

# Scratching the Surface: Elementary Programming

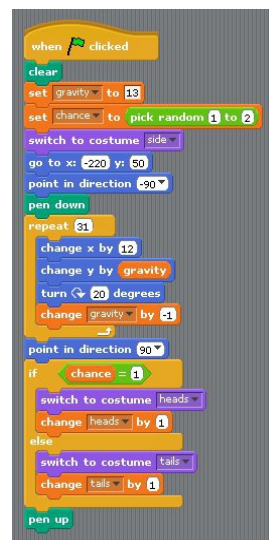
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## Abstract:

Programming is currently being taught at the high school and college levels; the earliest start an ambitious student might get is in middle school. While there are complicated concepts involved in programming, the basic problem solving skills and structure can be taught at a much earlier age. Programming can even be used throughout the first few years of elementary school, although more as a vehicle to teach other topics. This research project involved teaching a Kindergarten class programming through the use of Scratch, a language developed by MIT that focuses on visual output and creativity. The course had a heavy math focus, tying in various concepts such as geometry and probability that are required according to the Math Standards of Learning (SOL). The Kindergarten class learned math concepts such as the coordinate plane, geometry, degrees of a circle and random numbers. Programming concepts covered included starting on command, moving, turning, creating new sprites, and loops.

## Background:

In the previous two years, students have already done several research projects in this area. Jessica Gorman and Crystal Noel worked at Cardinal Forest last year, and helped students learn the mathematical techniques that the students needed to know. Paul Imm stayed behind at TJ to create visual lesson plans from Scratch. The main focus was on the coordinate plane, which required students to first comprehend the use of negative numbers. Gorman and Noel spent the first two months teaching these topics in order for the students to appropriately use the Scratch program. After the coordinate plane was well ingrained, they spent several months working on a basic program oriented around a winter theme in order to practically apply these skills in the Scratch program. The last part of the class was devoted to individual games of the student's choice, with the help of the Gorman and Noel to mentor the students in any other aspects of the language they needed to know.



## Testing and Analysis:

Weekly lessons were taught to a Kindergarten class at Cardinal Forest Elementary School. The expectation was that the students will have a working knowledge of programming the Scratch program by the end of the year. Scratch is an excellent way for young students to learn about programming skills. However, it is also a unique vehicle to introduce and teach concepts from fields other than programming. I was building and focusing my lessons from both a programming and mathematical standpoint, bringing in concepts from the Kindergarten SOL. They were taught in a variety of ways, from hands-on activities to straight step-by-step instructions.

## Results:

Scratch can be used at this level as a visual example to teach the Kindergarten Math SOL topics. There are several reasons to continue using Scratch with Kindergarten, primarily the greater understanding students have of topics taught with Scratch used as a visual example and as a way of increasing interest. Students also enjoy the creative freedom and simple way that Scratch approaches coding, which gives rewards that meet their efforts. It provides an excellent tool to shape lessons around, or even focus on the student's problem-solving abilities. The students demonstrated knowledge of the covered concepts in the Kindergarten Standards of Learning, as well as concepts from Scratch. The Scratch programming class gave them the tools and encouraged them to pursue programming throughout the rest of their education.

