

Action Research Plan

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**Topic of the action research**

The overarching goal of this project is to improve learning and foster better ties between the various subjects that student's take in school. Going back to the prior literature review on computational thinking ([follow link here](#)) I have found that computational thinking has a number of impacts on learning. It has positive impacts problem solving abilities, student confidence, and creates deeper learning in the subject. At the moment, our staff has been dealing with a lot of change. I cover that more in this blog post ([link here](#)). For that reason, I am limiting my research to be of a benefit to me, and more importantly, to the staff so that they can see a direct benefit from this work.

Most of the core teachers I work with are not opposed to the idea of adding in an activity such as Sphero if time allows. They see this as a diversion instead of a way to get to deeper learning. The idea of computational thinking is seen as something for programming classes not for the rest of the building. In my research I found that computational thinking is not only transferable but just as important to core classes as it is for programming. To that end it's important to make a strong case that teachers we'll find a benefit to their content without sacrificing time on something frivolous

**The purpose of the study**

It is difficult for teachers to see something as intangible as "problem solving skills". By focusing on the impact that the computational thinking activity will have on specific learning targets in class, teachers should be more likely to participate. To that end, having a project that can be tied directly to summative assessment results will help teachers see through the "whirlwind".

This study will be aimed at showing the impact that computational thinking has on the learning outcomes in class. Through the study, students will be measured on their growth in computational thinking skills and their growth in the course material. Through this analysis, teachers will be able to have clear evidence of the impact that the computational thinking activity has on problem-solving skills and on the original course goals.

### **Fundamental research question**

The fundamental research question I will be investigating is, “Does the integration of Sphero robots improve students’ mastery of learning targets?” In this research study, I am focusing the question even more. I will be centering on one particular computational thinking tool, Sphero robots. There are several reasons for this. First, our campus has several robots. Our digital learning coaches are well versed in their use. My students are also comfortable with them (they will be able to assist teachers in the implementation). Finally, there are several examples online of teachers using them. This provides a strong starting point that teachers can readily see. This will aid in collecting quality summative assessment data.

### **Research design and research methods**

The research project will be quantitative in its research design. I am looking for direct impacts to learning that can provide opportunities for implementation with other computational thinking tools. As teachers start to see positive results from the implementation of Sphero, it will support using other tools that are not as well known. Conversely, if the results do not give demonstrative improvements, the teachers will be able to talk with other teachers who have seen results in other areas of the classroom. These are some of the other intangible benefits seen from

computational thinking. Going back to the second literature review ([link here](#)), I am working on being intentional about the assessment tools being used.

There will be some qualitative data collected throughout the project, but it will be secondary in nature to the fundamental outcomes. The qualitative data collected will be used during the reflection stages and as the project iterations are developed.

### **The type of data collected**

For this project, I will be focusing on the summative assessment data for both the teachers using the Sphero robots and the teachers teaching the same content, but not using the Sphero robots. I will be using the summative assessment data that will come from the common assessments used by the teams. This will allow me to do a comparative analysis of the data. It also means that teachers do not have to give a second assessment in their class. We already have a number of assessments given by the state, college board, and the district. Adding another assessment will not lead to a lot of participation by teachers.

The teams also have pre-assessments already in place for units. These pre-assessments will be utilized as well for the analysis. The pre-assessments will help in gauging, not only the final level of mastery that students have achieved, but also the level of growth throughout the unit of study.

Throughout the unit, I will work with teachers on collecting formative assessment data and analyzing it during the weekly PLC team meetings. The formative data will be used to adjust the content just as they normally do in their PLC meetings.

Finally, I will collect surveys of the students and teachers at the conclusion of the unit. The surveys will be used to gauge attitudes and opinions about the implementation of the Sphero

robots and the perceived impacts it had on the daily operation of the class as well as the overall impact on the unit.

### **The measurement instruments to be used**

The first, and main assessment will be using the teacher's own pre- and post- summative assessments. By comparing classes that use the robots with classes that don't, I will be able to show if any effect is seen by adding in the robots. It will be easy for teachers to participate in and easy for the campus to see the results.

The teaches implementing Spheros (and any other interested teachers) will employ a variety of formative assessments during the unit. It will be pre-determined which formative assessment method will be used and when. Pre-determining and aligning the formative assessments will give the team valuable feedback to discuss during the weekly PLC meetings in order to calibrate and adjust the lessons as needed. It is recommended that the teachers utilize the assessments several times in order to allow the students to get comfortable with the format and provide more useful feedback. The formative assessments for the teachers to choose from are in Appendix A.

The post-unit survey has been put together to allow students a few minutes to reflect on the lesson and their feelings about it. For simplicity and comparisons, the questions for both the students and the teachers are similar. The survey length is short enough to not be intimidating but provides enough depth to elicit quality responses from the participants. The survey questions are found in Appendix B.

**How the literature review informed the project**

The literature review had a number of impacts on the final details of this project. First of all, there is not a pre-survey for the participants. The researchers found that pre-surveys tainted the results of the unit and the post-survey. It caused the participants to be aware of the study and caused it to skew the results in a negative direction. At the same time, the post-survey is short enough to provide data for researchers and teachers, but not so long as to be ignored by the students and the teachers. Open ended questions have been shown to be the most useful, but only to the point that there is time to implement and act on them. The formative assessments also provide short, open-ended opportunities for students to demonstrate their learning and provide feedback.

Most importantly, the computational thinking activities are implemented within an existing unit in the curriculum. A stand-alone computational thinking unit does not have much impact or provides transfer of learning. Students in these standalone units do not gain a long-lasting benefit and they have a great deal of difficulty transferring those problem-solving skills to other classes. When the activities are placed within the unit in a way that intentionally builds the problem-solving skills students have been found to have the greatest gains.

**Implement the plan-give a timeline**

## 1) August 2019

- a) Meet with partner teachers.
  - i) Work with the teachers of one team to create a control group and create comparable results.
  - ii) Working with a single team will allow for better implementation with minimal distractions. A single team of multiple teachers will also allow for a large enough sample size to provide higher quality results.
- b) Develop classroom implementation plans
  - i) Determine control and test groups.
  - ii) Notification of study implementation
    - (1) Students participating in the study, but not control groups. They will not be doing any activities not previously planned in the curriculum.
    - (2) Parents of students participating in the study
    - (3) Administration
  - iii) Pre-assessment
    - (1) Utilize the same pre-assessment through all courses.
  - iv) Formative assessments
    - (1) Short and frequent formative assessments
  - v) Summative assessment
    - (1) Utilize the same summative assessment for all courses
  - vi) Post-unit survey
    - (1) Provide a survey to students who were a part of the test group

- (2) Assess attitudes regarding use of Sphero in class
  - (3) Assess perception of implementation of Sphero with curriculum
- 2) September – October 2019
  - a) Implement plan with teachers
    - i) Notifications
    - ii) Pre-assessment
      - (1) Evaluate results
    - iii) Formative assessments
      - (1) Look for implementation issues with students that need immediate attention
      - (2) Assess student engagement and participation
      - (3) Meet weekly in PLC team to assess and adjust plans based on formative assessments
    - iv) Summative assessment
      - (1) Evaluate results
        - (a) Compare implementation classes
        - (b) Compare implementation group to control group
        - (c) Assess growth in learning from pre to post assessment.
    - v) Post-unit survey
      - (1) Student perceptions
      - (2) Teacher perceptions
- 3) November 2019
  - a) Review data with PLC team
    - i) Review results and impacts with PLC team



- ii) Lessons learned
- iii) Rewriting of lesson for next year
- b) Create plans to recreate test in 2<sup>nd</sup> semester
  - i) New lesson for 2<sup>nd</sup> semester to re-evaluate. Switch the control and implementation groups.
  - ii) Follow same procedures 1b – 3aiii
- 4) April 2020
  - a) Share results during district PL session

### **Collect & analyze the data**

Prior to the unit, the team will give the pre-test. The data from the pre-test will provide a benchmark for use with the summative assessment. The school uses Schoology as the required Learning Management System (LMS). The pre-assessment will be administered through Schoology as an in-class quiz.

During the unit, the formative assessment data will be analyzed for shortcomings in the delivery of the content. Specifically, the PLC teams will be looking for gaps in the original content. The formative assessments will be given by the teachers in class in the manner deemed most appropriate by the PLC team.

Following the delivery of the unit, the summative assessment will provide a whole class percentage of mastery of the content. The individual results will also be compared to provide a determination of growth for the class. This will be most valuable in looking at growth in the learning and comparing all of the students from all sections. For example: suppose one class

starts with a high percentage of students who already know most of the content (say, 80%), but do not learn any new material. Likewise, suppose a test class starts with previously knowing almost none of the content, but eventually masters 70%. When looking at the raw numbers, it looks like the first class did better. When the pre-test is factored in, the second class shows a much larger gain in learning. The final summative assessment will be given in class by the teachers through Schoology. Schoology will allow me and the PLC teams to analyze the data immediately following the test.

The survey data will not provide a great deal of insight into the effectiveness of the computational thinking activities. The usefulness of the data from the surveys will come in the reflection and future iterations of the project and the class unit. The information will help in making adjustments to the unit to provide a more engaging and impactful experience. The survey will be given to the students in class through Schoology as an in-class assignment. This data, like the summative assessment and pre-test will be able to be exported to spreadsheets for further analysis as needed.

### **Develop the action plan-what you will do to take action based on results**

The results of the project will be used in the second semester to implement a second iteration of the project. A useful implementation would be to switch the roles of the course sections on a new unit of study. The sections that used Sphero would not in this phase, and the other sections would. This will provide much more nuanced information about the effectiveness of the implementation of Spheros. The results from the formative assessments and the surveys will be useful in the design and implementation in the second semester.

In addition, the data collected will be useful in making adjustments to the implementation of the unit again in the following year. The year-to-year results will allow for an analysis of the specific changes in contrast to just implementing Spheros.

### **Share and communicate your results**

There will be several opportunities to share the results within the school, district, and larger community. By utilizing a PLC team there will be an ongoing sharing of information and learning within the team throughout the test unit. At the same time, these results will be able to be shared immediately with the rest of the department at the conclusion of the unit.

The results of the entire test and possibly the second iteration can be shared in the spring professional learning sessions given by the district. The district allows for teachers to provide peer-to-peer PL sessions and share learning. This format will allow for the results of the project to be shared with the whole district and possible implemented in a wider scale.

### **Reflect on the process**

There are several opportunities for reflection throughout the project. The weekly PLC team meetings allow for short reflection sessions on immediate impacts of the project. It also allows for adjustments to be made in a timely fashion.

At the end of the unit, there is another time for reflection to redesign the unit and make improvements for use in the following school year. At the same time, there will be an opportunity to work with the whole PLC team to implement the project in the other class sections that were not a part of the original implementation. The reflection on the first implementation will provide valuable data to make improvements for the second semester.

Finally, there will be an opportunity to reflect on all of the data and implementations to look for other opportunities to use the Spheros in other classes. The survey questions allow for teachers and students to make suggestions for where they see opportunities to utilize the project.

**References**

Mertler, C.A. (2019). *Action research: Improving schools and empowering educators* (5th ed.)  
Thousand Oaks, CA: Sage Publications.

## Appendix A

### Formative Assessments

Exit ticket prompts with responses given on index cards or in Schoology:

- What is the first step you would do to solve this problem...
- Write one positive and one negative thing during today's classwork

Discussion prompts (can be done as whole discussion or on Schoology:

- "I used to think...., Now I think...."
- Story spine related to the unit
  - Once upon a time there was...
  - One day...
  - Every day...
  - Because of that...
  - Because of that...
  - Because of that...
  - Until finally...
  - And, ever since then...
- 3-2-1 (3 facts about today's work, 2 questions about today's work, 1 opinion about today's work)

**Appendix B****Post-Unit Survey****Student**

What did you like most about this unit?

What change would you like to see in this unit?

What was the most important thing you learned in this unit?

How did the use of Sphero improve/distract the unit?

What is one way you could see the Sphero helping another lesson in this course or any other course?

There are other sections of this course that did not use the Sphero in this unit. Do you think you learned more/less than your peers in those sections? Why?

**Teacher**

What did you like most about this unit?

What change would you like to see in this unit?

What was the most important thing that students learned in this unit?

How did the use of Sphero improve/distract the unit?

What is one way you could see the Sphero helping another lesson in this course or any other course?

There are other sections of this course that did not use the Sphero in this unit. Do you think students learned more/less than their peers in those sections? Why?