the Endeavor STEM Certificate program. Two of the teachers expressed interest in this program and are going to look for possible funding sources through their school district to learn more and possibly apply to the program for future professional development opportunities. I also closed the workshop by talking about the importance of advocating for increased STEM integration and programming at each school, as well as providing encouragement to suggest working to become mentors, coaches, and science teacher leaders to their colleagues at their respective schools. I plan to reach out to as many participants possible to continue to collaborate and develop this workshop into a 5-hour seminar in the future. I am also planning to schedule one-on-one interviews and discussions with these participants to follow up and help develop sustainable STEM-integration practices into their classrooms.

d. How did this workshop relate to the readings?

The Journal of Technology Education article by Daugherty (Daugherty, 2009, p. 12) provides insight into creating interesting, applicable, and useful engineering-oriented concepts into high school coursework by attending professional development programs. This information was useful for this workshop as I was able to take those suggestions and incorporate the idea of improving content knowledge and increased practice of developing guided inquiry methodology into lesson plans for teachers. This was the motivation for pairing ELA and Fine Art teachers with math and science teachers during this workshop. This idea worked very well-- as the ELA teachers and Fine Art teachers were able to increase their knowledge base with basic math and science concepts by collaborating with those teachers-- and reciprocally the math and science teachers were able to build greater depth of knowledge with their ELA/expression and discussion skills, and also learn more effective methods for teaching, or demonstrating, Fine Art drawing techniques, including perspective sketching and

object shading, to improve their lectures. All the teachers were also able to better-connect with real-world practices of engineering design and share those ideas and experiences with their students by using the suggestion from this article to use scaffolded problem solving (Daugherty, 2009, p. 19). I also used this concept and tied it into the NASA resources for engineering design methodology, to give teachers a better understanding of the process, and ways to implement this approach into their existing lesson plans.

The Center for Teaching Quality and Teachers Network article by Berry (Berry, 2010) lists several points regarding the importance of teacher training & professional development programs. The third point in this article suggests that new in-service teachers should be trained in a sustainable, long term, or continuous manner to create a supportive system to help develop a life-long approach to content-knowledge improvement, pedagogical training, and awareness of the importance of advocating for the seven areas of teacher training (Berry, 2010). I used this finding as a basis for the design of my PD workshop as I helped the participants learn more about the importance of advocating for continuous improvement to their pedagogical practice via incorporating NGSS and other standards into an existing lesson plan, sharing (in a collaborative way) the importance of STEM content integration into their LP's to improve content knowledge on topics which the teachers were already specializing in, and to promote a greater appreciation for advocating for sustained PD training in their school systems to facilitate the implementation of PLC groups and STL development in the interest of helping the participants develop a life-long approach improving their practice.

e. Will the teachers use what was shared in the teaching at the PD workshop?

I received feedback at the end of the day, during the concluding discussion phase of the workshop as teachers explained how they intend to use the 5E lesson plan and NASA resources, specifically pre-designed lesson plans which emphasize the design approach to problem solving (see the NASA resource #12, *Design Squad*). The teachers expressed a combination of excitement, confidence, and relief as they shared their appreciation for learning about the NASA resources, and the Endeavor Program. The teachers hope to implement at least one or two new lesson plans into their curriculums over the next year of school, and also expressed interest in attending this workshop again for further PD opportunities in the future.

f. Reflection

Looking back at the first assignment for this course, which was to simply read the syllabus and submit acknowledgement that I had done this, I was overwhelmed at the list of assignments and description of the final project. It had the same feeling as considering a yachting expedition around the world—Very complex, challenging, lots of details to consider, yet full of potential for an amazing learning journey and the possibility of developing a strong skillset, with a deeper understanding of the importance of professional development and honing leadership practices with my fellow teachers. The coursework did not disappoint! The exploration of the professional development resources and readings

about (science teacher) leadership characteristics was a fantastic journey. I feel much more empowered now, and recharged as well, when it comes to advocating for STEM-based programs from my administration and professional development workshops, seminars, and resource mining for my fellow teachers, students, and myself. I enjoyed the break-out sessions during our zoom meetings, and also felt that I learned how to use this technology, as well as STEM resources, NASA lesson plans, and NGSS standards more effectively with my students. This course provides an excellent foundation for understanding how to create and participate in PLCs, organize, and establish STLs, and contribute to the team of teachers I work with throughout the school year, and beyond. I will cherish the time invested in this coursework and look forward to putting these experiences into practice in the future!

Works Cited

Berry, B., Daugherty, A., & Wieder, A. (2010). Preparing to Lead an Effective Classroom: The Role of Teacher Training and Professional Development Programs. *Center for Teaching Quality and Teachers Network*, 1–12.

Daugherty, J. L. (2009). Engineering professional development design for secondary school teachers: A multiple case study. *Journal of Technology Education, 21(1),* 10-24.

Taber, K. S. (2018). Scaffolding learning: principles for effective teaching and the design of classroom resources. In M. Abend (Ed.), Effective Teaching and Learning: Perspectives, strategies, and implementation (pp. 1-43). New York: Nova Science Publishers.

Appendices

Appendix 1. Learning Standards referenced during workshop and web links.

A. NGSS Standards

NGSS Standards web link:

https://www.nextgenscience.org/

HS-ESS1-1
The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

HS-ESS1-4
Earth's Place in the Universe; Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. This standard is addressed as students are presented with the concept of a launch window which utilizes the Hohmann transfer orbit criteria necessary to reach Mars from Earth. Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth)

HS-PS2-1
Motion and Stability: Forces and Interactions
Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. This standard will be used in the development of Free-body diagrams and vector analysis to solve systems of mathematical equations.

HS-PS2-2
Motion and Stability: Forces and Interactions
Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. This standard will be emphasized in the context of deriving equations to express relationships between matter and energy.

HS-PS2-4
Motion and Stability: Forces and Interactions
Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. Students will learn to calculate relationships between gravity and escape velocity on multiple planets and moons in our solar system.

HS-PS3-2
Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and

energy associated with the relative positions of particles (objects). This standard will be addressed as students learn about trajectory of spacecraft between Earth and Mars.

B. MEDIA ARTS Standards

Web link to National Core Arts standards:

https://www.nationalartsstandards.org/

MA:Cr1.1.I
Use identified generative methods to formulate multiple ideas, develop artistic goals, and problem solve in media arts creation processes.

MA:Cr2.1.II
Apply a personal aesthetic in designing, testing, and refining original artistic ideas, prototypes, and production strategies for media arts productions, considering artistic intentions, constraints of resources, and presentation context.

C. NCSTM Standards

Web link to National Council of Teachers of Mathematics Standards:

https://www.nctm.org/Standards-and-Positions/Focus-in-High-School-Mathematics/

A1.NQ.B.3
Use units of measure as a way to understand and solve problems involving quantities. a. Identify, label and use appropriate units of measure within a problem. b. Convert units and rates. c. Use units within problems. d. Choose and interpret the scale and the origin in graphs and data displays.

A1.NQ.B.4
Define and use appropriate quantities for representing a given context or problem.

A1.NQ.B.5
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

A1-SSE.A.1
Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.

A1.SSE.A.3
Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.

a) Find the zeros of a quadratic function by rewriting it in factored form.

Find the maximum or minimum value of a quadratic function by completing the square.

A1.CED.A.1
Create equations and inequalities in one variable and use them to model and/or solve problems.

A1.CED.A.2
Create and graph linear, quadratic, and exponential equations in two variables.

A1.CED.A.4
Solve literal equations and formulas for a specified variable that highlights a quantity of interest.

A1.DS.A.1
Analyze and interpret graphical displays of data.

D. ITEEA Standards

Web link to *Standards for Technological Literacy* published by the International Technology and Engineering Education Association:

https://www.iteea.org/175829.aspx

STEL-3C.
Demonstrate how simple technologies are often combined to form more complex systems.

STEL-3D.
Explain how various relationships can exist between technology and engineering and other content areas.

STEL-6G.
Verify that the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools, materials, and processes.

Appendix 2. Follow Up Interview Template

Follow – up 1:1 interview log and note sheet.

Name:

School:

Grade level(s) and subject(s) you teach:

Are there other topics you want to teach in the future?

Are there any PLCs you are involved with currently?

Other groups or organized activities you are responsible for at your school currently?

Are you planning on becoming a STL?

Are you interested in collaborative assistance developing stem-based integration methods with your lesson plans, and if so at what level do you expect to utilize these topics?

Would you be interested in attending this workshop again, for a longer 5-hour seminar?

What topics would you consider to be “must-keep” for future meetings?

Anything missing or specific you would like to incorporate into your classroom?