Computational Thinking and The Algebra Project: Developing Voice, Agency, and Identity

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Our project focuses on implementing a theoretical framework to engage young people in Imagination, Creativity, Reasoning, and Discourse to develop **Voice** → **Agency** → **Identity**.

THE ALGEBRA PROJECT

Problem

The brilliance of underserved youth is untapped in the mathematics classroom.

Educational practices reflect a cultural chauvinism, disadvantaging certain cultural influences, values, ways of being, and ways of interacting.

Creative Learning Spiral (Resnick, 2018)

We view culture as a rich resource for materials needed by builders (Papert, 1980)

We aim to tap into this brilliance by an explicit pedagogical model that engages orality — through *imagination, creativity, reasoning, & discourse*.

The Algebra Project

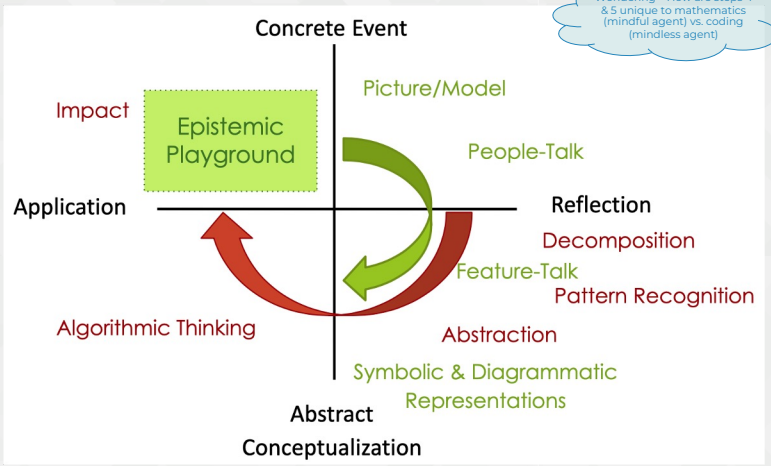
The Algebra Project (AP) is a legacy of the Student Nonviolent Coordinating Committee (SNCC), founded by Bob Moses in 1982.

AP uses mathematics literacy as an organizing tool to guarantee quality public school education for all children in the United States of America.

AP developed a culturally-based pedagogy from the critical role that social facilitation and social identity serves in communities of color, where collaborative models are prominent. This is evident in a "call and response" cultural pattern in classrooms but is also connected to the need to cooperatively and collectively solve persistent challenges in resource-poor communities.

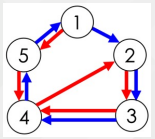
The AP curricular process is the synthesis of three distinct lines of thought: (1) experiential learning, (2) agency first through student voice, and (3) the regimentation of ordinary discourse (Quine, 1981)—seeing children's orality as an asset in their learning.

Experiential Learning Cycle



Wondering – How are steps 4 & 5 unique to mathematics (mindful agent) vs. coding (mindless agent)

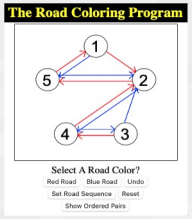
Concrete Event

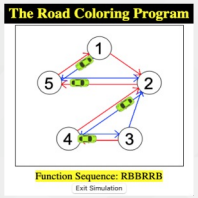


Begin with a shared experience. AP 5-Step process develops abstract conceptualization.

Playpen

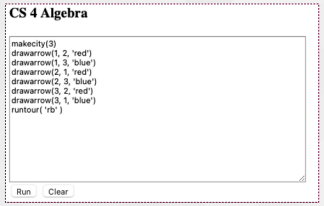
Move the concrete experience to virtual representation

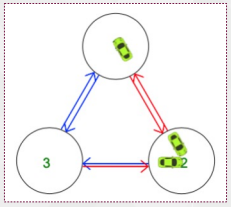




Playground

Remove structures of the playpen, raw coding in Python utilizing functions familiar to the concrete event, apply algorithmic thinking – imagine, create, play, share, reflect, ...





5-Step Curricular Process

1. **Concrete Event** – an activity, task, or game; builds on students' life experiences
2. **Picture or Model** – draw pictures or create a model of what was most interesting
3. **People Talk** – write and speak about the event at the intuitive level of everyday discourse
4. **Feature Talk** – through consideration of those features or attributes of the event that they consider most salient and interesting, teacher helps students bridge their language and pictorial representations of the mathematical concepts.
5. **Symbolic Representation** – capture these features and their relations in iconic or symbolic representations of their own construction

Mathematics is generated and learned as a collective enterprise. Students view the knowledge they build is not just for themselves, it benefits their team/class.

Mathematical work follows a pattern of individual thinking (production), small group work (publication), then whole group discussion (peer-review), parallel to the development of voice in the sharecroppers of the Mississippi Delta.

Voice, Identity, Agency

Voice – because all students have thoughts and opinions about a concrete event, all have a place and a voice (talking with themself and./or with others).

Agency – casting ideas implicit in the initial shared experience into symbolic form is both an expression of student agency (they are creating a little piece of mathematics) and a means to develop that agency.

Identity –student needs to see within mathematics a thick authenticity (Shaffer & Resnick, 1999), and an intellectual earned insurgency (Moses, 2009) for an empowering math identity,.

What students say (**voice**) and do (individually & collectively; **agency**), contributes to the building of their **identities**.

Realization that they can do mathematics and coding is a pathway to the recognition of their right to make a demand on the educational system for a quality education, an **earned insurgency**.

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