I. **Title:** Conquering Coding

II. Topic

My district received the PA Smart Grant for Computer Science and established an elementary team. As part of this team, we are attending a year long training and discovering the benefits of computer science. We have created a district vision statement in regards to computer science.

"*SASD will engage all learners in computer science in order to become productive citizens through critical thinking/problem solving, communication, collaboration, and creativity."*

To help reach this goal, we want to provide professional development for all teachers to show the importance of computer science. We are going to provide three phases of professional development. The first phase will be discussing the CSTA Standards and K-12 CS Framework. Phase two is using computer science across the curriculum. Phase three will be tools to help teach computer science. For this project, I am going to focus on phase three with a quick review of phases 1 and 2.

III. NASA/Endeavor Course Integration

For this professional development, I will be integrating content from the Endeavor course "Coding, Robotics, and 1 to 1 Devices", Code.org, and Nasa STEM Engagement: Computer Science Educational Resources. All of these resources will help provide content and research for my professional development.

IV. Audience

The goal of the SASD Computer Science Team is to provide professional development for all of our teachers K-12 in stages. I will be focusing on the K-5 teachers. When our district received the PA Smart Grant, our curriculum director bought iPads for the K-3 level for them to integrate coding into their classrooms. Some of the 4-5 teachers have begun to implement coding into their classrooms, but it is not consistent.

The SASD district has eleven classrooms at each grade level. The K-3 classes have an average of 18-20 students in each classroom. The 4-5 classes on average have 22-25 students in each classroom.

I am not sure if I will be able to conduct this professional development this year. My district has canceled other scheduled professional developments this year due to COVID. I haven't heard back from my curriculum director if I will be able to present this professional development.

V. STEM Concepts and Standards

NGSS Best Practices:

Science and Engineering Practice: Asking Questions and Defining Problems Students at any grade level should be able to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. For engineering, they should ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution. (NRC Framework 2012, p. 56)
Planning and Carrying Out Investigations Students should have opportunities to plan and carry out several different kinds of investigations during their K-12 years. At all levels, they should engage in investigations that range from those structured by the teacher—in order to expose an issue or question that they would be unlikely to explore on their own (e.g., measuring specific properties of materials)— to those that emerge from students' own questions. (NRC Framework, 2012, p. 61)
Analyzing and Interpreting Data Once collected, data must be presented in a form that can reveal any patterns and relationships and that allows results to be communicated to others. Because raw data as such have little meaning, a major practice of scientists is to organize and interpret data through tabulating, graphing, or statistical analysis. Such analysis can bring out the meaning of data—and their relevance—so that they may be used as evidence. Engineers, too, make decisions based on evidence that a given design will work; they rarely rely on trial and error. Engineers often analyze a design by creating a model or prototype and collecting extensive data on how it performs, including under extreme conditions. Analysis of this kind of data not only informs design decisions and enables the prediction or assessment of performance but also helps define or clarify problems, determine economic feasibility, evaluate alternatives, and investigate failures. (NRC Framework, 2012, p. 61-62)
Using Mathematics and Computational Thinking Although there are differences in how mathematics and computational thinking are applied in science and in engineering, mathematics often brings these two fields together by enabling engineers to apply the mathematical form of scientific theories and by enabling scientists to use powerful information technologies designed by engineers. Both kinds of professionals can thereby accomplish investigations and analyses and build complex models, which might otherwise be out of the question. (NRC Framework, 2012, p. 65)
Constructing Explanations and Designing Solutions Asking students to demonstrate their own understanding of the implications of a scientific idea by developing their own explanations of phenomena, whether based on observations they have made or models they have developed, engages them in an essential part of the process by which conceptual change can occur. In engineering, the goal is a design rather than an explanation. The process of developing a design is iterative and systematic, as is the process of developing an explanation or a theory in science. Engineers' activities, however, have elements that are distinct from those of

scientists. These elements include specifying constraints and criteria for desired qualities of the solution, developing a design plan, producing and testing models or prototypes, selecting among alternative design features to optimize the achievement of design criteria, and refining design ideas based on the performance of a prototype or simulation. (NRC Framework, 2012, p. 68-69)

PA Science and Technology Standards:

3.6. Technology Education
Technology education is the use of accumulated knowledge to process resources to meet human needs and improve the quality of life. Students develop the ability to select and correctly use materials, tools, techniques and processes to answer questions, understand explanations and solve problems encountered in real life situations. These overriding themes require students to design, create, use, evaluate and modify systems of Biotechnologies, Information Technologies, and Physical Technologies.

3.7. Technological Devices
Students use tools to observe, measure, move and make things. New technological tools and techniques make it possible to enact far-reaching changes in our world. Technology enhances the students' abilities to identify problems and determine solutions. Computers play an integral role in everyday life by extending our abilities to collect, analyze and communicate information and ideas.

VI. Session Information

This professional development will last one hour. I will break the hour into different sections to keep my audience engaged. Since computer science and coding is a district goal, all teachers will be required to attend the professional development. I would like to present the professional development in person, possibly at a faculty meeting; however, it may have to be done virtually.

VII. Pre- and Post-Survey

Pre-Survey

- What is your grade level band?
- What building do you teach in?
- Have you ever tried coding?
- Do you offer coding within your classroom?
- If so, how often do you have your students code within the classroom?
- What do you have within your classroom to assist you in coding and computer science? (Examples: DASH, DOT, Spheros, etc.)

Post-Survey

- Identify one thing that you have learned from this training.
- What is one thing you want to incorporate into your classroom?
- How many times a week do you hope to include coding within your classroom?
- What is one lesson or content area that you could include coding within your classroom?
- On a scale of 1-5, how excited do you think your students will be to try coding?

VIII. Outcomes/Expectations

After this professional development, I am hoping the teachers become motivated and excited to try coding in their classroom. Teachers will be able to identify a lesson or content area that coding could be integrated into. Teachers will become familiar with the technology tools that can be used with coding.

IX. Follow-Up

I would like to email the teachers a week after the professional development to see if anyone has tried coding since the training. If they haven't, I will try to help them identify the barriers they may be facing when it comes to coding. If they have incorporated some aspects of coding, I would like to get more details:

- What did they use?
- How did it go? (What worked? What didn't? What would you do differently?)
- Is there anything you need from me?

I will ask the teachers if they would be willing to share their experience with their grade level and be open to having other teachers, including myself, come observe a future lesson.

X. Data Collection Methods

My pre- and post-surveys will be collected with Google Forms.