

# “I want to be a Game Designer or Scientist”: Connected Learning and Developing Identities with Urban, African-American Youth

June Ahn, Mega Subramaniam, Elizabeth Bonsignore, Anthony Pellicone, Amanda Waugh, Jason Yip,  
University of Maryland, College Park, 4105 Hornbake Building, South Wing, College Park, MD 20742  
Email: juneahn@umd.edu, mmsubram@umd.edu, ebonsign@umd.edu, apellicone@gmail.com,  
awaugh@umd.edu, jyip@sesame.org

**Abstract:** Understanding identity, including how young people come to aspire to become someone, is vital to address the underrepresentation of minorities in science, technology, engineering, and mathematics (STEM). We report on a two-year, research project where we designed, implemented, and conducted case study research in an after-school program for inner city, middle school students. The program utilizes the school library, new media activities, and science fiction to engage young people to imagine STEM as relevant in their lives. We focus our analysis on two African-American boys, Damian and Jamal, who are best friends and avid gamers. Despite their similar backgrounds, they show starkly divergent identity trajectories while participating in our program. We highlight how they experienced different connected-learning activities and social positioning over time, and how these experiences related to Damian’s developing aspiration to become a game designer or scientist, contrasted with Jamal’s struggle to imagine a future in STEM.

## Introduction

Increasing the representation of minority groups in science, technology, engineering, and mathematics (STEM) fields is a high profile issue in education (Chen & Weko, 2009). However, helping individuals develop an aspiration to pursue STEM related fields is a complex endeavor. Identity-development experiences that help individuals define themselves and encounter positive positioning by others may provide important mechanisms to develop such aspirations. Research has shed light on how young people develop identity in a variety of formal and informal learning contexts (Barton et al., 2013; Nasir & Hand, 2008; Polman & Miller, 2010; Polman, 2006). We build on these studies to examine how young adolescents develop identity in a world in which they have increasing access to new media, online networks, and information.

In this paper, we report on a longitudinal, design-based research (DBR) project (Collins, Joseph, & Bielaczyc, 2004) in which we (a) designed and implemented an after-school program called Sci-Dentity for urban, middle school students that utilized science storytelling and new media to engage youths in STEM ideas, and (b) examined the students’ developing sense of personal identity over an 18-month time period. We developed the project within the ethos of recent efforts to understand young people’s new media participation, interest-driven practices, and connected learning experiences (Ito et al., 2013; Pinkard & Austin, 2010). Students in our after-school program engage in various storytelling and new media production activities that examine STEM in popular culture. We iteratively designed the program to allow youths to pursue their own interests and we leveraged this context to examine their experiences and identity development over time.

We focus our analysis on two African-American, adolescent males, Damian and Jamal (pseudonyms). They are best friends who share a deep affinity toward video games and technology. They attend the same middle school and are among a select group of students who have participated in our program consistently for the last two years (as 6<sup>th</sup> and 7<sup>th</sup> graders). Despite their similar backgrounds, Damian begins to assert an aspiration to be a game designer or scientist by the end of his 7<sup>th</sup> grade year, while his friend Jamal continues to struggle to imagine his future. In this paper, we outline how theories of identity development, new media literacy, and connected learning help us to understand their participation in our program and their evolving aspirations. Our findings contribute to current discussions about learning, such as Connected Learning models that foreground the potential for young people to leverage technology to produce, participate, and connect with resources – informational and social – to pursue their interests and develop career goals (Ito et al., 2013).

## Theoretical Framework

The driving motivation for our research is to shed light on the ways in which school libraries, storytelling activities, and new media participation can help young adolescents identify with STEM and develop aspirations to pursue a future in a STEM field. We build from prior scholars who have examined (a) learners’ identity development and (b) ideas about how individuals learn with new media and across informal environments.

## Identity Development

We leverage Barton and colleagues’ (2013) definition of identity as how a person figures themselves, and is perceived by others, in a given moment. How a person *figures themselves* can be observed as a series of stories

or narratives that are told about the self, such as the communities one affiliates with, what actions one is capable of, and what futures one can envision (Sfard & Prusak, 2005). Thus, an initial point of understanding is observing how the youths in our program voice their aspirations and interests. Figured selves are also enacted in specific contexts of practice that influence what actions and discourse can occur and are valued (Polman, 2006). The concept of positioning describes how a person authors him or herself in relation to the people with whom they interact, and the activities and community in which they participate (Polman & Miller, 2010). A key element of understanding an individual is how they are *perceived, recognized, and socially positioned by others*.

Recognition by others has been shown to play a major role in how female students connect with science and how they decide to pursue science careers (Carlone & Johnson, 2007). Learners are influenced by how a teacher or adult facilitator views and subsequently treats them, and what others see as their capabilities (Barton et al., 2013; Polman, 2006). In prior research, such identity-developing experiences have been analyzed as *moments* or scenes (Polman, 2006) that can illuminate how local and seemingly ephemeral interactions leave imprints on how individuals perceive their opportunities, position in society, and aspirations toward future activities. In our research we seek to examine the moments of interaction that our participant youths experience, and leverage these moments to glean insight into their developing identities over time. Identity develops through the history of accrued moments that span across contexts and time (Barton et al., 2013). Thus, we also turned an analytical eye toward understanding how our focal learners' moments (or scenes) linked together over time to relate to their own articulated aspirations and self-image.

### **Connected Learning, New Media Literacy, and Identity**

We examine our youths' developing sense of self in a Connected Learning context, in which young people have increased access to a wider ecology of information, technology, and interest-driven learning communities (Ito et al., 2013). For example, informal learning programs and online communities provide ways for young people to learn important skills, cultivate relationships, and develop their own identities in the process. Theoretically, these capabilities should provide more pathways for young people to develop deeper identification with a personal interest, develop expertise and skill, and connection to career and life goals. However, there is a need to understand how these pathways develop and how learners actually make these connections between interests, learning opportunities, and formal academic or career goals. Much of the early work has focused on understanding successful learners, but attention is also needed to articulate the challenges that arise for learners in these contexts.

The intersection of new media literacy and identity provides a framework to understand and articulate these ideas. Skills such as searching for information, assessing credibility of content, and understanding complex cultural practices such as remix, are vital to fully participate in connected, interest-driven learning experiences. Research is needed to better understand the consequences for learners who are still developing, or face obstacles in learning these literacy skills. There is also increased understanding that successful learners are able to effectively mobilize and activate their ecology of resources in order to pursue self-interested learning (Barron, 2006; Ito et al., 2013). For example, successful learners can search for information and connect to content in ways that further their knowledge. They can develop relationships with peers or mentors, in order to develop skills and guide their activities. However, there are open questions still concerning how to support struggling learners who might not yet have these skills to mobilize their ecosystem of resources. One potential link is understanding how literacy skills and identity moments intersect in the cycle of experiences that a learner may face. For example, in order for an individual to fully participate in an environment or learning community, they need to have some modicum of literacy skills. To gain skills, one needs incremental and sustained participation. However, to sustain participation, one also needs to self-identify with the community in the first place. How do these inter-related factors combine in cycles of experiences for learners, and subsequently relate to their developing sense of future aspirations?

### **Research Questions**

To delve deeper into this broader question, we focused on three research questions that were informed by the identity development and connected learning literature:

R1a: How did our youth participants position themselves, and how did others position them, throughout their experiences in Sci-Dentity?

R1b: How did these experiences relate to each other, and inform future interactions over time?

R1c: How did youth participation in the interest-driven, new media based activities in Sci-Dentity relate to their identity trajectories?

## Methodology

### Context of the Study and Design of Sci-Identity

The context of this study is an after-school program called *Sci-Identity* that is run in middle school libraries, in partnership with school librarians, and focuses on using science-based stories to help adolescents think about the relevance of science in their everyday lives (Subramaniam et al., 2013). The students read young adult books, or watch videos that incorporate science in stories. In addition, they engage in storytelling activities using traditional (e.g. writing) and new media (e.g. videos, infographics etc.) modes of production. Participants in the program also network and share their work in a private social network site (<http://sci-identity.org/>).

We implemented Sci-Identity in a large, urban school district where approximately 90% of students come from minority groups and nearly 77% qualify for free and reduced meal (FARM) programs. Damian and Jamal, our two focal learners, attend a school where nearly 100% of students qualify for FARM and 98% of the student population is African-American. Over an 18-month period, the research team planned and facilitated weekly after-school sessions at two urban middle school libraries. At various iterations of the project, the project team included seven graduate student assistants and ten masters student volunteers that helped with the program. This team attended the after-school sessions, worked individually with the students, and participated in data collection and weekly team debriefing meetings where we discussed what occurred each week, emerging issues, and redesigned activities based on our findings. The project was designed iteratively, with periodic redesigns of the general after-school program based on research and analysis.

### Data Collection

We collected several forms of data that spanned a period from January 2012 to June 2013. Each week, sessions at each school were video recorded. All members of the research team, including student assistants and volunteers, wrote weekly observation notes; took pictures, video, and audio recordings; and logged individual interactions with the youth participants. Our weekly team meetings were also audio recorded and included in our corpus of data. All artifacts and projects created by the students (e.g. stories, sketches) were collected, as well as log data of their activity on the social network site (e.g. record of logins, posts, comments etc.). Finally, students and librarians in our program were interviewed at the end of each school year, May 2012 and May 2013, which coincided with the end of 6<sup>th</sup> and 7<sup>th</sup> grade. In total, our data sources included nearly 60 hours of video and audio recordings, approximately 250 pages of written observation notes, and over 50 interviews.

### Data Analysis

We analyzed our corpus of data using a case study framework (Yin, 2003). Each member of the research team chose several focal learners in our program. For each focal learner, the researcher reviewed each week of data over the 18-month period, and chronologically catalogued: (1) specific learner interactions that were captured in video and audio recordings, with salient interactions transcribed for dialogue and actions, (2) mentions of the learner in written observation notes by the project team, (3) artifacts such as posts to the social network site and their project work, and (4) identity-related information culled from our interview transcripts.

Our chronological data trail allowed us to both triangulate data sources to develop our claims and check the trustworthiness of our interpretations in a systematic way. For example, we could match scenes on video recordings with observation notes of the same interaction made by the project team, and notes from team debriefing sessions that mentioned that scene. We could combine multiple perspectives of the same scene – from video, from the perspective of an actor in the scene, or group understanding of that scene in team meetings. This constant comparison process enabled us to examine how our focal learners positioned themselves in different interactions, how others perceived them, and how they experienced our program activities. Interview data from the focal learners provided insight into their aspirations, perceptions of self, their participation in the program, and their home life. Interviews with librarians provided an additional window into how our focal learners were perceived in school. Each researcher coded data for instances of participation, positioning, and literacy. Each researcher also annotated the data for emerging themes, particularly if they were recurring and related longitudinally across time. Thick case descriptions for each learner's identity trajectory were crafted through this process, and enabled us to make comparisons across learners as well.

## Findings

Many of Damian and Jamal's moments in the program occurred together or in close vicinity to one another. Likewise, we present their cases through intertwined vignettes that are representative of their closely linked experiences, while illuminating the contrasts in their identity trajectories over time.

### New Beginnings, New Friendships

We began our after-school program with the students in January 2012. In the first session, students watched a video about storm chasers (scientists who follow and study tornados), and did a short story exercise based on the

video. Immediately, we observed how Damian and Jamal positioned themselves and how our own project team positioned them. Several facilitators immediately recognized Damian as a young man seeking to make connections and being proactive about charting his own path. One facilitator noted, “Damian is a researcher in the group. Our first week with him, I noticed that he was searching a lot of information concerning Storm Chasers” and another added, “Damian was extremely proactive, even searching other websites for information to enhance his story”. These initial observations – a willingness to engage in activities, search for information online, and move off on his own based on the task given – became consistent ways that Damian positioned himself throughout the program.

In contrast, Jamal had a rather inauspicious beginning. One facilitator wrote in her observation notes, “Jamal had his head on the desk. Not sure why he was even there. He did not seem the least bit interested in the story writing. I tried working with him individually, but it was like pulling teeth. His story was uninspired, short and full of spelling errors. I’ll be surprised if we see him again.” Other project volunteers confirmed this observation, noting that the other students treated his disengaged behavior as if it was the norm. This characterized a recurring theme for Jamal, one in which he positioned himself as outwardly disengaged, while adults responded by positioning him as apathetic to the program and showing low literacy skills. Despite this initial perception, Jamal was one of the few participants who attended the program fairly consistently, for the entire two-year period of this study. What explains this contradiction?

Damian and Jamal began a close friendship during this time period that revealed aspects of their motivations and personalities. Damian was a new student to the middle school and had few existing relationships with peers. Perhaps it was this situation that related to our consistent observations of Damian seeking social connections with both peers and adult facilitators over time. In our second week, video observations showed Damian developing a friendship with Jamal. Jamal confirmed these observations in our interviews with him, and he explained how he became friends with Damian, “He came here in the sixth grade, and I just started talking about games. That’s how we became friends.” Jamal’s self identity as kind and helpful also relates to this developing friendship. In our interviews with students, we asked them to imagine writing a biography and explain how they would describe themselves. Jamal provided insight into how he saw himself, “I don’t really know. I’m kind of fun sometimes. I’m always there to mostly help. Like when a new student’s here and you know, he gets bullied and stuff, I’m always there to help. I’m easy to be friends with. I like to play games and fix stuff.” The school librarian corroborated these observations of Jamal saying, “So, in his class, he’s very well-behaved. Like, he’s one of the better students and kind of just has to deal with a bunch of ruckus going on around him all the time, because he’s very respectful and he’s not going to give anybody a hard time. [But] I think his problems come with engaging in the work.”

## Utopian and Dystopian Futures

The students’ primary 6<sup>th</sup> grade project was to develop a short story based on a discussion of utopian and dystopian future societies. The students read and discussed *The Hunger Games* (a popular young adult series that had a major movie release at the time). A requirement of the project was for students to search for and find an interesting scientific idea, around which they could craft a plot and characters. Damian and Jamal, like many of the other learners, struggled when using the library iPads to search for information related to their interests. In one video scene, we observed Jamal struggling to search for information and remarking, “everything is blocked” through the school district’s Internet filter. A facilitator asked Jamal what he was interested in and he replied “weapons”. This interaction led to a series of guided Internet searches about weapons, ballistics, and somehow to information about the game World of Warcraft. The two boys became very excited at this finding, leading to Damian jumping into the exchange:

Facilitator: ... Perhaps you can do a search about what it takes to make video games and use that in your story... have you ever seen Tron?

Damian: I love Tron! That’s a video game.

Facilitator: Yea it is a video game... Someone actually made a story about the game Tron.

Damian: Like a virtual world.

Facilitator: Yea, so I would find a fact about virtual worlds and write a story about that.”

Jamal: I want shooting games.

In this scene we noticed how the facilitator was initially helping Jamal through his difficulty in conceptualizing what to search for and how to conduct a search for information. However, Damian jumped into this activity and subtly took advantage of an opportunity to connect with this facilitator. We also observed how the adult facilitator positioned the boys’ interests in video games as a valid avenue to engage in the task. Damian made a connection, observing that the story of Tron was centered on the ramifications of designing and living in a virtual world. We later learned that Damian was an avid Minecraft player, a game where players can build a virtual world themselves. Damian realized that his interest in virtual worlds was a valid way by which he could connect his interest in games with the exercise of imagining futures. In contrast, Jamal exhibited behavior that

became a recurring pattern for him, where he was a silent participant who seemed passive but secretly listened in on the conversation and tried to make his own connections. Jamal chimed in at the end and voiced his interest in researching shooting games, revealing that he had been following the conversation silently. Both Damian and Jamal continued to follow this interaction pattern in future sessions.

In later weeks, we observed Damian searching for information on Minecraft. Video observations show Damian explaining to a facilitator that at home he was making a “cobblestone generator that mixes lava and water and makes cobblestones” in the game. Ultimately, Damian developed a story in which life was entirely lived in a virtual world, and incorporated his view of the societal ramifications of this future. His path to this project illuminated his propensity to connect ideas. His initial interest was in video games and Minecraft, but he was able to readily connect his out-of-school interest to the after-school activity of combining science (programming, virtual worlds) with stories (Tron) and apply it to his own imagination.

In contrast, Jamal faced obstacles that related to his self-doubts about his formal literacy skills. As a result, he consistently positioned himself in public as someone who was disengaged with formal academic work while privately attempting to engage behind the scenes. In one session the students worked in groups to think about utopian and dystopian futures, and how science and technology would play a role in those imagined futures. Jamal was a leader during group discussions, often contributing ideas such as zombies that the other students took up enthusiastically. However, a facilitator wrote in her observation notes that Jamal did not seem interested in writing his own story, “When he starts writing, his stories and ideas are always really interesting, but I think he is hesitant in people reading the materials or criticizing his work.” Video recordings show Jamal in this session, with his head down not knowing how to start. He also steals glances and listens in on his peers talking around him, searching for clues as to how to make progress, but does not readily accept help from adult facilitators. This pattern of interaction occurred regularly. Jamal would often engage when thinking about ideas or discussing topics of interest to him, but when asked to create formal products he often reverted quickly back to a posture of public disengagement.

### **Connections and Disconnections**

In the 7<sup>th</sup> grade, we guided the students to consider identity by imagining themselves as superhero characters in science fiction. The learners created infographics about their characters, linking science and life events to the stories. Damian particularly struggled to focus in this activity. He spent much of his time using an online avatar creator to visually depict his superhero character, and joked around with Jamal who was often not engaged with the project. However, he also spent time trying to connect with facilitators that led him to new discoveries.

Damian’s superhero character’s name was Wesker, who had a magic helmet and hammer, and came from another planet. We learned later in the year that Damian was interested in the movie Thor, which was about a comic book character that had a similar storyline. Eventually, Damian focused on exploring potential planets that Wesker could have come from, and in one session, he suddenly exclaimed out loud “Hey I found a new planet like Earth!!!” Damian proudly posted a news article to a section of our social network site called the “Brain”, where we encouraged learners to share science inspirations that could be used in stories. The article described NASA’s Kepler space telescope project that set out to discover planets that resided in “habitable zones” similar to Earth. This breakthrough energized Damian and in future sessions, we consistently observed him engaged in learning more about planets discovered through the Kepler satellite. In one session we saw Damian, working with a facilitator, leveraging his new discovery to engage with scientific ideas. Damian was excited, exclaiming, “Awww!! There’s more planets! ...I found another planet!!” He began to describe to the facilitator the facts about the planet, such as the number of candidate planets, the search for Earth sized worlds, and how satellites detect new planets by the dimming of star lights as a planet crosses a star.

While Damian found connections with facilitators and ideas, Jamal struggled. He often sat away from others during whole group activities or discussions, but still within the vicinity of his friend Damian and another female friend Chanda, who was close to the two boys. Often Jamal would not engage with tasks unless Damian or Chanda urged him on. For example, Jamal was not particularly interested in creating an infographic for his character, Dark Batman, who he envisioned as a more evil version of the comic book character. However, he readily engaged in describing his character when we encouraged Damian to “interview” Jamal using their iPad (instead of writing in a document). These patterns related to Jamal’s self-perceptions about his academic ability (not writing, but participating in other new media forms of storytelling). We also came to understand that his main motivation was to have a place to hang out with friends.

We learned through interviews with the school librarian, that Jamal was in the “lower academic track” in his school. His friends, including Damian, were all in the high academic track. In Jamal’s interview at the end of 6<sup>th</sup> grade, he noted that he had very little time to hang out with Damian and their friends during school time. They had different classes, different lunch periods, and Sci-Identity was one of the times that they were able to hang out together. These details of Jamal’s school life suggested that the opportunity to be with friends, whom he is otherwise disconnected from, was a main motivation that drove him to continually attend the program. Much of his 7<sup>th</sup> grade data described Jamal’s friendship, joking around, and social drama with Damian and

Chanda. The school librarian also confirmed this observation saying, “He wants to be around his friends, which are Damian and Chanda, but he doesn't to me really feel like doing anything. He just kind of wants to be there and not be missing anything.”

The baggage of Jamal's perceived lower-academic positioning also emerged in other instances. For example, in late Spring 2013, we had one session where nearly all of the students did not attend. We learned that the students had to practice for the school play, but only those in the high academic track were in the play. This situation left Jamal as one of the only youth in Sci-Dentity that afternoon and served as a reminder of his academic status in school and his disconnect from his friends. We noticed a consistent pattern of interaction and positioning with Jamal that harkened back to a previous comment by the school librarian that he was respectful, but just had to deal with the “ruckus” of his school environment. We observed that Jamal would often shut down at predictable moments. When his peers would get rowdy and the school librarian would shout at the students, he often just put his head down and tuned out. When the librarian or a facilitator would attempt to push Jamal to continue writing or searching for ideas online, he would disengage and respond with reasons for his lack of progress (often saying that he did not know how to spell). He also shied away from asking adults for help, instead preferring to listen-in on other students' conversations, to glean clues about what he should do. These series of experiences were related to Jamal often positioning himself at the outset of a session as cool and disengaged. In moments where we observed him striving to engage, his momentum was often halted by a myriad of factors: distractions from the sometimes hectic atmosphere of the school, lack of confidence in his literacy skills, and reticence to approach adults or peers for help (e.g. mobilizing his ecosystem).

### **Finding a Spark – Video Games**

At the end of 7<sup>th</sup> grade, the students defined their own interests and the after-school sessions were focused on guiding interest-driven learning. Jamal and Damian (along with several boys) decided to learn how to design video games. We leveraged this interest to focus on game design tasks and talking about computing related careers. This project seemed to ignite Jamal. The school librarian also noticed a change in him and began to position Jamal differently: “I feel like at the beginning of the year we couldn't even get him to sit and listen or pay any attention to what we were supposed to be doing. And by the end of the year, he started to come up with the video game. Once we started that video game project, he really came up with his own ideas. So, he definitely improved in that aspect.” Towards the end of 7<sup>th</sup> grade, we began to see a spark of interest with Jamal despite the fact that he continued to struggle with his self-positioning and literacy skills.

Damian also latched onto this project, having been one of the loudest voices to advocate a focus on video games. We introduced a tool called *GameMaker* that allowed the learners to design and develop simple games by loading sprites and coding simple scripts. Damian was immediately interested in learning how to use *GameMaker* and it was clear that the concept of actually building a video game himself ignited a passion in him. We observed the two friends deeply engaged in interest-driven learning activities and they spent much time deciding on the details of their game design. However, it was interesting to observe how members of our own team positioned these activities at times. One facilitator wrote in her notes, “Damian was working with Jamal on their game, but in fact spent the entire time looking up music to script to their game, which has not really been started. On the one hand, it is great to see them engaged in something, on the other, there was not a lot of product at the end. That said, they were very thoughtful about the kind of music they wanted.” While the boys were very engaged in the project, there were some tensions with facilitators viewing activities such as looking up music for the game as non-productive.

Ultimately, the school year ended before the students could fully develop their video games. The experience illuminated some of the tensions related to interest-driven learning environments. We touched on a passion for these two friends (games) that spurred engagement in other interest-driven learning practices such as using technology to research information (e.g. find music to fit their game narrative), design products, and learn about tools to produce artifacts (e.g. *GameMaker*). In contrast, this interest-driven process also required much more time and personal guidance from facilitators. The boys (and other learners doing this project) were excited about their game designs, but were somewhat disappointed when the school year ended before they could become fluent enough with *GameMaker* to realize their game designs as actual games. A spark – an interest – was a vital first step, but formal practices such as design and coding also need time to develop and learn. The boys were disappointed that summer vacation would bring a lull in the program. However, they both cited this project as the most memorable and interesting of their two-year experience in Sci-Dentity and voiced a strong desire to continue the project in their 8<sup>th</sup> grade year.

### **Discussion**

This study contributes additional understanding of Connected Learning contexts and the role of identity development in such learning environments (Ito et al., 2013). Past research has identified factors that contribute to a successful connected learning experience. For example, successful learners begin with an interest and utilize new media to work on active projects that promote further learning within those interests. They

participate in learning programs and online communities to glean support from peers and mentors. And, finally they find ways to connect their learning in these experiences to formal endeavors such as schoolwork or progressing toward a career aspiration. Much of the early research describes success cases and focuses on the importance of configuring access to an ecosystem of resources – technology, people, institutions etc. – to enable this type of technology-mediated, interest-driven process.

This study lends additional detail and considerations to this framework. The cases of Damian and Jamal highlight the local processes – identity and literacy experiences – within a connected learning environment that relate to their successes and challenges over time. Damian’s story shows a young man who was well served by our program. He was in the high academic track in school and was already deeply engaged in a well-defined interest (Minecraft). Damian brought this background to Sci-Dentity, and he accumulated positive experiences over time that further reinforced his interests and sense of self. Despite struggles he might have had with new media literacy skills or social distractions, he found ways to continually relate his experiences over time. Like more successful new media literacy learners, Damian developed an aptitude to productively mobilize his ecology of available resources. He sought help from facilitators and connected to peers, bridged his ideas across informal and formal contexts, and used technology to aid in these tasks. From an identity perspective, Damian positioned himself to achieve these goals and others positioned him in positive ways. We argue that this cycle of mutually reinforcing experiences related to Damian beginning to develop aspirations toward STEM. In his 7<sup>th</sup> grade interview, Damian voiced aspirations to become a “game designer or scientist”. He also shared details that spotlight his deepening identity trajectory. He disclosed that he knew of particular game design companies in his home state that he aspired to work for and had also done independent, online research to identify colleges that had game design degree programs.

Jamal’s case highlights a young man who could fall between the cracks, even in interest-driven programs that value alternative pathways to learning. Jamal brought his background to Sci-Dentity, as a student that was insecure about his academic positioning in school. These factors related to his self-positioning in the program. Outwardly, he did not ask for help, but instead took to silently listening in and observing his peers, in efforts to get clues about how to engage in tasks. When able to tackle tasks that he was literate in – recording videos, designing a game – he showed progress. When we asked him to work in formal ways – doing research or writing – he shut down. We observed a learner who identified with our program because it gave him a connection to his friends. Jamal’s story is of a well-intentioned learner, who progresses in fits and starts, due to a cycle of obstacles that accrue over time. These experiences related to Jamal’s struggle to connect his learning across contexts and imagine his future. When asked about his future aspirations he replied, “Hoping to mostly fix cars or to customize cars or become I don't really know. That's mostly what I think I can do.” Interestingly, Jamal had never voiced an interest in cars for the 18-months he had been in the program, although it could have been a valid avenue to engage with STEM ideas. Jamal also had few plans for his educational future, stating that he should get a good education but probably would not go to college. When probed further, we learned that his grandfather and his socioeconomic success were the salient identity stories in Jamal’s mind. Jamal stated that his grandfather was the person he most looked up to, “... he's successful. He's not like that big time rich person, but he is successful. He has his own house. He has three cars that he was able to buy. He has a big TV. He was able to do all that stuff and retire too.”

## **Design Considerations and Conclusions**

The results of this study have several implications for practice and research. In the context of our DBR project, the case studies introduce several considerations that we aim to explore in the next iteration (the students’ 8<sup>th</sup> grade year). A major challenge for interest-driven learning environments is designing experiences to continually promote each individual learner’s unique development of interest, expertise, and skill at every given moment in time (Edelson & Joseph, 2001). For Damian, we need to design activities that push him to further his expertise in formal technical skills, interact with individuals who can further his imagination of possible futures in game design or computing, and link his future educational plans to his developing interest. Damian needs further positive experiences that continue to add onto his positive identity trajectory and future aspirations. For learners like Jamal, we are faced with a complex task of how to break through his cycle of obstacles. We must find ways for him to engage in literate ways that do not lead to shut down, but also guide him towards more confidence in formally recognized practices and dispositions. Furthermore, there are other learners in Sci-Dentity who each have their own unique interests to address. For example, some learners are avid storywriters, and other learners in the program, like Jamal, are still searching for interests to pursue and facing their own unique obstacles.

In our next DBR iteration, we see intriguing opportunities to further integrate ideas of interest-driven learning, within the unique affordances of Connected Learning environments, while serving the specific goal of helping under-represented youths develop stronger identities in STEM. For example, Edelson & Joseph’s (2001) Interest-Driven Learning framework provides insights into the types of contextual motivation strategies that could be employed in our weekly sessions. The Connected Learning literature underscores the importance of putting into place a larger ecosystem of resources and experiences – beyond just our after school setting – that

could help our learners to begin explicitly linking their experiences across contexts and expand their imagination. Finally, research in learners' identity-development attunes us to examine the cycle of experiences that our youths experience, connected to their broader social, economic, and cultural settings, that relate to their deepening sense of self over time. Integrating these separate research streams may help us better understand complex challenges such as how to promote a learner from an interest to a deep commitment to pursue a STEM career. As one example, DiSalvo and Bruckman (2009) found that there is a correlation between video game interests and a student's decision to pursue computer science in college, but the relationship is very small and the majority of avid gamers never translate their interest in games to actually pursue computer science. Our findings offer a potential response to this perplexing relationship. The careful design and accumulation of interest-driven activities, enhanced through connected learning contexts, that promote identity-conscious experiences, may be required in concert to reduce the gap between a learner's *figured self* with their *potentially realizable self*. We posit that the cases of Damian and Jamal are applicable to other learners. By being attuned to the contextual factors at play, at key moments during the identity development of learners like Jamal and Damian, we can perceive and design for those moments that present opportunities to spark more productive trajectories and to sustain those already rocketing forward.

## References

- Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. *Human Development, 49*, 193–224.
- Barton, A. C., Kang, H., Tan, E., O'Neill, T. B., Bautista-Guerra, J., & Brecklin, C. (2013). Crafting a future in science: Tracing middle school girls' identity work over time and space. *American Educational Research Journal, 50*(1), 37–75.
- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching, 44*(8), 1187–1218.
- Chen, X., & Weko, T. (2009). *Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education* (No. 2009161). U.S. Department of Education, National Center for Education Statistics. Retrieved from <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2009161>
- Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences, 13*(1), 15–42.
- DiSalvo, B. J., & Bruckman, A. (2009). Questioning video games' influence on CS interest. In *Proceedings of the 4th International Conference on Foundations of Digital Games* (pp. 272–278). Retrieved from <http://dl.acm.org/citation.cfm?id=1536561>
- Edelson, D. C., & Joseph, D. M. (2001). Motivating active learning: A design framework for interest driven learning. Retrieved from <http://www.designbasedresearch.org/reppubs/edelson-joseph.pdf>
- Ito, M., Gutierrez, K., Livingstone, S., Penuel, W. R., Rhodes, J., Salen, K., ... Watkins, S. C. (2013). *Connected learning: An agenda for research and design*. Irvine, CA: Digital Media and Learning Research Hub.
- Nasir, N. S., & Hand, V. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *The Journal of the Learning Sciences, 17*(2), 143–179.
- Pinkard, N., & Austin, K. (2010). Digital youth network: Creating new media citizens through the affinity learning model. *International Journal of Learning and Media, 2*(4).
- Polman, J. L. (2006). Mastery and appropriation as means to understand the interplay of history learning and identity trajectories. *The Journal of the Learning Sciences, 15*(2), 221–259.
- Polman, J. L., & Miller, D. (2010). Changing stories: Trajectories of identification among african american youth in a science outreach apprenticeship. *American Educational Research Journal, 47*(4), 879–918.
- Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher, 34*(4), 14–22.
- Subramaniam, M., Ahn, J., Waugh, A., Taylor, N. G., Druin, A., Fleischmann, K. R., & Walsh, G. (2013). The role of school librarians in enhancing science learning. *Journal of Librarianship and Information Science, 0961000613493920*.
- Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

## Acknowledgments

We would like to thank all of the school librarians, our students, and graduate research assistants who played an integral role in this project. This material is based upon work supported by the National Science Foundation under Grant No. 1124176. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.