# 1 Research Question

How does visual programming affect the academic outcomes of multiplication and division for third grade students?

### Hypothesis

Visual programming can increase understanding of multiplication and division in third grade mathematics. Success in visual programming activities are good indicators that students understand concepts of division and multiplication. Visual programming can provide more appropriate transitions from one mathematical concept to a more advanced mathematical concept.

# 2 Methods

Due to the small sample population size and the scope of the study, we don't expect the study to be statistically significant. However, we do expect that it can provide insight for future studies and contribute to integrating computational thinking into the classroom through mathematics.

The study will be carried out during the USU Spring 2021 semester.

### Organization

The study will be divided up into programming activities. Each programming activity will have specific learning objectives that focus on learning a specific education standard. Each activity will also highlight different programming concepts.

These programming activities can be viewed as homework assignments accomplished either in the classroom or at home. One or two assignments will be given each week, or every day that a new multiplication or division topic is taught.

### Gathering Data

The study will be mainly quantitative but it may also involve some qualitative data. It will involve a control group and a test group, preferably taught by the same teacher. The purpose of this study is for academic and practical purposes. It contributes to the well studied topic of using programming as a teaching tool and it provides more specific application to elementary school.

#### Quantitative Data

Qualitative data will be gathered at various points during the study. Before the study students will participate in a pre-test. The purpose of the pre-test is to evaluate where each student stands and if they are meeting the current standards.

Before each activity in the study a short questionnaire will be given.

During the activities we can gather other various forms of data. These may include: the total time it takes for the student to complete the activity, the total number of blocks that they use to complete the activity, the total number of blocks they drag onto the canvas but don't use, the number of times they run the compiler and observe the program running, their final code block solution, and whether or not they successfully completed the activity among other things. This data can be used both for observing performance of a single activity and activities over time. If students take much longer than expected it may mean that there are flaws in the programming environment.

After each activity students will complete a second questionnaire for them to reflect on what they learned and to see how they felt about the activity. Coupled with pre-activity evaluations we may see trends.

After the study is complete a post-test will be given to determine if students met the learning objectives.

#### Qualitative Data

Qualitative data may include written feedback from the teacher, parents, or the student. This can give us general insight on the study overall.

### Participants

The students will participate in the programming activities. They may carry them out individually, as a class, or in small groups. They will provide feedback about the programming environment, learning activity, and their general experience.

Teachers will introduce the course material and the learning activities. They may also introduce the programming environment. They may provide feedback about the study in general.

### Example Activity

### Math Topics

## 3 Conclusion