International Society of the Learning Sciences

Being a Good Student: Risks and Reactive Coping Strategies Encountered in a Summer STEM Makerspace for Black Youth

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Abstract: There has been a large push over the last decade to drive STEM interest during the formative years of adolescence through computer science related initiatives such as computational makerspaces that allow students to design and build personally connected artifacts. However, these programs are not often designed to be culturally relevant to the students they aim to motivate. This paper presents a case study of one student who participated in the first iteration of a summer makerspace camp for Black youth ages 12-16. The design principles guiding this STEM camp adapted pedagogies for computational making for belonging and becoming (Escude et al., 2020) with a goal of fostering culturally relevant STEM identity development. Using the phenomenological variant of ecological systems theory (PVEST; Wigfield et al., 2007) as a theoretical and analytical lens, we present three phenomenological episodes representing an overview of the student's arc from Days 1-8 of the 12- day camp. Over time we see the student extend the boundaries and objects of their coping strategies, moving from just utilizing the resources in front of him to thinking more flexibly about where help can be found. We argue that this student is an ideal case for refining design principles and providing insights into supporting belonging and becoming in the context of computational making.

Students of color and girls have historically been underrepresented in STEM, and even after recent upticks in CS enrollment and federally funded programs like CS4All, Black students especially still lag well behind their contemporary counterparts in the increase of enrollment in STEM fields (Brown et al., 2013; Boroush, 2020).
As one potential solution, educators have leveraged informal learning environments to offer engaging computer science-related programming in hyper-locally relevant ways. Makerspaces are one such format. Makerspaces promise to bring together the worlds of "creativity and curricular content" in STEM, especially for students that previously found themselves at odds with traditional schooling (Hughes et al., 2018). In makerspaces, students can design and build projects of their interests using equipment and materials of their own choosing. The design process is typically driven by "ill-structured problems" solvable in numerous ways allowing for a wide range of unique and personal outcomes (Dousay, 2017). The constructivist and constructionist principles guiding the design of such spaces have been termed *computational making pedagogies* (e.g., Dousay, 2017; Hughes et al., 2018; Lee et al., 2020).

However, makerspaces have largely not delivered on the promise of fostering a new industrial revolution for all (Anderson, 2012; Blikstein, 2014). Makers are largely white, college-educated men, and the makerspaces themselves tend to reflect this by continuing "tensions and contradictions present that can give rise to inequalities that further suppress meaningful engagement from women and people of color" (Martin et al., 2018, p. 36). Without adopting critical lenses, computational making pedagogies remain neutral to the sociopolitical forces present in the communities they offer to serve. Such neutrality (unintentionally) perpetuates the status quo of makerspace environments.

This paper presents a case study of one student who participated in a summer makerspace camp for Black youth ages 12-16. This design guiding this STEM camp adapted pedagogies for computational making in order to design for belonging and becoming (Escude et al., 2020; Tissenbaum et al., 2021) with a goal of fostering culturally relevant STEM identity development. Using the phenomenological variant of ecological systems theory (PVEST; Wigfield et al., 2007) as a theoretical and analytical lens, this study examines the vulnerabilities that one student faced and the adaptive coping strategies they used to ultimately complete a computational making project. We argue that this student is an ideal case for providing insights into how to support belonging and becoming in the context of computational making.

Background: Adolescence and STEM Identity Development

Much of the decision-making around STEM identity is formed well before college, starting even before students make it to high school. Adolescence serves as a critical time of identity formation, and it is often here that students

think most deeply about who they are and where they fit into society. Even when students of color express an interest in science at a young age, this interest can be lost in a short time, often due to students developing an image of doing science that seems incongruent with who they, or the world, see themselves as (Carlone et al., 2014). There is also a negative trend in student engagement and motivation between elementary and secondary school, specifically in math and science (Carlone et al., 2014). While this is not a trend specific to Black students, students of color are often viewed negatively regarding their STEM abilities, including by teachers (Carlone, 2014). This ever-increasing understanding that the world views them in a specific way is rarely experienced as a protective factor regarding STEM identity development in students of color or girls (Brown et al., 2013; Carlone, 2014). Black students become hyper-aware that they are not often represented or wanted in STEM fields and that technology can act in racist ways (Benjamin, 2019).

Theoretical framework: Understanding culturally relevant identity development using the phenomenological variant of ecological systems theory (PVEST)

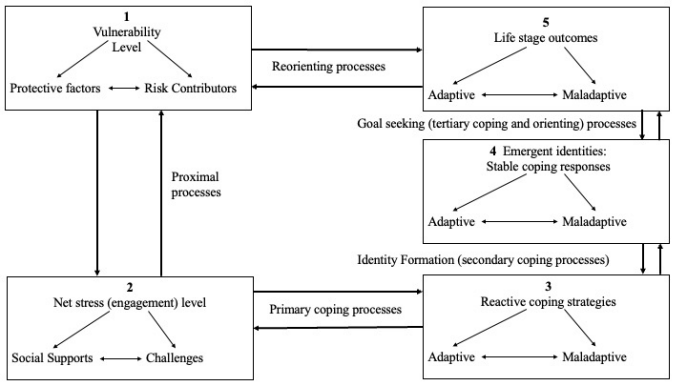
Identity development is a situated phenomenon that involves the dynamic interaction between an individual and their environment(s). Ecological systems theory (EST) is an ecological model that captures these interactions to describe an individual's identity development as being affected by systems outside of and including the self (Bronfenbrenner, 1977). Identity development, therefore, is the "outcome of an individual's interaction with their environment, including the people and physical objects within" (Ozaki et al., 2020 p. 256). These interactions, over time, affect the development of the individual's beliefs about themselves and who they are concerning these environments and other connected environments.

The Phenomenological Variant of Ecological Systems Theory (PVEST) introduced by Spencer et al. (1997) expands on EST by describing more clearly the mechanism by which individuals' interactions with their proximal processes (see Figure 1), moments, where net vulnerability interacts with net stress level, over time, can result in students drawing conclusions as to "who they are, with the goal of responding to negative feedback" (Wigfield et al., 2007). PVEST takes a magnifying lens to proximal processes and looks more specifically at student and environmental assets and how they might interact with each other during points of friction.

We will walk through this model using an example of one familiar type of friction a student might encounter in schooling: being called on out of the blue to answer a question by their teacher. Different students will react differently to this situation. For some, it may be inconsequential. PVEST describes these students as having low net vulnerability in this situation (see Figure 1, Box 1). One's net vulnerability is the outcome of particular individual-level risks and protective factors at play at that moment, such as race, gender, or social stereotypes. For others, however, it may be perceived as a challenge: they may perceive it as a test of themselves as an intelligent individual, a good student, or a myriad of other perceived beliefs about self. For these students with a higher degree of net vulnerability, this perceived challenge may raise their net stress (Box 2).

People respond to stress with reactive coping processes (Box 3). These coping processes can either be maladaptive or adaptive. For instance, the uncertain student, may attempt to answer the question, or they might avoid answering altogether by saying, "I don't know," or staying silent. Their decision about coping processes will depend largely on their past experiences and the perceived effectiveness of similar strategies in similar situations. Over time, these coping processes become part of who they are and how they respond to similar situations throughout life: in other words, one of a student's emergent identities (Box 4).

Figure 1.
Phenomenological Variant of Ecological Systems Theory, reprinted from Wigfield et al., 2007, p.708.



Inherent in this model is the assumption that microsystems are not neutral grounds. Rather, they bring challenges and supports that compose an individual's net stress, and, if high enough, may challenge the student's perception of self. By the same token, if higher levels of support exist, the situation will elicit less net stress. Based on what we see of Black STEM students, it is plausible that lowering the challenges of a specific microsystem could reduce their net stress. For example, a Black student who perceives themselves as a good student receiving critical feedback from an instructor may respond differently depending on how they experience this in relation to their racial identity within the institution (Cohen & Garcia, 2008). In other words, different microsystems influence what counts as a risk and for whom.

Importantly, PVEST also explains how students develop productive identities and coping outcomes while navigating risks, stresses, and vulnerabilities. All humans experience some level of vulnerability, and net stress in itself is also not necessarily a negative. In fact, overcoming challenges is an integral part of "positive growth and development" (Wigfield et al., 2007). Students may develop numerous strategies for engaging and succeeding in stressful environments, and over time, could transform these risks into support. As such, this model is helpful for understanding the mechanisms of resilience while simultaneously acknowledging the environmental, sociological, and systemic influences requiring that resilience.

Aims of the paper and research questions

This paper presents a micro-analysis of one student's (Jordan – pseudonym) participation in a 6-week summer maker camp to illuminate the tensions and proximal processes that Jordan encountered. In analyzing his specific reactive coping processes as well as how we as facilitators responded to these coping processes, we aim to address:

1. What aspects of the designed environment did Jordan experience as risks?
2. What kinds of reacting coping processes did he demonstrate?
3. How did those reactive coping processes evolve over the course of his interaction in the makerspace, including continued interactions with both facilitators and materials?

Methods

Study context and participants

During the summer of 2021, we (the first (Black male) and third (White male) authors) implemented a 6-week summer camp in an informal community center setting in the Midwest. The summer camp focused on computational making that aimed to foster and positively support the emerging identities of Black middle school boys. These goals were in alignment with those of the local community center, which had a mission of promoting college and career readiness as well as providing social and emotional support for Black boys and men between the ages of 3 and 24. Our camp focused on middle school boys and met twice a week for two hours each meeting period, for a total of approximately 24 hours of contact time. Participants were 12 middle school boys that were in the broader summer camp program at the community center. All except two students identified as Black. On any given day, the number of students in attendance ranged between 6 - 12. While they had all signed up for the broader summer camp, they had not specifically signed up for the makerspace camp. Students had little to no prior in-depth experience with physical computing.

Program design

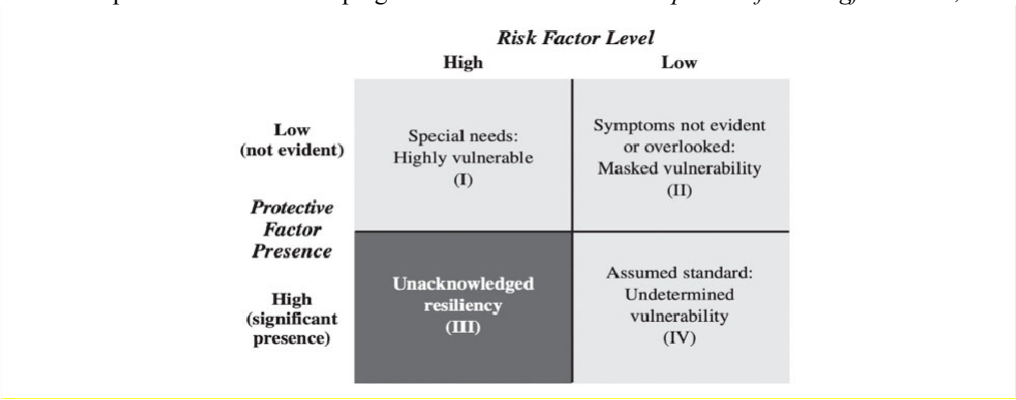
Our overall program design was driven by twin commitments to supporting belonging and becoming (Escude et al., 2020; Tissenbaum et al., 2021). Central to these commitments were principles for reflexively supporting student agency. Inspired by Escude et al.'s (2020) metaphor of stretching and releasing a rubber band, we tried to "open up" as much of the curriculum as possible, both in material usage as well how we as facilitators responded to student tensions in the moment. More specifically, three key design principles guiding this "opening up" included (1) *Maintaining curricular and pedagogical elasticity* - allowing for flexibility in student expectations and being responsive when they appear; (2*) Practicing transformative inclusion* - changing the space for the student instead of expecting the student to change; and (3) *Balancing organizational and structural priorities* - thinking more deeply about imbalances in expectations brought about by the organizations involved. Ideally, students would learn some basic skills in the use of microcontrollers that would then allow them to explore and build their own personal projects during the second three weeks of the implementation, followed by a symposium where they would share their projects with other tribes and community members. Over the course of three weeks, students built and modified artifacts that contained LEDs, motors, and a variety of onboard and external sensors, before following a design process to create their **own** personal or community-based project.

We utilized the BBC Micro:bit microcontroller due to its approachable nature and being purpose-built for education. For example, the numerous physical connection pins that one normally sees when looking at microcontrollers, have been abstracted away and are replaced with circular spaces where wires can be connected to by alligator clips or even screws. We also chose to initially expose them to a limited but useful array of electrical components such as LEDs, motors, and several useful onboard or external sensors.

Data collection, case selection, and analysis

Data included audio recorders at each table in the camp (often just two) and two cameras, one at the front and one at the back of the room, positioned to capture the students as they worked and their movement through the room. In total, approximately 24 hours of video and audio were captured across all the devices. Field observations were also captured, and the facilitators did daily debriefs on the days' activities to adapt the curriculum to student needs or other emergent factors.

Figure 2.
Spencer's dual axis coping formulation of PVEST *reprinted from Wigfield et al., 2007, p.731.*



Video clip segments were stitched together for each hour of the 24-hours recorded and imported into MAXQDA software for analysis. We utilized content-logging (Jordan & Henderson, 1995) of student interactions with each other and with materials of all the videos, close microanalysis of key moments, and interactions of the students throughout the process (Jordan & Henderson, 1995). This content-logging process led to the selection of a single student, Jordan, whose low literacy would be viewed as a large educational risk factor that would mark him as a quadrant I (see Figure 2) "highly vulnerable" student in Spencer's Dual Axis Coping Formulation (DACF) of PVEST (Wigfield et al., 2007). Jordan's reactive coping processes often mitigated this risk factor. We looked at this as an opportunity to look at his strategy selection, which could offer insight into his identity development and foreground possible areas of challenge or support for other students. Based on our repeated viewings, we began to identify sources of "unacknowledged resilience" in Jordan's interactions. This "unacknowledged resilience" that Spencer describes as individuals falling into quadrant III (Q3) of the DACF. Spencer describes these Q3 individuals as being often overlooked in research while also describing their importance in informing the design of programs and policy:

> "The group is also important for careful study since the unpacking of their experiences allows one to determine how much risk is facilitative…and how much risk…undermines positive health and development (i.e., pushing individuals from functioning as Quadrant III members and, instead, deteriorate into Quadrant I level of high vulnerability) (Wigfield et al., 2007, p. 733)."

We identified moments where Jordan was mentioned in the video content logs and re-watched those clips, generating more detailed logs. We began to identify emerging themes about Jordan's interactions and progression through the summer based on these detailed logs. These themes were related to Jordan's experiences of "friction" and his help-seeking strategies. We then identified four distinct moments that captured pivotal moments of "friction" for Jordan's trajectory and conducted close microanalysis of those four moments (Jordan & Henderson, 1995). The four identified moments represent *phenomenological episodes:* tensions that required Jordan to utilize a reactive coping strategy and could have been facilitative or undermined his protective factors. We documented Jordan's reactive coping strategies, as well as how we, as facilitators, responded to these coping

strategies. We then examined how Jordan leveraged them differentially over time to (ultimately) successfully navigate his own path through the program. In the interest of space, three of those four moments are presented here.

Findings

We present three phenomenological episodes that represent Jordan's arc from Days 1-8 of the 12-day camp. Across these three episodes, he shifted from passive reactive coping strategies to more active mechanisms by identifying and taking advantage of available supports. Across all three episodes, we provide in-text the connected strategies (S1, S2, etc.) that we saw Jordan use during the camp as revealed by our thematic analysis.

Phenomenological episode 1: Passive signals for help

Jordan's first phenomenological episode occurred during the initial task of the camp: messing around with a micro:bit and following some basic instructions to get it set up. Throughout this episode, Jordan's body language signaled that he was uncertain about how to proceed. He also utilized three distinct reactive coping strategies in response to this uncertainty: (S1) Sending silent signals while waiting for help to come; (S2) Shifting focus to others and the environment when "stuck" - what are other people doing?; (S3) Asking questions of available resources; and (S4) Attempting to figure things out on his own. The following vignette illustrates how Jordan utilized these coping strategies throughout the initial micro:bit activity, which lasted a total of 16 minutes.

After students completed a pre-survey, the instructors passed out the micro:bits and instructed students to "mess around" with them. Jordan's micro:bit can be seen sitting, wrapped, in the corner of his table. After sitting, arms folded, waiting (S1) He began to look around, saw others interacting with their micro:bits, before finally reached for his own. (S2). He picked it up, a gave it a quick turn in his hand, looking at it for 20 seconds before putting it back down and glancing around the room again (S4). He looked towards F1 for 2 seconds before verbally calling over for help and sat with his hands folded in front of him making small glances around the room (S4). As F1 arrived. Jordan held up the USB cable and asked something about it (S3). F1 told him he could plug in the micro:bit, to which he asked another inaudible question while holding up the USB cable. F1 held up his micro:bit and said that he can plug the USB cable into the micro:bit and then walked away (S3). He immediately reached for the micro:bit and struggled to unwrap it for 30 seconds before looking at Garfield, the student at the same table who had already plugged his in (S2).

At this point, Garfield finally succeeded in getting his micro:bit powered up, causing it to go through a sequence of flashing lights. This caught Jordan's attention, and after observing Garfield's micro:bit, Jordan connected his USB cable to his laptop (keeping it rolled up in the same way as Garfield), but struggled to plug it into his micro:bit. Jordan glanced around almost nervously, then tapped Garfield on the arm and asked for help (S3). Garfield helped Jordan get his micro:bit powered up, but Jordan sat there, looking around, not knowing what to do next (S4). Jordan continued this cycle of being shown what to do but not knowing how to proceed, moving between Strategies 3 and 4. F1 then told the class that he had handed out sheets with additional support, which Jordan picked up and turned right way up (S2). Jordan briefly glanced at the sheet before once again looking over at Garfield (S2). After several minutes F2 came over and helped Jordan use the document to go to the needed URL, including helping correct Jordan's typing.

Throughout this episode, Jordan encountered friction at nearly every encounter with materials and his coping strategies were incredibly passive. When he did leverage more active strategies, such as asking Garfield for help, it was coupled with a nervous look that suggested he may have felt that he was cheating. In addition, when I (F1) responded to Jordan's question, I did so operating under the principle of "student agency": wanting students to be able to "mess around" and manipulate things on their own without relying on a facilitator to do it for them. Upon reviewing the data, it's clear that this choice may have served to reduce belonging and prohibit opportunities for becoming, in that they essentially rendered Jordan's initial reactive coping strategies ineffective.

Phenomenological episode 2: Jordan's wheel-spinning cycle

This episode occurred on the second day of the first week of the program, where we wanted students to use their understanding of "addressing" LEDs to make a digital design on a larger 8x8 grid LED matrix. To help facilitate this, F1 coded a design of the Jamaican flag and used that as an example for them to think with. Our scaffolding required students to start by following a URL to get to (https://craftdesignonline.com/pattern-grid/) to develop their design using the interactive grid tool. After coming up with their design, we then asked them to transfer the design to paper, which would then later allow them to input these colors into MakeCode for use on the micro:bit.

The design document gave a basic set of directions for completion as well as abbreviations to use to denote what color the specific LED should be set to when they set it up. It is easy to overlook the tensions faced by Jordan during the episode. At first glance, each cell in his worksheet looked filled in, but on closer inspection,

we noticed that Jordan had erased everything he had originally written in the grid. He originally seemed to be trying to number his grid with a one in the 63rd cell and count to 64 by the time he got to the last cell. It is unclear truly why or what he was doing with these numbers, but numbering the grid was his takeaway from this portion of the design process.

Jordan faced the first of a chain of challenges immediately while trying to log in to the laptop with the password on the board. Jordan glanced around and noticed that others had opened their laptops and were typing. He, too, opened his laptop (S2). Jordan then focused on his laptop and began typing something. When F2 was close to Jordan, Jordan raised his hand (S3). This portion of the overall episode shows one of Jordan's consistent coping responses: "reading the room," collecting information from what others are saying or doing.

Throughout this interaction, F2 seemed to recognize that Jordan was having some trouble following the spelling of the URL and could be seen pointing to each letter as he said each out loud, even slowing down in his spelling of the URL. When they completed the URL, F2 took charge of the laptop to point out to Jordan what he needed to do before moving on to help another student.

After the facilitator left, Jordan entered what we refer to as the "wheel-spinning cycle" (WSC). The WSC loops Jordan's coping strategies endlessly until a source of external input arrives. For example, when the F2 moved away, Jordan's gaze followed his movement (S3). Jordan continued to glance around until F1 passed by. Jordan engaged him with a question: "What are these?" F1 responded that they were the different colors that he could use to design, then asked, "Does that make sense?" Jordan took the opportunity to ask a follow-up question about the paper. F1 again replied that "the screen is the place where you can do it and then transfer it to the paper." Jordan nodded his head, and F1 walked away to help another student.

F2 then walked by and said to the student sitting next to Jordan, "Cool checkerboard pattern!" Jordan craned his neck towards the student's screen before returning focus to his laptop (S2).

When Jordan engaged with his laptop on this occasion, he did not exhibit wheel spinning, rather, he continued to engage with his trackpad for the next ten minutes with all attention focused on his screen. After ten minutes, Jordan glanced over at the F2, who was helping another student, and raised his hand. F2 acknowledged Jordan but continued working with the student first. As he waited, Jordan sat back in his chair for several seconds before he got the attention of Garfield and Amari across the table from him. He turned his laptop screen around to them, and to the camera for the first time. He broke out into a wide smile and asked them to "check it out." Jordan had completed his design of a four-color checkerboard pattern that he was clearly happy with. Amari responds, "that's better than mine." In this episode, we saw Jordan break out of his WSC by utilizing a risk strategy (S2) to achieve a successful making outcome, promoting positive identity development.

Phenomenological episode 3: Jordan uses his laptop to help him complete a sentence

On the eighth day, students were completing a design planning document and being introduced to the materials and components to start building their personal projects. Here we saw Jordan using a different form of his strategies, as he needed to write sentences on the planning document. He moved to sit right next to Garfield. He glanced down at his planning document, on which he should have been working on a basketball game. F1 mentioned Jordan's basketball hoop and how he could use the design of the first one to make an improved version. He is attentive throughout F1's instructions, as well as when F2 begins to also give directions for the day, his gaze focused on the speaker with his hands clasped.

F2 asked if the directions made sense before looking directly at Jordan, who gave a small nod of yes. Jordan glanced down at the design document in front of him but still did not move it (S1). Jordan spent some time rubbing his eyes while he glanced around and looked over at the table where F2 was helping another student (S2). Jordan then pushed back from the table as he moved his hands away from the laptop (S1). Seemingly without conversation, Garfield reached over the table and picked up Jordan's paper, turning it to the correct page before placing it back in front of him. Jordan then looked at his paper but still seemed stuck. He looked at F2 and continued to wait (S2). After a moment, Garfield got up to get something to write with and Jordan also immediately followed, coming back with a pen before going back and replacing it with a pencil (S2). After coming back, his glances followed F2 until F2 sat down with another student. Jordan then looked down at his paper and began WSC, looking from F1 to F2 to the paper in front of him. After 3 minutes of holding the pen and staring at the page and the front of the room, Jordan turned to Garfield and asked, "What am I supposed to do?" (S3). Inaudibly Garfield explained something to him, after which he seemed to show more interest in interacting with the page. Jordan wrote on the paper off and on for the next 3 minutes before asking Garfield something again. Garfield looked at Jordan's paper and responded again (S3).

A minute later, Jordan got up again and went back to the materials table, coming back with a laptop. This time Jordan seemed to enter the password for the laptop correctly from the board. Two minutes later, Jordan started using the laptop as a reference (S3 + S4): he had typed something in and was now writing on his paper

while glancing back and forth to the laptop. This behavior went on for seven minutes, at which point he turned around to F2, raised his hands, and called for his help (S3). F2 acknowledged Jordan but was trying to finish something with another student, and Jordan began to wait. He did no more writing while waiting (S1).

Discussion

We presented a close analysis of three instances in Jordan's trajectory that allows us to see both how our design principles unintentionally functioned as risks for Jordan, as well as the reactive coping strategies that were more or less effective in this context. Looking across these episodes, it seems that Jordan's most persistent challenge was one of uncertainty, which then elicited a Responses Arc (RA): (RA1) Silent call for help (sitting away from the laptop with his arms folded). (RA2) Reading the room (Where are facilitators, what are they saying to others, are they close by? What are other students doing? What counts as good work?) (RA3) Public call for help (raising hands when a facilitator entered in proximity). (RA4) Where is help located in the room? (Going to look over someone's shoulder, asking student directly for help). (RA5) What can I figure out on my own? (Reading of board, looking at the instruction sheet) Throughout the camp, Jordan would enter this arc if it seemed that help was going to take too long for him to proceed or if he had just received help and was still uncertain as to how to proceed. By episode three, we can see that Jordan has started being more active in solving some of the problems that he runs into. Instead of waiting for the facilitators to make it to him, he instead breaks out of the wheel-spinning cycle by both specifically asking Garfield direct questions, as well as utilizing the laptop to help him spell out a sentence. This problem could have been solved by waiting for facilitators, but instead of waiting for direct assistance Jordan formulated alternative ways. In this case Jordan was able to leverage a computational resource to help get him past the friction brought about by his uncertainty. Over time we began trying to do more checking to see if Jordan understood what we explained, as seen in episodes 2 and 3, but these attempts did not always help.

These re-orientations seem to reflect the movement from a formal classroom to an informal learning environment: Jordan's initial responses were ones that would have been supported, even praised, in formal education settings. In addition, a teacher in a formal education setting would have had more information about Jordan's reading abilities than we did. Jordan's vulnerabilities were most exposed when he was asked to read and write, especially without the aid of the laptop. His silent bids for help when instructions were available and readable (e.g., on worksheets) were often overlooked. His main question was always, "What should I be doing?" While a knowing teacher would have immediately leveraged at-level literacy strategies, we most often simply redirected him to the written instructions. Still, Jordan was one of the few students that were consistently present throughout the camp, and he also started and completed a personal project by the last week of the camp. Jordan showed persistence in both his attendance and in his desire to complete what was asked of him.

Although Jordan was often more focused on completion than creation due to having to deal with consistent uncertainty, he was able to build off examples that he knew to be exemplars, including his final project. One of the problems with Jordan's reactive coping, especially for educators that are not his formal educators, is an ability to overlook both his efforts and subsequent achievements. Jordan's project, while being a remix of an earlier one, showed the ability to reason by working with the modular nature of the electronic components. His project utilized an infrared sensor that sensed when a ball went into a cup, sending a signal to his micro:bit, replicating an automated basketball hoop. With his understanding of these components, he was able to come up with a design that merged skills learned from separate projects by making the external LED strip light up when the infrared sensor was triggered. The basketball court that he built looked identical to the court that he drew on his design document, and the sentence that he wrote to describe it on his design sheet, while very rudimentary, is exactly what he ended up doing.

Jordan is more than a Black middle school boy. He is an intersection of so much more, and aspects of those intersections were overlooked during design. While trying to focus on a portion of his identity, we overlooked others. The scaffolds that we offered him were largely literacy based. This was exacerbated by Jordan's seeming belief that he needed to work largely as an individual. While Jordan found many of the holes present in our design, he also serves as a resource for improving future iterations of improved design. These responses also seemed to evolve over the course of the summer camp and moved from passive reactive coping to more active processes.

Conclusion

This paper explored the complexities of designing computational making curricula in a culturally supportive and responsive manner by closely following the experiences of Jordan, a Black student, during the first iteration of a makerspace summer camp. To better design future spaces that facilitate resilience in students like Jordan, we propose the following strategies: (1) *Maintaining curricular and pedagogical elasticity* – Our focus on flexibility

to allow personal choices in projects could be enhanced by considering elasticity in the context of instructional scaffolding. Jordan would have benefited more from exemplars, collaborative grouping, and one-on-one conversations rather than the numerous paper-based handouts provided. (2*) Practicing transformative inclusion* - the program would have benefitted from us as facilitators being more direct about recognizing and supporting students' individual coping skills, especially since our overall goal was supporting their emergent maker identities. (3) *Balancing organizational and structural priorities* – While community center members knew more about each participant student, the structure of our communication did not effectively support the exchange of personal student information. In subsequent iterations, we engaged more directly with staff members and parents to better understand the intricacies of each student. Jordan as a model is helpful in understanding the mechanisms of resilience while simultaneously acknowledging the environmental, sociological, and systemic influences requiring that resilience. Overall, this case study provides valuable insights for refining design principles and supporting belonging and becoming in the context of computational making for students similar to Jordan.

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Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant No. DRL #2048833. We would also like to express our gratitude to Chris Napolitano, as well as the Krist and Tissenbaum research groups, for their valuable insight and support throughout this process.