



# Learning Python in an Urban After-School Middle School Program

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# About The Authors

- **Suzanna Schmeelk** – Dr. Schmeelk is a Senior Security Analyst at Memorial Sloan Kettering Cancer Center in Manhattan, New York. Suzanna holds an Ed.D. in Mathematics Education from Rutgers University and is a DPS student in Computing at Pace University. She holds two MS degrees in Computer Science, Technology Management & Cyber Security and a BS degree in Computer Science with Mathematics. Suzanna has worked and/or interned with MSKCC, Bell Labs, a subsidiary of Bell Labs, eBay, Yahoo!, UC-Berkeley, Columbia University, New York University, Pace University, Battelle and Paradyne. In addition, Suzanna is an Adjunct Associate Professor at UMUC, an instructor at Parsons School of Design in Manhattan and Instructor with Cooper Union. Suzanna's website is <http://www.suzannaschmeelk.com>.
- **Alfred Aho** – Dr. Aho is the Lawrence Gussman Professor in the Department of Computer Science at Columbia University. He has a Ph.D. in Electrical Engineering/Computer Science from Princeton University. Professor Aho is well known for his papers and books on algorithms and data structures, programming languages, compilers, and the foundations of computer science. Prior to his current position, Professor Aho was Vice President of the Computing Sciences Research Center at Bell Labs, the lab that invented UNIX, C and C++.
- **Stephanie Wortel-London** – Dr. Wortel-London received a Ph.D in Science Education at Stony Brook University in 2017. She is the Director of STEM outreach at the New York Academy of Science (NYAS).
- **Kanika Bansal** - Dr. Bansal received her PhD in Experimental Physics from Indian Institute of Science Education and Research, India. She is currently a post-doctoral associate jointly between US Army Research Lab and University at Buffalo, SUNY in the department of Mathematics and works on Brain Networks. Before that she was a visiting researcher at IREAP, University of Maryland, working in the field of complex systems. Kanika is a STEM mentor with Global STEM Alliance, New York Academy of Sciences, New York and has worked with various science outreach institutions in India.

# Overview

- *We present the design of an after school intervention where students learn Python*
- *The curriculum spans 15-sessions where sessions are limited to 60 minutes*
- *We present unique findings from an after school program which guided the curriculum development*
- *Curriculum URL:  
<http://www.technologyinthepark.com/FOE2017>*

## ***Talk Outline***

- ***Introduction to NYAS Program***
- ***Intervention Design***
- ***Session Structures***
- ***Evaluating Understandings***
- ***Lessons Learned***



# ***NYAS STEM Mentoring Program***

- ***Started Fall 2010***
- ***Afterschool STEM mentoring program***
- ***Mentor one afternoon a week in underserved 4th through 8th grade afterschool classrooms at organizations like the YMCA and the Boys and Girls Clubs.***
- ***<http://www.nyas.org/landing/afterschool.aspx>***

# NYAS STEM Program to Date

## Afterschool STEM Mentoring Program



13,000+  
middle school students in:



1000+  
volunteer scientists



120+  
out of school time programs



17  
inquiry based STEM curricula



150,000+  
contact hours

# ***Intervention Design***

- ***Classroom Leadership***
- ***Inquiry***
- ***Classroom Environments***
- ***Interactive Tools***
- ***Computational Thinking***
- ***Personal Representations***

# ***Intervention Design: Classroom Leadership***

- ***Computing Professionals***
  - ***Diverse technical backgrounds***
  - ***Teaching backgrounds***
- ***NYAS Provides Two Mentees***
- ***Durable learning***



## ***Intervention Design: Inquiry***

- ***Learning is not linear***
  - ***Simon [5]***
- ***Open situations***
  - ***Fosnot and Dolk [6]***
- ***Open tasks***
  - ***Mueller, Yankelewitz and Maher [7]***
- ***Long-term understandings***

## ***Intervention Design: Classroom Environments***

- ***Segmented 60 minute interval***
- ***After school***
- ***Continual fluctuation of students***
- ***Independent or small group work***
- ***Encouraged to ask questions with each other and class***

## ***Intervention Design: Interactive Tools***

- **10-15 minutes**
- **Students that were not present could keep up**
- **A section using an interactive tool**
  - **‘children’ tools were either:**
    - not appropriate because of their themes
    - not clear on understanding programming languages fundamentals
  - **‘older-aged’ tools were either:**
    - difficult for younger students to parse dense text
    - not clear on understanding programming language fundamentals

## ***Intervention Design: Computational Thinking***

- **Create a program from abstract problem**
- **Representations which resonated with the students (e.g. Schmeelk [11])**
- **Understandings – Davis [13]**
  - “Put in its starkest terms, this theory postulates that one gets the feeling of understanding when a new idea can be fitted into a larger framework of previously-assembled ideas. A metaphor that reflects this quite well is the notion that one assembles ideas in one's own mind much as one assembles a jig-saw puzzle.”
- **Assimilation Paradigm – Davis and Maher [14]**

## ***Session Structures***

- **Open initial discussion**
  - **Fosnot & Dolk [8] - congress**
- **Introduce new concepts**
  - **Davis & Maher [14]- assimilation paradigm**
- **Independently use interactive tools**
- **Independently or small group**
  - **Tasks with sample programs**
  - **Final project construction**

## *Evaluating Understandings*

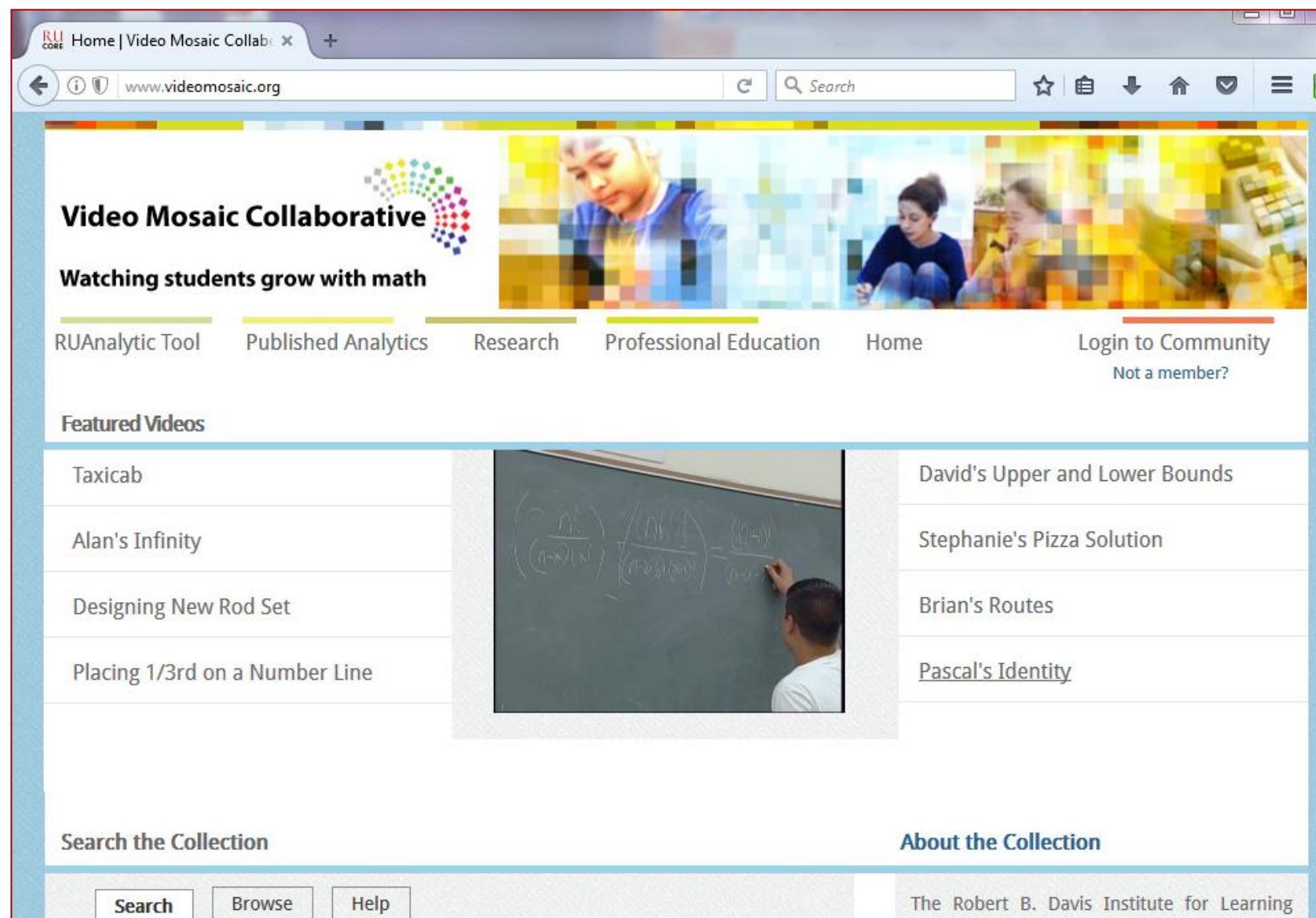
- ***Classroom discussion***
- ***Independent programs***
- ***Pirie and Kieren [15] multiple learning layers***
  - ***Classroom discussions***
  - ***Independent discussions with mentors***



## ***Lessons Learned***

- 1. Limited exposure to programming***
- 2. Missing system admin privileges***
- 3. Develop a take-home USB***
- 4. Online code games to supplement***
- 5. Video Mosaic Collaborative (VMC)***
- 6. Download Curriculum***

<http://www.videomosaic.org>



<http://www.technologyinthepark.com/FOE2017>



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Curriculum

## Python Curriculum

Week	Topics	Download Material
1	Survey Students Python Installation What is Python?	
2	What is Python? What is Computational Thinking? Program Examples	
3	Lets start writing a Program Variables and Loops	
4	Variables and Loops Selection Statements	
5	Selection Statements What is Software Engineering?	
...	...	...
All		<u>ALL</u>



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8 - 9 June 2017  
Grand Hotel Mediterraneo  
Lungarno del Tempio, 44 - Florence - Italy

# Thank you!