

Serving the Underserved

Curt Hill

Computer Systems and Software Engineering

Valley City State University

Valley City, North Dakota 58072

Curt.Hill@VCSU.edu

Abstract

In the summer of 2016, the author assembled a laboratory of Raspberry PI Model 3s for the instruction of inner city children. This was for the benefit of The Meeting Place Learning Center in East Cleveland, Ohio as part of their summer reading program for neighborhood children. This is an educational outreach that meets three days a week for about six weeks in June and July. About 25 children engage in a variety of programs that attempt to be both fun and educational.

For two weeks one of these activities was the author teaching a series of lessons on programming in Scratch. The content of this paper described how this laboratory was setup and the lessons delivered. The results presented here are encouraging, if not up to a scientific standard.

Introduction.

In the spring of 2016 the author embarked on a curious mission to inject into an inner city neighborhood some programming instruction to a host of children ill-prepared for, yet eager to receive this instruction.

The neighborhood in question is located on the East side of Cleveland, Ohio, some considerable distance from the author's normal locale. This is a predominantly African-American neighborhood locked in economic distress. The median household income in this neighborhood is around \$14,000 and the traditional nuclear family of two parents is a singular rarity. Since the area lacks the financial resources that many of us take for granted the public educational system also suffers from deprivation. Some have described it as a train wreck. The typical student is below grade level, has little experience on a computer and no experience with programming. However, most of them are familiar with a smart phone, including games and apps. Somewhat surprisingly, some of the middle school to junior high aged students had seen and played Minecraft.

The change agent in this story is The Meeting Place Learning Center (TMPLC) [1] an educational non-profit attempting to make a difference in this neighborhood. They conduct an after-school program and a summer program. It was the latter in which this instruction in programming was inserted.

The summer program is held three days a week for about six weeks in June and July, using a day camp model. A typical group would number about 25 grade school to junior high aged students. These children come from the surrounding neighborhood. The program starts at about 10:00. The children receive a snack when they arrive and are fed a lunch prior to their leaving at about 2:00. There is no charge for attending and most of those who do attend would not be able to do so if there were a charge.

During these hours the students are engaged in activities drawn from a common theme that provide both opportunities for learning as well as fun. In 2016 the theme was sports and one of the activities of one week was to visit a nearby ball field in a city park that was considerably run down. The children were then encouraged to compose letters to responsible officials. This particular activity was a huge success, since these officials reacted quite positively and the park was improved into a usable form.

Although the activities that are chosen have some educational and some entertainment value, there is also the possibility of intervention for students with educational issues. A typical intervention is a one on one with an adult volunteer where reading or arithmetic skills are pushed closer to grade level. Like many children of these ages, summer is a time to let skills slip and the intent of this program is to prevent this from happening. Those who are already behind cannot afford to let the gap grow wider.

The Meeting Place Learning Center operates from a refurbished house in this neighborhood and the house is the location of the summer program. The director of The Meeting Place Learning

Center is Judy Willard, she and her husband Robert, are personal friends with the author. Sometime in the spring of 2016 the author embarked with the goal to teach the programming language Scratch[2] in the context of the summer program.

Creating and assembling the laboratory.

The creation of a computer laboratory suitable for instruction in programming used to be an expensive process. However, one can sometimes do so with very limited resources. The author had only personal funds to do so, which constitutes limited resources. The Raspberry PI 3[2] is an obvious choice and a remarkably capable computer for \$35. It features a quad-core ARM processor, 3D video with socket for HDMI video, 4 USB ports, 1 G of memory and both wired and wireless ports. The operating system of choice is Raspberrian, a derivative of Debian Linux. This may be downloaded on micro SD card, which will also substitute for disk storage.

A Raspberry PI may be made into a full computing device by downloading an operating system onto the SD card and plugging in an HDMI monitor, USB keyboard and mouse. With the exception of monitors the other items are comparatively inexpensive.

As an underpaid, small public university faculty, the author could afford several Raspberry PIs with cases, micro SD cards, keyboards and mice, but a single monitor might easily exceed the sum of all these. In this case Valley City State University provided the monitors. These turned out to be older VGA style monitors that were declared surplus and then discarded. The institution was gracious enough to allow me to take eight monitors off of their hands. One was unworkable and the rest needed an inexpensive VGA to HDMI adaptor. With the addition of the monitors the laboratory was complete albeit in North Dakota instead of Ohio.

The computers and associated equipment was setup in the basement of the house operated by TMPLC. There were seven Raspberry PI stations and a projector driven by another Raspberry PI. The center of the basement was occupied by a furnace, with the stations set up on three sides of this. Figure 1 shows the furnace in the background and several of the workstations. This made moving around for the author was a bit challenging. The space was substantially less than ideal, but one does make do if need be.



Figure 1 Two students and instructor

The lessons.

The summer program divided the children into three groups for the main activity of the day. Each group consisted of 6 to 8 children depending on who was present on a given day. Each of the groups was led by an older and more responsible student, one who was generally in junior high. The groups are chosen so as to separate children who do not get along or to minimize the possibilities of disruptions. Many of these children do have behavioral issues.

There are three educational and fun activities that run concurrently. Each group attends one of the successive activities for approximately 25 minutes and then rotates onto the next one. For two weeks one of these activities was learning to program in Scratch.

The lessons all followed a convenient format. The author described in general what was going to be considered. This was followed by a demonstration on the projector. Finally, the students used these new skills to accomplish a simple task. During this latter time, the instructor, ie. the author, moved around helping students who had questions or who had become stuck.

A student was usually alone on a machine. Occasionally two students needed to be on one Raspberry PI, but this did not constitute pair programming in the usual sense. This was a free program, so some of the children were young enough to be pre-readers. Usually these were paired with the group leader or a sibling or cousin with whom they were comfortable.

In each week the program operates three days, Monday through Wednesday. Thus in two weeks six lessons were able to be taught. A brief description of the lessons used is given in Table 1.

Week	Day	Topics
1	1	Overview, importance and progress of computers, Code Org video, Raspberry PI and mouse usage, starting and stopping Scratch.
1	2	Moving Scratch characters, animation, saving.
1	3	Multiple animated characters, random walks, detecting proximity.
2	1	Interacting with Scratch.
2	2	Speech bubbles. Project: Tell me a story
2	3	Games, counting and variables. Project: The whack a thing game.

Table 1 The plan of lessons

The first lesson used a PowerPoint presentation, but from then on only Scratch demonstrations were used. The last two days did not have a lot of new information. However, the students were challenged to create a project on their own, rather than imitating what had been shown with possible small variations.

Week 2, day 2 the students were to tell a short story using the movement of the characters and speech bubbles. On the last day they were to create a whack a thing project. They would choose a character, make it disappear, do a random move and then reappear. If the person could click on it in the short time it was visible, they received a point.

Observations and Conclusions.

The author had no real expectations, since he was very unsure as to what to expect. The children seemed to enjoy the entire process. Most of them had heard that programming and programmers existed, but had little idea of what this was all about. They seemed especially pleased that they

could program in Scratch. It appears that it was the opening of a door that that they had known was shut and locked against them. It is impossible to guess how many might pursue a career in Computer Science or allied fields, but it seems reasonable to believe that a lot more of these children now believe that they would be able to pursue this course of action.

Scratch is well designed for this age group. This project demonstrates that it well designed, since even children on summer break did not have attention span issues. However, some of the older students discovered Minecraft in the Raspberry PI menu. This was something they knew about so would rather engage in that instead of Scratch. This was easily fixed with the menu editor.

There was some discussion about having the students connect to the Scratch web site. Being able to download other people's projects and upload their own could be a good experience for the students. However, it was unclear if the machines would be supervised well enough to keep the children from sites that are substantially less wholesome. Thus it seemed wise to disable the internet connectivity of all of the Raspberry PIs.

The number of children that finished the whack-a-thing project was not large. The author collected only five finished projects. Yet, every reading student was able to produce something and there were many of the tell-a-story projects.

At the close of the author's participation the laboratory space was reclaimed for other activities. Four of the Raspberry PIs were arranged on a back wall for continued use. The author received the report that at a later time these four were used for another Scratch day. When the children started the room became silent, but for the sliding of mice on the tables. This is not exactly a scientific proof of the success of this project, but gratifying none the less.

References.

[1] The Meeting Place Learning Center home page. <https://www.tmplc.org/> Date accessed 8 March 2017.

[2] Scratch – Imagine, Program, Share. <https://scratch.mit.edu/> Date accessed 11 March 2017.

[3] Raspberry PI. <https://www.raspberrypi.org/products/raspberry-pi-3-model-b/> Date accessed 8 March 2017.