

Alternative Science: An Examination of Practice-Linked Identity Formation Within the Context of an Art Science Program

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**ALTERNATIVE SCIENCE: AN EXAMINATION OF
PRACTICE-LINKED IDENTITY FORMATION
WITHIN THE CONTEXT OF AN ART SCIENCE PROGRAM**

Dissertation

by

ARIELLA FLORA SUCHOW

submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

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**ALTERNATIVE SCIENCE: AN EXAMINATION OF
PRACTICE-LINKED IDENTITY FORMATION
WITHIN THE CONTEXT OF AN ART SCIENCE PROGRAM**

**Author: Ariella Flora Suchow
Chair: G. Michael Barnett**

This dissertation documents the pilot year of an Art Science Program. This study asks: what is possible when we create learning environments modeled for the integration of theatre and other artistic media with science? What, in general, are the affordances of theatre and other art forms for fostering such meaning-making, what are good ways to make it happen, and what are the challenges? We analyze young learners' participation and attitude changes in the context of the Art Science Program. Findings indicate that (1) access to identity resources impacts learners' *practice-linked identities* (Nasir & Cooks, 2009); (2) face-saving behaviors impact practice-linked identities by inhibiting learners' access to identity resources; (3) the development of practice-linked identities parallels the development of possible selves; (4) the extent to which a learner is able to engage in their learning as a "whole person" (Wenger, 2006) is correlated with a learner's identity trajectory; (5) learners may fail to form new practice-linked identities despite robust access to identity resources; and (6) learners may succeed in forming new practice-linked identities despite lack of significant access to identity resources because the identity resources that they do access provide a strong hook into new, nascent practice-linked identities.

For my grandmother, Sondra L. Keller, and for my daughter, Maia L. Suchow.

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1

Introduction

Background

Middle school is a pivotal time in a learner's academic, social, and emotional life. Attitudes and identities are formulated largely during the elementary and middle school years (Barton et al., 2013), and the identities youth embody during these times can shape their experiences later on in life (Kinney, 1993).

Throughout adolescence, and in school settings in particular, youth continuously grapple with and negotiate their racial/ethnic and gender identities (Altschul, Oyserman, & Bybee, 2006; French, Seidman, Allen, & Aber, 2006; Hill, McQuillan, Spiegel, & Diamond, 2018; Rogers, Scott, & Way 2014; Hill, McQuillan, Spiegel, & Diamond, 2018). This has significant implications for youth's science identities, in particular. As adolescents, youth decide whether or not they want to engage in STEM subjects or fields in the future (Gasbarra & Johnson, 2008) and if they want to further develop their

interests and skills in these domains (Brown, Concannon, Mark, Donaldson, & Black, 2016). Unfortunately, many youth from underrepresented backgrounds — particularly youth of color — decide that science is “not for them” (Tawfik, Trueman, & Lorz, 2014). Reasons for this decision include the ways in which classroom conditions (including unequal distribution of praise) reinforce gender and racial/ethnic stereotypes about science abilities (Hill et al., 2018) and the cumulative effects of micro-interactions about who, exactly, can become a scientist (Banchefsky, Westfall, Park, & Judd, 2016; Grunspan et al. 2016; Hazari, Sadler, & Sonnert, 2013; Master & Cheryan, 2016; Walton & Spencer 2009). These interactions can impact the career choices for minority youth, girls, and learners from populations facing other disadvantages (Correll, 2004).

Despite recent increases in the number of youth from underrepresented backgrounds studying science, the percentage of these learners is still low (President’s Council of Advisors on Science and Technology, 2010); youth who are African American, Latinx, female, and come from low socioeconomic (SES) backgrounds or rural communities are less likely to enroll in science classes and pursue degrees and careers in the sciences (Alegria & Branch, 2015; National Science Board, 2016; Penner, 2015). Considering this, it is particularly important to understand and acknowledge underrepresented populations’ experiences with science and to find ways of supporting and providing positive experiences for these youth during the middle school years (Nadelson et al., 2017).

One possible way of providing this support is to make use of arts-based learning. In arts-based learning, learning environments are designed to provide opportunities for feedback and reflection through art-making and to have learners’ finished products

viewed by an audience that will engage with the artwork (Halverson & Sheridan, 2014). Arts-based learning involves the amalgamation of multiple art forms at the same time (Halverson & Sheridan, 2014), including visual art, dance, theatre, music, and digital media. Additionally, arts-based learning is often “a multidisciplinary act that requires understanding how the tools of a given medium afford representation and communicate meaning” (Halverson & Sheridan, 2014, p. 627). Arts-based learning involves an awareness of how work will be perceived by different audiences, an awareness of how small choices by the creator/artist impact the form and meaning of the piece at large, and examining identity and culture (particularly for adolescents) — all of which have significant impacts on learning (Halverson & Sheridan, 2014) and could, if designed with this in mind, have impacts on science learning as well.

Theatre-based learning environments have the potential to provide a form of arts-based learning that can be particularly impactful for youth from underrepresented populations struggling to connect with science. Theatre “includes any art form designed to communicate a story: staged theatre, creative writing, performance art, and (more recently) digital video/audio narratives” (Halverson & Sheridan, 2014, p. 626). In theatre programs where youth create their own performance pieces, youth use language as tools for empowerment and sense-making (Worthman, 2002). Through theatre constructed by youth, learners navigate how to represent themselves and their ideas through language, forging a relationship between the development of the self and the development of language through theatre (Halverson & Sheridan, 2014). This can have implications for youth seeking to represent ideas they find important about science to larger audiences and captivating that audience through language. Additionally, the opportunity for youth

(especially those in middle-school) to “explore possible selves” through drama and narrative arts may strengthen learners’ own identity development, particularly for historically marginalized youth (Halverson, 2010). This may also provide them with opportunities to empathize with (and perhaps think critically about) historically-marginalized narratives throughout history.

It is for these reasons that providing historically-marginalized youth (in particular, girls and learners of color) with opportunities to engage with science through theatre and the arts, in general, could be helpful for getting these youth to reimagine what it means for them to participate in science, both presently as adolescents and in their futures. Providing middle-school youth who do not enjoy, are intimidated by, or have been historically marginalized from science with an alternative context to explore science may allow these youth to view science differently, either in terms of the domain’s relevance to their own lives or lives of individuals in their community (i.e., viewing “science” as something that occurs outside of a vacuum in school) or in terms of their ability to connect with and enjoy science.

My aim in this project, therefore, is to help young people develop more meaningful identities of themselves as science doers, and to help others understand how theatre and arts education as a whole can be a useful tool for drawing personal connections to science. I hypothesize that arts-based education can be leveraged as a tool to get middle school learners excited about science in ways that traditional learning environments do not. In order to test this hypothesis, I created — in collaboration with other researchers and both arts and science educators — an arts-based program that is aimed towards doing that. My goal is to understand the extent to which an arts-based

science program can get middle school-aged learners excited about and appreciative of the sciences, including the ways in which these learners may eventually see themselves as scientists, and the circumstances in which these things occur.

But how, exactly, should these types of learning environments be shaped? And what is possible when we create learning environments modeled for the integration of theatre and other artistic media with science? What will these youth find engaging (or not) in these environments? What will allow them to connect with scientific content in deep and personal ways? What, in general, are the affordances of theatre and other art forms for fostering such meaning-making, what are good ways to make it happen, and what are the challenges? What does it take for an Art Science environment to be truly transformative?

Cross-disciplinary learning environments can be designed to enable learners to reimagine what it means for them to participate in and enjoy science and empower learners to establish personal connections between scientific material and their own lives (Ødegaard, 2003). Establishing these connections, and providing learners with the opportunity to tell, adapt, and perform these stories, can help them construct and understand their own personal identity (Halverson, 2010), particularly in relation to the relevance of science in their own lives.

In general, it is my goal for youth to see that sometimes creative, arts-based experiences can have a more profound impact on the public (or the audience member) and the artist themselves (the learner) than traditional print or other means of learning alone. Arts-based communication may result in the audience member or artist changing their behavior, feelings, and hopefully actions in relation to that particular social justice-

related science phenomenon. Though not every learner will want to be an artist or scientist after engaging in this type of learning environment, it is my hope that they will see the value in using theatre and the arts to create deeper, more personal connections to scientific concepts that may have otherwise seemed irrelevant to their lives.

By virtue of the way that art-making can have both an impact on the audience and the artist, I hope that by learners engaging in practices of science, theatre/art, and “science—theatre” (an umbrella term defined in this study as curriculum that explicitly connects science, theatre, and other artistic media intended to be presented to an audience) in this *transformative learning environment* (Cranton, 2002; Mezirow, 1991), they will see their own self-identities as “science people,” “theatre people,” or “science—theatre people” differently. For a learning environment to be transformative, and for a learner to have a *transformative learning experience*, the environment should allow participants to explore and identify new roles for themselves (Cranton, 2002; Mezirow, 1991).

In this particular *transformative learning environment*, the facilitators (consisting of researchers, administrators, and educators) and I aim to help learners see theatre and the arts as tools to broaden their own perceptions of what it means to “do science” and “do theatre/art” — both for themselves, personally, and in a broader societal context. We hope that the integration of these disciplines will allow learners to see the relevance of social justice-related phenomena in their own lives and community, and hopefully see the added value of combining these disciplines to communicate messages about social justice to wider audiences.

To encourage youth to see the added value of integrating the arts with science, I have worked with a multidisciplinary team to design an out-of-school learning environment where youth use theatre, visual art, filmmaking, and other artistic media to communicate ideas about scientific phenomena directly linked with issues of social justice. My hypothesis is that by youth engaging in practices of science, theatre/art, and “science-theatre” in this *transformative learning environment*, they will be able to relate to, and empathize with those impacted by, science phenomena in ways they may not otherwise be able to in a typical classroom environment. I also believe they may ultimately begin to see the development of their own *practice-linked identities*, defined as “the identities that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices” (Nasir & Hand, 2008, p. 147), having engaged in these practices.

Introduction to the Study

In this context, I will discuss the design of a particular transformative learning environment that I designed alongside other researchers and educators: the Coalesce Theatre Collaborative (a pseudonym) and College Bound Art Science Program (hereafter “Art Science Program”). Within the context of the Art Science Program, I discuss its design and the way in which its goals are intended to be achieved. I then analyze the way in which engaging in science, theatre/art, and “science-theatre” in this particular environment impact learners’ practice-linked identities in relation to these domains. I use what is learned from the analysis to make implications for the design and implementation of other transformative learning environments that link science and art.

The Art Science Program — sometimes referred to as the “Science-Theatre Program” in this study due to its original theatre-centric focus — is a transformative, out-of-school-time learning environment aimed to help middle schoolers use theatre and the arts as tools to dismantle stereotypes about what it means to “do science” and who can become a scientist, and to inspire youth to see themselves as scientists. We designed the environment to allow youth to use theatre (including spoken word, set design, and prop-making) and eventually other art forms (including filmmaking, visual art, cartoon-making, and rap) to communicate ideas about how water quality and climate change impact themselves, their community, and the world at large.

The research reported here was conducted as a design study. Over the course of two years, the facilitators and I iterated on the design and curriculum for the Art Science Program. Our design was based on the literature for creating informal learning environments that authentically integrate science and theatre and art for youth in middle school, our previous experiences as teachers and program designers, and our reflections and analysis of previous iterations of the curriculum.

Within this context, I present data from the first three Sessions of the Art Science Program in its pilot year: Session 1 (summer 2018), Session 2 (fall 2018), and Session 3 (spring 2019). From this data, I aim to understand how individual youths’ practice-linked identities evolve (or not) when they engage in practices of science, theatre/art, and “science-theatre” and what, if any, implications there are for other transformative learning environments. Therefore, I am using this particular Art Science Program I helped to create to answer the following two research questions:

1. How might participation in an Art Science program impact learners' practice-linked identities in relation to science, theatre/art, and "science-theatre"?
2. How can learners' practice-linked identities evolve over the course of an Art Science program, and what is responsible for those changes?

In order to answer these research questions, I constructed holistic, multiple case studies (Baxter & Jack, 2008; Yin, 2003) of three learners — Zeke, Richmond, and Rashida (pseudonyms) — all of whom were learners in Sessions 1, 2, and 3 of the Art Science Program. I sampled a group of learners with a range of interests and personalities to see how various types of learners' practice-linked identities were evolving throughout the Art Science Program.

I will introduce and describe the ways in which each learner's practice-linked identity in relation to science, theatre/art, and "science-theatre" were impacted and evolved throughout the Art Science Program. I will describe the ways in which each participant accessed three identity resources: *material resources* (what is present in the context of the learning environment, including both tangible resources and curriculum presented to learners), *relational resources* (positive relationships built between people in the learning environment), and *ideational resources* (broad ideas about the self in relation to the practice; Nasir & Cooks, 2009) throughout each Session of the Art Science Program.

Following an examination of participants' access to these three identity resources, they will be deemed as having *inbound learning and identity trajectories* or *peripheral learning and identity trajectories* (Nasir & Cooks, 2009; Wenger, 1998) at the conclusion of each Session. *Inbound learning and identity trajectories* (henceforth *inbound*

trajectories) refer to learners “joining the community with the prospect of becoming full participants in its practice” (Wenger, 1998, p. 154). By contrast, *peripheral learning and identity trajectories* (henceforth *peripheral trajectories*) refer to learners remaining marginal, and never fully participating in the practice, over time (Nasir & Cooks, 2009). Both trajectories provide learning and identity development opportunities for a learner and can change over time (Nasir & Cooks, 2009). Understanding learners’ access to identity resources and learning trajectories at the conclusion of each Session will inform understanding of the development and strength of their science, theatre/art, and “science-theatre” practice-linked identities throughout the Art Science Program.

Since not all learners interact with material, relational, and ideational resources in the same way, even in the same learning environment (Nasir & Cooks, 2009), it will be important to understand the role that learners’ access to (or exclusion from) these resources play in impacting their practice-linked identities and what accounts for this access or exclusion. Therefore, I will provide *thick descriptions* (Denzin, 1989) of each learner’s participation in the Art Science Program and how this participation evolved over time and impacted their practice-linked identities. I will then discuss the implications for designing other learning environments to foster practice-linked identities in relation to science and art for middle school-aged youth.

Overview

The study is organized into ten chapters.

In Chapters 1 through 3, I establish the context for the study and describe the foundations for my research, along with the history of the Coalesce Theatre Collaborative

and College Bound's Art Science Program, the design of the learning environment, and the research methodologies used in this study. Specifically, Chapter 2 examines (1) the literature surrounding theatre and art education as a whole's impact on learners' senses of identity; (2) what (outside of theatre and the arts) fosters learners' identity development and notions of what is possible for themselves; (3) identity development within learning contexts for middle schoolers; and (4) how understanding the development of practice-linked identities (Nasir & Hand, 2008) serves as a framework for understanding what is happening in the Art Science Program. Chapter 3 provides the history and context for the Art Science Program, including the history of the Coalesce Theatre Collaborative, College Bound, the transition of the program from a "science-theatre program" to an "Art Science program," and the design of the Art Science Program across Sessions 1, 2, and 3. The chapter goes on to discuss the research and analysis methods I used to understand the impact the Art Science Program had on each of the three participants' practice-linked identities in relation to science, theatre/art, and "science-theatre".

Chapter 4 serves as a review of key terms used throughout the case studies, which includes definitions of terms derived from the literature and definitions of terms that arose from my own analysis. Chapters 5, 6, and 7 present Zeke, Richmond, and Rashida's respective case studies. Within these case studies, I re-introduce my participants and document each learner's access to material, relational, and ideational resources throughout Sessions 1, 2, and 3. Based on that access, I determined the extent to which the learners appeared to be on inbound or peripheral learning trajectories at the end of each Session and why. Each case study concludes with a summary of each participant's

experiences throughout each Session, information about their inbound or peripheral learning trajectories, and a discussion of the evolution of their practice-linked identities.

Chapter 8 presents individual and cross-case analyses of Zeke, Richmond, and Rashida's development of their practice-linked identities throughout the Art Science Program in relation to their access to the three identity resources throughout each Session. Chapter 9 discusses the major findings of the research. Chapter 10, the concluding chapter, provides concluding remarks and implications for the design of future, similar learning environments.

2

Literature Review

Before describing the Art Science Program, it is important to understand several areas of related research that guide the research and analysis for this program. Here, I review literature central to answering the following questions:

1. What do we know about:
 - a. How the arts can impact learners' feelings of competence and exposure to what is possible — including learners' senses of imagination and identity?
 - b. Why it is important for middle school youth to engage in the arts?
2. How might understanding the benefits of the arts help broaden youths' participation in science and help them develop their own practice-linked identities?

3. Beyond the arts, what else fosters learners' feelings of competence and exposure to what is possible?
 - a. What do we know about identity development within the context of learning, including broadening participation and disciplinary identity, particularly for middle schoolers?
4. How can understanding the development of a *practice-linked identity*, defined as “the identities that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices” (Nasir & Hand, 2008, p. 147), serve as a framework for understanding what is happening in this particular Art Science Program, even if the youth are only in the nascent stages of their own practice-linked identities?

This background will help in answering the research questions that guide this study:

1. How might participation in an Art Science program impact learners' practice-linked identities in relation to science, theatre/art, and “science-theatre”?
2. How can learners' practice-linked identities evolve over the course of an Art Science program, and what is responsible for those changes?

The Arts, Including Theatre/Narrative Arts (Performing Arts)

Arts Education

The arts have long been studied in educational contexts, particularly regarding their links to learning and identity development (Halverson & Sheridan, 2014).

Considering the ways in which the Art Science Program transitioned from having a theatre-centric curriculum to one that promoted a variety of types of artistic media in

connection to science, it is important to consider the merits of both theatre and other forms of arts education within the context of this study.

Arts education is typically affiliated with five primary disciplines: visual arts, theatre/narrative arts, music, dance/movement, and more recently, digital media arts (Halverson & Sheridan, 2014). It “primarily involves perceiving, creating, and reflecting on artifacts and the processes involved in making them” (Halverson & Sheridan, 2014, p. 630). As part of this, learners acquire the skills necessary for manipulating materials in order to represent ideas and concepts, and also the ability to understand and analyze other artistic creations across cultures and history (Halverson & Sheridan, 2014).

Scholars have established links between learning, identity development, and engaging in a variety of artistic media. For instance, cognitive scientists have found that music education not only gives students the opportunity to learn to play an instrument, but it also furthers identity development as young musicians piecing together different facets of their musical lives, abilities of emotional expression, and overall motivation (McPherson, Davidson, & Faulkner, 2012; Halverson & Sheridan, 2014). Dance provides opportunities for embodied thinking and learning (Hanna, 1987). Dance can also allow young people from historically marginalized populations to express and embrace their ethnicities (Ball & Heath, 1993). Adolescents who engage with digital media production report that art-making promotes conversations about the construction and origins of stereotypes, their role in art, and how stereotypes can mirror an individual’s experience (Fleetwood, 2005). Importantly, exploring identity through the arts appears to be especially impactful and productive for individuals from historically marginalized populations (Halverson & Sheridan, 2014).

Scholarship on theatre/narrative arts — sometimes referred to as *performing arts* — are particularly important in framing this study considering the Art Science Program’s initial focus on combining theatre education, specifically, with science education. This next section will explore the connections between theatre/the narrative arts, learning, identity development, and imagination.

Theatre/Narrative Arts (Performing Arts)

Engaging in theatre inherently relies on being able to imagine worlds and realities other than our own, and to feel empathy in order to engage with a story or character. When “doing” theatre, participants have the opportunity to “step into the shoes” of a character without real-life consequences (Halverson & Sheridan, 2014). This can provide participants with opportunities to empathize and interact with characters (people) they wouldn’t necessarily interact with (Wiley & Feiner, 2001), and thereby expand their understanding of “what’s possible” within the context of the human experience. For instance, an adolescent girl can play the role of a teenage mother and experience that character’s plight within the context of the role, without actually experiencing teenage pregnancy herself (Halverson & Sheridan, 2014).

“Stepping into the shoes” of someone else can be particularly impactful for youth from historically marginalized populations engaging in processes of *detyfication*, “the mechanism by which participating youth work toward building a viable social identity” (Halverson, 2010, p. 637). Detyfication allows youth to engage with identities stigmatized in society (of which they may feel membership in) in a positive way (Halverson & Sheridan, 2014). Using detyfication to explore different identities requires adolescents to take emotional and intellectual risks, which is easier in learning

communities and environments that foster high levels of collective trust-building and risk-taking.

Part of the collective nature of theatre is the creation of a *theatrical ensemble*, or a theatrical community. Theatrical ensembles foster “a way of modeling...collective artistry, negotiation, contracting of behavior and skillful leading” (Neelands, 2009, p. 4). When participating in drama-based activities, students work as a collective team to create “safe spaces” that promote trust-building, and ultimately risk-taking in a supportive environment (Neelands, 2009). This may fuel, and further, the extent to which youth engage in processes like detypification.

Many of the drama-based activities that help create the trust necessary for creating a theatrical ensemble, which in and of itself is grounded in trust-building and trust-making (Neelands, 2009), revolve around movement. These activities can include theatre games that permit youth to be silly with one another as well as more focused activities such as collectively moving like the characters they are trying to represent. Yet engaging with movement, like the creation of a theatrical ensemble, does not benefit theatre-based curriculum alone. Movement is an inherent part of “doing theatre,” but it is also crucial for STEM-related learning, and learning in general (Abrahamson & Lindgren, 2014). From a learning sciences perspective, “cognition is grounded in bodily experience” (Abrahamson & Lindgren, 2014, p. 370). Namely, when we move, we learn (Abrahamson & Lindgren, 2014).

Science and Theatre/Narrative Arts (Performing Arts)

Interestingly, most of the studies on science and theatre, and the affordances of combining the two for student learning, have been conducted in museum settings (Baum

& Hughes, 2001; Hughes, 2010; Peleg & Baram-Tsabari, 2011; 2016; 2017) or have documented the benefits of using theatre as a tool to teach scientific content (Kerby, Cantor, Weiland, Babiarz, & Kerby, 2010; Kerby, Dekorver, Cantor, Weiland, & Babiarz, 2016). There has been far less research on using theatre as a tool to further identity development or expand notions of what it means to “do science.” Some studies have documented the extent to which student behaviors or attitudes about science and scientific content are shaped while watching science-based theatrical performances (Carpineti, Cavinato, Giliberti, Ludwig, & Perini, 2011; Wieringa et al., 2011; Walker, Stocklmayer, & Grant, 2013; Lanza, Crescimbene, La Longa, & D’Addezio, 2014). Yet there do not seem to be any studies that emulate the study this paper documents — specifically, studies that examine how theatre/narrative arts, and perhaps even the “arts” on a broader level, impact youths’ practice-linked identities when creating original theatrical or other artistic works in non-museum-based settings.

Despite the lack of scholarship about this particular topic, studies do allude to the merits of trying to understand these concepts. Learning environments that fuse science education with theatre education enable youth to reimagine what it means for them to participate in and enjoy science (Long, 2014) by challenging them to draw personal connections between the scientific material and their own lives (Ødegaard, 2003). Establishing these connections, and providing learners with opportunities to tell, adapt, and perform these stories can help them construct and understand their own personal identities (Halverson, 2010), particularly in relation to the relevance of science in their own lives. The way in which theatre asks learners to explore different “selves” (Halverson & Sheridan, 2014) has the potential to challenge learners (particularly those

who do not connect with science at the middle school level) to reimagine what it means for them to participate in and enjoy science (Long, 2014). It is therefore important to explore how engaging in both science and theatre can help shape middle school youths' practice-linked identities.

Beyond Theatre: Feelings of Competence and Belonging, and Exposure to What Is Possible

Communities of Practice

When participating in drama-based activities, students and teachers work as a collective team — or ensemble — to create spaces that foster and support risk-taking (Neelands, 2009). Learning communities like theatrical ensembles that promote productive failure are important for learning (Kapur & Bielaczyc, 2012) and creating a sense of belonging (Eckert, 2006). Therefore, it is helpful to understand how learning communities support — or undermine — learners' feelings of belonging and trust, in addition to feelings of competence, all of which are intertwined with one's ability to learn.

A community of practice is a collection of people who engage with one another on an ongoing basis through some common endeavor (Eckert, 2006). Within learning contexts such as classrooms, communities of practice are defined as “groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2006, p. 1). Outside of learning contexts, a “common endeavor” can be anything, ranging from a bowling team to a book club, or even “a crack house” (Eckert, 2006, p.1). Communities of practice are fundamental in helping people

identify membership in social categories (Eckert, 2006). For instance, a student who is in the school play and a member of the robotics club (two distinct communities of practice) may be motivated to identify as both a “theatre person” and a “science/engineering person.”

Communities of practice also provide opportunities for joint sense-making and a deepening of shared knowledge (Eckert, 2006). This sense-making is based on a commitment to mutual engagement and a mutual understanding of that engagement, regardless of whether or not this mutual sense-making is consensual or based in conflict (Eckert, 2006). Therefore, communities of practice consist of both core members and peripheral members — where some are integral to the practices of that community, while some are less engaged and operate on the periphery of the community (Wenger, 2006). Nonetheless, communities of practice are dynamic and involve learning for everyone, including both core and peripheral members (Wenger, 2006).

Three characteristics are crucial for creating a community of practice within learning contexts: *domain*, *community*, and *practice* (Wenger, 2006). The *domain* is defined as the shared competence that distinguishes membership from other people or groups (Wenger, 2006). *Community* is defined as the joint attributes and discussions where people share information and help each other or learn from one another (Wenger, 2006). Lastly, *practice* is defined as the shared practices members of a community of practice develop — namely, ways of addressing recurring problems, experiences, stories, and tools (Wenger, 2006).

Communities of practice can impact educational practices, specifically, across three dimensions: *externally*, *internally*, and *over the lifetime of students* (Wenger, 2006).

External impacts ask us to consider how we can help students connect their experiences to practices, experiences, and life-in-general outside of the classroom walls (Wenger, 2006). *Internal impacts* ask us to consider how to organize educational experiences of practice around subject matter (Wenger, 2006). Consideration of impacts *over the lifetime of students* asks us to consider how to ensure that students want to continue learning beyond the classroom and develop a lifelong love of learning; for this, the curriculum needs to broach topics relevant and of interest to students (Wenger, 2006).

Exposure to What is Possible

Many scholars have determined that it is impossible to divorce learning — and imagining what is possible for oneself in the future — from identity construction and context (Lave & Wenger, 1991; Wenger, 1998; Wenger, 2006). Activities, tasks, and the processes of creating understanding do not exist in a vacuum: they are a part of the broader systems and contexts that a person relates to (Lave & Wenger, 1991).

Part of learning as “the whole person” (Lave & Wenger, 1991) includes understanding the ways in which context impacts learning. Learning as a “whole person” “includ[es] our bodies, minds, emotions, and social relations” (Wenger, 2006, p. 56). *Context* is defined as “...a place in which persons, activities, and objects are linked with each other...in a structure of social practice” (Dreier, 2008, p. 23-24). Since knowing, learning, social membership, and identity necessitate one another (Lave & Wenger, 1991), it is crucial to consider how identities are historically, socially, and individually situated (Halverson, Lowenhaupt, Gibbons, & Bass, 2009), and how some of those identities only exist within specific social contexts (Wortham, 2004). This includes

considering the ways in which culture helps shape identity, and allows for different ways of envisioning what is possible for one's future.

Culture, like context, also has a significant impact on learning, especially within a community of practice. Nasir, Roseberry, Warren, and Lee (2014) define culture as “the constellations of practices historically developed and dynamically shaped by communities in order to accomplish the purposes they value” (Nasir, Roseberry, Warren, & Lee, 2014, p. 489). When youth feel alienated from the cultures of formal learning environments, they may not view themselves as members of a school community or see themselves pursuing additional schooling in the future (Bonnett, 2010). Adolescent youth are continuously grappling with and negotiating their racial/ethnic and gender identities within school contexts (Altschul et al., 2006; French et al. 2006; Rogers, Scott, & Way, 2015; Hill et al., 2018). Therefore, a lack of connection to school communities can have significant implications in how youth imagine “what is possible” for themselves in relation to science, the connections between youths’ senses of identity, culture, and notions of “what is possible” for themselves as a whole and in relation to their science identities have implications for the development of their *possible selves* (Markus & Nurius, 1986; Heise, 1977; Oyserman, Bybee, & Terry, 2006; Oyserman & Fryberg, 2006) and *academic possible selves* (Oyserman et al., 2006)

Possible Selves

Possible selves refers both to the ideal “selves” we would like to become, and the “selves” we may potentially become but are afraid of (Markus & Nurius, 1986). These selves are manifestations of past selves, self-goals, aspirations, and fears (Markus & Nurius, 1986).

Possible selves provide a link between motivation and *self-concept*, or the potential for growth and change, and represent personal fantasies, hopes, and fears (Markus & Nurius, 1986). They are sensitive to situations that communicate inconsistent information about the self. For example, a student who believes she is smart will have her possible self rattled when she receives a bad grade on a test (Markus & Nurius, 1986). In line with this concept, possible selves are largely derived from an individual's sociocultural reference points, including sociocultural contexts, media (Markus & Nurius, 1986), and specific people — including parents and significant others (Oyserman & Fryberg, 2006).

While one is capable of envisioning many possible selves, one cannot be all things at once (James, 1950; Oyserman & Fryberg, 2006). The activities involved in being different types of *desired selves* (who we might want to become) may conflict with one another — for instance, the ways of being for “the party girl” and “the quiet introvert” may directly oppose each other (Oyserman & Fryberg, 2006). Thus, compromise is required for envisioning one's realistic possible selves (James, 1950).

Possible Selves of Adolescents

The development of possible selves have specific implications for adolescents. Adolescents who believe that positive possible selves are attainable have higher self-esteem than those who believe otherwise (Knox, Funk, Elliot, & Bush, 1998). Moreover, adolescents' shifts in thinking about their possible selves can lead to both positive and negative shifts in behavior and feelings towards academics (Oyserman, Terry, & Bybee, 2002). This, combined with the particularly strong impact of social context on adolescents' possible selves (Oyserman & Markus, 1993) can lead to starkly contrasting

conceptions of “me’s” and “not-me’s” — who they feel they are or are not — for adolescents (Oyserman & Fryberg, 2006).

In addition to conceptions of “me’s” and “not me’s,” adolescents who feel they lack role models to emulate may fail to envision viable possible selves (Oyserman & Fryberg, 2006). This applies to adolescents’ notions of *academic possible selves* as well (Oyserman & Fryberg, 2006). Longitudinal research indicates that youth experience an overall decline in their thinking about their academic possible selves when transitioning from middle to high school, with adolescents reporting more academic possible selves in the fall than at the conclusion of the academic year (Oyserman & Fryberg, 2006).

Possible Selves of Historically Marginalized Youth

For all youth, notions about where one belongs, who one is, and what is possible are reflected in culturally significant stories, images, and symbols (Oyserman & Harrison, 1998). However, for minority youth, their stories, images, and symbols may not align with mainstream American ideals and values (Oyserman & Fryberg, 2006). These stories, images, and symbols, whether mainstream or marginalized, implicitly dictate messages about where minority youth do or do not belong, or what they can or cannot do in life (Oyserman & Fryberg, 2006).

What it means to be a member of a particular minority group is actualized by the interaction between mainstream American culture, one’s culture of origin, and mainstream America’s perception of that minority group’s ways of being (Oyserman & Fryberg, 2006). Possible selves, then, play a significant role in the imagination of minority youth. They provide these youth with the ability to imagine various roles and identities in relation to both their culture of origin and mainstream American culture

without making real-life, and potentially life-altering commitments (Oyserman & Fryberg, 2006).

Feelings of belonging and the development of academic possible selves have different implications for youth from different historically minoritized populations. Youth from stereotypically “higher achieving” historically minoritized groups may have different conceptions of possible selves than youth from stereotypically “lower achieving” historically marginalized groups (Oyserman & Fryberg, 2006). In similar studies of 6th to 8th grade youth, the impact of positive possible academic selves varied for students from different backgrounds. Among majority white middle school students, the effects were evidenced by increased grade point averages, while middle school students of mixed-race descent demonstrated a desire to do more work in an effort to prove with competence (Oyserman & Fryberg, 2006).

For many youth, possible selves are fluid and dynamic due to the nature of adolescence, and the examination of the progression of possible selves requires attention to many factors. It is particularly important to consider how cultural backgrounds, including perceptions of minority groups as “higher achieving” or “lower achieving” can impact notions of possible selves and, in turn, academic achievement.

Attention to interactions between conceptions of possible selves, feelings of belonging, and identity is valuable for understanding youths’ differing experiences in a variety of learning contexts. These conceptions of possible selves, belonging, and identity of learners concepts are shaped by specific actions, practices, and activities, which can be understood through the concept of practice-linked identities.

Practice-Linked Identities

To develop a richer notion of practice-linked identity (Nasir & Hand, 2008; Nasir & Cooks, 2009), a term used throughout this study, we next turn our attention to scholarship that has identified links between engaging in practices and identity. Specifically, we discuss scholarship about “identities-in-practice” (Tan & Barton, 2007) and the ways in which activity systems impact learning (Greeno & Gresalfi, 2008) for the purpose of better understanding how they can contribute to identity formation.

Identities-In-Practice

Tan and Barton’s (2007) work on identities-in-practice found that as students do science in the science classroom, they take on certain identities that align with who they are and who they want to be. The authors emphasize the idea of viewing these identities as “identities-in-practice,” and not merely as identities because they believe that the environmental factors of a particular community of practice (like a science classroom) influence how members of that community impact novice — or new — members of that community (Tan & Barton, 2007). A learner’s individual identities, and manifestation of those identities, shift from context to context — for instance, “the identities-in-practice that are manifested when a student is asked to speak during a whole-class discussion differ from those manifested when she is engaged in a small group activity, which in turn may vary from those adopted when the student is immersed in an individual project” (Tan & Barton, 2007, p. 50).

Tan and Barton (2007) found positive outcomes with students when they framed identity development through the lens of identities-in-practice. For example, girls who participated in their study became progressively more interested in science, and felt they

had the agency to engage meaningfully in learning science (Tan & Barton, 2007). They also felt as though they were active stakeholders in their learning experience (Tan & Barton, 2007).

Activity Systems and Learning within Communities of Practice

While identities-in-practice allows us to see how identity development is fluid and multifaceted (Tan & Barton, 2007), *activity systems* (Greeno & Gresalfi, 2008) allow us to understand the dynamic nature of identities within a community of practice.

Activity systems (Greeno & Gresalfi, 2008) involve one or more people interacting with each other and with materials and information within a particular setting (Greeno & Gresalfi, 2008). In an activity system, what participants learn “is specific to the situation in which it is learned” (Anderson, Reder, & Simon, 1996, p. 5). Learning occurs when new members of an activity system participate in ways that are similar to older members of that same activity system (Greeno & Gresalfi, 2008, p. 171).

Relationships exist between the ways in which individuals are positioned and the activity itself, which has implications for individuals’ engagement with content (Greeno & Gresalfi, 2008). As a learner moves from being more peripherally to centrally involved in an activity system, so too does their engagement with the specific practices of that learning community (Greeno & Gresalfi, 2008). Learner participation evolves over time in a community of practice — a type of activity system (Greeno & Gresalfi, 2008). While learning in and of itself is a process, learning also results from interactions between numerous elements, including the practices of the activity system and the characteristics of the learners (Greeno & Gresalfi, 2008).

On an interpersonal level, a student's learning trajectory can lead to more personal engagement with learning content and the community of practice itself (Greeno & Gresalfi, 2008). A learning trajectory can also impact the way in which a learner interacts with a community of practice at large: their learning trajectory can allow them to make positive contributions through group-work, or make positive contributions through concentrated, individualized work (Greeno & Gresalfi, 2008). Students' feelings toward individual versus group work can affect their identity within the community of practice and their views about the subject matter (Greeno & Gresalfi, 2008). Identifying which subject matter and practices are meaningful is important for individual student growth and identity development (Greeno & Gresalfi, 2008).

Similar to learning at the individual level, a group's learning trajectory can evolve in a variety of ways. Groups can become more collective and cohesive over time, or become more collaborative — yet they can also become fragmented or marginalize some learners over others (Greeno & Gresalfi, 2008). Opportunities for members of a community of practice/activity system to grow include engaging with resources and practices that support the ways in which learning and engagement happen outside of the classroom (Greeno & Gresalfi, 2008).

One way learners can grow within a classroom is through *disciplinary agency* or *conceptual agency* (Pickering, 1995). Disciplinary agency refers to the actions taken by an individual or group where the outcome is dictated by an established procedure (Pickering, 1995). For instance, a learner uses disciplinary agency when she uses the quadratic equation to solve a quadratic formula (Greeno & Gresalfi, 2008). Conceptual agency refers to actions taken by an individual or group where the outcome is dictated by

the actor's choices (Pickering, 1995) — for instance, the way in which someone poses a question to a group, or how an individual chooses to answer a question (Greeno & Gresalfi, 2008). Concepts of disciplinary and conceptual agency speaks to ideas about *participatory identity* (Holland, Lachicotte, Skinner, & Cain, 2001), where a person within a particular activity system seizes or creates opportunities for themselves or the group within the context of that system (Gresalfi, 2006) because they feel that they have disciplinary/conceptual agency.

Practice-Linked Identities

Due to the methodological parallels between Nasir and Hand's and Nasir and Cooks' studies documenting the practice-linked identities of athletes and this particular study, *practice-linked identities* (Nasir & Hand, 2008; Nasir & Cooks, 2009) will serve as a framework for this study. It is for this reason that particular attention will be paid to a discussion of Nasir and Hand's and Nasir and Cooks' studies on practice-linked identities.

Practice-linked identities are “the identities that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices” (Nasir & Hand, 2008, p. 147). Different practices or activities lead to varying levels of engagement for participants and support the development of practice-linked identities differently for different people (Nasir & Hand, 2008). “Because practice-linked identities are defined as a sense of connection between the self and the practice” (Nasir & Hand, 2008, p. 147), the more connected an individual feels to a practice, the more intensively and extensively they will participate in that practice. Some practices allow for a wider range of acceptable forms of engagement than others — for instance, deep engagement is

required for a surgeon performing open-heart surgery, while watching television requires less intense, sporadic levels of engagement for proper enjoyment (Nasir & Hand, 2008).

Culture plays a significant role in the development of practice-linked identities and learning (Nasir & Hand, 2008). Individuals from many non-dominant cultures engage in complex thinking in activities outside of school that may not be readily apparent in a classroom (Nasir & Hand, 2008). For instance, Nasir (1996) found that adolescent basketball players were able to understand the concepts of averages and percentages within the context of a basketball game, but struggled with identical problems in math class (Nasir & Hand, 2008). Students' motivations to learn can be connected to general feelings of belonging, connection to the school setting, and overall engagement (Nasir & Hand, 2008). These factors may account for why the basketball players in Nasir's study were able to do mathematics problems within the context of playing basketball — where they were very engaged — and not in a typical mathematics classroom, where they were less engaged.

While Wenger defines *engagement* as active involvement in shared processes of negotiating meaning (Wenger, 1998), Nasir and Hand define engagement as “active, goal-directed, flexible, contrastive, persistent, focused interactions with...social and physical environments” (Nasir & Hand, 2008, p. 149). Wenger's definition of engagement emphasizes notions of meaning-making on a cognitive level, while Nasir and Hand's definition emphasizes the distinctly physical and social processes involved in engagement and meaning-making (Nasir & Hand, 2008). Nasir and Hand's conceptualization of engagement aligns particularly well with both the active, and interactive, nature of practice-linked identities.

In their study on practice-linked identities in basketball game and mathematics classroom contexts, Nasir and Hand (2008) identify three aspects of both mathematics and basketball that are important for engagement: *access to the domain*, *integral roles*, and *opportunities to make a unique contribution and feel valued* (Nasir & Hand, 2008). *Access to the domain* refers to the extent to which participants have the opportunity to both learn about a practice or activity and about the particular tasks that are required for that domain knowledge. *Integral roles* refers to the extent to which participants are held accountable when doing particular tasks and are expected to become competent, if not master, the activities required for a particular practice. Lastly, *opportunities to make a unique contribution and feel valued* refer to the ways that students include aspects of themselves in a practice.

When considering the ways in which practice impacts identity development, Nasir and Hand (2008) found that basketball helps young players grow as people — students’ selves and development of those selves grow while they are engaging in the sport (Nasir & Hand, 2008). The basketball players in their study were made to feel important and that they made unique contributions to the team — they “express[ed] themselves through their practice and [brought] something of themselves to the game” (Nasir & Hand, 2008, p. 161). This accountability, combined with self-expression and access to the domain of basketball, prompted learners to develop practice-linked identities related to basketball that allowed them to incorporate elements of who they were as people into the game (Nasir & Hand, 2008).

Nasir and Hand (2008) found that while basketball allowed for deep engagement for players on multiple levels, there were fewer opportunities for deep engagement in

math class. They found that these differences in engagement were linked to the different practice-linked identities expressed in different contexts (Nasir & Hand, 2008). They also found that access was fundamental for becoming a participant in a community of practice, that defined roles provided different avenues into a community (impacting accountability), and that individual quirks and preferences were inherently linked to practice (Nasir & Hand, 2008). When considering the question of: “why not just focus on learning?”, the authors reply that recognizing practice-linked identities allows for an understanding of the personalized nature of learning and how settings can impact deep connections to learning (Nasir & Hand, 2008).

In a similar study about track athletes, Nasir and Cooks (2009) highlighted that “learning is considered a characteristic of practice” (p. 41). Similar to Greeno and Grisalfi’s (2008) findings, Nasir and Cooks highlight two types of learning and identity trajectories that exist in a community of practice: *inbound trajectories* and *peripheral trajectories*. With inbound trajectories, newcomers join a community of practice and become a full participant in that community (Nasir & Cooks, 2009). With peripheral trajectories, individuals, particularly newcomers, stay peripheral to the practice over time (Nasir & Cooks, 2009). Despite the differences in these trajectories, both can lead to learning opportunities for all members of a community of practice, along with opportunities for identity development (Nasir & Cooks, 2009). The authors also emphasize that learning is not simply an “in-the-head phenomenon” (Nasir & Cooks, 2009, p. 42), but revolve around participation, engagement, and membership within a community of practice (Nasir & Cooks, 2009).

Related to the three aspects of mathematics and basketball that Nasir and Hand (2008) documented, they also found that access to particular elements, or *identity resources*, supported students' identities as track athletes while doing track: *material resources*, *relational resources*, and *ideational resources*. *Material resources* refer to "the way in which the physical environment, its organization, and the artifacts in it support one's sense of connection to the practice" (Nasir & Cooks, 2009, p. 47). *Relational resources* are the positive relationships built with others within the particular context that can strengthen the participant's connection to the practice (Nasir & Cooks, 2009). Lastly, *ideational resources* are ideas about the self and one's relationship to the practice, one's place in both the practice and the world, and what is valued and good in both the practice and the world (Nasir & Cooks, 2009).

The authors found that individuals who connected to others during the practice (participating in track) ultimately increased their connection to the practice itself — specifically, that everyone defined themselves as "a member of a community that participated in track" (Nasir & Cooks, 2009, p. 48). The organizational structure of the track meets, which included access to material resources, contributed to access to relational resources; day-long meets allowed for the athletes and coaches to spend time with one another and bond over food (Nasir & Cooks, 2009). Building relationships with coaches also helped sustain the athletes during difficult moments (Nasir & Cooks, 2009). This finding, in particular, indicates that relational resources are crucial in teaching and learning processes, since relational resources help provide reason and motivation for learning (Nasir & Cooks, 2009). Lastly, ideational resources were made available through discourse and socialization — for instance, the coach in this study would encourage

athletes to control their emotions and channel it towards winning a race, which impacted the athletes' connection to track (Nasir & Cooks, 2009).

Broader findings from Nasir and Cooks' (2009) study indicate that identity trajectories can evolve and change over time and that not everyone takes up resources the same way. Personal relationships between the coach and the athletes were critical in providing athletes with access to other material and ideational resources, in that both teaching and learning happened in one-on-one interactions (Nasir & Cooks, 2009). Relational resources function as a gateway to ideational and material resources; however, access to relational resources varied with individual learners, resulting in a variety of connections to track, the coach, and other athletes (Nasir & Cooks, 2009). In sum, ideational resources helped determine the goal of learning and what was "good," relational resources determined the "how" and "why" of learning, and material resources provided the content for learning (Nasir & Cooks, 2009).

Face-Saving

In line with understanding and accepting that not all learners accessing identity resources the same way, it is similarly crucial to understand the barriers that learners may put up themselves that can inhibit their ability to access these identity resources. This next section will therefore explore how *face-saving* (Goffman, 1956; DiSalvo, Guzdial, Bruckman, & McKlin, 2014) can be a particularly significant self-imposed barrier and prevent youth from accessing the maximum number of identity resources possible in a learning environment.

Face-saving is "a method for protecting the participant's *presentation of self* when threatened by the identity of wanting to learn" (DiSalvo et al., 2014, p. 274). How an

individual chooses to present themselves or be viewed by others can vary in different circumstances and is impacted by *cultural values*, or the strategies an individual uses based on the stories, experiences, worldviews, and rituals they have been exposed to (DiSalvo et al., 2014). These cultural values influence how an individual acts and aims to be seen by others (Swidler 1986).

The concept of *face* is “the conscious façade that people present to an audience, the identity they try to protect in moments of embarrassment” (DiSalvo et al., 2014, p. 276). Saving the presentation of self is applicable to saving face by helping to protect against embarrassment (Goffman, 1955; DiSalvo et al., 2014). There is often conflict between the expectation of one face, and the presentation of another (DiSalvo et al., 2014) — such as instances where a teacher expects a student to appear attentive, but the student would rather appear inattentive, even if they’re actually interested in the learning material (DiSalvo et al., 2014). Ways of face-saving are strongly linked with cultural values (DiSalvo et al., 2014). For example, in Asian cultures, maintaining one’s presentation of self is less important than helping others maintain face (Ting-Toomey et al., 1993).

Oftentimes, face-saving and cultural values conflict with processes of learning (DiSalvo et al., 2014). African American males, in particular, may actively choose to not learn in traditional education settings that they feel are inherently racist institutions (Kohl, 1994). This choice is defined as a *cool pose*, where African American males actively reject institutions they feel actively reject them (Majors & Billson, 1993). Similarly, *disidentification* (Osborne, 1999; DiSalvo et al., 2014) functions as “an active rejection of any identification with education and educational institutions that is the result

of stereotypes, cultural influences, and the active rejection of White culture” (DiSalvo et al., 2014, p. 277). Both *disidentification* and the choice to adopt a *cool pose* can operate as self-imposed barriers minority students, and African American males in particular, may put up that actively hinder their ability to learn.

DiSalvo, Guzdial, Bruckman, and McKlin (2014) conducted a study on the links between face-saving and learning in a science-based environment. The authors aimed to provide face-saving tactics to African American male adolescents in an engineering program in order to allow them to negotiate conflicting identities — those that wanted to learn while still maintaining a “cool” identity (DiSalvo et al., 2014). They found that participant’s “faces” — the identities they presented — were often in direct conflict with what they talked about enjoying or disliking in the program; participants admitted that they misrepresented their true feelings about the program to others in order to save face (DiSalvo et al., 2014).

The authors suggest that cultural values that conflict with classroom values and expectations prompt students to actively reject learning opportunities (DiSalvo et al., 2014). They recommend that future designers consider a number of factors when designing programs for youth who may heavily engage in face-saving, including: (1) considering the value youth place in the opinions and values of their caretakers (parents or guardians) and peers; (2) respect learners’ current attitudes and viewpoints, rather than demanding that these values shift to reflect those of the learning environment; and (3) continuously make learners feel as though they are part of a community.

Summary

This literature review explored scholarship pertaining to identity, notions of belonging, competence, and ideas about what is possible for youth and their futures, both within and outside of theatre- and arts-education contexts. It also explored what it means to develop a community of practice (Wenger, 1998), practice-linked identities (Nasir & Hand, 2008; Nasir & Cooks, 2009), and identities-in-practice (Tan & Barton, 2007) within both communities of practice and activity systems (Greeno & Gresalfi, 2008). It also unpacked potential barriers to learning that, however self-imposed, reflect many youths' negotiation of their varying identities, including those that they are expected to present in academic settings, versus those that are in line with their cultural values (DiSalvo et al., 2014).

Exploring middle school youths' practice-linked identities in relation to science, theatre/art, and "science-theatre" will help us determine the extent to which environments like the Art Science Program make it possible (or problematic) for middle-school youth to begin developing their practice-linked identities in relation to these domains. Therefore, this study will also highlight the extent to which these types of learning environments help middle schoolers solidify their feelings of belongingness in the worlds of science and art and if they want to continue along a particular trajectory (or perhaps forge their own path, somewhere in the middle of these domains) in the future.

3

Methods

Overview

Within the context of this study, I aim to understand the ways in which individual middle school youths' practice-linked identities (Nasir & Hand, 2008; Nasir & Cooks, 2009) evolved and were impacted during a 10-month Art Science Program. I do this in order to gain further understanding on the extent to which arts-based programs can impact middle school learners' science identities.

My approach to research design is collaborative, and I identify as a collaborative social researcher (Miles, Huberman, & Saldaña, 2014). In line with this approach, I collaborated with the Coalesce Theatre Collaborative and College Bound and the major Northeast research institute's teaching, administrative, and research personnel to design the Art Science Program and iteratively refine it.

Prior to discussing the research methodology used in this study, I begin this chapter with an overview of the history and context of the Art Science Program — specifically, the collaboration between the Coalesce Theatre Collaborative, College Bound, and the major Northeast research institute — the three entities that make up the Art Science Program. I also provide information about what, exactly, constitutes Sessions 1, 2, and 3 — the periods of the pilot-year of the Art Science Program documented in this study — and provide information about the teachers, researchers, and administrators involved in creating and administering the Art Science Program — its *facilitators*. Lastly, I provide an overview of what occurred throughout each Session of the program to contextualize the study and the three case studies in particular.

Following the history and context of the Art Science Program, I discuss the research methods used in this design study. I begin by describing the participants, who include both the facilitators (adult participants) and learners (student participants). Next, I describe the sources of data, which include interviews, observations, videos, and artifacts. I then describe data-collection procedures over the three Sessions of the program. Finally, I discuss methods used for coding and analyzing the data.

History, Context, and Design

College Bound and the Coalesce Theatre Collaborative

College Bound (CB) is a 15+-year-old Saturday and summer program, housed at a major research institute in the Northeast United States. College Bound provides urban middle and high school-aged youth (most of whom are students of color) with STEAM (Science, Technology, Engineering, Arts, and Math) and social justice-related programs

that aim to place students in a “college pipeline.” In order to encourage the youth — many of whom are low-income — to regularly attend College Bound (including those in the Art Science Program) and to offset any financial burden by attending CB instead of a job, all youth receive stipends for each hour they are in College Bound.

The Coalesce Theatre Collaborative (Coalesce) is a partnership between the same major research institute in the Northeast that houses College Bound and a professional children’s theatre (Riverwatch Children’s Theatre, a pseudonym). It aims to use theatre as a tool to get middle school youth excited about science in ways that traditional science classrooms typically do not.

Coalesce has two primary programs: a touring program that puts on science-based plays written, directed, and acted by theatre professionals for local middle schools, and a student/learner-driven program where youth create their own artistic works. The latter program, referred to as the *Art Science Program* in this study, was (and continues to be) housed within the College Bound program. The Art Science Program operates under the auspices of College Bound since the major Northeast research institute that houses CB obtained a grant from the National Science Foundation (NSF) that allowed for the inclusion of a pilot Art Science Program for all incoming middle school-aged youth.

Like the other programs within the College Bound program, the Art Science Program was designed to have two components: a summer component and a school-year Saturday component. It was designed to run at corresponding times to other College Bound sessions in order for all College Bound learners and staff to get to know one another and to build community. When the Art Science Program was documented for this particular study, the summer component lasted over the course of three weeks in July

2018 (when the other College Bound summer programs ran) from Monday through Thursday between 8:30am and 3:30pm. The Saturday component lasted over the course of approximately 18 Saturdays from October 2018 through May 2019. Each session lasted approximately 3 hours, with a handful of “full-day sessions” that lasted 6 hours and included a lunch break for the learners. When the learners were not with the Art Science Program during the 3-hour sessions, they were participating in social-justice and college-preparation programs offered to (and expected of) all learners participating in the College Bound programs. All College Bound programs (including the Art Science Program) continue to run according to these 3-week, full-day summer sessions, and 3-6 hour Saturday sessions throughout the academic year.

The Art Science Program’s facilitators also originally conceived that each session throughout the summer and academic year — regardless of how long each session would be — would have three components: a science curriculum, a theatre/arts curriculum, and a “science-theatre” curriculum that would meld concepts from the science curriculum with the theatre curriculum. In this sense, a full “year” in the Art Science Program would span from the summer session to the next spring session. Therefore, the “year” documented in this study spanned three sessions: Summer (July) 2018, Fall (October-December) 2018, and Spring (January-May) 2019. Table 1 outlines the overarching goals for the science, theatre/art, and “science-theatre” curriculum during the summer and school-year sessions.

Table 1

Overarching goals for science, theatre/art, and “science-theatre” curriculum during the summer and school-year sessions

Session	Science curriculum overarching goal(s)	Theatre/arts curriculum overarching goal(s)	“Science-theatre” overarching goal(s)
Summer 2018	Exploration of climate change, particularly impacts of climate change on the Greater Boston Area.	Create original 10-minute plays about science. By the end of the summer, goals evolved into getting learners to simply enjoy theatre.	Getting learners to create any arts-based product that reflected scientific concepts they had learned about over the summer for the Summer 2018 final showcase.
Fall 2018	Exploration of concepts surrounding water quality and environmental justice on both local and global scales.	Continue getting learners to enjoy theatre and feel comfortable using the arts as tools for both self-expression and as vehicles for social activism.	Begin creating an artistic “mixtape,” where learners create various artistic pieces through a variety of mediums (visual arts, theatre, rap, etc.) to express concepts they care about pertaining to environmental justice in preparation for May 2019 final showcase.
Spring 2019	Continue with exploration of concepts surrounding water quality and environmental justice on both local and global scales.	Continue getting learners to enjoy theatre and feel comfortable using the arts as tools for self-expression and as vehicles for social activism.	Create any sort of group project using artistic media (visual art, music, theatre, etc.) that expresses concepts of environmental justice learned at some point during Art Science Program that is important to the learners.

Importantly, the Art Science Program was originally referred to by the facilitators (all team members involved in the design and implementation of the Program from the Northeast research institute, College Bound, and Coalesce, as well as outside science and art educators) as the “science-theatre program” due to the theatre-centric NSF proposal, which originally described a program where youth would write and perform their own 10-minute science-based plays. As the program evolved over time, the facilitators realized that the learners’ interests extended beyond theatre and into other artistic media, including visual art, dance, filmmaking, and fashion/costume design. This led to the program still being referred to as the “science-theatre program,” with the understanding that “theatre” was a larger umbrella term the facilitators and learners used to reference any form of art (visual art, music, filmmaking, dance, poetry, etc.) created within the Art

Science Program intended to be presented to an audience. At the end of the pilot year of the program (which this study documents), the Art Science Program transitioned from being referred to as the “science-theatre program” to the “Art Science Program,” a name that takes into account the broad range of artistic media that were being used as tools to convey knowledge about science, environmental justice, and social justice to larger audiences.

It is for these reasons that the participants in this study and I usually refer to the Art Science Program as the “science-theatre program.” Additionally, since the program (particularly during Session 1) was intended to revolve around the domains of science and theatre, specifically, rather than multiple artistic media, the curricula it includes are generally referred to as the “science curriculum,” “theatre curriculum,” and/or “science-theatre curriculum” by the facilitators and learners.

In line with the discourse used by the facilitators and learners to describe the curricula in the Art Science Program, this study examines learners’ practice-linked identities pertaining to *science*, *theatre/art*, and “*science-theatre*,” rather than *science*, *art*, and *Art Science*. This is largely due to the fact that my interviews with participants — which were completed approximately one month prior to the program transitioning from a “science-theatre program” to an “Art Science Program” — typically refer to concepts of “theatre” (even if it was being used as an umbrella term for numerous art forms) rather than “art” in general.

Generally speaking, the Art Science Program aims to use the arts (theatre, visual arts, music, filmmaking, and other artistic media) as tools to reshape youths’ perceptions

of what it means to “do science” and to dismantle stereotypes about who can become a scientist.

The Art Science Program

Recruitment of Students into the Program

Despite the voluntary nature of enrolling in College Bound, students did not voluntarily opt into the Art Science program; instead, all incoming middle school-aged youth were required to be a part of the Art Science Program. Some youth were excited by with this, while others were simply satisfied, and some were not happy. This unfortunately resulted in many one-on-one interactions between learners and facilitators occurring whenever learners were being disruptive, rather than whenever learners were producing good if not excellent work (which was often done in the Art Science Program). This is not because the facilitators, particularly the teachers, wanted to get learners into trouble: it’s because the learners who did not want to be in the program were [understandably] frustrated and acting out, oftentimes creating a chaotic learning environment where only small portions of planned curriculum were actually implemented.

Initial Design of the Program

The facilitators prepared the summer- and academic-year learning environments based on research of successful informal learning environments (Bell, Lewenstein, Shouse, & Feder, 2009; Ødegaard, 2003) — particularly those that can integrate storytelling, narrative, and drama with science (Peleg & Baram-Tsabari, 2011; Kerby et al., 2010). Design choices were also based on our Theatre Principal Investigator’s and my

own past experiences in designing theatre-based informal learning environments since the Art Science Program was initially intended to revolve around science and theatre.

The overall curriculum and weekly goals (with a few detailed plans for specific days) were created in three planning sessions roughly four weeks prior to the start of each Session.

Timeline

The three Sessions of the Art Science Program documented in this study spanned approximately 10 months. They began in the summer of 2018, through to the end of spring, 2019 — specifically, *Session 1* in summer 2018; *Session 2* in the fall 2018; and *Session 3* in the spring of 2019. I refer to these timeframes as “sessions,” rather than semesters (or some other term) to encapsulate a particular, stand-alone period of time within the context of the pilot year of this program. Figure 1 outlines the defining characteristics of each Session, including when they ran relative to the academic year, the overarching curriculum for each Session, and how many days, hours, etc. spanned each Session.

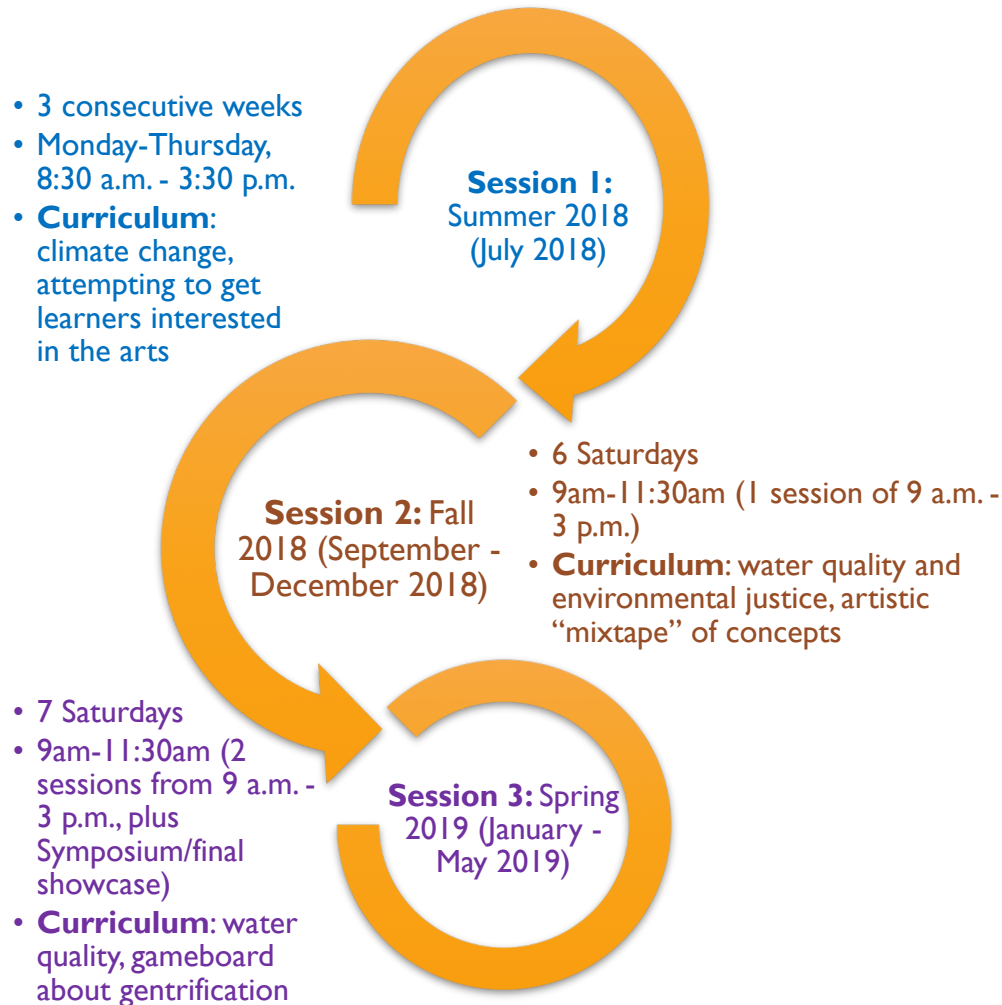


Figure 1: Timeframe and description of 3 Sessions of the Art Science Program.

Iterating on the Design of the Program

Initial Design

The Curriculum

The curriculum for the Art Science Program was initially thought of as three separate, overarching curricula: “science,” “theatre/art,” and “science-theatre”. As time progressed

throughout the program, these distinct curricula became more and more blended — for instance, even though the learners would technically be in “science time,” they would likely be finishing up their theatre/art work from a previous session. Sometimes this had to do with not wanting to break momentum for student engagement, but sometimes it had to do with classroom management or other factors (like learners arriving late because their bus never came — a major issue during Session 2, in particular, for all College Bound learners). See Appendix E for detailed information about how these three curricula were implanted — or were intended to be implemented — on a day-by-day basis throughout Sessions 1, 2, and 3.

Implementing Curriculum

Planning sessions for each Session occurred before and during the implementation of each Session. The facilitators’ reflection sessions — which occurred roughly 1—3 weeks after the conclusion of each Session — helped determine design and curriculum choices for the following Session. The Co-Principal Investigators, Mike (science education PI) and Meghan (theatre education PI) joined me, Megan (the other lead graduate student researcher on the project), and the teachers for these whole-Session reflection and planning sessions. College Bound administrators occasionally attended these sessions as well. Necessary iterations on the curriculum, large and small, were also made during daily and weekly reflection sessions between the science and theatre/art teachers, myself, and Megan. The teachers, Megan, and I would also debrief on how each day went for up to 30 minutes after almost every session during each of the three Sessions.

Staffing the Program

A number of adults worked with the youth throughout each Session of the Art Science Program. The core administrative/research team (myself, Megan, Mike, Helen, and Meghan) originally envisioned hiring one science educator and one or two theatre/arts educators who would ideally teach with the program indefinitely; however, we hired new science and theatre educators after Session 1.

During Session 1, Deborah, the science teacher, was with the youth every day for three consecutive weeks from 8:30 a.m.—3:30 p.m., Monday through Thursday — barring lunch and other personal breaks. Megan and I were also present during this same time period, assisting Deborah with classroom management and teaching while also taking observational notes for our respective dissertations as *participatory observers* (Mertler, 2009). The theatre teacher, Leslie, was with the youth for the same time period as Deborah during the first week of Session 1. It was ultimately decided that Leslie was not a good fit for the program. Therefore, during the second half of Session 1 (1.5 weeks into the 3-week Session) I took over as the primary theatre teacher for the remainder of the Session, with the understanding that the facilitators would hire new, permanent theatre teachers beginning in Session 2. Two college-age interns who were former College Bound students were also present each day during Session 1, primarily assisting with classroom management. Deborah chose not to return to the Art Science Program once Session 1 concluded.

A new science teacher, Jennifer, and two new theatre teachers, Kevin and Lyla, were hired prior to the start of Session 2; all three teachers stayed with the Art Science Program through Session 3. Since both Kevin and Lyla are professional actors, they

shared teaching responsibilities; they often co-taught, with one taking over teaching duties for the other depending on their production schedules. No undergraduate interns were present in Sessions 2 or 3.

The facilitation of all activities and curricula were implemented by the primary science and theatre teachers throughout each Session, barring the reflective conversations Megan and I would facilitate about ways of understanding connections between science and theatre/art. As previously mentioned, many learners in the Art Science Program who did not want to be in the program acted out. This resulted in many of the one-on-one interactions between facilitators and learners being negative, with facilitators reprimanding learners who were being disruptive. This also unfortunately took time away from facilitators praising learners who were doing excellent work (which occurred often), resulting in facilitators often “leaving alone” the learners who appeared to be getting their work done.

Occasional guest lectures (approximately two per Session, one taught in Session 1 by Lyla) were taught by outside science and theatre teachers. Table 2 lists all adult facilitators’ names, affiliations, and Sessions for which they were present. Note that these individuals are not necessarily members of the original “design team,” which will be discussed within the context of Table 3.

Table 2

Names and time-present for adult facilitators in the Art Science Program

Pseudonym for Facilitator	Role	Sessions Present
Deborah Leslie	Science educator Theatre educator (first half of Session 1)	Session 1 1.5 weeks in Session 1
Jennifer	Science educator	Session 2, Session 3

Kevin	Theatre educator	Session 2, Session 3. Shared teaching duties with Lyla
Lyla	Guest lecturer, Theatre educator	1 day in Session 1 (guest lecturer), Session 2, Session 3. Shared teaching duties with Kevin
Ariella (me)	Ph.D. candidate, lead graduate student researcher (theatre), theatre educator (second half of Session 1)	Session 1, Session 2, Session 3
Megan	Ph.D. candidate, lead graduate student researcher (science)	Session 1, Session 2, Session 3
Mike	Co-Principal Investigator, guest lecturer	1 day in Session 1
Melissa	Guest lecturer, theatre educator	1 day in Session 1
Amanda Lily	Guest lecturer, activist	1 day in Session 2
Sharonda	College intern (former College Bound student)	Session 1
Mikayla	College intern (former College Bound student)	Session 1

The following sections briefly outline the curriculum, flow, and major events that occurred throughout each Session. This will provide context for understanding design choices made by the facilitators during the pilot-year of the Art Science Program, and will also provide context for following the three case studies documented in this study.

Session 1

Session 1 occurred over the course of three weeks in July 2018. I interviewed and hired two teachers to begin during this Session: Deborah, a veteran middle-school science teacher in her 30s with a background in arts-integration, and Leslie, a less-seasoned theatre educator in her 40s with a robust career as a professional actor. Although Deborah is of Portuguese descent, both teachers present as White women. The learners all

appeared to like Deborah, despite her occasional tough demeanor, but generally struggled to connect with Leslie.

Leslie and Deborah struggled to effectively collaborate together, and by the end of the first week of the program, the facilitators determined that Leslie was not a good fit for the Art Science Program. During the second week of the program, I transitioned from my role as lead graduate-student researcher and ethnographer to primary theatre teacher.

Though the curriculum for Session 1 was backed by research and diligent planning from the facilitators, it was not always engaging for the learners — particularly the theatre curriculum. Most of the learners in the program had never been exposed to theatre before (either as audience members or participants) and were often embarrassed to act in front of or play theatre games with their peers. Because of this, the facilitators determined that the theatre curriculum for the remainder of the summer would revolve around whatever arts-based media the youth enjoyed doing, with the idea (or hope) that the new theatre teachers would help “reset” the theatre curriculum beginning in Session 2. Therefore, the goal for the final showcase project for the end of Session 1 — where all students/learners in College Bound would showcase final projects to their friends, family, and each other during an end-of-summer celebration — shifted from the learners creating their own 10-minute science-based plays to learners creating (in small groups or as individuals) any art that conveyed personally meaningful scientific information they learned over the summer to an audience. This resulted in one group creating a movie trailer for a fictional Marvel Avengers-style film about combating climate change, three public service announcement posters intended to warn the public about climate change

and rising sea levels in Boston, one letter to politicians, and one graphic novel-style poster about climate change.

Session 2

Session 2 spanned approximately 4 Saturdays between October and December, each 3 to 6 hours long between October 2018 and December 2018. As previously mentioned, new science and theatre educators were hired prior to the start of this Session. Lyla and Kevin — both veteran teachers of African American descent who had worked extensively with one another in the past as both actors and theatre educators in urban school settings — were hired to teach theatre. In addition to teaching theatre and being a professional actor, Kevin, who is in his late 20s, is also a musician and rapper. Lyla, who is in her 30s, has an extensive background in Montessori education.

Jennifer — who is also a person of color, is from Jamaica, and had attended the urban-education Master's program at the major Northeast research institute that houses College Bound — was hired to teach science. Jennifer, who is also in her 20s, had taught science for three years in urban middle schools after graduating from the Master's program, and also happened to be the primary science teacher for one of the participants in this study (Zeke). All three teachers (Kevin, Lyla, and Jennifer) appeared to be well-liked by the learners — especially Kevin, who connected with many of the male learners, in particular.

Considering the varied expertise, passions, and experiences of the new educators, combined with what the learners expressed as having enjoyed (or not) during Session 1, the facilitators decided that the science curriculum would focus on the relationship between water quality and environmental justice for Sessions 2 and 3. Most of the

activities revolved around testing water quality from various local sources (including reservoirs, drinking fountains, and even toilets), creating water-filtration devices, and understanding the ways in which water quality and access pertained to social and environmental justice on both local and global levels.

The theatre curriculum during Session 2 focused on creating “theatre” (or performing arts at-large, including theatre, music, and rap, plus creative writing) pieces and games that related to the science curriculum. Lyla and Kevin strove to create theatre curricula that generally allowed the learners to engage with the arts in personalized, meaningful, and fun ways that could still be tied back to the science curriculum. The theatre curriculum in Session 2 was intended to feed into the theatre curriculum for Session 3, where learners would create a “mixtape” — a collection of performing arts pieces created individually or in small groups — that generally related to issues surrounding water quality and environmental justice that were personally relevant and meaningful to the youth. The facilitators also aimed for Megan and me to facilitate more conversations with the youth that had them reflect on connections between what they were learning during “science time” and “theatre time.”

As in Session 1, learners vacillated between being engaged with the science and theatre curriculum and not — largely because so many of learners in the program wanted to transfer into more science-centric strands of College Bound rather than staying in the Art Science Program. This contributed to a variety of behavioral challenges among the learners that led to Lyla, Kevin, and Jennifer spending significant amounts of time with Megan and me strategizing the best ways of keeping the majority of learners engaged in the program.

Session 3

Session 3 spanned approximately five sessions, also each between 3 and 6 hours long, between February 2019 and May 2019. During this Session in particular, learners were frequently absent from the program, and behavioral challenges stemming largely from waning interest in many aspects of the curriculum continued to present themselves during each session. The teachers worked to re-establish the classroom/College Bound norms that were previously established in Session 2 in an attempt to remedy some of these behavioral challenges.

There were two particularly successful days and activities in terms of engagement, focus, and overall joy for the majority of learners during Session 3. The first was February 9, 2019, a “full-day session” (approximately 6 hours long) where Jennifer had the youth engage in a “gallery walk” and various other activities surrounding issues of water equity, access, and quality around the world. In the last two hours of the day, the learners collectively created a fictional news show, Apex News, with Lyla and Kevin. During this activity, learners collectively found creative ways to address the majority (if not all) of the scientific concepts learned earlier in the day in the form of a news show about climate change and water access. The overwhelming majority of learners were extremely enthusiastic about the Apex News activity, with learners who were often disengaged in the program taking on leadership roles, or otherwise demonstrating significant interest in creating the news show.

The second particularly successful activity during Session 3 was during the following Art Science session, where the learners collectively created a fictional talk show (The Mama and Papa Bear Show) that similarly addressed issues of environmental

justice. Like the Apex News activity, numerous learners who frequently struggled to fully engage with the Art Science Program's curricula appeared to greatly enjoy the activity, taking on leadership roles within the context of the project.

Due to many learners' dwindling enthusiasm for theatre but interest in a variety of other artistic mediums, Jennifer, Lyla, and Kevin decided that it would be best for the learners to explore final-project options other than a theatre/performing arts-centric "mixtape" for the Session 3 final showcase which, like in Session 1, was intended for the entire College Bound community, family and friends. As a result of this decision, the learners decided to collectively create a game board about gentrification titled "What's Gonna Happen Now?" The learners created all elements of the game — including its rules, game-pieces, and any other decorative elements they deemed necessary for the gameboard. During the Session 3 final showcase, the learners collectively presented their gameboard concept to audience members, and allowed them to play a few rounds of the game. Like with the Apex News and Mama and Papa Bear Shows, a significant number of learners were enthusiastic about their final showcase piece.

Following this history of the Art Science Program and context for understanding this study, the next section of this chapter will explore the research methodologies used in this study.

Methods

As a reminder, the research questions that guided this study were as follows:

1. How might participation in an Art Science program impact learners' practice-linked identities in relation to science, theatre/art, and "science-theatre"?; and
2. How can learners' practice-linked identities evolve over the course of an Art Science program, and what is responsible for those changes?

The methodology outlined below was intended to help answer these research questions

Participants

Facilitators

A multitude of adults worked with learners and were integral to designing the Art Science Program; however, not all of these adults were participants in this study. Table 3 provides an overview of the entire Coalesce Theatre Collaborative and College Bound design team (the "Art Science Program facilitators"), the overwhelming majority of whom are participants in this study, as indicated by an asterisk next to their name. Though Helen is an integral member of this team, she did not work directly with the learners in this study and therefore was not included as a participant. Participants listed in this table are the only adult participants in this study.

It should be noted that Megan, the other lead graduate-student researcher on the project, who is also conducting her own, independent study on the Art Science Program,

shared most (if not all) of the same adult participants for our respective dissertations/studies. Data-sharing (including interview-sharing) techniques will be discussed later on in this chapter.

Table 3

Art Science Program design team/facilitators. Gives the names, time present, and defined role of each members of the Art Science Program design team. Asterisks indicate which design team member/facilitators were participants in this study

Design Team Member/Facilitator Name (Participant*)	Timeframe Present with the Art Science Program	Role
Ariella (Me)*	Spring 2018—Present	Lead graduate student researcher (Theatre/Art)
Megan*	Spring 2018—Present	Lead graduate student researcher (Science)
Mike*	Spring 2018—Present	Science Principal Investigator, College Bound Principal Investigator
Meghan*	Spring 2018—Present	Theatre/Art Principal Investigator
Helen	Spring 2018—Present	Science education researcher
Deborah* (pseudonym)	Spring 2018—Summer 2018	Science educator for Session 1
Leslie (pseudonym)*	Spring 2018—Summer 2018	Theatre/art educator for Session 1
Kevin (pseudonym)*	Fall 2018—Present	Theatre/art educator beginning in Session 2
Lyla (pseudonym)*	Summer 2018—Spring 2019	Theatre/art guest lecturer in Session 1, theatre/art educator for Sessions 2 and 3
Jennifer* (pseudonym)	Fall 2018—Present	Science educator beginning in Session 2

Student/Learner Participants

Because data for both Megan's and my dissertations were coming out of the Art Science Program, she and I originally decided to each work with half of the learners in the program as participants for our respective studies. My original participant pool ($N=8$) included one seventh grader who identifies as female, four eighth graders who identify as male, and three eighth graders who identify as female. Table 4 includes student

participant information for this study. All participants are students of color who identified as either Latinx, African American, Asian American, or mixed-race.

Due to student attrition and absences from the program, we could not collect data from learners consistently throughout each of the three Sessions, I narrowed my participant pool ($N=3$) to three learners: Zeke, Richmond, and Rashida (all pseudonyms). Each of these three learners had markedly different experiences in the Art Science Program reflecting their differing levels of access to the three identity resources, inbound and peripheral learning trajectories, and developing practice-linked identities (Nasir & Cooks, 2009). All three learners were present throughout Sessions 1, 2, and 3 of the program.

Though Rashida was present for all three Sessions, she was interviewed only once for this study due to researcher error. Therefore, her one interview, completed at the end of Session 3, is an amalgam of questions (known as her “mashup” interview) consistent with the questions Zeke and Richmond addressed throughout each Session. See Appendix A for student interview protocols.

Table 4

Student participant information

Participant	Participant Grade	Participant Ethnicity
Zeke	8	African American
Rashida	8	Mixed-race (Cambodian and African American)
Richmond	8	African American (Caribbean descent)

I focused on the experiences of these three particular learners for two reasons, one theoretical and one practical:

First, I wanted to understand the ways that different types of learners with a variety of interests, personalities, and backgrounds — or *characteristics as learners* (Greeno & Gresalfi, 2008) — were learning and developing practice-linked identities in the Art Science Program. The way in which an individual learns and engages with a community of practice (in this case, the Art Science Program), and the extent to which they maintain an inbound or peripheral learning and identity trajectory (Wenger, 1998; Nasir & Cooks, 2009) in that community of practice, results largely from how that learner forms relationships and interacts with other people and materials in that community (Greeno & Gresalfi, 2008; Wenger, 1998). Similarly, the formation of learners' practice-linked identities results largely from how those learners interact with the material, relational, and ideational resources in a learning environment (Nasir & Cooks, 2009). Considering the diverse ways in which these learners interacted with each other and with materials in the Art Science Program, I wanted to know if the program favored the development of practice-linked identities for certain types of learners over others.

Second, I wanted to work with learners who attended the Art Science Program for all three Sessions. All three participants attended the Program throughout all three Sessions, except for daily absences. This includes Rashida, who was present for all three Sessions, but joined my study during Session 3.

Data Sources

I tried to understand the extent to which design choices impacted student engagement, growth, and development of practice-linked identities in relation to

theatre/art, science, and “science-theatre.” For that reason, I decided to interview a variety of people (learners, their parents, and the program’s facilitators) who might be able to shed light on the learners’ experiences in the program, and what — both within and outside of the Art Science Program — may be contributing to those experiences. To that end, I attempted to triangulate (Creswell & Miller, 2000) interviews with the learners, their parents, and the program facilitators. Although I attempted to contact the learners’ parents in the summer of 2019 in order to get their perspective on their children’s experiences in the Art Science Program, there were a variety of barriers and challenges that prevented me from doing so — all of which, according to one of the Principal Investigators, other graduate students researchers working with College Bound had consistently encountered over the course of many years. These barriers included being provided with incorrect email addresses and phone numbers, parents’ limited time, and parents’ general trepidation towards speaking with researchers, a trend found by numerous researchers working with the College Bound program over the years. One cause of this trepidation was that some parents had undocumented immigration status. Since my dissertation chair and Principal Investigator of the program anticipated that I would encounter these challenges when trying to interview the participants’ parents given the experiences of his other graduate students, I knew I would likely need to gather data about these learners from other sources.

Considering these factors and limitations, I ultimately relied on one-on-one interviews with the learners, daily written observations shared between me and Megan, peer debriefing with Megan (Creswell & Miller, 2000), videos and pictures of learners participating in the Art Science Program throughout each Session, other artifacts created

by the learners throughout each Session (artwork, journal entries, etc.), and lesson- and curriculum-planning documents created by the facilitators. Figures 2, 3, and 4 provide timelines for the data that was collected throughout each Session — namely, the overarching activities the learners were doing, and when they were interviewed. Refer to Appendix E for detailed breakdowns of the day-by-day schedules in each Session.

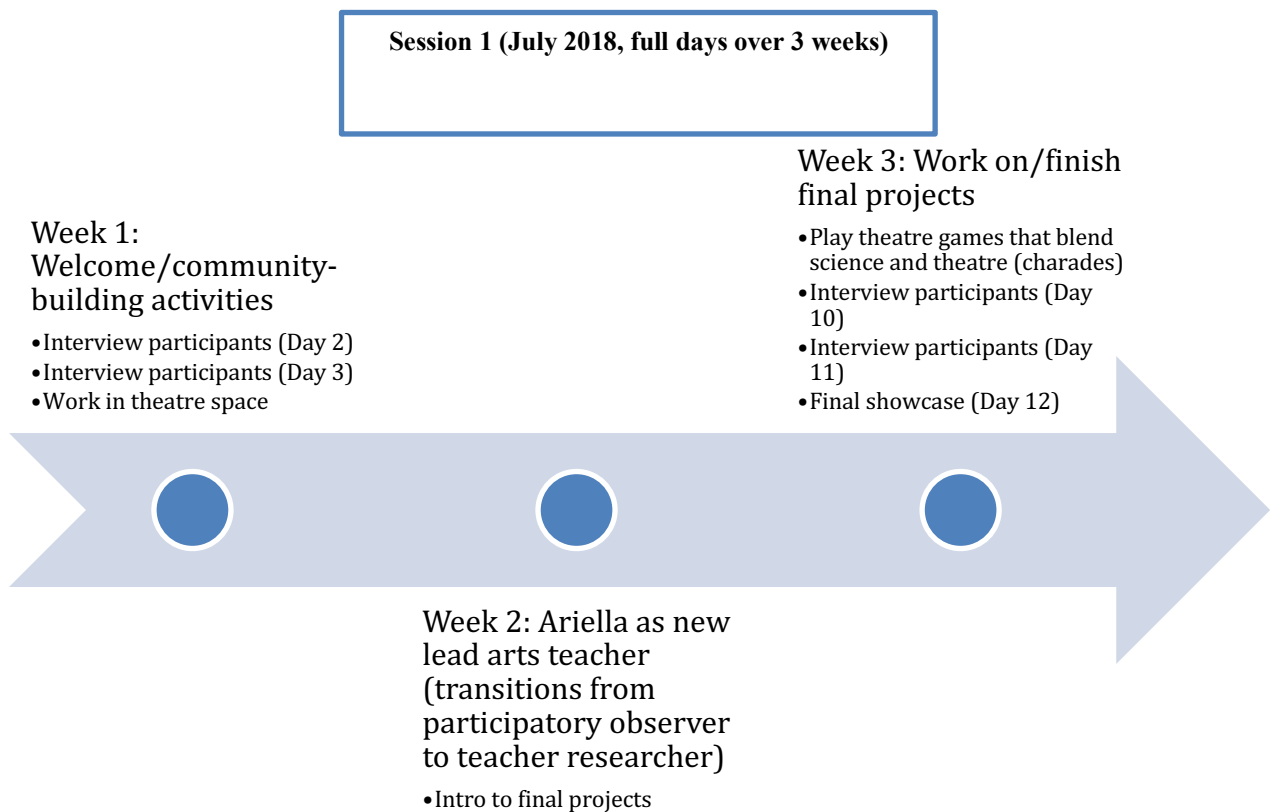


Figure 2: Timeline of Session 1 data collected/overview of daily activities for learners.

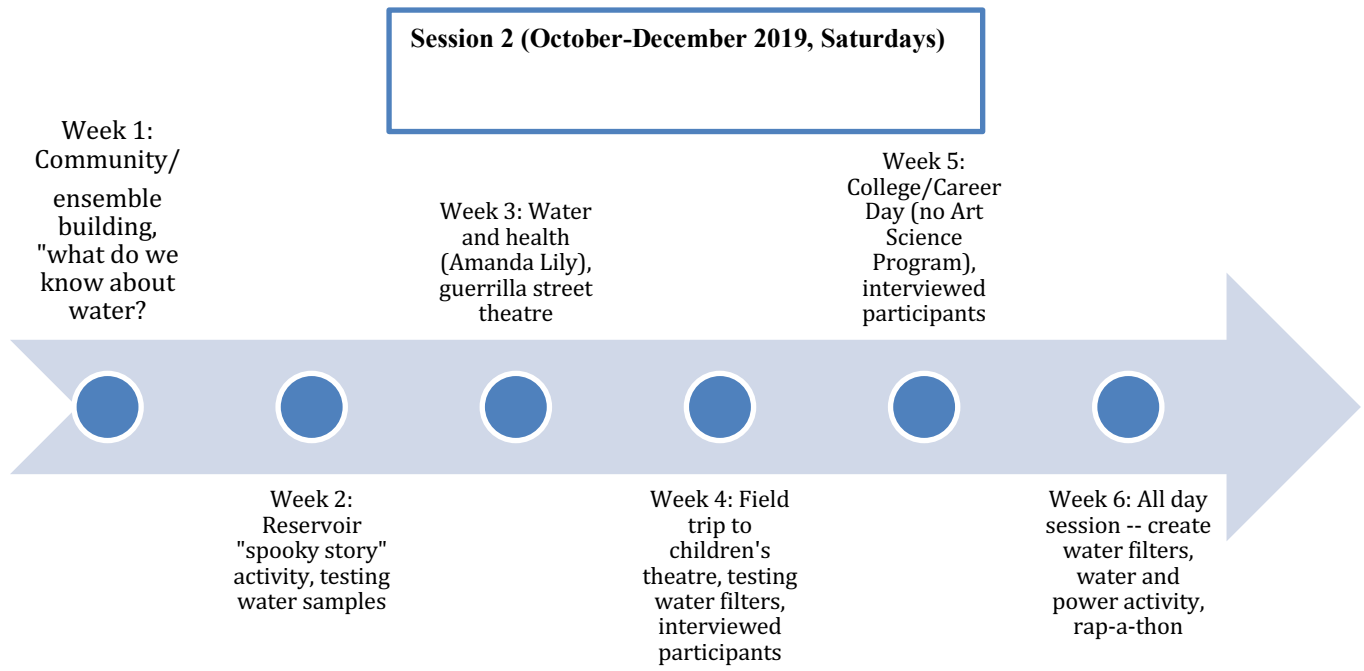


Figure 3: Timeline of Session 2 data collected/overview of daily activities for learners.

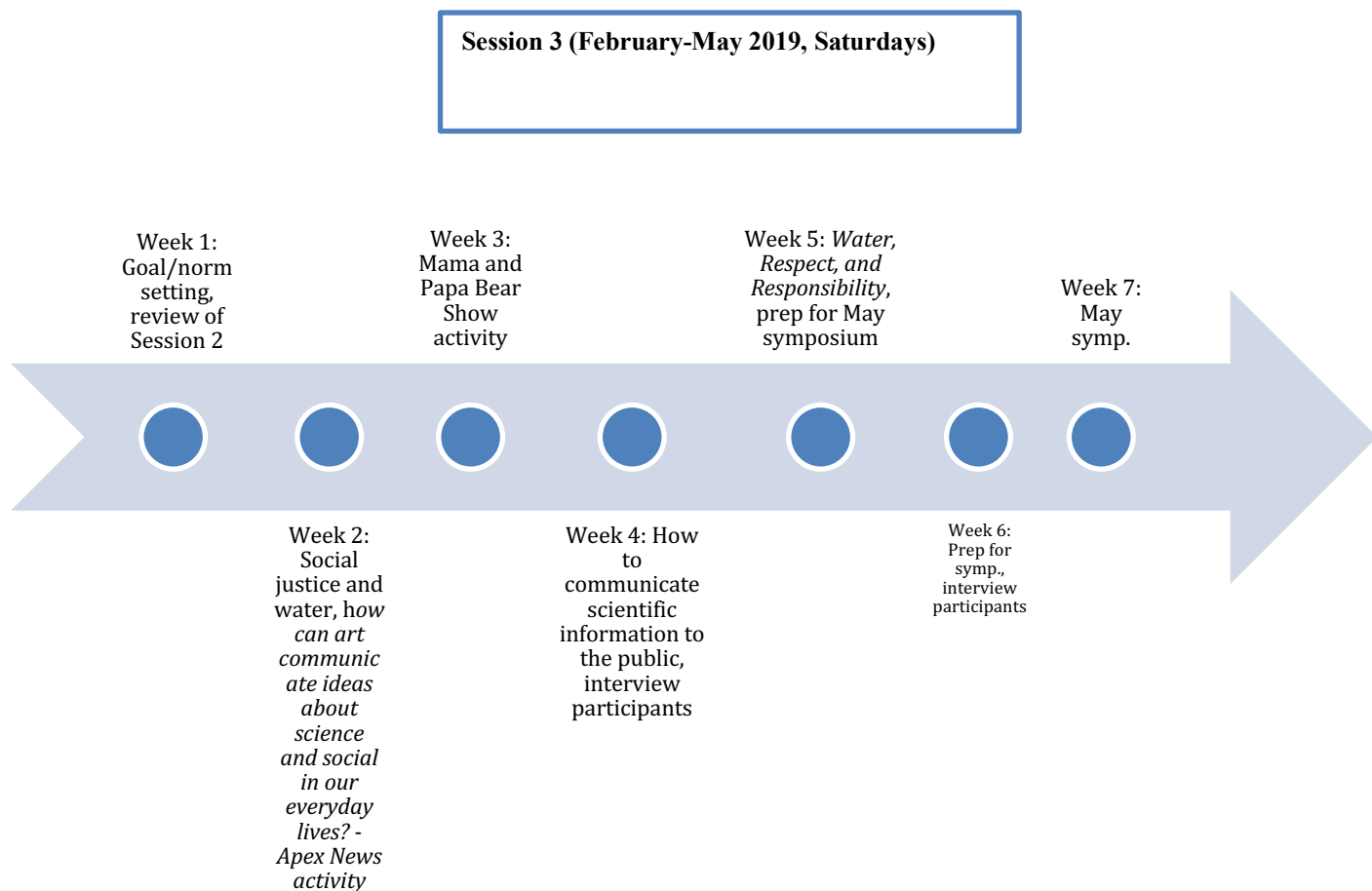


Figure 4: Timeline of Session 3 data collected/overview of daily activities for learners.

Interviews with Learners

Interviews — particularly between adults and young people — provide both the interviewer and interviewee with opportunities to learn about one another in the interview process (Ackermann, 2003). Interviewing my participants gave me the opportunity to learn about them as people, including their interests in and relationship to science, theatre/art, and science-theatre. Understanding their backgrounds, including their preferences and their perceptions of themselves, helped provide context for how and why their practice-linked identities evolved in the ways that they did during the program. The

interviews also provided clues as to how the learners engaged with material, relational, and ideational resources throughout each Session.

Interviews were designed for me to get to know my participants as people and to make sense of their growth within the context of the program (Seidman, 2013). I also wanted the learners to feel comfortable opening up to me, given that I would be interviewing them one-on-one over nearly a full year. Participants' responses influenced the questions and content of the next round of interviews (Seidman, 2013), in that I would often follow up on points that they brought up and ask if their views or perceptions of something had changed since our last interview. I asked participants how they (and others) would describe themselves as people, and why. I also asked them questions about their evolving understanding of themselves as "science people," "theatre people," or "science-theatre people". In addition to questions that enabled me to get to know my participants as individuals, I also asked them to reflect on what they enjoyed (or did not enjoy) throughout the Art Science Program. I asked them to consider everything from their interactions with peers and members of the facilitators to the Art Science curriculum at large. Lastly, I asked participants what the benefits or drawbacks of "doing" science, theatre/art, and science-theatre entailed for them personally, and why.

Appendix A includes the interview protocols used in each of the three Sessions. This includes the protocol for the "mashup" interview with Rashida. Appendix B includes the science and theatre relational maps that learners reference in Interview 1, Session 3.

Observations and Peer Debriefing

In order to triangulate the interview data, I additionally relied on written observation notes taken by myself and Megan during each session of the Art Science Program. Appendix C includes the shared observation protocol that Megan and I used for our observations. Appendix D includes a comprehensive list of observational notes created on each day of the Art Science Program.

Either Megan or I was present for every session in Sessions 1, 2, and 3. Due to Leslie's unforeseen departure during the second half of Session 1, I transitioned from being a participatory observer (Denzin, 2001), where I actively engaged with participants but maintained a sense of objectivity (Denzin, 2001; Reeves, Peller, Goldman, & Kitto, 2013) to being a full participant (Glesne, 2016) as a teacher-researcher (Mertler, 2009) for the second half of Session 1. In my new role as teacher-researcher and full participant, I became a full member of the community of practice, as opposed to a participatory observer (Mertler, 2009) who also happened to be collecting data from the Art Science Program.

In this new role, I was unable to take observational notes with the frequency I did before becoming the primary theatre instructor for the program. My primary responsibility shifted from collecting data for the study to ensuring that the theatre/arts portion of the Art Science Program stayed afloat until we could hire a new theatre/arts teacher for the fall. Because of this, I relied heavily on observational notes taken by Megan to triangulate all sources of data collected during the second half of Session 1. I also depended on peer debriefing (Creswell & Miller, 2000) with Megan to triangulate data collected during this time period, particularly to validate any instances I vividly

recalled from my own memory and experience, but for which I did not have adequate observational notes to support what I had remembered. As such, a number of in-text citations throughout the three case studies state “confirmed with other researcher” (Megan) in order to indicate instances from the second half of Session 1 where, in the absence of observational notes, I relied exclusively on peer debriefing with Megan to determine the validity of my claims.

I also relied on peer debriefing with Megan, as opposed to member checking (Creswell & Miller, 2000), after I moved to another state once Session 3 concluded. Considering the relatively limited amount of time learners were with the College Bound program during the academic year, student absences, and the ways learners sometimes transferred to different College Bound strands throughout the academic year, I couldn’t feasibly coordinate times to Skype or speak on the phone with my participants to “confirm the credibility of the information and narrative account” (Creswell & Miller, 2000, p. 127) once I finished writing their individual case studies. My dissertation committee therefore approved peer debriefing with Megan as a substitute for member checking.

Videos

Video data is primarily from student rehearsals and performances — namely, when the youth were putting together and rehearsing material for a fictional news show (Apex News Show) and talk show (The Mama and Papa Bear Show) they created during Session 3. Appendix D includes a comprehensive listing of videos created on specific days throughout the Art Science Program.

These videos are observational in nature, and they capture in-the-moment interactions the youth are having with one another and the facilitators. They also document the ways in which the youth engage with practices of science, theatre, and science-theatre in the moment, along with their interactions with material, relational, and possibly even ideational resources.

Artifacts

Artifacts include journal entries, art-pieces, doodles on the blackboard, and photos of participants in-action collected throughout the three Sessions of the program. Appendix D includes a comprehensive listing of artifacts created on specific days throughout the Art Science Program.

Journal-entries include any written reflections or assignments created by the learners. Art-pieces include any piece of visual or performance art documented within the program — including posters and game-boards that were created, or dramatic tableaux or scenes created by the youth. They also include videos of final performances, presentations, or videos created or presented at the conclusion of each Session. Doodles include drawings that were created in-the-moment on the blackboard in workspaces or classrooms (mostly in spite of protests from the facilitators). All artifacts were collected at the end of each day throughout each Session. All photos were stored in a Google Drive folder on a secure server.

Documents from the Facilitators

Planning notes created in the days and weeks before, during, and after each Session were also used as data for this study. These notes include overarching goals

created collaboratively by the facilitators throughout each Session. They also include comprehensive lesson plans created by the teachers, myself, and Megan for each session. These lesson plans include specific learning goals for each Art Science Program session — including specific goals for the science, theatre/art, and science-theatre portions of each day — the sequencing of the day’s events, and materials needed/used throughout that day. Appendix D includes a comprehensive listing of the planning documents referenced throughout this study.

Data Collection

Data was collected over 13 months (May 2018—May 2019) before, during, and after each of the three Art Science Program Sessions. Specifically, data was collected 3—6 weeks before the start of each Session during teacher planning and debrief sessions. Data was also collected before, during, and after each day throughout each Session.

I conducted two rounds of interviews with two of my three participants (Zeke and Richmond) towards the beginning and end of Session 1, one interview towards the middle of Session 2, and one interview towards the end of Session 3. Though artifact- and observational-based data was collected for all three participants throughout each Session, Rashida was only interviewed once at the end of Session 3 due to miscommunication between myself and Megan about whose study Rashida was a participant in. As such, Rashida’s one “mashup” interview consisted of questions Zeke and Richmond addressed in their interviews throughout each Session. See Appendix A for the interview protocols used throughout each Session, including Rashida’s “mashup” interview.

In order to not over-test the youth (which occurred in previous years with other researchers working with College Bound programs) or to take them away from too much instructional time, I was advised to only interview the youth two times at the most during each Session. I decided to interview the learners only one time each throughout Sessions 2 and 3 since each session only lasted for approximately 3 hours during the school year, and I wanted to interrupt as few teaching and learning moments as possible.

One-on-one interviews were structured in a similar manner to Seidman's phenomenological approach, with the first interview establishing a context for participants' experiences and who the participant is as a person, the second interview allowing participants to provide details of the experience, and the final two interviews encouraging participants to reflect on the impact that experience had on them (Seidman, 2013). Table 5 provides a summary of the goals for each interview and roughly when in each Session the interviews occurred.

Table 5

Summary of goals and timeline for each interview.

Interview Round	When Interview Occurred	Goal of Interview
Interview 1, Session 1 (Summer 2018)	First week of Session 1	Get to know learners as people (how they and others would describe themselves to others and why, what allows them to express who they are) Thoughts, questions, and feelings about doing "science-theatre program" (Art Science Program) Whether or not they consider themselves to be a "science person" and/or a "theatre person," and why
Interview 2, Session 1 (Summer 2018)	Last week of Session 1	How have personal feelings about science and theatre/art evolved (or not) over the course of the

		summer? What is it about “doing” science and theatre/art that has allowed for this shift (or not) in perception?
		How have views on who participant is as a person changed (or not) over the summer?
		Whether or not they consider themselves to be a “science person” and/or “theatre person,” and why
Interview 1, Session 2 (Fall 2018)	First four Saturdays of Session 2	Reflections on Session 1 (what participants remembered from the summer, what they enjoyed or didn’t enjoy, and why)
		What they are hoping to accomplish in CB this academic year, and why
		Seeing any similarities/overlap between science and theatre/art
		What does it mean to be a “science person” or “theatre person?”
		Whether or not they consider themselves to be a “science person” and/or “theatre person,” and why
Interview 1, Session 3 (Spring 2019)	Last four Saturdays of Session 3	Overall feelings about the “science-theatre program” (Art Science Program) — what they’re enjoying, not enjoying, and why
		What they’ve done in the Program so far that they’re proud of, or that has surprised them, and why
		Science and theatre relational map: what certain words mean to them in relation to “doing science” and “doing theatre”
		Whether or not they consider themselves to be a “science person” and/or “theatre person,” and why

Data Coding and Analysis

Because different participants have different experiences and different levels of access to identity resources, the three case studies provide three variations on how identity develops.

Considering that the three participants in this study all had vastly different experiences in the Art Science Program throughout Sessions 1, 2, and 3, it is important to

keep in mind a key finding from Nasir and Cooks' study that findings from this study support: that individual learners are provided with different levels of access to identity resources based on a variety of factors — including personal relationships with adult mentors who often operate as gatekeepers to a multitude of resources (Nasir & Cooks, 2009). Additionally, learning trajectories are not fixed — they can, and often do, evolve over time (Nasir & Cooks, 2009).

Interview data is at the core of my methodology. Within the context of my interviews, I looked at the ways in which learners accessed three identity resources that impacted their practice-linked identities (Nasir & Cooks, 2009) in relation to science, theatre/art, and science-theatre: *material resources*, *relational resources*, and *ideational resources* (Nasir & Cooks, 2009) throughout each Session of the program. I used data from my observational notes and the learners' artifacts to confirm this information as well. I examined the ways in which the three learners independently accessed these resources over time, including between and across Sessions 1, 2, and 3. I determined whether learners appeared to be on *inbound* or *peripheral* learning and identity trajectories (Wenger, 1998; Nasir & Cooks, 2009) — often referred to simply as *learning trajectories* in this study — at the end of each Session based on the extent to which they accessed material, relational, and ideational resources during that time period. Examining learners' access to identity resources, combined with determining whether they were on inbound or peripheral learning trajectories at the conclusion of each Session, helped determine the strength of each learner's practice-linked identity in relation to science, theatre/art, and science-theatre. Observational data taken and shared by myself and

Megan, videos, artifacts, lesson plans created by the facilitators, and peer debriefing between myself and Megan helped to triangulate the learners' interview data.

Coding the Interviews

I used a grounded-theory-like approach (Saldaña, 2015) in coding and analyzing the data — specifically, *initial coding*, *in vivo coding*, and *axial coding* (Charmaz, 2006; Saldaña, 2015). Memo-writing, a critical component of initial and axial coding (Saldaña, 2015), was done throughout each coding process in order for me to summarize and help make sense of participants' data. I used the Dedoose software platform to analyze all data.

Before coding, I read through each interview transcript as part of the “digesting and reflecting” (Clarke, 2005, p. 84) research process in order to familiarize myself with the data before creating initial codes (Saldaña, 2015). I wrote memos of my understandings and impressions of what each participant said at the conclusion of reading each transcript.

My codes were categorized by and corresponded to the interview in which a question was asked — Session 1 Pre-Interview (beginning of Session 1, summer 2018), Session 1 Post-Interview (end of Session 1, summer 2018), Session 2 (fall 2018), or Session 3 (spring 2019). As such, each code was labelled with the following suffixes:

- (S'18_Pre)
- (S'18_Post)
- (F'18)
- (Sp'19)

A handful of questions (with slight variations in wording) appeared throughout multiple interviews in order to measure any change over time in the learners' responses. Those

questions, and the chronological order in which they appeared throughout various interviews, were as follows:

1. Do you consider yourself to be a “science person?” Why or why not?
2. Can you explain to me who you think a “science person” is?
3. Do you consider yourself to be a “theatre person?” Why or why not?
4. Can you explain to me who you think a “theatre person” is?
5. Do you consider yourself to be a “science-theatre person?” Why or why not?
6. Can you explain to me who you think a “science-theatre person” is?

In order to differentiate learners’ responses to these questions throughout each Session, their responses to these particular questions were coded identically, but with different suffixes to reflect which interview the code corresponded to. See Appendix A for the precise wording of these questions, and in which interview protocols they appear in.

Notwithstanding the fact that different codes were created to correspond with different interview protocols, I created approximately 150 initial and in vivo codes (Charmaz, 2006; Saldaña, 2015) based on common themes and patterns I noticed across each interview transcript — of which there were very few. Each participant appeared to have markedly different experiences throughout the Art Science Program and in life in general. This accounted for the learners having precious few discernable common experiences, thoughts, or feelings across their interviews. The only detectable pattern was learners’ positive associations with *hands-on work*, which constituted anything where the learner was actively engaged in creating something alone or with others. This included hands-on work the learners had done in the past (including positive memories of fun activities, games, or programs they were involved in both within and outside of school),

hands-on work they were currently involved in (including activities and games they were doing in the Art Science Program), and hands-on work they intended or envisioned themselves doing in the future (including actively pursuing careers in the arts or sciences).

As such, I created approximately 31 axial codes (Saldaña, 2015), predominantly child codes, labeled as *actions* that corresponded with approximately 15 parent codes that spanned across each Session. The parent codes included the six above-referenced questions that were repeated throughout multiple interview Sessions. Table 6 provides a list of the finalized parent, child, and sub-child axial codes, all of which correspond with the common theme of *actions*.

Table 6

Final list of axial codes.

Parent code	Child code	Sub-child code
Surprised self — sci time (Sp'19)	Actions: Fully engaged in activity	
Hoping to accomplish this year (F'18)	Actions: Use theatre/art to portray knowledge Actions: Finish work, get paid	
Ideal science CB class (F'18)	Actions: Doing interesting/new things (science)	
Learn more about (Sp'19)	Learn more about connecting sci+theatre	Actions: Do more to connect sci+theatre
Others describe self (S'18_Pre)	Why others describe self	Actions: Being economical Actions: judgement (+ or -) from others
Science person (S'18_Pre)	Science person_Yes (S'18_Pre)	Actions: Making observations Actions: Doing experiments Actions: Teaching about science Actions: Asking questions
Something proud of (Sp'19)	Actions: Figure things out on own	

Describe self (S'18_Pre)	What allows self-expression (S'18_Pre)	Actions: Cosplay Actions: Play games Actions: Talk
	Why describe self (S'18_Pre)	Actions: Helps others Actions: Won't stop talking/sit Actions: Creates art
Surprised self — theatre time (Sp'19)	Actions: Doing interesting/new things (Theatre)	
Theatre person (F'18)	Theatre person — yes (F'18)	Actions: uses theatre (lying) to get out of situations
Theatre person (S'18_Pre)	Theatre person — yes (S'18_Pre)	Actions indicate theatre technique/experience
Who is science person (Sp'19)	Actions: Doing science	
Who is science-theatre person (Sp'19)	Actions: Doing science and theatre	Actions: Expressing science and theatre together
Who is theatre person (S'18_Pre)	Actions: Does backstage Actions: Someone who directs or critiques Actions: Someone who goes to the theatre Actions: Use of body and voice/acting for expression	
Why doing → change of feelings (S'18_Post)	Actions: Doing theatre	

I coded participants' artifacts (journal entries, artwork, etc.), observational data, and videos in a manner similar to the way I coded interview transcripts. I applied the initial codes (Saldaña, 2015), and ultimately axial codes (Saldaña, 2015) created during the coding process for interviews to these data points, identifying the ways in which they paralleled or contradicted reports made by participants during their interviews.

Analysis

I analyzed my data both within and across cases, in the form of holistic case studies (Baxter & Jack, 2008; Yin, 2003) of each of my participants. I examined their

data in relation to each of the three Sessions and broadly across all three Sessions. Within the context of each Session, I analyzed the extent to which each participant accessed material, relational, and ideational resources and what accounted for that access (or lack of access). I analyzed how each learner's access to these identity resources contributed to their peripheral or inbound learning trajectories at the conclusion of each Session, how each learner's practice-linked identities in relation to science, theatre/art, and science-theatre were developing in light of access to these identity resources, and how their respective learning trajectories at the conclusion of each Session were progressing. Lastly, I examined how each learner evolved across each Session relative to other participants in this study.

4

Prelude to the Case Studies

Before delving into individual case studies, let us review key terms used frequently throughout the cases and analyses (Table 7). These definitions are drawn from the scholarly literature that grounds the arguments made throughout this study.

Recall that each of the three cases (Zeke, Richmond, and Rashida) document all three Sessions (1, 2, and 3) of the art—science program. Each study explores a participant’s access to three identity resources — *material*, *relational*, and *ideational resources* (Nasir & Cooks, 2009) — within the context of each Session and how access to those resources impacts these learners’ *practice-linked identities* (Nasir & Hand, 2008; Nasir & Cooks, 2009). These descriptions are followed by a discussion about whether the learner appears to be on an *inbound* or *peripheral learning and identity trajectory* (Wenger, 1998; Nasir & Cooks, 2009). The structure of these case studies — framed

around the description of each learner's access to all three identity resources and implications about their inbound or peripheral learning trajectories at the conclusion of the documentation of their cases — is modeled on the case-study design (and, ultimately, analytical structure) used by Nasir and Cooks in their 2009 study on track athletes' practice-linked identities (Nasir & Cooks, 2009).

Note that inbound and peripheral trajectories are just that: *trajectories*, not steadfast determinations of whether the youth fit in the Art Science Program. This is particularly true because this study documents only the first year of an ongoing and evolving program. As will be discussed further in the analysis section, identity trajectories can shift over time (Nasir & Cooks, 2009).

Furthermore, not everyone in the same learning environment is offered (or is otherwise able to access), material, relational, and ideational resources for the evolution of practice-linked identities in the same way. Rather, their access varies based on several factors, including their relationships with others (both peers and mentors) and overall levels of engagement (Nasir & Cooks, 2009). To this end, the term “access” to resources sometimes, but not always, means “engagement with” resources — primarily because concepts of “access to” resources are both grounded in and borrowed from Nasir and Cooks' (2009) and Nasir and Hands' (2008) scholarship about practice-linked identities. I use the terminology of “access to” resources so as to remain consistent with the way in which they discuss learners in relation to identity resources in specific learning contexts.

Table 7

Important terms used in the present case studies and analyses, their definitions, and how these terms support the development of practice-linked identities and learning (if applicable)

Term	Definition	How term supports both learning and practice-linked identities with science, theatre, and science-theatre (if applicable)
Practice-linked identities (Nasir & Hand, 2008; Nasir & Cooks, 2009)	The identities that people come to establish, build, and embrace that are linked to participation in particular cultural and social practices — namely “a sense of connection between the self and the practice” (Nasir & Hand, 2008, p. 147). Practices provide differing levels of engagement for different participants, and therefore support the development of practice-linked identities differently for different individuals (Nasir & Hand, 2008).	A connection exists between the self and activity, thereby impacting engagement, learning, and overall connection to the practice (Nasir & Hand, 2008). The more connected a person feels to a particular practice, the more likely they are to participate thoroughly and extensively in that practice (Nasir & Hand, 2008).
Material resources (Nasir & Cooks, 2009)	How the physical environment, its organization, and the artifacts and materials within it bolster a learner’s sense of connection to the practice (Nasir & Cooks, 2009). In the context of this study, material resources include all elements of the Art Science curriculum, including structured debates and conversations prompted by the instructors.	Artifacts a learner masters as part of learning the practice (Nasir & Cooks, 2009) — including science, theatre/art, or science-theatre.
Relational resources (Nasir & Cooks, 2009)	Positive relationships with others in the learning context (both peers and mentors/teachers) that can increase a learner’s connection to the practice (Nasir & Cooks, 2009).	Provide both a means for learning (learning through group or one-on-one interactions, particularly with teachers/mentors) and a reason to learn (Nasir & Cooks, 2009).
Ideational resources (Nasir & Cooks, 2009)	One’s ideas about oneself, one’s place in and relationship to the practice and the world at large, and general conceptions of what is “good” or valued (Nasir & Cooks, 2009).	Help determine what is worth learning for an individual, and ultimately becomes part of what defines learning and competence (Nasir & Cooks, 2009).
Inbound learning trajectory (Wenger, 1998; Nasir & Cooks, 2009)	Involves learners joining a community of practice with the expectation of becoming full participants in the practice (Wenger, 1998; Nasir & Cooks, 2009).	Learners move towards becoming more active participants in the practices (Nasir & Cooks, 2009) of science, theatre/art, and/or science-theatre, and develop more robust practice-linked identities (Nasir &

		Cooks, 2009) in science, theatre, and/or science-theatre.
Peripheral learning trajectory (Wenger, 1998; Nasir & Cooks, 2009)	Individuals who stay marginal to the practice over time and never fully participate in the practice (Wenger, 1998; Nasir & Cooks, 2009).	“Treading water” (Nasir & Cooks, 2009, p. 57) — did not move towards becoming principal participants, yet did not necessarily move entirely towards non-participation, either (Nasir & Cooks, 2009)

In addition to the above-referenced terms that help frame the development of the learners’ practice-linked identities over time, there are other, learning-context-specific terms that arose from my own experiences working with these three learners as a teacher, ethnographer, and general member of the facilitators over the course of approximately 10 months (Sessions 1, 2, and 3). Table 7 outlines these terms, which are used throughout the three case studies and analysis section of this study.

It is important to mention that the terms in Table 7 include distinctions between the “Art Science Program” and “science-theatre,” and science practice-linked identity, theatre/art practice-linked identity, and science-theatre practice-linked identity — all of which are definitions and terms of my own, or coined collaboratively by the Art Science Program’s facilitators; however, note that I ask participants throughout their interviews to provide me with their own, individual definitions of “what it means to be a science-person, theatre-person, and science-theatre person” (Artifacts 1-10). Therefore, the definitions for the terms defined in Table 8 merely serve as points of reference for the reader, rather than the youth’s own conceptions of these terms.

Table 8

Learning context-specific terms for this study.

Term	Definition
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Art Science Program	The term used to refer to the program this study documents. The program was previously referred to as the “science-theatre program” (and was referred to as such within the context of participants’ interviews, and often during class time) but ultimately changed its title towards the end of Session 3 due to the increasing integration of (1) artistic mediums aside from theatre into the curriculum (including visual art, filmmaking, and music); and (2) the facilitators’ expanding definition of “theatre” within the context of this program, which came to include (but was not limited to) filmmaking and any and all visual art created for the purposes of being presented to an audience.
Science	The specific curriculum in the Art Science Program geared towards science, engineering, and other science-based concepts. Interview questions explicitly refer to concepts of “science.”
Theatre	The specific curriculum, couched within the all-encompassing term “theatre,” in the Art Science Program geared towards theatre, filmmaking, music, visual arts, and other performing arts intended to be presented to an audience. The facilitators’ definition of “theatre” within the context of the Art Science Program expanded and evolved after Session 1 (1) upon realizing that many of the learners were resistant to engaging in traditional forms of theatre (presenting to a live audience onstage) but seemed open to engaging in other artistic mediums that could be presented to an audience; and (2) when Ariella took over as the primary theatre teacher, and the youth were given the opportunity to engage with numerous artistic mediums during “theatre time” throughout the day. Interview questions explicitly refer to concepts of “theatre,” which often functions as this all-encompassing term.
Science-theatre	The specific curriculum in the Art Science Program that intended to merge concepts of science with concepts of theatre (which includes theatre, music, filmmaking, visual arts, and other performing arts).
Science practice-linked identity	The practice-linked identity learners develop when engaging with the science curriculum in the Art Science Program. Linked with interview questions “Would you consider yourself to be a science person?” and “who is a ‘science person’?” (Artifacts 1—10).
Theatre/art practice-linked identity	The practice-linked identity learners develop when engaging with the theatre curriculum (and eventually a variety of types of artistic media) in the Art Science Program. Linked with interview questions “Would you consider yourself to be a theatre person?” and “who is a ‘theatre person’?” (Artifacts 1—10).
Science-theatre practice-linked identity	The practice-linked identity learners develop when engaging with the science-theatre curriculum in the Art Science Program. Linked with interview questions “Would you consider yourself to be a science-theatre person?” and “who is a ‘science-theatre person’?” (Artifacts 1—10).

Additionally, it is important to remember that a significant number of facts and occurrences throughout Session 1 are confirmed with the other researcher on the project, rather than being confirmed or cited with a particular artifact. As a reminder, this is due to the fact that I unexpectedly took on the role as the primary theatre/arts teacher when Leslie left the program, and transitioned into a role as teacher-researcher, rather than participatory ethnographer.

5

Case study of Zeke

Zeke entered the Art Science Program as a rising eighth grader and is approximately twelve years old. He is of African American descent, of average height, with short dreadlocks and full cheeks. He almost always, regardless of the weather, wears a black hooded sweatshirt with a multicolored drawing of Africa on it. He previously attended the pilot public school the majority of other youth in the Art Science Program attended but at some point transferred to a charter school specializing in culturally relevant education. Jennifer (the science teacher during Sessions 2 and 3) is Zeke's science teacher at his new school.

Zeke is articulate and thoughtful, but moody; he often chooses to work and generally be alone, at least during class-time. This is despite the fact that he does, on

some level, connect with other youth in the Art Science Program, particularly a group of girls that included Rashida during Session 1 (Artifacts 11—14, entirety of Session 1), and Richmond (another self-proclaimed “science person”) during Sessions 2 and 3 (Artifacts 15—23, entirety of Sessions 2 and 3). He frequently laments about how he “hates art” (despite him expressing his desire to attend the local audition-based arts public high school), openly complains that he finds many of the activities we do in class to be futile, and opines about the futility of life in general (Artifacts 1, 3, Session 1; 7, Session 2; 9, Session 3; 11—23; Sessions 1-3). At times he outright refuses to do any work. When he does do work, he often has trouble focusing (Artifacts 11—23, Sessions 1-3).

Despite his moodiness and sometimes outright defiance, Zeke gets very excited and invested in activities he finds interesting and fun. During Session 1, he engaged in games of “science-theatre charades” with the same fervor and excitement of a professional athlete, shouting for joy when he won the game at a volume that made one of the College Bound administrators poke her head into the classroom to make sure that everything (and everyone) was okay (confirmed with other researcher). During Session 1, he began working with the group of girls he was close with on the final small-group showcase project, but was ultimately removed from the group, and ordered to work alone by Deborah (the science teacher during Session 1).

Importantly, it is unclear exactly why Deborah decided to have Zeke work alone for this project: I remember Deborah having made this decision after the group of girls complained that Zeke was distracting them from getting work done, and may even have been bullying Rashida — thereby separating Zeke from the group to perhaps protect the girls and ensure that all parties completed their work. Megan has a different recollection

of this: she did not remember Deborah having separated Zeke from the group for any specific reason. Needless to say, we (Megan and I) both agreed that Zeke had been working with, but was ultimately removed from the group.

Zeke is also self-aware: he is conscious of his frequent inability to focus — largely because he gets bored when he feels he is not being challenged or stimulated intellectually — but also acknowledges that “they [the program and teachers] can’t just cater to me” (Zeke, Artifact 9). He also feels that he has “a severe lack of empathy,” (Zeke, Artifact 9, end of Session 3) acknowledging that he “need[s] to work on that” (Zeke, Artifact 9, end of Session 3). Zeke also admits that he frequently lies to get out of situations (Artifacts 7, end of Session 2; 9, end of Session 3). Despite this, he can be charming, a good conversationalist, and is quick to strike up conversations with adults in the Art Science Program (Artifact 11, beginning of Session 1). He does not elaborate in his interviews about where, exactly, this level of self-reflection comes from, but it is apparent throughout his interviews that he is self-reflective.

Throughout Sessions 1, 2, and 3, Zeke consistently described himself as a “science person” (Zeke, Artifacts 1, beginning of Session 1; 3 end of Session 1; 7, end of Session 2; 9, end of Session 3). Since childhood, he has been interested in pursuing a career in the sciences and attending MIT, something he mentions consistently throughout his interviews (Artifact 3, end of Session 1; Artifact 7, end of Session 2; Artifact 9, end of Session 3).

Zeke is, in many ways, a paradox: he believes himself to be very smart (Artifacts 7, end of Session 2; 9, end of Session 3), yet he struggles with completing most tasks (Artifacts 11-19, entirety of Sessions 1 and 2). He is largely kind to teachers and seems to

have a small group of friends, yet he can be defiant and obstinate when completing tasks with a group (Artifacts 12-20).

Session 1

Zeke generally has a negative perception of himself in terms of how others see him, except for his family, who "just love me for me I guess" (Zeke, Artifact 1, beginning of Session 1) — he feels that his friends would generally describe him as “pretty annoying” (Zeke, Artifact 1, beginning of Session 1) because he talks “too much” (Zeke, Artifact 1, beginning of Session 1), while his teachers would describe him as “disrespectful” (Zeke, Artifact 1, beginning of Session 1), most likely due to his ADHD (Artifact 1, beginning of Session 1). He describes himself as “hyperactive...because I don't want to sit down, or go to sleep, or rest or stop talking” (Zeke, Artifact 1, beginning of Session 1).

Towards the beginning of Session 1, Zeke views himself as both a science person and a theatre person, but wants to grow up to be a scientist and go to MIT (Artifact 3, end of Session 1). He feels that a “science person” “believes in the art of science and math...using math and logical information to find out the mysteries in the world” (Zeke, Artifact 1, beginning of Session 1). He describes a “theatre person” as “someone who uses their body or voice...[or] just themselves to project themselves to a crowd or audience to express themselves” (Zeke, Artifact 1, beginning of Session 1).

By the end of Session 1, Zeke believes there were missed opportunities for combining science and theatre (which he implied were somewhat of a waste of his time), yet talks about all of the new things he’s learned, including his general place in the world (Artifact 3, end of Session 1). The following passage from Zeke’s post-interview from

Session 1 encapsulates the complex (if not paradoxical) nature of what Zeke seemed to have gathered from the Art Science Program thus far:

Ariella: Is there anything else you learned about yourself from this program?

Zeke: That I hate life.

Ariella: Okay. In what ways does that relate to what you did throughout this camp?

Zeke: Well, one thing that it did was remind me about how the world, and how everything around me works. And how, sometimes a lot of things are not compatible with the way that my lifestyle goes. And that helped me accept that.

Ariella: Okay.

Zeke: Mostly because the way the teachers talked to me, the way... Like what we were doing. Learning about climate change and humans, that kind of reminded me, or really opened my eyes, you know it really sounds like it has nothing to do with it.

Ariella: What did it open your eyes to exactly?

Zeke: Just the world around me and how sometimes that you have to change and react to it.

Ariella: Can you give me an example?

Zeke: Let's say all of the sudden College Bound, couldn't run anymore. My schedule would be kind of more free and I would have to change my... Because I would have nothing to do anymore. And that means I would have to adjust everything I did and have to look out more often for things that I want.

Ariella: So...

Zeke: And opportunities.

Ariella: And opportunities. So, are you saying that it's more like College Bound has helped you understand your place in the world?

Zeke: Yes

(Zeke, Artifact 3).

At the end of Session 1, Zeke demonstrates that he is bright and articulate, but struggles with completing work. It is possible that Zeke's access to material, relational, and ideational resources in the Art Science Program throughout Session 1 have had a substantial impact on this disconnect. The following section will explore the way in which Zeke's access to these resources throughout Session 1 may have impacted his practice-linked identities in relation to science, theatre, and science-theatre.

Access to material resources

At the start of Session 1, Zeke readily engaged in the theatre assignments Leslie presented to him, and generally seemed enthusiastic about engaging in most activities (Artifacts 11 and 12, beginning of Session 1). In the science portion of the day, he seemed similarly engaged; when conducting research on rising sea levels in Boston, Zeke grew frustrated (but ultimately began to explore) trying to understand why one part of Boston was more prone to flooding than others, repeatedly shouting variations of “what’s the big deal about Back Bay?” (Zeke, Artifact 12, beginning of Session 1). It is possible that Zeke's frustration with not understanding “what...the big deal about Back Bay” motivated him to try to understand this phenomenon.

Access to relational resources

Interestingly, Zeke's engagement with tangible material resources (things within the particular learning environment, in addition to the curriculum) seemed intertwined with his access to relational resources, particularly in the creation of the final showcase project for Session 1.

During Session 1, Zeke seemed to have a close group of approximately three girlfriends, one of whom included Rashida; they would hang out together during recess, the four of them frequently walking around the large grass field recess was held on, and could often be found eating lunch together (confirmed with other researcher). When it came time for the learners in the Art Science Program to decide what they wanted to do for the final summer showcase at the end of Session 1, Zeke wanted to work with the same group of girls, who decided to make a graphic novel-inspired poster warning about the dangers of climate change (Artifact 55). As previously mentioned, Zeke was removed from the group and informed by Deborah that he would be working alone for the final group project, for reasons that are unclear based on my and Megan's differing recollections of the event. Figure 5 contains a picture of his final project, a letter to politicians about curbing climate change, with a multicolored drawing on the front page of the letter.

Help!!

Dear politicians you ignore a problem sitting right in your faces.
You ignore simple solutions to a Advanced Problem. I'm not asking
you to believe or invest your money into global warming. But prepare for
the worst because when it all give up on climate change and you were wrong.

I'm telling you this because there are cases at stake. Your home could be in danger.
But you don't care do you? Hopefully I can change your mindset.

We can not stop, see, or control climate change but we can try to reduce
the amount of damage. The gas and coal we burn is causing a warming in
Earth's atmosphere. We have the data to prove it but you ignore it.
All for the money and power we need to do something now before it's too
late.

We have many ways to solve this problem of ours. Our government can invest
in electric modes of transportation. This will give us cleaner ways to get around. We
can use wind power to make our energy. Solar power is also an option. It's
clean, safe, and it's earth friendly. The only problem with this is that the sun
is only so long. This is some ways to combat climate change.

Dear

(confirmed with other researcher) — neither Megan nor I have any recollection of Deborah having a conversation with Zeke before she separated him from his final showcase group, where she may have tried to understand what happened from his perspective (confirmed with other researcher).

When Deborah separated Zeke from the group of girls for the final showcase towards the end of Session 1 after the girls expressed concern about him to Deborah, he became one of (and perhaps the only) learner in the Art Science Program to create a solo, rather than a small group, project for the summer 2018 showcase. Once he was separated from the group, Zeke began acting more and more defiant in the program, leading to arguments with both Deborah and myself (Artifact 12). It is unclear if Zeke continued socializing with this group of girls after Deborah chose to separate him from this group for the final showcase project (confirmed with other researcher).

Zeke's general attitude towards group work also seemed to shift once Deborah removed him from his final showcase group. He claimed to be less enthusiastic about working in a group than his actions suggested:

Zeke: I don't think that my group is compatible to make something excellent, but that's just my opinion.

Ariella: Well, forget about your group for a second. Think about you.

Zeke: If I was working by myself I'd be like enthusiastic about it.

Ariella: Okay.

Zeke: I'd be extremely excited.

Ariella: If you could do your own thing you'd be extremely excited?

Zeke: Yes.

Ariella: Okay, that's really good to know. Why would you be extremely excited to be in the Science Theatre program if you could do your own thing?

Zeke: Because I like being alone. [crosstalk] I usually don't like groups. [inaudible] specific set of people that I get along with.

(Zeke, Artifact 1, beginning of Session 1)

It's entirely possible that Zeke enjoys being and working alone, in addition to working with friends; however, it's also possible that his claims that his group "is [not] compatible to make something excellent" (Zeke, Artifact 1, beginning of session 1) were prompted by his relational resources being sapped for this particular project when Deborah had him work alone.

Access to ideational resources

Throughout Session 1, Zeke's access to ideational resources were depicted through his pre- and post-interviews, rather than through particular actions. According to Zeke, College Bound and the Art Science Program helped him find his place in the world. The program prompted him to see the urgency of combating climate change (the primary science theme during Session 1) and generally plays a major role in his life (Artifact 3, end of Session 3); he claims that if he couldn't go to College Bound "I would have nothing to do anymore" (Zeke, Artifact 3, end of Session 3). In line with this — and unlike many of his peers in the Art Science Program — Zeke had a virtually perfect attendance record throughout each Session (Artifacts 11—23, Sessions 1-3).

The ideational resources Zeke accessed seemed to impact his perception of himself as a "science person," "theatre person," and "science-theatre person." In his pre- and post-interviews, Zeke consistently defined himself as a "science-person" (Artifacts 1,

beginning of Session 1; 3, end of Session 1) “because science is how I define everything that I do” (Zeke, Artifact 3, end of Session 1). He felt that his conception of himself as a “theatre person” stayed “the same...because we really didn’t do much theatre [during this Session]” (Zeke, Artifact 3, end of Session 1). Zeke did not seem to identify as a “science-theatre” person for similar reasons; as exemplified in the quote below, it is unclear if the “science-theatre” curriculum during Session 1 provided Zeke with the material — and perhaps even relational — resources necessary to fuel his ideational resources pertaining to science-theatre:

Ariella: Would you consider yourself to be a "science/theatre person" after having done

this program. Does that even mean anything to you?

Zeke: Huh?

Ariella: To be a science/theatre person.

Zeke: I don't know, science and theatre. Theatre can be used a lot to express science in

many different ways.

Ariella: Mm-hmm (affirmative).

Zeke: So, I feel like theatre and science can go hand in hand, in some way.

Someone

needs to figure out how to do it correctly. What I mean by correctly is,

try to figure out a way to keep the theatre interesting. To make it serious

but be able to [inaudible] the core of theatre, which is entertainment.

That's kind of hard when a lot of our communities, and a lot of the world

right now is really based on just fun and not understanding that science

is... Right now, in our generation currently, science is the least favored

thing. Probably because it's complicated, but it's weird, you have one thing was the core was fun, one thing was a core of seriousness and understanding. But, both of them can be fun, it's just it's hard to put them together.

Ariella: Do you think that this summer program... There's no right or wrong answer, you won't hurt my feelings. Do you think this summer program did that successfully?

Zeke: No.

Ariella: No. Why?

Zeke: We did really good on the science part, making a fun way to express science, but it really wasn't using theatre, my theatre can really be anything. A motion picture, like we're doing videos, so I guess. There was a lot of, I feel like, not time wasted, but opportunities missed, to combine science and theatre completely, intertwine it. I'm not saying that the games were not fun or not needed, because we definitely needed some breaks here and there. But, I felt like, sometimes those games were not necessary. The games with Lindsey, we really didn't need at the time because we were going to get a break anyway. And not just that, we just really didn't need to start off with games. I know just to introduce everybody, even though she knew we already knew each other, but she didn't know us. I felt like maybe one game would have been fine, then we needed to focus on what we were going to get into. Because we only had three more days and then we were presenting our science.

Implications about inbound or peripheral trajectories

Despite the fact that Zeke struggled with accessing relational resources once Deborah separated him from his friends, Zeke presented glimmers of enthusiasm and engagement with the Art Science Program throughout Session 1. Because of this willingness to engage — even through the acts of completing tasks at all — it is reasonable to assume Zeke was on an inbound trajectory by the end of Session 1 in the Art Science Program. Despite his upset after Deborah separated him from his final summer showcase group, he still managed to find moments of enjoyment and connection with material and relational resources.

Zeke's enthusiasm for the Art Science Program does not look the same as a quintessential “good student” in a classroom, who may be consistently engaged in and enthusiastic about a program. Zeke was occasionally defiant, often complained openly about what he was experiencing, and sometimes clashed with teachers/facilitators in ways that impacted his experience in the program dramatically. Yet considering Zeke's various challenges — both personal, in terms of his own struggle with focusing, and interpersonal, in terms of his sporadic obstinance and defiance — he was nonetheless enthusiastic about the Art Science Program in his own way.

Session 2

Similar to Session 1, Zeke seemed to vacillate between being engaged and defiant throughout Session 2; sometimes he enthusiastically engaged with the curriculum (Artifacts 37-39, entirety of Session 2), while at other times his obstinance and frustration

was readily apparent. For instance, for one assignment, he wrote that he would rather “would write a well written essay because it will actually get into people’s head instead of a dumbass play, song, dance, picture, or animation” (Artifact 37, beginning of Session 2). It should be noted that Zeke wrote this despite stating in his Session 2 interview that “I think I always was a theatre person. I think yeah, I can call myself a theatre person” (Artifact 7, end of Session 2).

Zeke formed new relationships throughout Session 2, including with teachers (Artifacts 15-19, entirety of Session 2). His mindset pertaining to science and art, and the way in which they play a role in his life, remained relatively consistent from Session 1 (Artifacts 1, beginning of Session 1; 3, end of session 1; 7, end of Session 2).

Access to material resources

Zeke was frequently engaged during “science-time” throughout Session 2, perhaps becoming progressively (albeit gradually) more and more invested in the work being done during these sessions — as a reminder, curriculum, and the way in which it is implemented, is considered a material resource within the context of this study. He was particularly engaged in creating water filtration devices with the rest of the group. Zeke was so focused on his task that when Richmond, his partner for the activity, began talking to Rashida, Zeke yelled at him “Richmond! Stop fraternizing! Let’s go!” (Artifact 16, beginning of Session 2). When a guest-lecturer, Amanda Lily (a former teacher of Zeke’s) presented to the class about the work she does to promote environmental justice through art Zeke was engaged to the point where his mouth was agape, seemingly hanging on every word in her story (Artifact 17, middle of Session 2). He also seemed engaged on a tour of Riverwatch Children’s Theatre (Artifact 18, end of Session 2).

Lastly, he was willing to engage in debates with both Kevin and his classmates about water as a human right, which was part of the curriculum for the “science-theatre” portion of the day (Artifact 19, end of Session 2).

Access to relational resources

Though Zeke’s practice-linked identities were impacted by his access to material resources during Session 2 — either through the ways in which he took advantage of them, or deliberately chose not to — relational resources may have had a much more significant impact on him during this Session.

In addition to recalling charades as a significant memory from Session 1 (Artifact 7), Zeke was also struck by “[getting] kicked out of my own group [for the final showcase project]” (Zeke, Artifact 7) during that Session as well:

- Zeke:* ...there's one personal experience I wish I could forget...
- Ariella:* Can you tell me about that personal experience you wish you could forget?
- Zeke:* I was kicked out of my own group.
- Ariella:* Yeah, what happened there?
- Zeke:* I don't know. I just... I don't really care. I got into a better group. And I got to do something that I'm good at, which is programming and editing, so...

(Zeke, Artifact 7)

Interestingly, though Deborah had Zeke work alone for the final showcase project, Zeke remembered having joined a “better group” (Zeke, Artifact 7, end of Session 2). This “better group” was Richmond’s group — the group that created a movie trailer for a

fictional Avengers-type film (TATOAVENGERS) about climate change (Artifact 56, end of Session 1). As the design-team member who spent the most time working with the TATOAVENGERS group, I have little to no memory of Zeke making any contributions to this group; he claimed “I wasn't there when they filmed it, but I did do some of the editing for like the music and the sound effects” (Zeke, Artifact 7, end of Session 2). Zeke also remembered the “comic thing” (Zeke, Artifact 7, end of Session 2) his previous group from Session 1 had made as something that stood out to him during Session 1.

During Session 2, Zeke did not appear to spend much time with his friends from Session 1, who “kicked [him] out” (Zeke, Artifact 7, end of Session 2) of their summer showcase project (confirmed with other researcher); however, he took advantage of other relational resources during Session 2. Zeke began working closely on a number of small-group projects with Richmond — both of whom identify as a “science person” (Richmond, Artifacts 2, beginning of Session 1; 4, end of Session 1; Zeke, Artifacts 1, beginning of Session 1; 3, end of Session 1; 7, end of Session 1) — throughout Session 2. The two collaborated on building a water-filtration system (Artifact 16, beginning of Session 1), and were some of the few students willing to engage in a lively debate about access to water as a human right (Artifact 19, end of Session 2).

Zeke also had a number of friendly conversations and interactions with teachers and other facilitators, including randomly trying to dance with me one day (Artifact 19, end of Session 2), engaging Megan in a conversation about how good a teacher Amanda Lily was when she taught at his school (Artifact 17, middle of Session 2), and generally engaging other teachers in pleasant conversation during breaks and small-group time (confirmed with other researcher). Yet, perhaps in his attempt to build his relational

resources in the Art Science Program, Zeke took his friendly interactions with his classmates too far one day, at least according to Kevin; Zeke engaged in an animated pretend fist-fight with Daniel (another learner in the program who was not a participant in this study). Although this was likely typically 12-year-old-boy behavior, the play fight got the two boys in trouble with Kevin, who thought they were having a real fight (Artifact 19, end of Session 2).

Access to ideational resources

In many ways, Zeke took advantage of more relational resources during Session 2 than during Session 1 — whether this was deliberate or not, or made possible by the new overall structures, teachers, and curriculum during Session 2. Zeke also seemed to have access to more ideational resources in Session 2 than in Session 1, which helped solidify many of his thoughts about the roles science, theatre/art, and “science-theatre” play in his daily life.

In reflecting on feelings towards science, theatre/art, and “science-theatre” based on his experiences from Session 1, Zeke felt “I think we need to learn about why we're doing it [theatre and arts in general in the Art Science Program]. Because we can't do something without knowing the purpose” (Zeke, Artifact 7, end of Session 2). Zeke wanted to learn more about the “why” involved with doing theatre/art in the Art Science Program, and generally wanted to learn more about theatre/art than science “because I have less of a background [in theatre]” (Zeke, Artifact 7):

Ariella: So what are you hoping to do or accomplish in the theatre portion of the program specifically?

Zeke: To better understand theatre. Like how it started, why it's still... I just want to know why theatre is important to people. Or why is it important in today, or back then. Or how it can be improved in the future. I think I just want to know more of the "why".

Ariella: Yeah. Why are you interested in the "why"?

Zeke: I always just do. I want to have an explanation for what I'm doing. I don't want to do anything aimlessly

(Zeke, Artifact 7, end of Session 2)

Despite wanting to understand more of the “why” of theatre, Zeke felt that theatre played a significant role in his daily life. He claimed to have talked about the plays he wrote in his application to the local arts-based high school (Artifact 7, end of Session 2); however, he also believed he has always been a “theatre person” in atypical ways:

Zeke: I think I always was a theatre person. I think yeah, I can call myself a theatre person. Since I was born, I never thought of it as a career goal, but I can... I think in a negative way, I apply theatre to myself. Like, this is a personal example. I could get myself out of a lot of stuff, through lying or something. Like if I did something that was bad and I wasn't ready to confess to it yet, I could improvise and make it look like... instead of me being like... say I'm really sensitive about something and I was mad, and I broke a vase or something. I could make it look like an accident and I was sad about it. I could force tears. You could call me a drama queen, to be honest. If I wanted to be a theatre major, that could work. I can over express my emotions. In the future, like growing up, when I had theatre classes, that came in handy. If I close my eyes real

quick and put myself in a position where I feel sad... Other people say, that I know can spontaneously cry is, "I put myself in the saddest place possible." Well, I don't do that. I just force myself into this lie that I'm sad.

Ariella: Mm.

Zeke: Theatre is just like a grand, sugar-coated way of lying.

Ariella: Hmm.

Zeke: Like you're not actually this person on a ship, fighting. You're portraying this

message to them, which is technically lying to them.

Ariella: Mm.

Zeke: Though it's not lying, because lying is like not telling the truth if you steal

something.

Ariella: Yeah.

Zeke: But you're not really just saying something, you're using a guise or a lie to bring

entertainment, so that's pretty much what I do, to the point where I can cry.

Ariella: Mm.

Zeke: I can put myself so far to a position where I can get emotional about that. Like if I'm in a play where the lover dies, and she falls off a ship or something. I'll put myself in a situation where I feel like she just died.

Ariella: Yeah.

Zeke: Kind of like that. I force myself into that lie so much where it's useful.

Ariella: Yeah.

Zeke: It's not like... I don't like over exaggerating. I bring it to a point where it can be used in theatre. So that's where I think I could be a theatre person

(Zeke, Artifact 7, end of Session 2)

Zeke also generally felt that being a “theatre person” “means you can just express yourself in your own unique way...Cause you don't always have to... it doesn't have to be a structured play all the time...Like literally, storming out of a room when you're not mad is theatre right there...being a theatre person is similar to being a science person. It's what you think of yourself” (Zeke, Artifact 7, end of Session 2). Zeke had a similarly broad definition about what it means to be a “science person”:

Ariella: So what does it mean to you to be a "science person"?

Zeke: It just means whatever it means to the person who considers themselves one. A

science person can mean literally anything. It could mean anything, because a science person doesn't just mean you could just be like... you could be a professor, right? And you could call yourself a science person because you're a science professor. Any time you called yourself a science person because you're pursuing science, you don't know much, but you're pursuing it at your own pace. So I feel like being a science person... anyone can be a science person, because they're a result of science. So if you want to say they're a science person, then that works. It's just really what you want to be titled. Some people may know a lot about science, but they don't think they're a science person, they just say, "Oh, I have the knowledge." I know one of my friends, they know a lot

about chemistry, but, they're in high school, they know a lot about chemistry, they just don't care for that information... They're a fast learner, they know a lot, but they want to be a writer. They don't really think about all that information that they have in their brain could be applied. So they don't think they're a science person. But I think they're a science person, because if I asked them right then and there, they know the melting point of that metal bar. They could calculate it with an equation right then and there, they know that. But they don't think it's important to them, so they don't want to call themselves a science person. So I think it's just a personal title you want to put yourself in”

(Zeke, Artifact 7)

Zeke appeared to have a firm grasp on his own identity as a “science person”:

Ariella: So now that you've been in the program for a little bit, I'm curious about the

following thing. So, would you consider yourself to be a science person—(cuts off interviewer)

Zeke: Yes.

Ariella: ... Yeah, how come?

Zeke: Because even before the program, science was my thing. I already mapped out

what middle school, high school and college I would go to become an astrophysicist. Since I was, I think five my mom said, I knew my route to MIT from my house. I knew what I wanted to do. As soon as I heard about what a star was, I wanted to know everything.

Ariella: Do you still want to be an astrophysicist?

Zeke: Yes

(Zeke, Artifact 7)

In contrast to his definitions of what it means to be a “science person” or “theatre person,” Zeke struggled to provide a definition for what it means to be a “science-theatre person,” and didn’t know if he would consider himself to be one:

Ariella: Would you consider yourself to be a science theatre person after having done this

program? And what does it mean to be a science theatre person?

Zeke: I think that's a question I can't answer right now.

Ariella: Why?

Zeke: Because, right now, I usually like to keep subjects separate, for myself... Who knows, this program could change my perspective, but for right now, I don't think about it combined like that.

Ariella: What does it mean to be a science theatre person, do you think?

Zeke: I think it just means you can take those two things, those two ideas, and just put them together and express it through yourself.

Ariella: Gotcha.

Interviewer: But I don't think right now, as of right now, I can do that. Well, I think I can do that, but I don't think I want to do that. I'm not passionate about doing something like that.

(Zeke, Artifact 7)

Zeke's access to ideational resources throughout Session 2 are more difficult to pinpoint than his access to material and relational resources. It is possible he accessed these resources whenever he worked with Richmond, another self-proclaimed "science person" in the Art Science Program. It is also possible he accesses these resources in his conversations and generally positive interactions with the facilitators (Artifacts 18, 19, end of Session 2), or through his general willingness to engage with the curriculum, and other material resources in the program. It is also possible that, through these interviews, a lot has been uncovered about Zeke's identity coming into the Art Science Program, and how that identity affects some of what he gets excited about and pays attention to. The program provided him with experiences in theatre, and it is possible he is beginning to figure out what theatre is and how it matches his practice-linked identity.

Implications about inbound/peripheral trajectory

Though Zeke still presented behavioral challenges throughout Session 2, he appeared progressively more and more engaged with the curriculum (material resources) throughout this Session — whether this was through fewer outbursts and confrontations with teachers, or with a general (though not necessarily consistent) willingness to do the work expected of him in the Art Science Program. He also appeared to have accessed more relational resources during Session 2 — even if some of his interactions were perceived as negative by facilitators, like the play-fight he got into with Daniel — largely because he wasn't intentionally isolated from other students like in Session 1. He also clearly articulated his thoughts about his own identity and his general thoughts about what it means for him and others to engage in science, theatre/art, and "science-theatre."

Session 3

Zeke's progressive (however inconsistent) increase in access to material, relational, and ideational resources throughout Session 2 suggests that he was on an inbound trajectory throughout this Session. Session 3, similar to Sessions 2 and 1, exemplify the nuanced and sometimes disparate ways that Zeke continued to access identity resources throughout the Art Science Program. He also seeks to better understand his own identity, which is unusual for a 12-year-old.

On the whole, Zeke accessed identity resources throughout Session 3 with progressively increasing vigor and enthusiasm. He seemed more willing to participate in class activities and debates, even when his participation was punctuated with statements of defiance like "I'm not doing this" (Zeke, Artifact 21). He also continued — intentionally or not — to interact with other students, and Richmond in particular. He also continued to clearly articulate his thoughts on what it means to be a "science person," "theatre person," or "science-theatre person" and the extent to which those views may or may not have been impacted by the Art Science Program (Artifact 9, end of Session 3).

One particular event appeared to have a significant impact on Zeke (and seemed to impact many of the other learners as well) during this Session: the second day of Session 3, which will be referred to as "Apex News Day" (Artifact 21, middle of Session 3). "Apex News Day" (Artifact 21, middle of Session 3) provided most of the learners in the Art Science Program, including Zeke, with plentiful access to all three types of resources. Apex News Day (Artifact 21, middle of Session 3) was one of the few day-long sessions (9am-3:30pm, with a lunch break), as opposed to half-day sessions (9am-

11:30am, or 12:30pm-3:30pm) during Sessions 2 and 3 (Artifacts 69 and 70). It began with a gallery walk during the science portion of the day that aimed to link concepts of water access with social justice. After lunch, the learners were supposed to create a piece of art that exemplified what they had learned in the beginning of the day (Artifact 21, middle of Session 3). This resulted in the learners collectively deciding to create a fictional news show, which they titled Apex News, and was created and implemented in a flurry over the last 1.5 hours of the day (confirmed with other researcher). Interestingly, it was one of the few activities during Session 3 (and perhaps the entire Art Science Program) where seemingly all of the learners were engaged and enthusiastic about the activity (confirmed with other researcher). Though the Apex News activity itself only began and ended in the last 1.5 hours of the day, it appeared to be particularly engaging and exciting for Zeke.

Access to material resources

As previously mentioned, Zeke (on the whole) became progressively more and more engaged in the curriculum during Session 3 — specifically with class discussions and a willingness to complete work in general (Artifacts 20-23, entirety of Session 3). Yet he seemed to take advantage of material resources the most during Apex News Day.

As previously mentioned, Apex News Day began with a “gallery walk,” where youth examined photos and other artifacts pertaining to water quality issues and human rights (Artifact 21, middle of Session 3). Zeke was engaged in the activity; he provided relevant commentary on what he saw and what stood out to him during this activity (Artifact 21, middle of Session 3). He engaged enthusiastically, interjecting comments like “that looks disgusting” and [it looks] like they [someone] burned an oil facility”

(Zeke, Artifact 21, middle of Session 3) when confronted with somewhat disturbing photos of landscapes impacted by climate change.

When the learners had to identify one photo that particularly resonated with them during the gallery walk for the purpose of reading an article associated with that photo (Artifact 70), Zeke chose a picture of a Native Canadian girl speaking in front of a microphone to the UN about climate change. Zeke felt “If I want to know her, I’d find out her name, birthday, and where she’s from” (Zeke, Artifact 21, middle of Session 3). Zeke volunteered to go first to share what he learned with the whole class. He provided personal commentary including “it’s amazing that someone at her age could bring those problems [to the UN]” (Zeke, Artifact 21, middle of Session 3). He engaged in conversations with his classmates about why Native and poorer communities, in particular, want to hold onto their land (Artifact 21, middle of Session 3). Interestingly, when Jennifer introduced the activity for the second half of the day — where the youth would use artistic representations to demonstrate what they had learned that morning — Zeke announced “I’m not doing this,” (Zeke, Artifact 21, middle of Session 3), which was the first time he expressed resistance to an activity that day (Artifact 21, middle of Session 3).

Despite this proclamation, Zeke did, in fact, continue to engage with material resources during the arts portion of the day. This was especially the case when the learners watched and unpacked a music video about water inequality, where Zeke expressed “even though that [the content of the video] had nothing to do with me...I want to know more, I want to learn more...I like the way it was executed” (Zeke, Artifact 21, middle of Session 3).

After lunch, the whole class decided to create a fictional news show (Apex News) to convey what they had learned about climate change earlier that day. Zeke, at Lyla's suggestion, enthusiastically took on the roles of cameraman and director of the news show (confirmed with other researcher). Zeke, like the rest of his peers, remained both focused and enthusiastic about creating the Apex News Show (confirmed with other researcher).

Unlike in Session 1, when he was unwilling to present the work he created by himself for the final showcase (confirmed with other researcher), Zeke was both eager and proud to read the commentary he created, on camera and in front of his peers, about the Native Canadian girl he learned about during the first part of the day (Artifact 60).

Zeke's interest in and engagement with material resources continued throughout the remainder of Session 3, despite this engagement being peppered with occasional outbursts and other acts of defiance (confirmed with other researcher). He continued to engage in group conversations during class-time, was excited about many of the activities and games (Artifact 23, end of Session 3), and managed to stay away from confrontations and altercations with other learners in the Art Science Program when they arose (Artifact 22, end of Session 3). On the day of the final showcase in Session 3, which marked the end of a whole academic year for College Bound, Zeke actively helped to create the final whole-group showcase product for the College Bound audience: a board game about gentrification created collectively by all the learners in the Art Science Program (Artifacts 59 and 59a). Zeke also gave a presentation to the entire College Bound audience about the game, and what he learned from the Art Science Program (Artifact 67).

Access to relational resources

Like during Sessions 1 and 2, Zeke's access to material resources were often intertwined with his access to relational resources.

Continuing the trend he began in Session 2, Zeke appeared progressively more comfortable interacting with facilitators during Session 3. For instance, he told Lyla at some point that he refused to sign the Art Science class contract about behavioral expectations because he “can’t be bounded” (Zeke, Artifact 20, beginning of Session 3) to which Lyla replied, with an affectionate and friendly laugh, “time to sell your soul” (Zeke, Artifact 20, beginning of Session 3). Interestingly, he was switched out of the Art Science Program for the summer of 2019 (after this study concluded) because of a supposedly tense relationship with Jennifer, who was still his primary science teacher at school (confirmed with other researcher).

Zeke also seemed more inclined to have productive conversations with his peers during class time in Session 3. For example, when learners were experimenting with a LifeStraw (a water filtration device) and the device did not filter, Zeke quietly suggested — rather than having an outburst — “maybe we [are] using it improperly” (Zeke, Artifact 20, beginning of Session 3).

These positive interactions continued during Apex News Day (Artifact 21, middle of Session 3). Zeke engaged with Jennifer and his peers in productive, focused conversations about the gallery walk activity (Artifact 21, middle of Session 3), and even yelled at Richmond to focus — “Richmond!!!” (Zeke, Artifact 21, middle of Session 3) — when Richmond lost focus during Zeke's presentation about the young Native Canadian activist (Artifact 21, middle of Session 3). He also, with ease and enthusiasm,

took up the role as director and cameraman during the Apex News activity and even seemed to help guide the whole group towards creating a product in a timely fashion by the end of the day (Artifact 21, middle of session 3; confirmed with other researcher).

Zeke's significant access to relational resources continued throughout the remainder of Session 3. Lyla encouraged the whole group to pursue an idea for the final showcase that Zeke came up with called "Water Respect and Responsibility" (Artifact 23, end of Session 3). This encouragement resulted in the Art Science group creating their board-game about gentrification for the Session 3 final showcase (Artifact 23, end of Session 3).

On the day of the final showcase, Zeke looked happy, and was consistently interacting with his peers (Artifact 59). At some point he even engaged in some friendly stage-combat with Kevin in between presentation sessions (Artifact 64).

Access to ideational resources

Like with his access to relational and material resources, Zeke accessed substantial amounts of ideational resources during the Apex News activity. Yet he also accessed these resources during other instances throughout Session 3 as well.

Though Zeke was still unsure why, exactly, the Art Science program chose to combine the theatre/arts with science in the form of "science-theatre" (Artifact 9, end of Session 3), he felt a willingness to "go with the flow" (Zeke, Artifact 9, end of Session 3) of the program. He felt similarly about engaging with the curriculum during the theatre/arts portion of the day, too:

Zeke: Not even the teachers really know how theatre's going to go, and I guess that also

makes me excited because it's like every new day is like a fresh start for everyone. The teacher's not repeating it for another class after this. She's [Lyla's] not agitated that she can't get through it with one class. It's us as a community just figuring out how this class is going to fit into our day."

(Zeke, Artifact 9, end of Session 3)

He also generally felt that he grew a lot in the program in relation to theatre:

Ariella: Has the program changed the way you think about theatre?

Zeke: Definitely.

Ariella: Yeah?

Zeke: Because I am actively trying. I was into theatre, but not enough. When it came to

movie stuff, I would look into actors, voice actors, in shows and all that.

But this is taking me serious by doing it myself...I don't think I'm a theatre person, but I think it's opening my eyes to what theatre could be.

Ariella: This program is?

Zeke: Yes.

Ariella: How come?

Zeke: I don't know, it's just that I finally have a class that's teaching me something, I guess.

Ariella: ...What is this program teaching you, specifically? Just go back to that, with the

theatre.

Zeke: Well, it's teaching me the importance and the capabilities of theatre.

Ariella: And what are those capabilities of theatre?

Zeke: How it can be used to express different ideas and portray different messages.

(Zeke, Artifact 9, end of Session 3)

Though Zeke's views about theatre/arts and "science theatre" evolved since Session 2, he did not feel his views towards science changed since Session 2, and perhaps even since Session 1:

Ariella: Would you consider yourself to be a science person?

Zeke: Definitely.

Ariella: How come?

Zeke: Just 100 percent. Science is just my thing since I was young. I just wanted to go

to MIT since I was five. It was just a thing.

Ariella: What does it mean to you to be a science person?

Zeke: I don't know. It's hard to explain. I just think that being a science person doesn't

have to be specific. I feel like just whatever you make it to be

(Zeke, Artifact 9, end of Session 3)

Although Zeke still felt hesitant about combining science with theatre/art (Artifact 9, end of Session 3), he felt there are appropriate places in which science and theatre/art are

combined, stating “it's very ambitious to mix these two because the art and science is often thought of apart” (Zeke, Artifact 9, end of Session 3):

Zeke: I even said this this morning at the round table. One girl was trying to be a marine biologist, but she also was getting into art. She couldn't understand how she could integrate that into her future. And I was like well, you can have the science of that but also illustrate your research into a drawing or a photo. And right now, for example, we're using theatre as our medium with art to express science. So it could work. And I think that it's unique that you all thought of that because I don't see much of that at all

(Zeke, Artifact 9, end of Session 3)

The ways in which Zeke interacted with material resources throughout this Session — ranging from express his knowledge about science through conversations to engaging in hands-on work, including taking on the roles of director and cameraman during Apex News Day — also may have provided Zeke with access to ideational resources that reinforced his mindset about what it means to be a science, theatre/art, or “science-theatre” person. The positive interactions he had with the facilitators and his peers (particularly Richmond) may have reinforced — or at least not actively squelched — his access to these resources as well.

Implications about inbound/peripheral trajectory

Like in Session 2, Zeke slowly but surely continued to engage with the material, relational, and ideational resources throughout Session 3. Yet unlike Session 2, he had

more positive than negative interactions and was less actively disruptive and defiant. This may have allowed him to access more relational resources, particularly with Lyla and Kevin, than he did in Session 2.

Zeke's growing connection with Art Science Program's community of practice warrants identifying him as being on an inbound trajectory for another Session in the Art Science Program. This is particularly evident from the ways in which Zeke accessed relational resources during Session 3, frequently trying to refocus his peers during activities when they became unfocused (Artifacts 20, beginning of Session 3; 21, middle of Session 3) and taking on leadership roles, including his role as director and cameraman of Apex News (Artifact 21, middle of Session 3) and the "speaker" of the Art Science Program during the final showcase of the year (Artifact 66).

Summary

Zeke's practice-linked identity as a "science person" remained consistent throughout Sessions 1, 2, and 3. He considered himself to "definitely" (Zeke, Artifact 9, end of Session 3) be a science person and provided detailed explanations of what he personally felt it meant to engage with science (Artifacts 7, end of Session 2; 9, end of Session 3):

Zeke: There's nothing I don't like [in the science portion of the day in the Art Science program]. If there's something I had to nitpick is that we're not learning something new, but it's new to most of the people in the classroom. And they can't cater just to me, so.

Ariella: So how might we change things if we were to cater things to you?

Zeke: ... I'm just saying, if it was catered to me then we would probably be learning

more advanced things. But it's not just me. So, even if you did cater to me, I'd probably try and cater to everybody.

(Zeke, Artifact 9, end of Session 3)

In contrast to his firm perception of himself as a “science-person,” Zeke would not necessarily identify as a theatre person; however, he acknowledged that he had learned a lot about theatre in the Art Science Program, including his own capabilities and what it means to engage with theatre (Artifact 9, end of Session 3).

Zeke remains hesitant about calling himself a “science-theatre person,” even though he acknowledged (seemingly with ease) the multitude of ways in which science and theatre/art can be combined in everyday life, or in a career in the sciences (Artifact 9, end of Session 3). Zeke’s practice-linked identities in relation to theatre/art and “science-theatre” are tied to the ways in which he accessed material, relational, and ideational resources in relation to these subject areas that were new — and perhaps even exciting — to him.

Though Zeke is not a quintessential “model” student in the Art Science Program, having presented numerous behavioral challenges in both whole-class and one-on-one contexts with both peers and members of the facilitators (particularly during Session 1), his escalating enthusiasm for the Art Science Program and willingness to participate in activities enabled him to access increasingly more material, relational, and ideational resources throughout each Session. Though it was not always obvious as to whether he was on an inbound or peripheral learning trajectory at the conclusion of each Session, his

ability to access material, relational, and ideational resources suggests that he has an inbound learning trajectory in the Art Science Program as a whole.

6

Case study of Richmond

Richmond is an African American male who began his time with the Art Science program as he was entering eighth grade, and like the other participants in this study, began his time with the Art Science Program when he was approximately twelve years old. He is of Caribbean descent; Jennifer (who is from Jamaica) notes this when he says to her, on the first day of Session 2, “I like your Jamaican accent” (Richmond, Artifact 15, beginning of Session 2). He is of average height and moderately overweight, with a neatly shaved head.

Richmond’s personality and demeanor changed drastically over the three Sessions of Art Science Program. During Session 1, Richmond was a model student: he was consistently attentive, enthusiastic, and an avid participant in almost every session

(Artifacts 11-14, entirety of Session 1); he even won an award during the final summer showcase for being a model College Bound student and a role model to others (Artifact 69). He genuinely seemed to enjoy his time with the Art Science Program and identified strongly as a “science person” who also enjoyed theatre (Artifacts 2, beginning of Session 1; 4, end of Session 1).

Yet Richmond’s demeanor changed drastically during Session 2; he became unfocused, defiant, and even distracting to the others, and claimed to be less interested in both science and theatre/arts (Artifacts 6, end of Session 2; 8, end of Session 3; 15-23, entirety of Sessions 2 and 3). The facilitators and College Bound administrative staff suspected that bullying — either within or outside of College Bound, but most likely at school — was contributing to his changed behavior; however, no instances of bullying were ever confirmed, either with the facilitators or liaisons with Richmond’s school (confirmed with other researcher). Despite these behavioral challenges, Richmond did seem to maintain some friendships, particularly with Zeke and Rashida, in Sessions 2 and 3 (Artifacts 15-23, entirety of Sessions 2 and 3).

While Richmond may have been enthusiastic about the Art Science Program during Session 1, his precipitous decline in interest in the Program and increased behavioral challenges did not, on the whole, make him a good fit for the program. This placed him on a peripheral trajectory for the majority of the pilot year of the Art Science Program, despite his standing as a role-model during Session 1 and moments of enthusiasm and leadership during Session 3’s Apex News Day (Artifact 21, middle of Session 3).

The analysis chapter will examine the factors that may have transformed an enthusiastic learner like Richmond, who began as a central member of the Art Science

Program's community of practice during Session 1, into someone so much on the periphery of the community that he ultimately transferred out of the program, and how that relates to his access to material, relational, and ideational resources throughout each Session of the Art Science Program.

Session 1

Access to material resources

Session 1 was generally successful for Richmond. He had consistent, copious access to material, relational, and ideational resources — particularly during the creation and implementation of his final small-group showcase project at the end of Session 1.

Richmond broadly engaged with material resources throughout Session 1, in that he consistently participated in activities — or was, at the very least, compliant (confirmed with other researcher). This was evident in his willingness to engage in conversations and research about climate change (Artifact 12, beginning of Session 1) and frustration over learners in one of his small-group activities not taking an activity seriously enough for his liking (Artifact 14, middle of Session 1).

Perhaps the most striking example of Richmond taking up material resources (and possibly relational and ideational resources as well) during Session 1 was during the creation of his final small-group project, the TATOAVENGERS movie trailer (Artifact 56).

It should be noted that learners in the Art Science program were primarily working on their final showcase projects during the time I took over as the primary theatre/art teacher in place of Leslie, and that I was the design-team member who worked

the most closely with Richmond's final showcase group. Therefore, I relied primarily on peer debriefing with Megan and my own memory as data points for understanding what Richmond and his group did for their Session 1 final showcase project. It is also worth noting that I will often refer to Richmond and his small group collectively as the "filmmaker group" or "filmmakers" because the five typically worked so collaboratively and with such equal effort that it is difficult to separate Richmond's actions and access to resources from his collaborative partners'.

The filmmaker group consisted of Richmond and three other boys: Fabien, Daniel, and Marcus (none of whom were participants in this study). When this particular group of boys realized that they could create some sort of film for their final summer showcase project, they immediately jumped at the opportunity and decided to create a movie trailer for a non-existent, climate-change-related film that occurred within the world of Marvel's Avengers (the film release date is listed as "IDK When" within the context of the movie trailer) (Artifact 56).

Fabien quickly emerged as the primary "film director" while Richmond and the others took on a variety of roles, including set designer, filmmaker, and actor, filming and planning their work as they went along. As a teacher and supervisor, I remember feeling disoriented by the improvisational and unstructured planning methodology the boys used to film their movie trailer; I wanted to be supportive of the filmmakers but oftentimes wondered: to what extent are they fooling around versus actually getting work done? For instance, during one particularly rainy day, Richmond decided to film the rain outside, and provided no reason for doing so — he just stuck his phone out a window and began filming (Artifact 56). That rainy-day scene made the final cut for the movie trailer, and

you can hear me concerningly yelling Richmond's name in the background, exemplifying the extent to which I was uncertain about the filmmakers' abilities to remain focused (Artifact 56).

A snowball effect seemed to occur with accessing material resources for this particular project. Whenever the filmmakers — oftentimes spearheaded by Richmond — asked if they were allowed to do or access something for their movie trailer, I usually said yes. For example, at some point, Richmond and Marcus realized their film would benefit from Claymation, so they asked me if they could have clay or Playdough to work with. I said “yes”, and subsequently went on a hunt for multicolored playdough, which was featured in their film (Artifact 58). The filmmakers also realized they would benefit from various types of animation filters in their trailer, which they would need to download onto their phones. I agreed to let them use these filters — even though I knew nothing about them — and needed to trust that they were using their phones for work and not playing games on their phones (Artifact 58). In sum, none of the ideas the filmmakers generated were off-limits: everything from drawing stick-figures on whiteboards for creating “movie extras” to borrowing news clips of Donald Trump, to jumping off of desks for epic fight-scenes (Artifact 58). This culminated into a cohesive, funny, artfully done movie trailer that I — and other facilitators — had little to no involvement in creating (Artifact 58).

Access to relational resources

As with his access to material resources, Richmond accessed the most significant number of relational resources during Session 1 in the creation of the TATOAVENGERS movie trailer; however, there were other instances where he accessed relational resources

during this Session as well. He engaged with his peers in conversations about climate change in unstructured, enthusiastic ways during class-time (Artifact 12, beginning of Session 1). He also frequently — during both appropriate times (recess) and inappropriate times (during class) — socialized with other boys in the Art Science Program, where they would hang out in the back of the classroom and would talk or play computer games (Artifact 14, middle of Session 1).

Richmond naturally assumed a leadership role during the creation of the TATOAVENGERS trailer. He helped Fabien direct the film, and also collaborated with Daniel and Marcus to ensure that work was getting done in a timely fashion (even though that wasn't always obvious to me as a supervisor). As previously mentioned, the filmmakers' collaboration style was improvisational and unstructured, with one of them typically blurting out an idea (or just starting to do something) and the others quickly tagging along in the creation of that unit. Little verbal strategy or storyboarding was utilized; they would try out an idea, and if that idea didn't work, they would re-film or re-block a scene until they were satisfied with what they created.

Interestingly, the filmmakers never seemed to argue during the filmmaking process, and they never seemed to say “no” to one another; almost every idea was tried out. Despite what often looked like chaos during their filmmaking process — with me often fearing for their safety or for the program getting fined because of accidental damage to university property during a moment of filmmaking bliss — the filmmakers worked diligently and tirelessly. One day they were so focused that I had to convince them to stop working so that they didn't miss their buses home (confirmed with other researcher). The filmmakers' levels of focus and determination over long stretches of

time (often 1.5 hours at a time) to create a well-done movie trailer stood in stark contrast to the way they — particularly Richmond — would often work during the rest of Session 1; learners would typically work in short, focused bursts, followed by breaks to socialize (Artifacts 11-14, entirety of Session 1).

The strong bond the filmmakers built was evident during the Session 1 final showcase. They — unlike many other learners in the Art Science Program — did not need to be pushed by the facilitators to talk about their work to the final showcase audience; they seemed proud of their work and more than willing to talk to an audience about what they created (confirmed with other researcher).

Access to ideational resources

Richmond accessed a significant number of ideational resources throughout Session 1, both within and outside the contexts of creating the TATOAVENGERS trailer. Richmond described himself confidently at the start of Session 1:

Ariella: If you had to describe yourself to someone as who you are, how would you describe yourself?

Richmond: A weeaboo and a gamer.

Ariella: Huh?

Richmond: A weeaboo and a gamer.

Ariella: ...What's a weeaboo?

Richmond: ...It's a person that loves anime, cosplays anime, watches anime.

Ariella: ...Cool. So, why would you describe yourself as a weeaboo and a gamer?

Richmond: I feel like anime is one of the most things I can't live without, and gaming... it's a thing for me to relax after a day, or just wake up and play with my friends. And, I get to make a lot of cool friends when I'm playing games

(Richmond, Artifact 2, beginning of Session 1)

Unlike the other participants in this study who noted discrepancies in how they see themselves and how others see them, Richmond was confident that his self-descriptions match the way others view him as well, but added additional descriptors about himself in relation to his family's perception of him:

Ariella: Cool. How do you think other people see you?

Richmond: Same way I describe myself.

Ariella: So, let's think about... How do you think your friends see you? Or, how would they describe you?

Richmond: A weeaboo and a gamer.

Ariella: And your family?

Richmond: A scientist.

Ariella: Your family would describe you as a scientist?

Richmond: Mm-hmm (affirmative).

Ariella: And how about your teachers?

Richmond: My teachers... I feel like all three of them. A weeaboo, a scientist, and a gamer

(Richmond, Artifact 2, beginning of Session 1)

Consistent with his self-descriptions, Richmond was excited about his future with the Art Science Program at College Bound (Artifact 2, beginning of Session 1):

- Ariella:* ...are you looking forward to staying in the science-theatre program?
- Richmond:* Well, yeah.
- Ariella:* Yeah? Why?
- Richmond:* I mean, I like the science part. [crosstalk] I just have a general love of science. And, the theatre part is pretty easy. I just have to write a script. I'm even writing a script with my friend, so it's pretty easy.
- Ariella:* Oh, cool. Who are you writing a script with?
- Richmond:* I don't really know his real name. He's one of those people that I game with, but we've kind of created our own friendship side-gaming. It's me, him, and two other people. We're writing a script about a zombie survival.
- Ariella:* That's amazing.
- Richmond:* Yeah. And then, we would post some of the episodes on YouTube. We're still
- trying to do the first episode, because not everyone is ready. So, yeah

(Richmond, Artifact 2, beginning of Session 1).

Richmond explicitly identified as a “science person” towards the start of Session 1 “Because I like science. I want to have a science job, and most of the times, when I'm not watching anime, or playing games, I would go online and look for science-related stuff, science-related YouTube videos, try to buy a book about science” (Richmond, Artifact 2, beginning of Session 1). Yet he did not identify as a theatre/arts person, despite writing scripts in his spare time (Artifact 2, beginning of Session 1). Richmond described “a bad

experience with theatre as a [kid]" (Richmond, Artifact 2, beginning of Session 1) with a mean theatre teacher who left him with a negative impression of theatre. Despite this, he felt "the [Art Science] program's pretty nice" (Richmond, Artifact 2, beginning of Session 1).

By the end of Session 1, Richmond had accessed even more ideational resources that helped reinforce and influence his practice-linked identities as a science person, theatre/arts person, and "science-theatre" person. Even as a self-described "scientist" (Richmond, Artifact 2, beginning of Session 1), Richmond felt "I like science more now...I get to be like exploring a new branch of science, I haven't explored yet...I got to think of innovative ideas, about solutions for Boston floods. I got to do my own experiments. So yeah, I still view myself a science person" (Richmond, Artifact 4, end of Session 1). He even acknowledged a shift in his personal feelings about theatre and perception of himself as a "theatre person," largely because of his involvement in creating the TATOVENGERS movie trailer:

Ariella: ... Why have your feelings changed [about theatre]?

Richmond: Because remember that story that I told you when I was in first grade?

Ariella: Yeah.

Richmond: Yeah. That was a bad experience...Making that movie was a good experience. So

like my feelings for theatre kind of [changed]

Ariella: Do you think your view of yourself as a theatre person has changed over the

course of this camp?

Richmond: [Yeah]

Ariella: How come?

Richmond: Because I made a movie.

Ariella: ...what about that movie made you say, yeah, I'm a theatre person?

Richmond: Well, before I, every time my mom tried to make me go to the theatre, I would absolutely just hate it. But then now that I got to experience what goes on behind the scenes, it's really fun.

(Richmond, Artifact 4, end of Session 1)

Richmond enjoyed the hands-on nature of creating the TATOAVENGERS trailer (Artifact 4, end of Session 1). He also felt the choice, freedom, and perhaps even facilitators' kindness allowed him to enjoy doing theatre/arts, specifically:

Richmond: So here I got to enjoy it [theatre] because there wasn't an angry person yelling at me like, do this, do this, do that. And like if you mess up, that messes everyone up. But here we were like free to choose. We all decided what we wanted to do, we all have to choose our characters along the way instead of having to be like, set, you're done. You have to come here. If you miss a day I'm going to be mad... And angry.

Ariella: Angry. Angry. We're not angry? Cool.

Richmond: You're chill.

(Richmond, Artifact 4, end of Session 1)

As a result of his positive experiences in Session 1, Richmond considered himself to be a "science-theatre person." He defined a "science-theatre person" based on what he experienced in the Art Science Program over the summer:

Ariella: Would you consider yourself to be a quote, science theatre person after having

done this program? And who do you think a science theatre person is?

Richmond: A person that does science like work in a chemistry lab bio chemistry lab, no not

a bio, biology lab but also has time. Like when they're not looking to like either go and watch a play or be part of a play, like a side.

Ariella: And would you consider yourself to be a science theatre person after having done

this program?

Richmond: Yeah.

Ariella: Yeah. How come?

Richmond: Because as I said before, we do science in the beginning and then like in the after

lunch or like sometimes before lunch we would do some theatre.

(Richmond, Artifact 4, end of Session 1)

Richmond even acknowledged looking forward to the Art Science program for the fall, and was particularly excited to do more theatre/arts (Artifact 4, end of Session 1).

Implications about inbound/peripheral trajectory

As a result of his consistent access to a wealth of material, relational, and ideational resources, particularly when creating the TATOAVENGERS trailer, Richmond was on an inbound learning trajectory by the end of Session 1. At this point in the Art Science Program, he was looking forward to continuing his time with the Program, and was particularly looking forward to doing more theatre/arts work since he associated

theatre/arts with opportunities to create in a hands-on manner (Artifact 4). Despite his negative experiences with theatre as a child, he learned in Session 1 that there is, in fact, a place for him as a “theatre/arts person”: engaging in backstage, hands-on creative work (Artifact 4). His love for science remained strong throughout Session 1, and was reinforced by the end of this Session as well (Artifact 4).

Session 2

Despite being on an inbound learning trajectory by the end of Session 1, Richmond underwent a stark transition before or during Session 2 that made him almost unrecognizable to the facilitators (myself included) as a learner, in terms of his willingness to access material, relational, and ideational resources — and his general fit in the Art Science Program.

Session 2 was less successful for Richmond than Session 1; he began to exhibit some behavioral challenges and claimed to feel bored by a lot of the work in the science and theatre/arts sections of the day. He formed new relationships during this Session — mostly flirting with Rashida, and working in small-group activities with Zeke. His love for science seemed to remain constant during this Session, but his general interest in theatre/arts began to dwindle.

Access to material resources

Richmond began Session 2 by accessing material resources in a manner that differed from how he accessed them in Session 1. For instance, on the first day of Session 2, when playing a name-game designed to learn each other’s names, Richmond kept insisting that his name was Tyrone until his peers got annoyed and told him to tell

everyone his real name (Artifact 15, beginning of Session 2). He also seemed particularly fidgety that day, appearing grateful when the teachers gave him and the other learners the opportunity to work on the classroom floor, if they wanted to. At that point, Richmond began to fake-swim on the classroom floor (Artifact 15, beginning of Session 2).

Yet at other points in time, Richmond was unquestionably engaged with material resources in the Art Science Program, particularly when with debates and curriculum-related classroom conversations. In one science class, he had a thoughtful conversation with Jennifer about nitrates (Artifact 16, beginning of Session 2), and related a conversation about water quality to his knowledge of shrimp and why they turn pink (Artifact 16, beginning of Session 2). For more details about activities in each Session, refer to Appendix E.

Towards the end of Session 2, all the learners in the Art Science Program were taken on a half-day field trip to Riverwatch Children’s Theatre in order to experience and understand the way a professional theatre operates (Artifact 18, end of Session 2). To some extent, the majority of the learners enjoyed their time at the theatre, except for Richmond, who felt the field trip was “really boring” (Richmond, Artifacts 6, end of Session 2; 18, end of Session 2). Even though he managed to complete the assignment Lyla gave to everyone on the field trip — which was to create a public service announcement about water quality (Artifact 18, end of Session 2) — he and many of the other learners were still chastised by Lyla for not following instructions throughout the day (Artifact 18, end of Session 2).

On the last day of Session 2, Richmond appeared to be particularly enthusiastic about the day's activities. He participated in a fairly intense debate about a variety of topics including human rights, water, and wealth (Artifact 19, end of Session 2). Additionally, when Kevin led the group in a theatre game, Richmond exclaimed, "I go first, guys!" (Richmond, Artifact 19, end of Session 2). Yet he still demonstrated resistance to engaging with the entirety of the curriculum — for instance, he refused to sit with the group during a whole-group circle-related activity (Artifact 19, end of Session 2).

Access to relational resources

Richmond engaged less with relational resources in Session 2 than in Session 1; there were no singular, remarkable events like creating the TATOVENGERS movie trailer that he participated in during this Session. He spent time flirting with Rashida (Artifacts 17, middle of Session 2; 19, end of Session 2), but also working with Zeke in small groups/pairs (Artifact 19, end of Session 2) and generally trying to be friendly with his other peers in the program (Artifact 20). He also seemed to access — or try to access — relational resources with teachers and the facilitators; he commented to Jennifer in a friendly way, "I like your Jamaican accent" (Richmond, Artifact 15, beginning of Session 2) and generally interacted positively with Kevin during debate activities that Kevin led (Artifact 19, end of Session 2).

Despite these positive interactions, Richmond had a number of negative interactions with Lyla. She reprimanded him and others for acting inappropriately during the field trip (Artifact 18, end of Session 2). Lyla also had numerous side conversations

with Richmond about his distracting behavior during this Session (Artifacts 15-19, entirety of Session 2).

It is important to note that during Session 2, both Megan and I expressed concern to a College Bound administrator about Richmond's conduct, which was substantially different than over the summer (confirmed with other researcher). Throughout this Session, the facilitators were frequently having side conversations with Richmond to remind him to focus and not distract others (Artifacts 16-20). This was the point where we learned that Richmond may have been experiencing some bullying. This, however, was never confirmed by the facilitators, College Bound administrators, or liaisons from Richmond's school (confirmed with other researcher).

Access to ideational resources

Richmond's shift in feelings about the Art Science Program and general feelings towards theatre/art and science-theatre represented a shift in his engagement with ideational resources during Session 2. When asked what he remembered from Session 1, Richmond automatically replied "I remember we made a movie...it was nice...because I got to work with friends...it's the only thing I can really remember...because it was the most exciting thing" (Richmond, Artifact 6, end of Session 2). Despite having enjoyed this particular project, he claimed: "I don't like the way we would combine what we learned in theatre with science" (Richmond, Artifact 6, end of Session 2). On the whole, he felt he struggled to see connections between science and theatre/art during Session 2 (Artifact 6, end of Session 2).

When asked what he wanted to accomplish in the Art Science Program, and what an ideal classroom would look like, Richmond provided a somewhat dejected response,

claiming he only wanted to stay in the Art Science Program for the sole purpose of getting paid (Artifact 6, end of Session 2):

Ariella: What would an idea theatre classroom at college bound look like to you?

Richmond: I don't know, us sitting in a room talking.

Ariella: Why is that ideal?

Richmond: Because it's what we've been doing the past three months now. No, four.

Ariella: Well is that, and this is not a trick question, is that what you would want to be

doing in theatre?

Richmond: I mean, no.

Ariella: So what would you want to be doing in theatre?

Richmond: I really don't know because I never actually wanted...I've never actually wanted

to do theatre...

Ariella: So what are you hoping to accomplish in the theatre portion of the program?

Richmond: Same thing as science.

Ariella: Which is what?

Richmond: Completing things y'all give us.

Ariella: Because that's how you get paid?

Richmond: Well yeah, also because like that's the only thing we're doing...the only thing I'm

looking to accomplish.

Ariella: Got it. So the only thing that you're looking to accomplish is what exactly?

Richmond: The work that you guys give us.

Ariella: Do you enjoy the work that we give you?

Richmond: No.

Ariella: No?

Richmond: Kind of boring after a little while.

(Richmond, Artifact 6, end of Session 2)

Richmond specifically felt that the science curriculum in the Art Science Program wasn't stimulating enough for him, at least compared to the science curriculum he had in school:

Ariella: ...how would you describe what you do in science here?

Richmond: Here, I feel like the science that we do here is just getting water samples and testing the water to see if it's drinkable or not.

Ariella: Do you like the science that you do here?

Richmond: No. It gets boring because we're technically doing a repeat of everything. Because the first week we came here, the first few weeks that we came here, all we've really done is, 'Oh, look at this water. Let's see how much stuff is in here.' Watch few videos. And then this week, finally, 'Oh let's do the same exact thing, but we're going to filter the water'".

(Richmond, Artifact 6, end of Session 2)

Richmond found some aspects of the theatre/arts work enjoyable — mostly, playing theatre games and having the opportunity to do hands-on work (Richmond, Artifact 6, end of Session 2). Yet, as was previously mentioned, he found the field trip to Riverwatch Children's Theatre to be generally boring (Artifact 6, end of Session 2).

Interestingly, discrepancies exist between what Richmond reported during his interviews in Session 1 and Session 2, perhaps due to his lessening enthusiasm about the program, or perhaps due to factors like the potential bullying that have little to do with the program itself (although this is merely speculation). When asked if he identified as a “science person,” Richmond stated “I’ve already always quoted myself as a science person before I came here, so yeah” (Richmond, Artifact 6, end of Session 2).

Interestingly, Richmond did not consider himself to be a theatre/arts person since having done the Art Science Program because “we haven’t done that much theatre stuff” (Richmond, Artifact 6, end of Session 2). Unlike what he reported during Session 1, Richmond did not consider himself to be a science-theatre person because “[we] haven’t done anything like really science theatre related” (Richmond, Artifact 6, end of Session 2). When asked what could be done to make the science and theatre/arts portions of the day more interesting for him, Richmond responded with the following:

Richmond: Try to make the theatre and the science portion a little bit more interesting

because like, last time it wasn’t that interesting. Just simple, “Oh, watch the video, oh now do really easy experiment.” That’s all I felt like we were doing during summer. And then the theatre wasn’t really that nice because all we really did was, “Oh wow, look at this theatre. Look at this play. Let’s go and look at a theatre.” But never did anything like theatre, theatre.

(Richmond, Artifact 6, end of Session 2)

It is unclear if Richmond came to recognize that film and theatre are not the same thing.

Implications about youths' inbound/peripheral trajectories

Richmond's interest in the Art Science Program dwindled throughout Session 2. This may have had to do with the unsubstantiated claims about him being bullied (confirmed with other researcher) and his unwillingness to fully engage with the curriculum and therefore access material resources. Notably, he expressed more feelings of boredom and a general lack of stimulation — feeling as though “we're technically doing a repeat of everything [from the summer]” (Richmond, Artifact 6, end of Session 2).

Despite moments of engagement, particularly during intense debates (Artifact 20) — Richmond appeared to be on a peripheral learning trajectory at the end of Session 2.

Session 3

As in Session 2, during Session 3 Richmond appeared to be on a peripheral learning trajectory. This was primarily indicated by his reactions and responses during his Session 3 interview, despite being moments of significant engagement throughout this Session. Although he had some very positive moments during Session 3 — particularly during Apex News Day (Artifact 21, middle of Session 3) — the frustration with and general lack of enthusiasm for the Program that he expressed in his interviews placed him on a peripheral learning trajectory during this Session.

Access to material resources

Richmond began Session 3 with inconsistent engagement with material resources. For instance, on the first day of Session 3, he participated in classroom debates (Artifact 20, beginning of Session 3), but was also generally disruptive and unwilling to fully

participate in activities and adhere to classroom norms; my observation notes from the first day of Session 3 include a note to myself to check in with Richmond because his energy was “off the wall” (Ariella, Artifact 20, beginning of Session 3). Also on this day, when the whole class did an activity where they moved to different parts of the classroom to indicate their interest in different types of art (dance, visual arts, theatre, film/animation, and music) (Artifact 20, beginning of Session 3), Richmond moved to the film/animation section. But when asked to move to a part of the room to indicate which art-form learners personally enjoyed the most, he stayed in the middle of the room for the remainder of the activity, unmoving. He was eventually pulled aside by Lyla in order to find out why he was not participating. She may have viewed him sitting in the middle of the floor as being disruptive, since — considering that he was in the middle of the floor and not moving during an activity that required moving about the room — the other learners in the room appeared distracted by his lack of participation (Artifact 20, beginning of Session 3).

Richmond continued to exhibit behavior that was viewed as distracting during the second session of Session 3 (what would ultimately become Apex News Day — refer to page 62 for details about what creating this and the Mama and Papa Bear Show entailed). He arrived late and was defiant to the extent where Jennifer told him he would need to leave if his behavior continued (Artifact 21, middle of Session 3). He was even yelled at by Zeke for derailing the class and not allowing them to progress with the curriculum (Artifact 21, middle of Session 3). Yet similar to during Session 2, he readily engaged in classroom debates and discussions (Artifact 21, middle of Session 3), and was even engaged when the class viewed pieces of art that interwove elements of science and

engineering with art (Artifact 21, middle of Session 3). However, when the learners were asked if and how science and engineering were embedded in some of those art pieces, Richmond sarcastically responded with “the stage is brown. And brown is a color” (Richmond, Artifact 21, middle of Session 3).

Interestingly, when the youth decided to create the Apex News show, Richmond’s engagement quickly went from moderately interested to fully engaged, even taking on a leadership role during the activity. He and Marcus (one of the “filmmakers” who helped create the TATOVAENGERS movie trailer) were instrumental in designing the logo for Apex News (Artifact 45), and immediately decided they would be lead news anchors together (Artifacts 63a—c). Figure 6 contains the logo for Apex News that he designed. Richmond also took on the role of lead anchor during the following Art Science Program session, where the youth created a fictional talk show, The Mama and Papa Bear Show (Artifact 64).

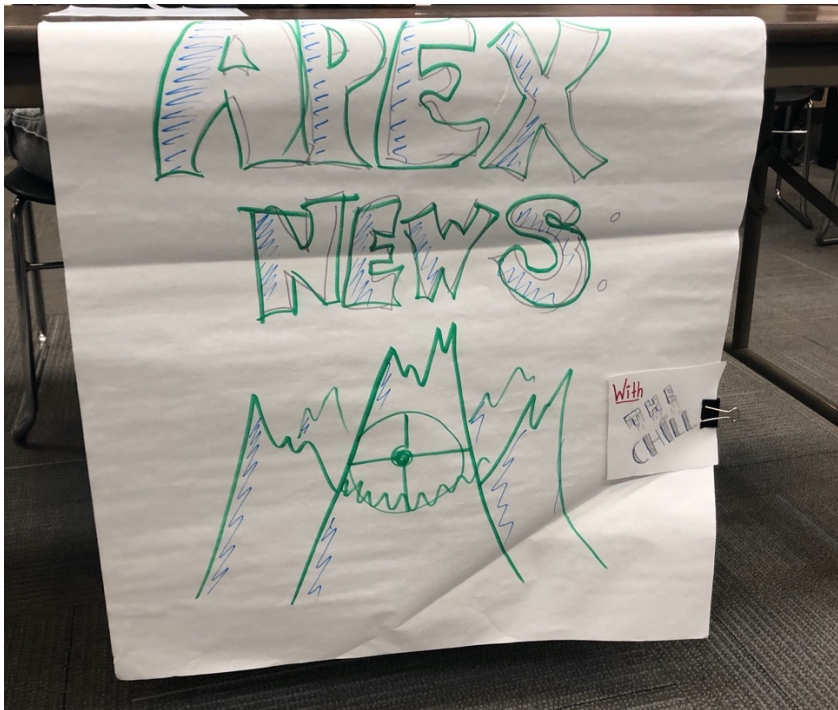


Figure 6: Apex News logo

Richmond continuously contributed to group discussions in later sessions throughout Session 3, especially whenever Zeke would also participate (Artifact 23, end of Session 3). Richmond, like Zeke, seemed especially excited about the board-game concept for the Session 3 final showcase (Artifact 23, end of Session 3). His enthusiasm for the game was apparent during the final showcase — he worked with his peers and was helpful when audience members tried to play the game with the Art Science Program learners (Artifact 61).

Access to relational resources

As previously stated, there was speculation that Richmond was being bullied — perhaps for being overweight — either during College Bound or during school time. Nonetheless, Richmond accessed ample relational resources from his peers during Session 3, but struggled to access substantial relational resources from the facilitators. He would have side conversations with Marcus and other youth during instructional time or small-group work time (Artifacts 21, middle of Session 3; 23, end of Session 3) — sometimes being the primary cause for derailing a group's focus (Artifact 21, middle of Session 3). He continued work on small-group projects with Zeke (Artifact 23, end of Session 3), but Zeke would frequently remind him to remain focused, (Artifact 21, middle of Session 3) despite Richmond's enthusiasm for some of these activities (Artifact 23, end of Session 3). As previously stated, his disruptive behavior prompted numerous side conversations with Lyla (Artifact 20, beginning of Session 3) and a warning from Jennifer (Artifact 21, middle of Session 3) that he would be kicked out of the classroom if his distracting behavior didn't improve.

Access to ideational resources

Overall, Richmond's engagement with ideational resources deteriorated during Session 3, with the exception of the ideational resources he accessed relative to being a "filmmaker" during Apex News Day and when creating the Mama and Papa Bear Show with his peers.

Richmond was proud of, and even surprised by, his success with the Apex News activity — this was, notably, the only specific event from this Session that he remembered having done (Artifact 8, end of Session 3). He was proud to have contributed to such a fun activity with his friends (Artifact 8, end of Session 3) and surprised that he could "keep a straight face [on camera]...since most of us kept failing at our lines" (Richmond, Artifact 8, end of Session 3). When asked what he wanted to learn more about during both science and theatre/arts time, the only thing he could identify was "the news channel" (Artifact 8, end of Session 3). He still had no idea why theatre/art and science would be put together within the context of this program (Artifact 8, end of Session 3). This is despite the fact that he seemed to understand the relationship between theatre and science at the end of Session 1 (Artifact 4, end of Session 1), and despite his participation in Apex News and the Mama and Papa Bear Show during Session 3 (similar to his participation in film making in Session 1); he still claimed to see no connection between the two domains.

Interestingly, when asked if and how the Art Science Program impacted his life or holistic perceptions of science or theatre/art, he replied with "nothing I do in my daily life has anything to do with science, or...theatre" (Richmond, Artifact 8, end of Session 3). This stands in stark contrast to how he described himself as a "science person" and as

someone who wrote plays for fun during Session 1 (Artifacts 2, beginning of Session 1; 4, end of Session 1). When explicitly asked if he considered himself to be a “science person,” he replied with the following:

- Ariella:* Would you consider yourself to be a science person?
- Richmond:* I used to, not anymore.
- Ariella:* Why?
- Richmond:* I don't know. I don't find anything in science really enjoyable anymore.
- Ariella:* Why do you think that is?
- Richmond:* I gave up on a science career.
- Ariella:* Why did you give up on a science career?
- Richmond:* Boring. I don't know. I don't find it enjoyable anymore.
- Ariella:* Was there anything that made you feel like it wasn't enjoyable anymore?
- Richmond:* No, I just lost the motivation to be a science person

(Richmond, Artifact 8, end of Session 3)

When asked if he considered himself to be a “theatre person,” Richmond said no, because “I've never done theatre” (Richmond, Artifact 8, end of Session 3), despite having previously been excited about the theater work he did during Session 1. Similarly, when asked if he considered himself to be a “science-theatre person,” he said no, because he didn’t enjoy combining science with theatre/art (Richmond, Artifact 8, end of Session 3), again inconsistent with what he reported at the end of Session 1.

Despite Richmond’s dissipating interest in science and theatre/art, he articulated — through a conversation about his science and theatre/art relational maps — his thoughts on what it means to engage in both science and theatre/art in nuanced ways. Specifically, he felt creativity and imagination are integral parts of doing science, because

“When I think of science, I think of innovation, so you have to make up what you want to make up for, what you want to make” (Richmond, Artifact 8). He also felt that being curious and asking questions was integral to science, because “you [one person] don’t really know everything about science” (Richmond, Artifact 8). Interestingly, Richmond didn’t feel that empathy is required for science (Artifact 8, end of Session 3), despite the fact that the facilitators were trying to get the learners to recognize that empathy is, in fact, important when doing science. It’s also interesting that Richmond interpreted “stories” as “a view into someone’s past, a fairy tale, an adventure” (Richmond, Artifact 8, end of Session 3) rather than thinking about stories in terms of a message a scientist may want to get across to a non-scientific audience — another concept the facilitators tried to impart into the in learners.

Implications about inbound/peripheral trajectory

Despite moments of engagement with material, relational, and ideational resources, particularly during the Apex News activity, Richmond’s interview in Session 3 conveyed ever-increasing feelings of disinterest in his overall place in the Art Science Program and feelings towards science, theatre/art, and science-theatre in general (Artifact 8, end of Session 3).

I also found Richmond to grow increasingly more and more frustrated in his interviews; in contrast to his claims about not liking the program, Richmond seemed to want to get back to class as quickly as possible (Artifact 8, end of Session 3). Yet considering the consistent and increasingly negative language Richmond used in his interviews about no longer liking science, his general frustrations with the Art Science

curricula, and his erratic behavior in class, Richmond remained on a peripheral learning trajectory during Session 3 in the Art Science Program.

Summary

Richmond's access to material, relational, and ideational resources progressively declined as he participated in Sessions 1, 2, and 3 of the program. Though he was enthusiastic about the Art Science Program during Session 1, his behavior became recalcitrant during Session 2 and varied between recalcitrant and fully engaged in Session 3. His noncompliance impacted his access to relational resources relative to both the facilitators and his peers, where both groups were sometimes (if not often) frustrated by his lack of focus (Artifacts 21, middle of Session 3; 22, end of Session 3). Despite this, Richmond was occasionally so engaged with the learning material that he emerged as a leader, especially when he had opportunities for filmmaking (Artifacts 21, middle of Session 3; 63-64).



Case study of Rashida

Rashida began her time with the Art Science Program as a rising eighth grader. At that time, she was approximately twelve years old. She identifies as Black and Cambodian. She is petite, with glasses, and frequently wears her hair with two buns on top of her head. She is kind to both her peers and teachers, and she is what most teachers would likely describe as a “good student”; she works hard, does all the work expected of her with enthusiasm (or at the very least, compliance), thought, and effort. She is generally quiet but seems to have a group of friends with whom she spends time with regularly (during Session 1, this group of friends included Zeke).

Rashida described herself in her “mashup” interview (her sole interview in Session 3 that contained all of the interview questions the other learners answered in their interviews from Sessions 1 and 2) as “very creative and just centered around art and

things like that...art has just been a really big part of my life” (Rashida, Artifact 10, end of Session 3). She feels that the more opportunities she has to create and engage in hands-on learning, the better (Artifact 10, end of Session 3).

Rashida believes that people who don’t know her well would describe her as “just the quiet kid who draws in the corner or something like that. Because I don’t really talk. I’m really shy.” (Rashida, Artifact 10, end of Session 3). However, she believes that people who know her well — in particular, her friends — “probably find me more annoying since I’m very talkative and things like that” (Rashida, Artifact 10, end of Session 3). Meanwhile, she says her family would describe her as “very smart” (Rashida, Artifact 10, end of Session 3) and her teachers (one, in particular) would describe her as helpful and caring, because of her constant involvement in her class (Artifact 10, end of Session 3).

Though Rashida typically keeps to herself (with the exception of her small group of girlfriends), she fits well into the Art—Science Program. She generally liked the program (Artifact 10, end of Session 3), and in particular liked that she felt a connection to science that she previously hadn’t felt before (Artifact 10, end of Session 3). Rashida felt this despite sometimes finding the program boring (Artifact 10, end of Session 3). She also seemed to enjoy her time with the Art—Science Program throughout each Session within the context of class time — or at the very least did not outwardly express any discontent (Artifacts 11—23, Sessions 1-3) — which was not necessarily the case for other participants in the group.

In many ways, Rashida can be considered an exemplary learner for the Art—Science Program, largely because she seemed to reconceptualize, in a positive way, what it means for her to engage with science in her daily life (Artifact 10, end of Session 3) —

even though she doesn't necessarily want to pursue a career in the sciences, and even, at the end of the program, she still thought that science was "kind of hard" (Rashida, Artifact 10, end of Session 3). Rashida produced pieces of art that seemed to effectively integrate art with science, a primary goal that the facilitators had for learners in the program. Her practice-linked identities, particularly in relation to science, seemed to evolve substantially throughout the course of each Session, in ways that promote the value of having youth — particularly those who do not identify as "science people," engage in an art—science program like the one documented here (Artifact 10, end of Session 3). She also seemed to recognize the value of integrating science with art (Artifact 10, end of Session 3).

Session 1

Session 1 seemed to be successful for Rashida. She was almost constantly engaged in activities, despite the tumult of changing theatre teachers from Leslie to me during Session 1 (Artifacts 12—15).

Access to material resources

Rashida seemed to enthusiastically engage with all material resources — and if she wasn't enthusiastic about them, she didn't outwardly express frustration or discontent during class time. She completed all tasks and put a significant amount of thought into all work required of her, particularly activities that required drawing (31, 32, 40—42, 48—55). These activities include a project where the youth designed an architectural structure that would address climate change in Boston (Artifact 32). Rashida created an intricate birds-eye view and written explanation of an environmentally efficient lettuce farm that

considered expectations about climate change in Boston (Artifact 32). Figure 7 contains a picture of that design. Although all the learners engaged in this activity, I focused solely on what Rashida did for this assignment due to the thoroughness with which she completed it.

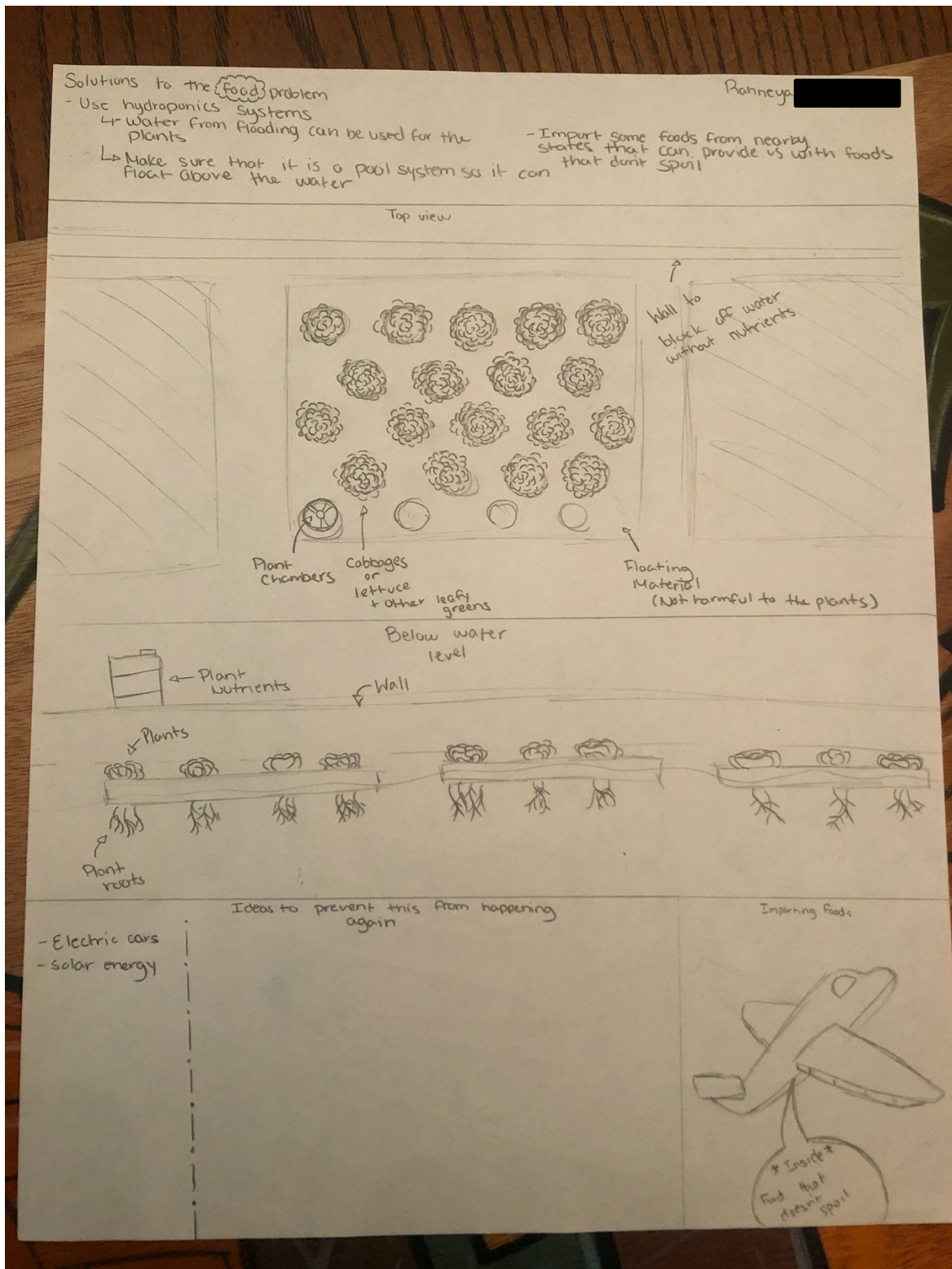


Figure 7: Rashida's rendering of an architectural structure that would address climate change in Boston. Black box added over Rashida's real name, written at the top of the document

Rashida often included all of her own doodles and drawings into the written work she created (Artifacts 31 and 32). Her signature anime-style drawings appeared in the Session 1 final group project, a graphic novel-style public service announcement poster about the dangers of climate change that she created alongside two of her friends and classmates (Artifact 57). Figure 8 contains a picture of that graphic novel-style public service announcement. Note that this comic was what she and her group chose to do for their final showcase project for Session 1.

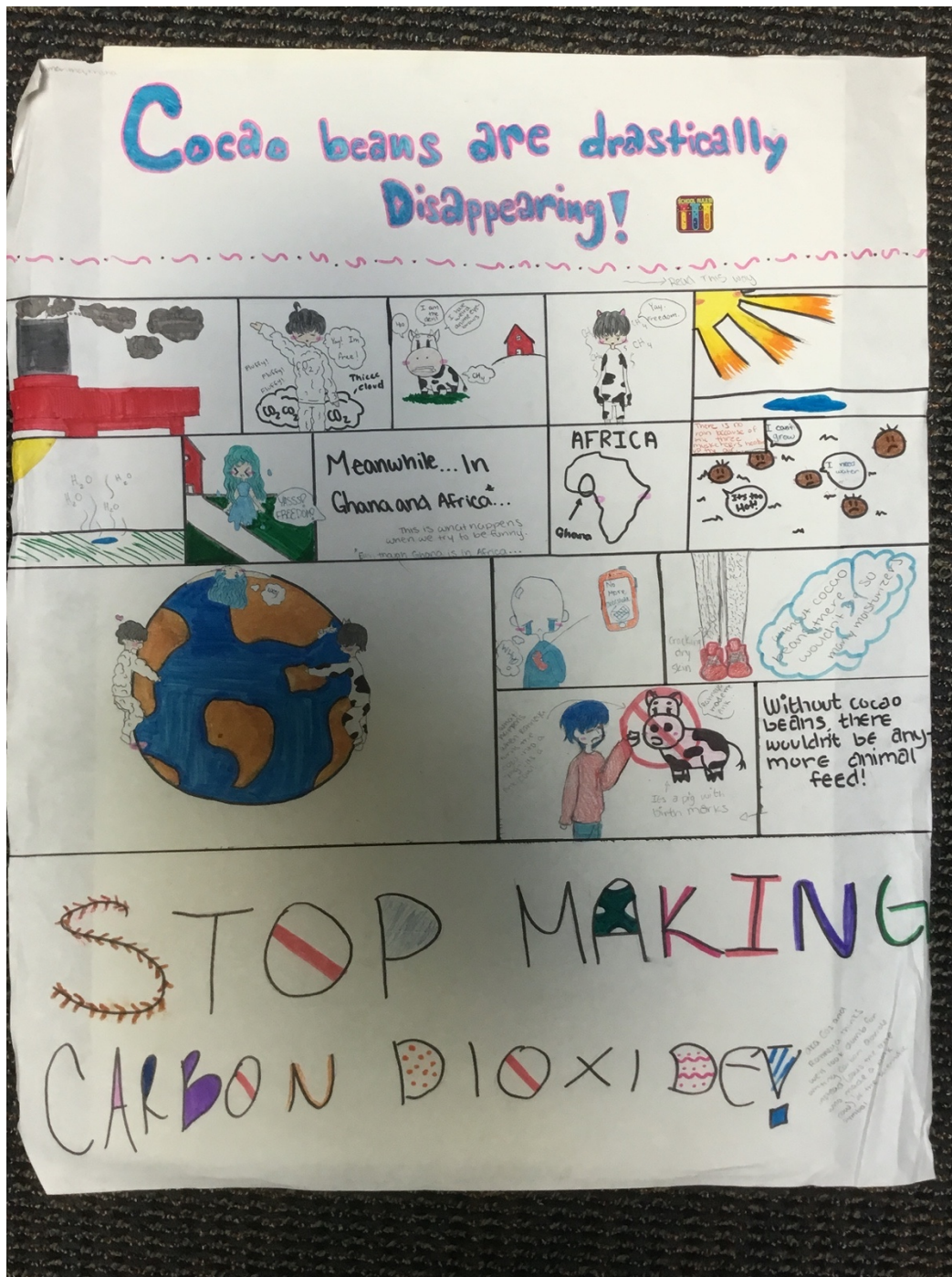


Figure 8. Rashida's final group project for the Session 1 showcase.

During Session 1, Rashida also generally felt that the more hands-on work she could do, the better (Artifact 10, end of Session 3). For instance, Rashida enjoyed having the opportunity to work, even for 2 hours, in a black-box theatre, because “we weren't

just inside a classroom staring at a screen looking at what it looks like. We actually got to see [a theatre] with our own eyes” (Rashida, Artifact 10, end of Session 3). She also felt that the more choice the youth had in terms of what to do with their time, and how to interact with material resources, the better (Artifact 10, end of Session 3). In reflecting on her summer experiences, she felt “we didn't really have that much creative control [over the summer]. I mean, we had choices, but it was like two. We are either the shadow puppets [with Leslie] or the comics or things like that.” (Rashida, Artifact 10, end of Session 3).

Access to relational resources

During Session 1, Rashida gravitated towards the same group of learners, both within and outside of classroom contexts. One of these learners was Zeke, a participant in this study, while the other two were Serena and Karla (neither of whom were participants in this study). Whereas Zeke was energetic and often rambunctious, Serena, Karla, and Rashida were all quiet, kind, and studious — or at least gave off that impression to the facilitators. This group of four learners — particularly the girls — always worked together during class time whenever possible, and were almost always together during lunch, recess, and other break-times. Zeke would usually join the group of three in walks around the perimeter of the quad during recess (confirmed with other researcher). The group of four chose to work together for the final showcase project for Session 1. Zeke spent less time with the group once Deborah removed Zeke from their group project (confirmed with other researcher). Though Rashida was always with this one particular group of learners, she always appeared friendly towards others — this was especially the

case with Richmond, who she would occasionally flirt with throughout Session 1 (confirmed with other researcher).

Rashida would occasionally access relational resources while accessing material resources. Though she was typically, as she described, quiet (Artifact 10, end of Session 3), Rashida would engage in conversations as part of the curriculum if and when she needed to (confirmed with other researcher). Yet when the idea of group work came up in her interview, Rashida stated “I’m not really a fan of group work” (Rashida, Artifact 10, end of Session 3); Rashida generally felt there was too much group work expected of the learners over the summer (Artifact 10, end of Session 3).

Access to ideational resources

Rashida’s identity as an “arts person” seemed to be both simultaneously reinforced and stifled throughout Session 1 with respect to her access to material and relational resources. The facilitators — mostly Deborah, myself, and Megan — consistently complimented her on the artwork she created, and she was often lauded for her talent and efforts as an artist in one-on-one (albeit quick) interactions with the facilitators (confirmed with other researcher). She was never actively discouraged from doodling, since she always completed her work in a timely fashion, and there was little to no concern that the doodling would distract her from class work (confirmed with other researcher).

Yet in some ways her access to ideational resources as an “arts person” may have been limited, in spite of the occasional reinforcement she received from the facilitators. In reflecting on her experiences in Session 1, Rashida reported that “in the summer [Session 1], we had to do whatever the teacher said, so we couldn’t really expand upon

our ideas [in relation to projects] and things like that” (Rashida, Artifact 10, end of Session 3), citing a lack of “creative control” (Rashida, Artifact 10, end of Session 3) during Session 1.

Though Rashida did not actively identify as a “science person” (Rashida, Artifact 10, end of Session 3), she had substantial access to ideational resources throughout Session 1 that may have impacted her practice-linked identity as a “science person.” She particularly enjoyed doing hands-on experiments over the summer, like “the ice one, the black ice and how it melted” (Rashida, Artifact 10, end of Session 3). She came to new realizations about herself in relation to science, and what it means for her, personally, to do science:

Ariella: What is something that you've done where you've surprised yourself during science time?...And why did that thing surprise you?

Rashida: I guess it's just coming up with new ways to solve problems. Like how the climate change, I didn't think that I could come up with a solution to a problem that's currently going on in the real world.

Ariella: That surprised you because you didn't think that you were able to come up with that?

Rashida: Yeah.

Ariella: And that's particularly during science camp?

Rashida: Yeah.

(Rashida, Artifact 10, end of Session 3)

Rashida gave the impression of having substantial access to ideational resources in relation to her practice-linked identity as a “science-theatre person” throughout Session 1.

Rashida felt that her understanding of science, and the potential role she and other creative youth could play in science, shifted in a positive way, even though she initially “thought that they're [science and theatre] two completely different things, there's no way you can connect them” (Rashida, Artifact 10, end of Session 3):

Rashida: I want to learn how we can connect science and theatre. I mean, we're already

learning about that to tell a story, but... Yeah.

Ariella: Say more about that. What do you mean connect science and theatre? In general?

In the real world?

Rashida: In the real world. Like in schools, because we don't really have our programs like

that. In my science class, it gets kind of boring because all they do is go fact after fact after fact instead of connecting our experience from outside of school and put it inside of school...I feel like it would open a lot more opportunities for students that are more creative to join in on the conversation [about science].

(Rashida, Artifact 10, end of Session 3)

Rashida enjoyed opportunities that allowed her to connect science and theatre/art during Session 1 — particularly when she had the opportunity to create the final showcase project of a “comic about methane and how it's contributing to climate change” (Rashida, Artifact 10, end of Session 3, Artifact 57).

Implications for inbound/peripheral trajectory

Rashida was on an inbound learning trajectory in the Art—Science Program at the conclusion of Session 1. She consistently came across as engaged in classroom contexts, and confirmed this engagement in her interview, despite the fact that she found some of the activities “kind of boring” (Rashida, Artifact 10, end of Session 3).

It is also noticeable that she is one of the few youths in the Program, at least in this study, who actively identified as a creative/arts person (Artifact 10, end of Session 3), and that her relationship to science, rather than art, evolved over the course of Session 1 (Artifact 10, end of Session 3). This is despite her initial discomfort with science and comfort with art (Artifact 10, end of Session 3). She also seemed to easily find connections between theatre/art and science — specifically that “you can tell a story with the numbers, but it would be boring because it's just data, thing after thing after thing. But when you connect theatre with it, there's more entertainment and it grabs people's attention. So you'd be able to keep them staying for the data and they actually get to see what's going on” (Rashida, Artifact 10, end of Session 3). This evolution in Rashida’s thinking about telling a story with numbers, and explicitly seeing the value of infusing art with science, helped determine that she was in an inbound trajectory in this program.

Session 2

Like Session 1, Session 2 appeared to be successful for Rashida. She continued to actively, diligently, consistently, and enthusiastically engage with material resources. Her friend-group evolved after the end of Session 1, and she (like the rest of the youth in the program) worked with new arts and science teachers (Kevin, Lyla, and Jennifer), who

provided her with both different and new access to relational resources by virtue of the differences between their personalities and teaching styles and those of the teachers during Session 1. Her consistent access to a plethora of new (and sometimes revisited) material and relational resources also provided her with access to new ideational resources in relation to science, theatre/art and science-theatre, which continuously impacted her practice-linked identities related to these domains.

Access to material resources

Rashida continued to take advantage of material resources in the Art—Science Program; she is the only participant in this study who completed all class assignments without needing reminders from the facilitators (Artifacts 31, 32, 40—42, 48—55; confirmed with other researcher). For instance, on the second day of Session 2 — which was right before Halloween — the youth went to the local reservoir with the facilitators to collect water samples for their water purity tests, and then to write spooky Halloween stories inspired by any and all creepy things that could happen at a reservoir (Artifact 16, beginning of Session 2). Rashida is the only participant from this study who not only produced a written story — which was intended to be a primary outcome for the day (Artifact 69) — but also created an intricate tale about a girl who was pushed into a local reservoir and drowned (Artifact 42). She also was one of the few learners to keep her work in a physical journal, which was expected of all learners in the program (Artifacts 40, 41, 42).

Rashida also actively engaged with material resources in ways that were not necessarily comfortable for her, but nonetheless were expected of her and the other learners in the Art Science Program. She did not outwardly complain about the variety of

group activities expected of the learners during this Session even though she's feels "not really a fan of group work" (Rashida, Artifact 10, end of Session 3). Additionally, as someone who feels she is "really shy" (Rashida, Artifact 10, end of Session 3), she willingly and thoughtfully engaged in classroom debates and conversations (Artifact 20). For instance, rather than keeping her thoughts to herself in an "agree/disagree" debate activity led by Kevin, Rashida explicitly asked Kevin, in front of her classmates "what if you're in the middle [and neither agree nor disagree]?" (Rashida, Artifact 19, end of Session 2) about debate topics like "rich people worked hard to be rich" (Rashida, Artifact 19, end of Session 2). For a description of what these debate activities entailed, see Appendix E.

Access to relational resources

Rashida's engagement with relational resources evolved after Session 1. In addition to having new science and theatre/art teachers from Session 1, her close-knit friend group during Session 1 dissolved; Karla left the Art—Science Program after Session 1, and Zeke either spent time alone, with Richmond, or occasionally with other learners in the program (Artifacts 16—20). Rashida still spent ample time with Serena, both of whom were generally regarded by the facilitators as "good students" (Artifacts 11-19, entirety of Sessions 1 and 2; confirmed with other researcher). Rashida worked with Serena in virtually all small-group projects, and they spent most of their free time together (Artifacts 16—18, middle of Session 2). As previously stated, Rashida also occasionally flirted with Richmond (Artifact 17, Artifact 19). The facilitators (the teachers, myself, and Megan) continued, throughout Session 2, to interact with Rashida in

a manner similar to Session 1; she was generally regarded by all as a good student and largely left alone (if not ignored) during class time (confirmed with other researcher).

Access to ideational resources

Rashida's access to ideational resources evolved throughout Session 2, which may have helped further the development of her practice-linked identities related to science, theatre/art, and science-theatre. It is possible that the dearth of one-on-one attention Rashida received from the facilitators as a result of her being a "good student" and not needing extra supervision prevented Rashida from accessing relational resources provided in one-on-one interactions with mentors. One-on-one interactions between learners and adult mentors are crucial for both teaching and learning, and for providing learners with access to both relational and ideational resources (Nasir & Cooks, 2009). Yet this lack of one-on-one attention from adults may have provided Rashida with the space to continue developing her practice-linked identity as a theatre/arts person in an unencumbered way.

Rashida felt Session 2 provided her with opportunities to "come up with animation ideas" (Rashida, Artifact 10, end of Session 3) she hadn't previously explored, since, as was previously mentioned, she felt she had more "creative control [during the academic year]" (Rashida, Artifact 10, end of Session 3).

Despite Rashida's recognizing more opportunities for her to effectively to combine science with theatre/art during the academic year (Artifact 10, end of Session 3), Rashida still did not identify as a science person; she still regarded it as "not one of my best subjects. It seems really hard to understand for me" (Rashida, Artifact 10, end of Session 3). She also appeared to harbor stereotypical views about scientists —

specifically, that “they [a science person] rely more on numbers and data instead of the more creative side of things.” (Rashida, Artifact 10, end of Session 3). Nevertheless, Rashida felt more comfortable engaging with science in the Art Science Program than she previously had in school:

Ariella: Do you feel this program so far, the Science Theatre Program, thinking about the summer, thinking about the academic year, do you think it's changed the way you think about science in your daily life outside of CB? Like at home and in school with friends?

Rashida: I think so. Because at school, we don't really have that much room to be creative, so I suggest to my teachers, oh, we should have this as an option. Like adding art or telling a story or acting and things like that, into interpreting the data that we have.

(Rashida, Artifact 10, end of Session 3)

She also acknowledged a shift in her thinking about why College Bound would have an Art—Science Program at all:

Ariella: Since the summer until now, do you think there's been an evolution of your thoughts or feelings about why we would be doing this in the first place?

Rashida: Yeah, because in the summertime, I thought that they're two completely different things, there's no way you can connect them. But during the academic year, I feel like there's a way to do that. Because when you have science,

there's data and numbers, and when you have theatre and art, you just tell a story. And you can connect those to tell a story with the data and numbers

(Rashida, Artifact 10, end of Session 3)

Despite her newfound knowledge and realizations, Rashida claimed not to enjoy the act of connecting science with theatre/art “because it's kind of hard. Because when you look at science, there's mostly just numbers and observations. When there's theatre, you can just do whatever. I guess to be more creative and think outside of the box. With science, it's just that's the data, you have to stick with that. You can't go outside of the box” (Rashida, Artifact 10, end of Session 3).

Implications about inbound/peripheral trajectory

As at the end of Session 1, Rashida remained on an inbound trajectory at the conclusion of Session 2. Though she has paradoxical views about what it means for her, personally, to engage in science and theatre/art and what it means for someone else to “do science,” she was an active participant in daily sessions, pushed herself to do work that went outside of her comfort zone, and generally remained engaged in the activities and program as a whole by the end of this Session, and was readily able and willing to access and engage with material, relational, and ideational resources.

Session 3

Despite a handful of absences, including on the day of the final showcase (Artifacts 21, middle of Session 3; 23, end of Session 3, 59—62) — which Megan believes may have been a coordinated effort with Serena (confirmed with other

researcher) — Session 3 seemed, like Sessions 1 and 2, to go well for Rashida. Like the other two Sessions, she consistently accessed material resources despite a handful of instances where she looked bored (Artifacts 21, 24). Her access to material, relational, and ideational resources were relatively consistent with Session 2.

Access to material resources

As during Sessions 1 and 2, Rashida consistently engaged with material resources during Session 3 and did all work expected of her (Artifacts 20—23, entirety of Session 3). As during Session 2, Rashida presented little to no resistance to the physical activities and games played during theatre/arts time (Artifact 20, beginning of Session 3), even though she consistently described herself as shy (Artifact 10, end of Session 3). Also as during Session 2, she was one of the few youth to complete written work, so her journal took on a portfolio-like quality (Artifacts 50—55). She also made substantial contributions to the board-game the learners collectively created for the final showcase of Session 3, decorating the board game with her anime-style drawings (Artifact 59f.).

It should be noted that Rashida was not present during Apex News Day, which was a transformational day for many learners in the Art—Science Program (Artifact 21, middle of Session 3). This could provide some insight into why Rashida left out Apex News Day (which had significant impact on both Zeke and Richmond) when listing things she was particularly proud of.

Access to relational resources

Rashida's access to relational resources were similar to those she accessed during Session 2. She continued to flirt with Richmond (Artifact 20, beginning of Session 3) and

still spent the majority of her time with Serena (Artifact 20, beginning of Session 3; 22 end of Session 3). Rashida and Serena frequently acted and reacted to classroom activities as a pair. When Megan and Jennifer showed the class a poem about water that Serena had written as an exemplar model (her name was redacted from the poem), Rashida and Serena both denied knowing who had written it — even though it was obviously Serena’s (Artifact 20, beginning of Session 3). Additionally, the few instances where Rashida seemed disengaged were also the same instances when Serena seemed disengaged (Artifacts 20, beginning of Session 3; 23, end of Session 3). Rashida’s absences may have prevented her from accessing more — or at least new — relational resources during Session 3.

Rashida’s access to relational resources from facilitators was consistent with her access during Sessions 1 and 2; she continued to be regarded as a “good student” (confirmed with other researcher) and was infrequently provided with one-on-one attention; none of the observational notes indicate that there were any one-on-one interactions between Rashida and the facilitators (the teachers, myself, and Megan) during this Session (Artifacts 20—23, entirety of Session 3).

Access to ideational resources

Rashida’s engagement with ideational resources during Session 3 were plentiful. Rashida felt proud of having helped create the gameboard for the final showcase in Session 3 (Artifact 10, end of Session 3). By the end of Session 3, Rashida generally found value in integrating science with theatre/art in order to “grab people’s attention” (Rashida, Artifact 10, end of Session 3) when presenting scientific information to the public. In line with this, Rashida was able to see substantial overlap in the practices of

science and theatre/art (Artifact 10, end of Session 3). She demonstrated this through her science and theatre/art “relational maps” (Artifact 26). Figures 9 and 10 contain images of her science and theatre/art relational maps. See Appendix B for details about the relational maps assignment.

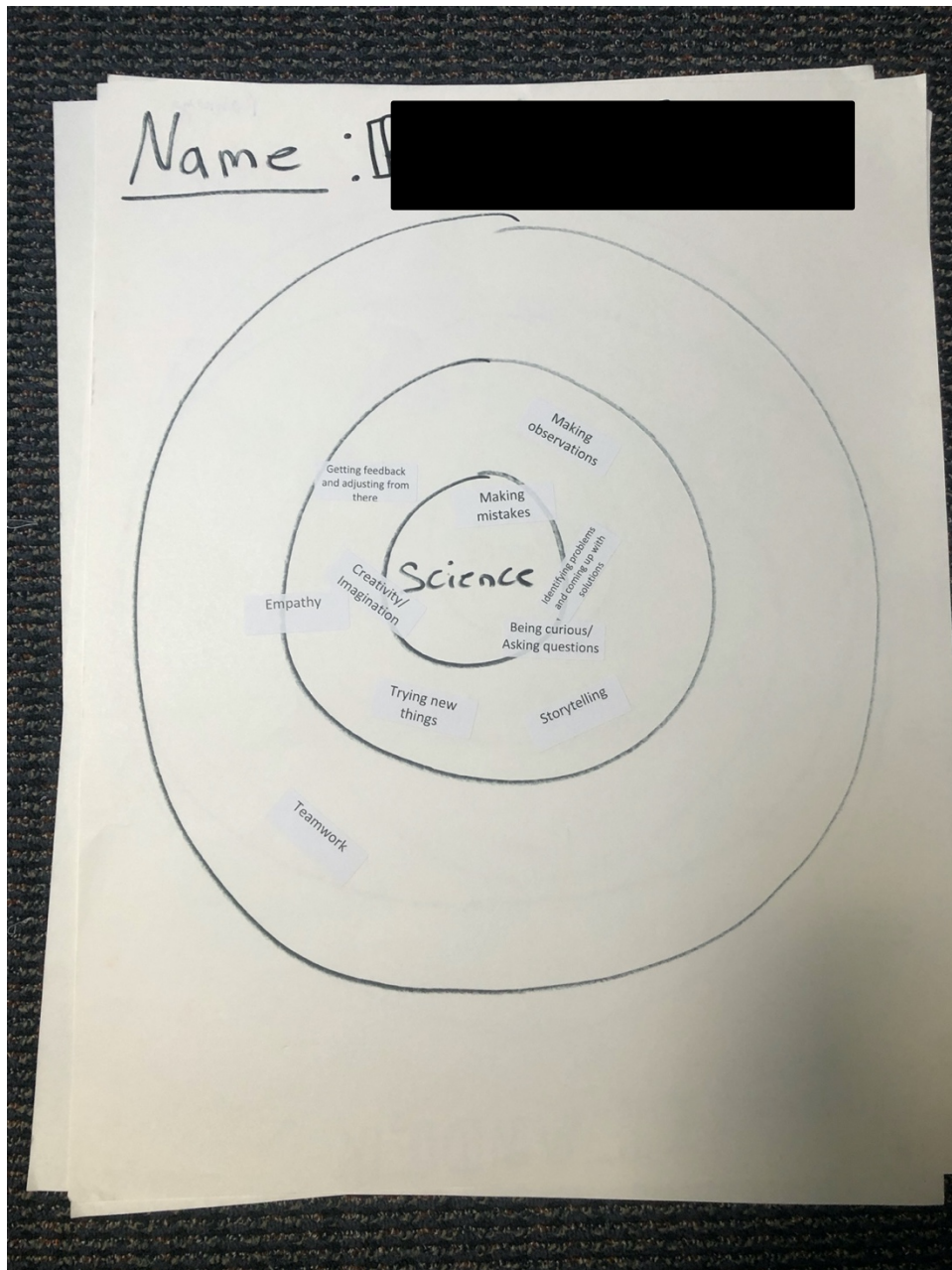


Figure 9: Rashida’s science relational map. Black box added over Rashida’s real name at the top of the document.

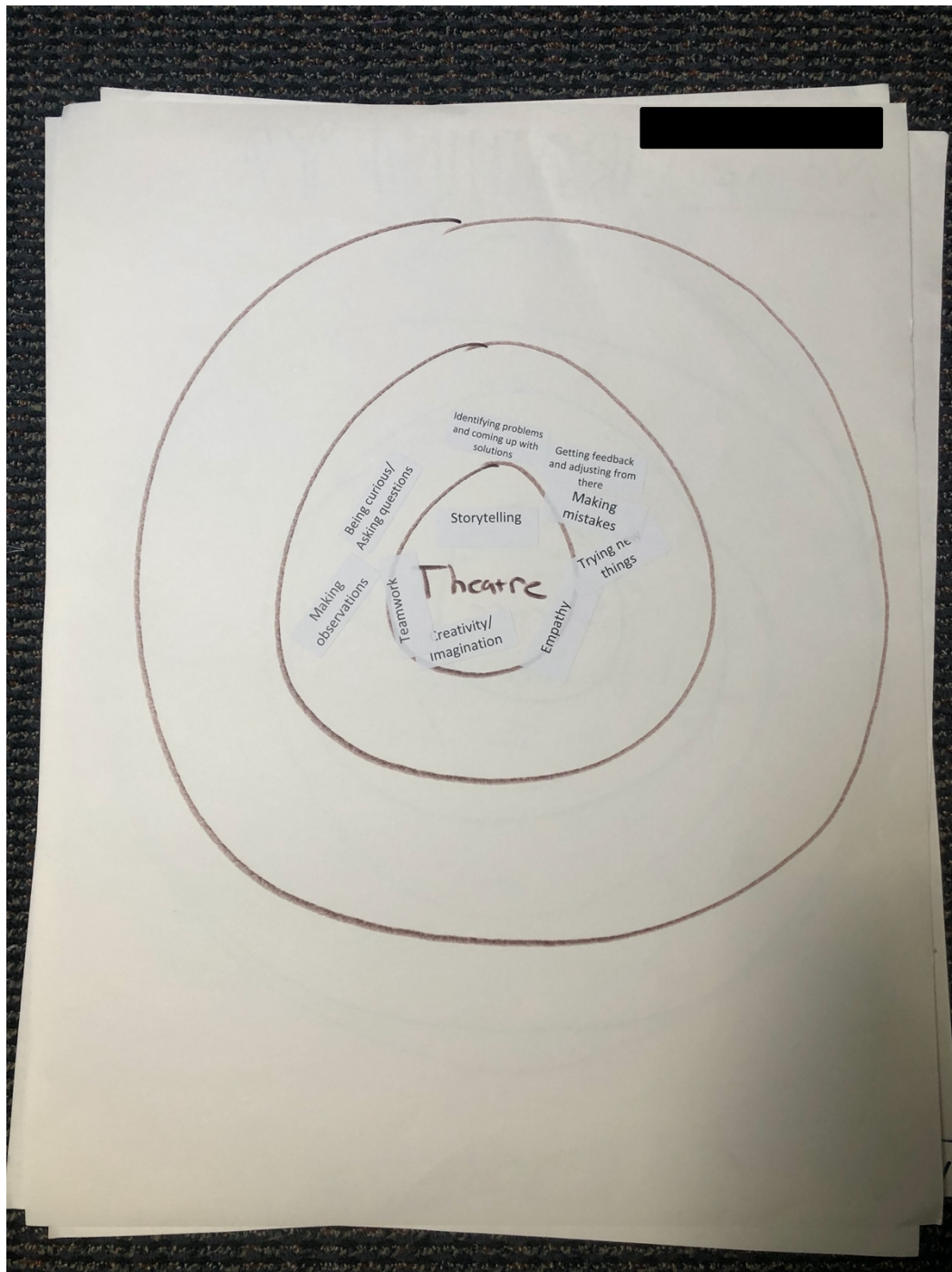


Figure 10: Rashida's theatre relational map. Black box added over Rashida's real name at the top of the document.

Notably, Rashida felt empathy, storytelling, and making mistakes — practices the facilitators felt were traditionally more associated with theatre/art than with science (Artifact 71) — play a significant role in practices of science (Artifact 10, end of Session 3). She is the only participant in this study to have made that connection. Rashida expressed that “I feel like you'd need to try to understand someone else's experiences to understand why they said something. Like two scientists, they could interpret data two different ways because of the experiences that they've been through” (Rashida, Artifact 10, end of Session 3). She felt storytelling is important “because you have to find a way to tell the public about your findings” (Rashida, Artifact 10, end of Session 3). Lastly, she felt that making mistakes is “another big part of science, because when you're experimenting what works and what doesn't work, you're obviously going to make some mistakes during your trials, and you have to make up for that. You have to make sure you're not going to do it again and you know that at least that didn't work” (Rashida, Artifact 10, end of Session 3). Despite describing the relevance of these terms to practices of science, Rashida did not see much connection between creativity and doing science, feeling the connection “is kind of...vague...because there's things that you need to design in order to walk through your experiment and do things like that” (Rashida, Artifact 10, end of Session 3).

At some point during Rashida's “mashup” interview, she and had a more casual conversation about integrating the “arts” (generally speaking) into science, versus “theatre,” specifically. This conversation arose from a discussion about enjoying the act of connecting science with theatre:

Ariella: Here's a question for you. Do you think you would feel differently about the program if we were talking about connecting science and art more generally, rather than science and theatre?

Rashida: Yeah. I feel like I'd feel a lot more strongly and more connected to it. Because art, like I said, it's just a really big part of what I do.

Ariella: What does that, quote unquote, art mean to you? When I say science and art, what do you think? What do you think of with the art stuff?

Rashida: With the art stuff, there's different types of art, like music, visual arts, and, of course theatre. So if you could just say science and art, then it could mean a lot of different things. You can tell a story using different mediums. I think that's the word.

(Rashida, Artifact 10, end of Session 3)

This quote is notable in terms of thinking about Rashida's access to ideational resources in relation to "art" versus "theatre. Though the program, up until this point, was referring to the art component of the Art Science Program's curriculum broadly as "theatre," and the program was still being referred to as the "science-theatre program," Rashida participated in a variety of types of art-making between all of the drawings and short-stories she created for both her in-class journal activities and final showcase project during Session 3 (Artifacts 50—55, 59f).

Rashida's definitions of "science people" and "theatre people" are particularly notable at the end of Session 3, given the overlaps she saw between art and science integration, and the way in which her own understanding of science as a whole evolved throughout the Art Science Program. This also pertains to the ways in which she views

herself as a “science person” (which she does not) or “theatre/arts person” (which she does):

Ariella: Would you consider yourself to be a science person?

Rashida: I don't really think so. Science is not one of my best subjects. It seems really hard to understand for me.

Ariella: What does it mean to you to be a, quote unquote, science person? Who is a science person?

Rashida: I guess a science person would be someone that's very... I guess they rely more on numbers and data instead of the more creative side of things.

Ariella: Would you consider yourself to be a theatre person?

Rashida: I think so. I used to do theatre about two years ago. It was really fun and I wanted to keep doing that, but I couldn't really find opportunities to.

Ariella: What does it mean to you to be a, quote unquote, theatre person?

Rashida: I think a theatre person is someone who's very creative and in touch with their creative side instead of being more like a science person, whereas they rely on numbers and data and things like that.

(Rashida, Artifact 10, end of Session 3)

Implications for inbound/peripheral trajectory: Session 3

Rashida's progression through Session 3 was consistent with her participation in Sessions 1 and 2: she remained diligent, focused, and pleasant throughout all three

Sessions of the program. She did, however, seem to shift her thinking about the utility of integrating theatre/arts with science during Session 3. Her consistent engagement, even though she claimed not to enjoy connecting science with theatre/art (Artifact 10, end of Session 3), and her willingness to access material, relational, and ideas, continued to be consistent with an inbound trajectory at the end of this Session.

Summary

On the whole, Rashida appeared to have benefitted from the Art—Science Program. Though she didn't necessarily enjoy the practices of integrating science with theatre/arts, she established new ideas about her own engagement in science and may even have liked science more because of the connections she made between science and theatre/art. Interestingly, although the facilitators tried to help students recognize the creativity in science, Rashida did not see much overlap between science and creativity. Despite feeling that storytelling is an important part of “doing science” and newfound understandings of how science and theatre/art can be integrated in life, she still viewed “science people” and “theatre people” in stereotypical lights and in opposition to each other.

Rashida's consistent, high-quality work and the generally positive feelings she felt towards the Program as a whole (Artifact 10, end of Session 3) suggest she was on an inbound learning trajectory throughout the three Sessions of the Program. Her negative feelings towards the integration of science and theatre/art, however, are notable about how she may feel that this integration could work for others (or even in the world at

large) but not necessarily for her, personally. The mismatch between Rashida's actions her purported feelings will be further explored in the analysis chapter.

8

Analysis

This study aims to answer the following research questions: (1) how might participation in an Art Science program impact learners' practice-linked identities in relation to science, theatre/art, and "science-theatre"?; and (2) how can learners' practice-linked identities evolve over the course of an Art Science program, and what is responsible for those changes? These questions are useful in order to better understand how alternative science programs can help learners connect with science and art/theatre in ways that traditional classroom environments cannot, or do not necessarily do.

In order to answer these questions, I examine the extent to which each participant accessed material, relational, and ideational resources throughout the Art Science Program. I analyze how each learner's access to these identity resources contributed to their peripheral or inbound learning trajectories, and how each learner's practice-linked identities in relation to science, theatre/art, and science-theatre developed in light of

access to these identity resources. Lastly, I examine how each learner evolved across each Session relative to other participants in this study. Importantly, though all participants may have technically had the same access to material, relational, and ideational resources throughout each Session by virtue of being in the same learning environment, in actuality, all three learners accessed these resources differently.

This analysis will help answer the above-referenced research questions in specific ways: Access to identity resources (material, relational, and ideational resources) in a learning environment — and the ways in which accessing one type of identity resource impacts access to another — affects the development of learners’ practice-linked identities by providing learners with specific means for engaging with a particular practice (or practices) in a learning environment (Nasir & Cooks, 2009). Similarly, identifying whether learners are on inbound or peripheral learning trajectories helps contextualize the extent to which learners are accessing the maximum number of identity resources within a learning environment that are made available to them; the more identity resources a learner is able to access in a particular learning context, the more likely they are to be — and perhaps remain — on an inbound learning trajectory rather than a peripheral learning trajectory (Nasir & Cooks, 2009). Learners on inbound learning trajectories may have more robust practice-linked identities than those on peripheral learning trajectories by virtue of increased access to all three identity resources (Nasir & Cooks, 2009). Therefore, in order to understand how participating in an Art Science program impacts the development of learners’ practice-linked identities in relation to science, theatre/art, and “science theatre,” and to understand what is responsible for any changes in learners’ practice-linked identities, it is critical to

understand the extent to which each learner accessed each identity resource and why. It is also crucial to understand whether these learners appear to be on inbound or peripheral learning trajectories, which helps contextualize the extent to which learners are accessing different identity resources.

Access to Material Resources

Access to material resources constitute how a learning interacts with a learning context's physical environment, its organization, and the artifacts and materials within it that ultimately bolster a learner's sense of connection to the practice (Nasir & Cooks, 2009). Within the context of this study, this also includes the way in which a learner interacts with the curriculum at large. Examples of a learner within the Art Science program accessing material resources would be Rashida writing her "spooky story" about a reservoir (Artifact 42, beginning of Session 2), and Zeke engaging in an intense game of charades (confirmed with other researcher).

In the subsections that follow, I compare and contrast Zeke, Richmond, and Rashida's access to material resources within and across Sessions 1, 2, and 3. I also provide links between learners' access to material resources in relation to other identity resources.

Session 1

In their study on track athletes' practice-linked identities, Nasir and Cooks found that all three identity resources operated in relation to one another, but that material resources provided learners with the actual learning content required for learning a

particular practice or subject area (Nasir & Cooks, 2009, p. 58). Relational resources functioned as a gateway to both material and ideational resources — specifically, that the teaching and learning that occurred in one-on-one interactions with adult mentors facilitated (or hindered) learners’ ability to access material and ideational resources (Nasir & Cooks, 2009). They also found that interactions with peers impacted learners’ access to these same identity resources (Nasir & Cooks, 2009). This interplay of relational resources with material resources is particularly evident in Session 1 throughout the cases of all three learners.

Zeke often had difficulty focusing, and he frequently needed one-on-one guidance from a design team member (usually Megan or me) to ensure that he stayed on task (Artifacts 12–15, entirety of Session 1). The one-on-one attention from facilitators helped ensure that Zeke was able to access the maximum number of material resources. These material resources included completing worksheets that corresponded with science experiments, creative writing assignments, arts-based activities that required drawing or creating blueprints, and other brain-storming activities that required focusing on tasks at hand. For instance, when I encouraged Zeke to remain focused during the architectural design-challenge on rising sea levels in Boston (Artifact 30, middle of Session 1), I was also encouraging him to access all the material resources he needed to excel in the design challenge. The relational resources I provided him in this particular one-on-one interaction may have been instrumental to Zeke’s learning in that moment (Nasir & Cooks, 2009), and they may have allowed him to master the concepts he explored that were necessary for him to complete — and perhaps even excel at — the architectural design challenge.

Zeke also simultaneously accessed material and relational resources through small-group interactions with his peers — specifically when he was working on the final showcase project during Session 1 with Rashida, Serena, and Karla. During these work sessions in the small group — a *community of practice* (Eckert, 2006) by virtue of being a group of learners engaged with one another on an ongoing basis to complete a common endeavor — Zeke was privy to the abundance of art supplies his group used to create their graphic-novel-style poster (Artifact 57, end of Session 3) and the articles and other materials from “science-time” that were used to inform the story they created for their poster. When Deborah decided to separate Zeke from this group (his CoP), Zeke was deprived of the material resources they had been exploring and generating together. It was particularly difficult for him to continue storytelling, as the visual arts expertise of the other team members had been essential to the group’s joint story-telling efforts. He also may have felt angered by Deborah’s decision to separate him from the group, and also angered (perhaps even embarrassed) that his community of practice acquiesced to this choice, as indicated by him expressing his “wish [to] forget...[getting] kicked out of my own group” (Zeke, Artifact 7, middle of Session 2) Not surprisingly, Zeke’s solo project — the last main artistic work he created during Session 1 — contained little in the way of visual representations. Had Zeke not been required to work alone, and had he been able to continue to access the material resources provided through this community of practice, perhaps he would have acquired some of the skills necessary to include drawings in his final showcase project.

In reflecting on what stood out to him the most during Session 1, Zeke remembered being particularly engaged with charades, which he also excelled at (Artifact

7, end of Session 2). As previously mentioned, Nasir and Cooks found that material resources provide content for learning, constituting the spaces and physical artifacts “that novices came to master as part of their learning” (Nasir & Cooks, 2009, p. 58) — this study also identifies all curricula within a particular learning environment as a material resource. It is possible that Zeke came to view himself as an expert in charades because of the way he excelled at the game (confirmed with other researcher). It would therefore make sense that this stand-alone activity, which allowed him to demonstrate a mastery of something, stood out to Zeke as something memorable from Session 1.

Aside from Zeke, Richmond experienced his own successes and challenges during Session 1. The facilitators had confidence in the abilities of all members of the filmmaker group — a community of practice in and of itself — to do whatever they needed within reason to create a movie trailer they felt proud of, and to access any and all material resources that were necessary for them to create their movie trailer. This trust between the design team and the filmmakers, and Richmond in particular, is similar to the trust built between the coach and one particular athlete in Nasir and Cooks’ study (2009). In that study, the athlete was provided with increased relational resources in the form of trust from the coach and access to material resources from the coach after the athlete apologized for doing something disdainful in the past (Nasir & Cooks, 2009). Similarly, the trust the design team granted this particular community of practice provided them with a gateway to a trove of material resources necessary for the creation of their movie trailer.

Like with Zeke’s original team during the Session 1 showcase, the immense number of relational resources Richmond accessed through his team also provided him

with an abundance of both material and ideational resources. Richmond's practice-linked identity as a theatre person/arts evolved from virtually non-existent to strong once he realized that he could consider himself to be a "filmmaker" within the context of being a theatre/arts person in the Art Science Program (Richmond, Artifact 8, end of Session 3). Though Rashida did not receive the same kind of one-on-one attention from the design team as Zeke and Richmond, the design team's overall perception of Rashida as a "good student" allowed them to trust her to access whatever materials she wanted, whenever she wanted (confirmed with other researcher).

The analyses of Zeke's, Richmond's, and Rashida's access to material resources during Session 1 highlights the ways that different learners in the same learning environment can access material resources through the relational resources afforded (or withheld) by adults in the learning environment (Nasir & Cooks, 2009). The more the adults felt confident that the learners would accomplish their tasks at hand with as little oversight as possible, the more likely the adults were to let the learners work freely, and access whatever material resources they felt they needed for their projects (as was the case with Richmond's filmmaker group, and Rashida's small group). This trust from adults also meant learners were able to access both more material resources and more relational resources through peer-to-peer interactions.

Session 2

Zeke was particularly engaged with material resources during Session 2; he engaged heavily in the creation of water-filtration devices during science time (Artifacts

16 and 17, beginning of Session 2), was very engaged in debates during theatre/arts time (Artifact 20, end of Session 2), and seemed enraptured by guest-lecturer Amanda Lily's presentation during science-theatre time (Artifact 18, middle of Session 2). In these instances, Zeke accessed both material and relational resources. Creating the water filtration device led him to work one-on-one frequently with Richmond throughout Sessions 2 and 3. Working with Richmond allowed him to access new material and relational resources from Session 1 by virtue of working with a new person. Similarly, Amanda Lily's presentation inspired Zeke to have conversations with facilitators about what he found interesting and inspiring, which he hadn't necessarily done in Session 1 (Artifact 17, beginning of Session 2).

Richmond also managed to access new material resources through relational resources during Session 2. Yet unlike Zeke, who had largely positive interactions with peers and facilitators during this Session (Artifacts 16–19, entirety of Session 2), Richmond had a significant number of negative interactions with the design team (and sometimes his peers) throughout this Session that impacted his access to material resources (Artifacts 16–20, entirety of Session 2). For instance, although Zeke enthusiastically engaged in classroom debates (Artifacts 16–20, entirety of Session 2), he refused to participate in other aspects of the curriculum. He gave a fake name during the name-game on the first day of Session 2 (Artifact 16, beginning of Session 2) and openly objected to going on a “boring” field trip (Artifact 19, end of Session 2). Some of these actions would annoy his peers in addition to design-team members (Artifacts 16-20, entirety of Session 2). Like the two athletes on peripheral learning trajectories in Nasir and Cooks' study whose access to material resources was impacted by either poor or

limited relationships with the coach and other athletes on the team (Nasir & Cooks, 2009), it is worth questioning whether Richmond's access to material resources during Session 2 were impacted by his negative interactions with peers and facilitators .

It is also worth considering the extent to which Richmond's hindered access to material resources were self-inflicted mechanisms for *face-saving* (DiSalvo, Guzdial, Bruckman, & McKlin, 2014; Goffman, 1956). Face-saving is "a method for protecting the participant's presentation of self when threatened by the identity of wanting to learn" (DiSalvo et al., 2014, p. 274). It is possible, considering the (unconfirmed) reports of Richmond being bullied, that Richmond was adopting a "cool pose" (hooks, 2003; Majors & Billson, 1993) as a means of self-protection, which had repercussions for him accessing material resources during this Session. Yet it is also worth questioning whether Richmond was simply bored by the Art Science curricula, and thus unmotivated to access material resources during Session 2 in the same way that he did during Session 1, which will be explored later in this section.

Rashida's access to material resources throughout Session 2 was also impacted by her access to relational resources, albeit in different ways from Zeke and Richmond. Consistent with Session 1, Rashida and her team generally worked independently during Session 2 since the design team were often tending to students who struggled to maintain focus throughout the day on their own (confirmed with other researcher). For Rashida, this seemed to be a gift: she cited enjoying the "creative control" she had (Rashida, Artifact 10, end of Session 3) over her access to material resources throughout both Sessions 2 and 3, feeling as though she had ample opportunities to expand on her creative ideas (Artifact 10, end of Session 3).

Rashida took advantage of the independence she was given by honing her practice-linked identity as an artist. As demonstrated by the work she created during this Session, Rashida took advantage of opportunities to explore a variety of creative mediums for expressing herself, including visual art, creative writing, and debates, not all of which she was necessarily comfortable with as a self-described “shy” person (Rashida, Artifact 10, end of Session 3). It is worth considering whether Rashida recognized the lack of direction by the design team as not simply permission to explore those media in ways that pleased her but also as some sort of tacit encouragement to do so.

Session 3

All three learners expressed in their interviews that hands-on learning was important to them; the more opportunities they had to create, play games, or be part of any type of activity, the more enthusiastic they were about learning (Artifacts 1-10, Sessions 1-3). These ideas largely align with both Wenger’s (1998) and Nasir and Hand’s (2008) definitions of *engagement*. Wenger defines engagement as active involvement in shared processes of negotiating meaning (Wenger, 1998) and Nasir and Hand define engagement as “active, goal-directed, flexible, contrastive, persistent, focused interactions with...social and physical environments” (Nasir & Hand, 2008, p. 149). The ways in which Zeke and Richmond accessed material resources during Apex News Day, and the way in which Rashida accessed material resources throughout Session 3 and especially when creating the board-game for the final showcase, adhere to these scholars’ notions of engagement. This also speaks to what all three learners claimed to find important and valuable in their interviews.

The gallery-walk activity at the start of Apex News Day served as a new way for Zeke and other learners to engage with material resources in a variety of ways. This included walking around the room, physically handling articles and pictures, commenting on what he and the other learners saw in the pictures, and expressing knowledge about what they learned from the pictures (Artifact 22, end of Session 3). This activity provided Zeke with new hands-on learning activities that deviated from the normal “art” activities done in the program that Zeke often openly and loudly rejected, like drawing and playing theatre games. It is possible that Zeke’s rejection of these arts-based activities — and positive feelings towards the gallery walk — was actually a means of face-saving (DiSalvo et al., 2014) from embarrassment of actually liking theatre/art, a potentially “uncool” subject. Yet it is also possible that Zeke liked this activity because of the positive encouragement (relational resources) he received from both Jennifer and his peers as a participant in this activity (Artifact 22, end of Session 3).

The readily-apparent nature of the link between relational resources and the way in which they can impact access to material resources (Nasir & Cooks, 2009) was also visible during the creation of the actual Apex News show for Zeke. Lyla had encouraged Zeke to take on the roles of director and cameraman during this activity (Artifact 22, end of Session 3). These new roles, and access to material and relational resources provided through Lyla’s approval, demonstrates how positive relationships between a teacher/mentor and learner can allow for the learner to connect with the practice in new ways (Nasir & Cooks, 2009). Zeke enthusiastically launched into these roles without hesitation and was eager to ensure that the creation of the news show was going smoothly (Artifact 22, end of Session 3; Artifacts 63a-c, end of Session 3).

Similarly, Richmond — who had previously been chastised for his distracting behavior by Lyla — was either actively encouraged, often as the lead news anchor of both the Apex News Show and The Mama and Papa Bear Show. Having the opportunity to work individually and without oversight allowed Richmond to access material resources that helped encourage his practice-linked identity as a filmmaker during this Session.

The way in which the design team trusted Richmond to operate as a filmmaker is similar to the ways in which the design team trusted Rashida to operate in her role as a “good student” and artist; both were trusted to create their respective works unencumbered, and ultimately to have “creative control” (Rashida, Artifact 10, end of Session 3) over what they created. After Richmond demonstrated at the end of Session 1 that he could work productively on his own and access material resources successfully in his role as a “filmmaker.” The design team’s confidence in Richmond’s capabilities during both the Apex News and Mama and Papa Bear activities encouraged Richmond to take initiative. As a result of this, he gained access to material resources that allowed him to hone his skills, and possibly practice-linked identity, as a filmmaker/theatre person.

Similar to the ways in which Zeke and Richmond claim to have been most proud of creating the Apex News show (Artifacts 8, 9, end of Session 3), Rashida felt most proud of having created the art and game pieces for the Session 3 final showcase group-project (Artifact 10, end of Session 3). Like with Richmond, and consistent with the way she had been regarded throughout the other two Sessions, Rashida was able to draw and create whatever she wanted for this activity, resulting in her signature animation style being present throughout the board game (Artifacts 59e, 59f, end of Session 3). This trust

helped fuel the way in which she accessed and came to master material resources throughout this Session. As part of this mastery, she came up with new animation ideas, something she was previously uncomfortable doing (Artifact 10, end of Session 3).

The differing relationships Zeke, Richmond, and Rashida had with the design team, and the ways in which those relationships provided access to material resources throughout Session 3 highlight that not all learners take up identity resources in the same way — particularly material resources — and that learners' relationships to these resources can fluctuate over time (Nasir & Cooks, 2009). Richmond was largely resistant to accessing material resources prior to opportunities for him to engage in his practice-linked identity as a filmmaker/theatre person, while Zeke accessed material resources in relation to him engaging in a practice-linked identity as a filmmaker/theatre person in ways he hadn't previously done in the program. Rashida continued to access material resources in deeper, yet consistent ways that helped strengthen her already flourishing practice-linked identity as an arts person, and now with an additional layer, possibly, as an animator.

Access to Relational Resources

The way in which learners access relational resources is defined by the way they build positive relationships with others in the learning context (peers and mentors/teachers), which can increase a learner's connection to the practice (Nasir & Cooks, 2009). Within the context of the Art Science Program, this includes Richmond playfully saying to Jennifer "I like your Jamaican accent" (Richmond, Artifact 16,

beginning of Session 2), and Richmond working collaboratively with the other “filmmakers” for the Summer 2018 final showcase (confirmed with other researcher).

In the subsections that follow, I compare and contrast Zeke, Richmond, and Rashida’s access to relational resources within and across Sessions 1, 2, and 3. I also provide links between learners’ access to relational resources and other identity resources.

Session 1

Relational resources “often constitute the ‘how’ and ‘why’ of learning” (Nasir & Cooks, 2009, p. 58). The personal relationships developed through social interactions help to “sustain motivation through difficult moments” (Nasir & Cooks, 2009, p. 58) and provide learners with a means and motivation for learning in general (Nasir & Cooks, 2009). This also provides them with access to ideational resources (Nasir & Cooks, 2009). As indicated by Zeke, Richmond, and Rashida’s interviews throughout Session 1, their motivation to learn was largely fueled by the ways in which they accessed relational resources, particularly when working on their final showcase projects.

When Zeke reflected on Session 1, he stated “I think we need to learn about why we're doing it [theatre and science-theatre in the Art Science Program]. Because we can't do something without knowing the purpose” (Zeke, Artifact 7, end of Session 2). Having been deprived of significant relational resources when Deborah removed him from his community of practice, it is worth considering the extent to which Zeke was also deprived of understanding the “how” and “why” an Art Science program would be offered through the College Bound Program. The notions of “how” and “why” are both fundamentals of learning identified by Nasir and Cooks (2009). Zeke's inability to

understand the “how” and “why” related to the Art Science Program may have been addressed had he been allowed to remain in his small group and access relational resources through peer-to-peer interactions afforded by being a member of that particular community of practice.

This denial of relational resources may also help explain why Zeke didn’t identify as a “science-theatre person” by the end of Session 1, given that he felt “I haven’t tried it [integrating science and theatre] personally” (Zeke, Artifact 3, end of Session 1). Perhaps staying in the community of practice he created with Rashida, Serena, and Karla would have helped him “sustain motivation through difficult moments” (Nasir & Cooks, 2009, p. 58) of not understanding the purpose of integrating theatre/art into this particular strand of College Bound. Working through those questions with his peers may have provided Zeke with the relational, and ultimately ideational resources, to begin viewing himself as a “science-theatre person.”

Richmond, in contrast to Zeke, had access to a wealth of relational resources when creating his final showcase project during Session 1. The group of filmmakers worked well together and were determined to create a movie trailer they were proud of (confirmed with other researcher). This particular community of practice’s level of focus and commitment to getting their work done allowed me, as the primary member of the design team supervising their efforts, to trust them to continue working together with little input about their processes and choices. This included trusting the group to work and think through “difficult moments,” (Nasir & Cooks, 2009) where the group would shoot scenes, create artwork, or generally try out something that didn’t make its way into the movie trailer. Rather than giving up on creating the trailer entirely during these

instances of frustration, Richmond and the other filmmakers would keep experimenting until they figured out what was worth keeping in their trailer. This persistence demonstrates how relational resources help “sustain motivation through difficult moments” (Nasir & Cooks, 2009, p. 58). Given Nasir and Cooks’ findings that relational resources function as a gateway to ideational resources (Nasir & Cooks, 2009), it is not surprising that Richmond considered himself to be a “science-theatre person” by the end of Session 1 (Artifact 4, end of Session 1).

Although Rashida, like Richmond, had access to a substantial number of relational resources in her own final showcase community of practice, she — unlike Zeke — rarely received one-on-one attention from design-team members. The lack of relational resources from one-on-one interactions with adults who could have helped position Rashida as a “science person” or “science-theatre person” may have prevented her from accessing ideational resources related to her science and science-theatre practice-linked identities, specifically. Unlike the athletes who received one-on-one attention from their coach in Nasir and Cooks’ study (2009), and who were explicitly called “hurdlers” or received other nicknames or praise that positioned them as track athletes (Nasir & Cooks, 2009), Rashida was only infrequently praised for her natural abilities to seamlessly intertwine science with art. It was assumed (at least by Megan and me) that Rashida knew she was a good artist and was naturally good at creating pieces of art that interwove science (confirmed with other researcher). This was not inherently evident to Rashida who, despite the beautiful science-infused art she created, did not identify as a science-theatre person (Artifact 10). Perhaps active praise for the work she created during “science time” and “science-theatre time” — or at least more general one-

on-one attention from facilitators — would have provided her with the relational and ideational resources necessary to help her advance her science and/or science-theatre practice-linked identities.

It is important to consider how adult mentors serve as gatekeepers for both relational and material resources. As demonstrated by the three learners' interactions with adult mentors and facilitators in the Art Science Program, trust from adults can grant learners access to a plethora of material and relational resources — including extra material resources and the ability to freely interact and collaborate with their peers in their communities of practice. By contrast, lack of trust from adults can actively bar learners from accessing these same identity resources. Rashida, Zeke, and Richmond demonstrated the different ways that different forms of access to these resources can impact learners' practice-linked identities, and how those resources ultimately impact a learner's inbound or peripheral learning trajectories in a particular learning environment as well.

Session 2

Much has already been said about the learners' access to relational resources during Session 2, but it is also worth exploring the extent to which the learners' access to relational resources impacted their reasons and motivations to learn (Nasir & Cooks, 2009) and their potential inbound and peripheral trajectories.

As reported in Zeke's case study, Zeke had access to more positive relational resources during Session 2 than during Session 1. Although he no longer spent time with Serena, Karla, and Rashida, he often worked closely with Richmond, interacted more

freely with other learners in the Art Science Program, and generally had more positive interactions with design-team members (Artifacts 16-19, entirety of Session 2). The play-fight he had with Daniel during Session 2 got him in trouble with Kevin (Artifact 19, end of Session 2), but it is possible that this interaction was an example of face-saving (Goffman, 1956; DiSalvo et al., 2014), an add-on to an interaction with Richmond that had been particularly productive (or non-productive), and/or perhaps a sign that he felt comfortable in the Art Science Program community of practice as a whole (Nasir & Cooks, 2009). This play-fight may have been an indicator of Zeke's inbound trajectory in the Art Science program; although it got him into trouble, the way he accessed relational resources with Daniel (who was not a participant in this study) during this play-fight may have signaled that he felt central enough and comfortable enough in the Art Science Program to be silly with his peers.

Richmond may have similarly been trying to make himself feel like a central member of the Art Science Program's community of practice through his interactions with teachers, specifically, during this Session. Despite his efforts, though, Richmond was having progressively worsening interactions with the design team throughout Session 2. Though he occasionally had friendly conversations with Jennifer and Kevin (Artifacts 16-19, entirety of Session 2), Richmond was often disruptive, which led to a strained relationship between him and Lyla. Though he was not explicitly labelled as a "goof-off" like one particular athlete on a peripheral learning trajectory in Nasir and Cook's study (Nasir & Cooks, 2009), Richmond's behavior was becoming increasingly problematic and bothersome to the design team and to some of his peers. Like the athletes on peripheral trajectories in Nasir and Cooks' study with tense relationships with the

coaches (Nasir & Cooks, 2009), the lack of positive attention from the design team may have contributed to his peripheral learning trajectory during this Session.

It is also possible that Richmond's problematic behavior was an example of increasing *disidentification* (Osborne, 1999; DiSalvo et al., 2014) and overall boredom with the curriculum in the Art Science Program. This boredom and lack of engagement — which Richmond mentioned often in his Session 2 interview (Artifact 6, end of Session 2) — would help explain his strained relationship with facilitators and lessening initiative to access relational resources throughout this Session. Yet, given the relatively limited data surrounding Richmond's behavior, it is also possible that it is impossible to know what, exactly, caused what: it is unclear if Richmond's boredom caused disidentification and lack of engagement, or if his disruptive behavior arose from bullying, causing others to view him badly and leave him out, which may have resulted in boredom and lack of engagement, or a combination of the two.

Session 3

Session 3 had instances of anomalies for the three learners: despite being on a peripheral learning trajectory during this Session, Richmond emerged as an enthusiastic, engaged leader during the two filmmaking activities. Similarly, Zeke's frequent cantankerous demeanor and attitude was put at bay during these activities,; he also emerged as a leader. Contrastingly, the ever-engaged Rashida had stark moments where she appeared aloof and uncaring, perhaps mirroring her friend Serena. Considering these stand-out events, it is worth exploring how and why Zeke and Richmond functioned as leaders during Apex News Day and during the creation of the Mama and Papa Bear Show, and how and why that leadership allowed them to access new relational resources.

It is also worth unpacking how and why Rashida may have engaged in face-saving (DiSalvo et al., 2014) during Session 3.

When Zeke and Richmond took on leadership roles during the two filmmaking activities during Session 3 — with Zeke functioning as the cameraman/director and Richmond functioning as the primary news anchor — they had opportunities to interact with their peers in new ways (for Richmond, ways that were reminiscent of his time as a filmmaker during Session 1). Richmond resumed his role as filmmaker, teaming up with Marcus as lead anchors for Apex News (Artifact 22, middle of Session 3) and with another learner, Rebecca (not a participant in this study) for the Mama and Papa Bear Show (Artifact 64, middle of Session 3). Zeke took on leadership for the first time during the program during this Session (barring his mastery of charades during Session 1).

Taking on leadership roles allowed these learners to shift from having little to no involvement as key members of the community of practice (the Art Science Program) to being integrally involved in the community (Nasir & Cooks, 2009), even if only for two isolated activities. Leadership provided Zeke and Richmond with increased opportunities to bond with their peers in ways that made them feel more connected to the community of practice (Nasir & Cooks, 2009). This, in turn, may also have equipped them with new ways of accessing material and ideational resources that would further the development of their theatre/arts-related practice-linked identities, as evidenced by the ways in which they both felt proud of what they achieved as filmmakers during this activity (Artifacts 8 and 9, end of Session 3). As demonstrated by Nasir and Cooks, opportunities to connect with others, including peers, strengthens a practice by allowing the learner to feel as though they are part of a community where they belong (Nasir & Cooks, 2009).

It is possible that the organizational structures of the Apex News activity and Mama and Papa Bear Show allowed Zeke and Richmond to feel more connected to the Art Science Program. For example, unlike other activities during Session 3 that were short, highly structured, and largely teacher-directed (Artifact 72, entirety of Session 3), Apex News and The Mama and Papa Bear Show were structured to provide learners with time to explore and work independently with a clear end-goal in mind (Artifact 72, entirety of Session 3). Like in Nasir and Cooks' study, where the structure of the track meets provided the athletes with ample time to bond and interact with one another (Nasir & Cooks, 2009), it is possible that the structure of these two activities during Session 3 allowed for similar levels of interaction and bonding.

Rashida and Serena's interactions, while strongly in sync with each other, may have been what led them to become less engaged with the program and its other identity resources. Aside from Session 1, where their friend group appeared to be slightly larger, Rashida and Serena's interactions (and thus access to peer-related relational resources, specifically) were primarily with each other, and not with other learners in the program. Their limited social interactions with other learners were magnified by the fact that Rashida and Serena may even have often operated (and even sometimes emoted) as a unit. For example, the few moments where Serena looked disengaged were also the moments where Rashida looked disengaged (Artifacts 21 and 24, beginning and end of Session 3); both Serena and Rashida denied knowing who wrote the "water" poem when it was clearly Serena's (Artifact 21, beginning of Session 3); and Serena and Rashida may — according to another researcher — have coordinated their absences for the Session 3 final showcase. Contrastingly, with Richmond and Zeke, their access to other

peers led to more access to all three identity resources to positive identity-making; Rashida and Serena's relationship led to decreased access to identity resources and therefore less in the way of science and Art Science identity making.

Though students may want to portray themselves as hard-working to their teachers, they may not necessarily want to display this to their peers (Juvonen & Murdock, 1993,1995; Juvonen; 2000), possibly in order to generate different and preferred responses from each (Juvonen, 2000). Thus, Rashida (regardless of whether Serena was trying to look "cool" in front of Rashida, or vice-versa) may have shown "different faces" (Juvonen, 2000) to the design team and to Serena for self-presentation and face-saving purposes.

By acting disengaged or aloof with Serena, Rashida may have deprived herself of opportunities to interact with peers and access relational resources that may have impacted her science-theatre practice-linked identity, specifically, since she was notably absent or disengaged primarily during "science-theatre time" (Artifacts 21 and 24, beginning and end of Session 3). Rashida may not have developed strong enough relationships with her peers during "science-theatre time" to have had impacted science-theatre practice- linked identity (Artifact 10, end of Session 3).

Access to Ideational Resources

Accessing ideational resources includes the way in which one formulates ideas about oneself within a learning context, one's beliefs about their place in and relationship to the practice and the world at large, and general conceptions of what is "good" or valued (Nasir & Cooks, 2009). Examples of learners accessing ideational resources within the context of the Art Science Program include Richmond confidently describing himself as a

weeaboo —someone who loves Japanese anime culture — and a gamer (Richmond, Artifact 2, beginning of Session 1) and the teachers and Zeke describing the ways in which science and theatre could be combined in real life (Artifact 9, beginning of Session 3).

In the subsections that follow, I compare and contrast Zeke, Richmond, and Rashida's access to ideational resources within and across Sessions 1, 2, and 3. I also provide links between learners' access to ideational resources in relation to other identity resources.

Session 1

As previously mentioned, access to both material and relational resources provide access to ideational resources (Nasir & Cooks, 2009). In Nasir and Cooks' study, ideational resources were often accessed when athletes were positioned by coaches, through one-on-one conversation and groupings as “hurdlers,” “jumpers,” and “sprinters,” which constituted both roles they competed in at track meets and specific practice-linked identities related to track and field (Nasir & Cooks, 2009). Zeke, Richmond, and Rashida may have been similarly positioned as science people, theatre/arts people, or science-theatre people in their one-on-one interactions with members of the design team and peers, albeit in different ways.

As mentioned in the previous section of this chapter, the design team engaged in many one-on-one interactions with Zeke. Though some of these were specifically intended to help him focus, most other one-on-one interactions reflected the design team's feelings towards Zeke. These interactions included Deborah jokingly referring to Zeke as her “ray of sunshine” to poke fun at the way he often dramatically opined about

the world (confirmed with other researcher). I would similarly joke with Zeke about this, but I would also acknowledge his ability to articulate his thoughts clearly and with sophistication (Artifacts 1 and 3, beginning and middle of Session 1; Artifacts 12-15, entirety of Session 1).

While Zeke's interactions with Deborah may have contributed to his view of himself as "pretty annoying" (Zeke, Artifact 1, beginning of Session 1), they didn't necessarily support his practice-linked identities as a science person, theatre/arts person, or science-theatre person. Interestingly, though perhaps not surprisingly, Zeke did not feel by the end of Session 1 that the program had impacted his identity as a science person, theatre/arts person, or science-theatre person (Artifact 3, end of Session 1). Specifically, he said he felt that "nothing was really new for me" and "we didn't do that much [new work]" (Zeke, Artifact 3, end of Session 1). Perhaps if his one-on-one interactions with adults helped position him in a particular role as a science, theatre/arts, or science-theatre person, he would have had more developed practice-linked identities by the end of this Session.

In contrast to Zeke, Richmond and the other four boys he worked with for the final showcase project were consistently positioned as filmmakers when creating their final showcase; they were explicitly called the "filmmaker group" by the design team (confirmed with other researcher), and were consistently lauded for their overall progress and accomplishments when creating their film — either by me, individually, when I was supervising their filmmaking process, by the rest of the design team when the learners were creating their final projects, or by family and friends who praised the groups' efforts during the final showcase. This group also consistently reinforced their filmmaker

identities with one another, assuming roles as directors, cameramen, actors, and designers with confidence and without pushback from group-members (confirmed with other researcher).

Richmond's development of his theatre/arts practice-linked identity, specifically, is consistent with findings from Nasir and Cooks (2009) about the correlation between positioning learners in a certain way and strengthening practice-linked identities (Nasir & Cook, 2009). Richmond went from not considering himself to be a theatre person at the beginning of Session 1 (Artifact 2, beginning of Session 1) to feeling as though he was a theatre person "because I made a movie... every time my mom tried to make me go to the theatre [before this program], I would absolutely just hate it. But...now that I got to experience what goes on behind the scenes, it's really fun" (Richmond, Artifact 4, end of Session 1). The ideational resources Richmond accessed from being positioned as a filmmaker led to a shift in his practice-linked identity as a theatre/arts person, since he now felt he had the ability and talent to engage in theatre/arts in ways that worked for him (Artifact 4, end of Session 1).

Though Rashida did not receive as much one-on-one attention from design-team members as Zeke, she was lauded (though infrequently) by members of the design team for her exceptional artistic abilities. She was rarely, however, lauded for abilities to complete tasks and assignments during science-time or for her abilities to seamlessly interweave concepts she learned about science with theatre/arts. The dearth of one-on-one interactions during science and science-theatre time, which could have provided her with enough ideational resources to strengthen her practice-linked identities as a science person or science-theatre person, seem to be reflected in her own feelings about these

particular practice-linked identities. Despite her natural talent for creating artwork that connected science with theatre/art, Rashida felt it was “really hard” (Rashida, Artifact 10, end of Session 3) to successfully connect science with theatre/art, and generally felt that “science is not one of my best subjects” (Rashida, Artifact 10, end of Session 3). She did identify as a theatre/art person, stating “I think a theatre person is someone who’s very creative and in touch with their creative side” (Rashida, Artifact 10). These feelings may reflect the occasional reinforcement Rashida received in one-on-one interactions with the design team during theatre/art-time (but not science or science-theatre time).

Session 2

Despite the markedly different experiences Zeke, Richmond, and Rashida had throughout the Art Science Program, all three learners struggled to grasp “what was worthy to be learned” (Nasir & Cooks, 2009, p. 47), during science-theatre time in particular. Understanding concepts that are “worthy to be learned” (Nasir & Cooks, 2009, p. 47) is an example of an ideational resource that bolsters learners’ practice-linked identities (Nasir & Cooks, 2009). Since relational resources provide (or hinder) access to ideational resources (Nasir & Cooks, 2009), it is worth exploring the ways in which Zeke, Richmond, and Rashida’s access to relational and material resources may have impacted their understandings of the ways in which “the ‘how’ and ‘why’ of learning” (Nasir & Cooks, 2009, p. 58) afforded by relational resources impacted their access to ideational resources.

Despite his lack of connection to the science-theatre curriculum as a whole, Zeke maintained that he “always” (Zeke, Artifact 7, end of Session 2) was both a science and theatre/arts person (Artifact 7, end of Session 2). Like Zeke, Richmond maintained at the

end of Session 2 that “I’ve... always quoted myself as a science person before I came here, so yeah” (Richmond, Artifact 6, end of Session 2), but also that “[we] haven’t done anything like really science-theatre related” (Richmond, Artifact 6, end of Session 2). Perhaps this reflects both the one-on-one work Richmond readily did with Zeke, another self-described “science person” in the program, but also the fact that Richmond didn’t connect with enough of the science-theatre curriculum to impact the development of his practice-linked identity as a science-theatre person.

Yet unlike Zeke, who maintained that “I think I always was a theatre person” (Zeke, Artifact 7, end of Session 2), Richmond’s interest in both science and theatre dwindled during this Session, where Richmond claimed to only care about completing tasks in the curriculum for the sole purpose of getting paid (Artifact 6, end of Session 2). Valuing paid work is not unusual, and even reflects a strong value held by African American males, in particular (DiSalvo et al., 2014). Perhaps his rejection of the Art Science Program was also an example of him assuming a “cool pose” (DiSalvo et al., 2014) and saving face (Goffman, 1956), particularly if he was actually being bullied. Yet it may also reflect the way in which Richmond felt the science curriculum as a whole was genuinely “boring” and repetitive from the summer (Richmond, Artifact 6, end of Session 2).

Richmond’s rejection of the Art Science Program may also reflect his strained relationship with both Lyla and Jennifer. Despite the positive one-on-one relationship Richmond had with Zeke, his lack of engagement with material resources during both science time and theatre time could have resulted from and his troubled relationship with these two teachers.

As previously mentioned, Nasir and Cooks found that ideational resources were often directly reinforced by coaches who positioned athletes in relation to their track events (Nasir & Cooks, 2009), and through one-on-one interactions between the athletes and the coach, helped them to consider themselves to “be” track athletes (Nasir & Cooks, 2009). Although Rashida was on an inbound learning trajectory during this Session, the lack of one-on-one attention she received from the facilitators mirror the lack of attention received by athletes on peripheral trajectories in Nasir and Cooks’ study (2009); Rashida, like these athletes, was not actively positioned by adults in relation to her science practice-linked identity, nor was she given feedback that would have facilitated her science learning — which could have provided her with additional science-specific ideational resources. It is no wonder, then, that despite Rashida’s general worldview about the benefits of connecting science with theatre/art (Artifact 10, end of Session 3), she still could not see herself, personally, as a “science person” or “science-theatre person.”

Ironically, the lack of relational resources Rashida received from facilitators during Session 2 seemed to have had a positive impact on Rashida’s ideational resources related to science, though it seemed to have a more negative impact on developing her science practice-linked identity. Rashida took initiative to be particularly creative in using art to express science content, and although she acknowledged the many benefits of integrating the arts with science, she still did not feel like a science person herself (Artifact 10, end of Session 3). She also still held relatively stereotypical beliefs about scientists despite her general views about the overlaps between science and theater/art and the benefits of integrating them (Artifact 10, end of Session 3). She felt that scientists

lacked creativity, maintaining that “with science... You can't go [think] outside of the box” (Rashida, Artifact 10, end of Session 3).

Session 3

It is particularly interesting to consider Zeke, Richmond, and Rashida’s access to ideational resources, specifically, during Session 3. Although all three had instances during this Session that granted them significant access to identity resources that further developed their practice-linked identities in relation to science, theatre, and science-theatre, Zeke and Rashida ultimately had more access to ideational resources that both strengthened their practice-linked identities and allowed them to retain inbound learning trajectories throughout the Art Science Program. Though Richmond may have accessed a significant number of ideational resources in relation to his theatre (filmmaking) practice-linked identity during the Apex News and Mama and Papa Bear activities, he ultimately had inadequate access to ideational resources throughout Session 3, resulting in him remaining on a peripheral learning trajectory for this Session as well.

Both Zeke and Rashida independently acknowledged the ways in which the Art Science Program expanded their conceptions of what it means to directly engage with either science or theatre/art during their Session 3 interviews (Artifacts 9 and 10, end of Session 3), which they previously felt hesitant about (Artifacts 1 and 3, beginning and end of Session 1; Artifact 7, end of Session 2; Artifacts 9 and 10, end of Session 3). Though Zeke, specifically, still did not necessarily understand why the two domains would be combined in the first place (Artifact 9, end of Session 3) and felt hesitant about combining science and theatre/art himself (Artifact 9, end of Session 3), he was able to

clearly articulate the various ways in which one could combine art with science as a whole (Artifact 9, end of Session 3).

Though a discrepancy exists between how Zeke feels about engaging in science-theatre himself in the future and how he views others engaging in science-theatre in the future (Artifact 9, end of Session 2), the shift in his mindset from Sessions 1 and 2 of generally not understanding how or why these two domains would ever been combined (Artifacts 1 and 3, beginning and end of Session 1; Artifact 7, end of Session 2) to recognizing the possibilities for combining them in Session 3 (Artifact 9, end of Session 3) suggests that he accessed a significant number of ideational resources pertaining to science-theatre during Session 3, or, perhaps, progressively throughout all three Sessions that culminated in new understandings about his own science-theatre practice-linked identity during Session 3. It is possible that he did not access enough ideational resources through relational resources — similar to the way in which the coach in Nasir and Cooks’ study constantly positioned and referred to athletes as “hurdlers,” “jumpers,” or “sprinters” (Nasir & Cooks, 2009) — to have shifted his own practice-linked identity about science-theatre, however.

Similarly, Rashida was also able to acknowledge the many ways in which science and theatre/art could be successfully intertwined for others, but not necessarily for herself. Though she, as previously stated, claimed to not enjoy combining science with theatre/art “because it’s kind of hard” (Rashida, Artifact 10, end of Session 3), she felt that her thinking about connecting science and theatre/art evolved from Session 1 — likely as a result of the “creative control” (Rashida, Artifact 10, end of Session 3) she felt she had beginning in Session 2. Similar to Zeke, she originally felt clueless at the start of

Session 1 about how these subject areas could be intertwined (Artifact 10, end of Session 3). Yet in reflecting on her time with the Program at the end of Session 3, she acknowledged that “with science, you can tell a story with the numbers, but it would be boring because it's just data... But when you connect theatre with it, there's more entertainment and it grabs people's attention” (Rashida, Artifact 10, end of Session 3).

Zeke underwent a similar shift in his practice-linked identity relative to theatre/art. Though he felt theatre always played a significant role in his life (Artifact 7, end of Session 2), his understanding of the “the importance and the capabilities of theatre” (Zeke, Artifact 9, end of Session 3) emerged from “finally hav[ing] a class that's teaching me something” (Zeke, Artifact 9, end of Session 3). Zeke's excitement over “us as a community just figuring out how this class [theatre] is going to fit into our day” (Zeke, Artifact 9, end of Session 3) suggests that he accessed enough ideational resources that allowed him to shift both his feelings and thoughts about theatre as a whole, and his general way of being expressed in Session 2 that he needs to “have an explanation for what I'm doing. I don't want to do anything aimlessly” (Zeke, Artifact 7, end of Session 2). It is possible that the ideational resources Zeke accessed in relation to his science-theatre and theatre/art practice-linked identities resulted from the positive relationship he generated with Lyla throughout Session 3, and the way in which that relationship, and their one-on-one interactions, may have provided both teaching and learning opportunities that increased his access to material resources (Nasir & Cooks, 2009) that offered him opportunities to further develop his practice-linked identities in relation to theatre and science-theatre.

It is hard to know why, exactly, Richmond went from being on an inbound learning trajectory at the end of Session 1 to mostly non-participatory in Sessions 2 and 3. Richmond felt, at the conclusion of Session 3 that “I don't find anything in science really enjoyable anymore... I just lost the motivation to be a science person (Richmond, Artifact 8, end of Session 3); that “I've never done theatre” (Richmond, Artifact 8, end of Session 3); and that he generally does not enjoy combining science with theatre (Richmond, Artifact 8, end of Session 3), which stands in stark contrast to what he expressed during Session 1 in particular. It is possible, considering the way Richmond claimed to have enjoyed, learned from, and surprised himself during the two filmmaking activities (Artifact 8) that his shifting attitude was an attempt at face-saving (DiSalvo et al., 2014) in order not to be associated with potentially “uncool” subjects (Eglash, 2002; Margolis, 2008; Steele, Spencer, & Aronson, 2002; DiSalvo et al., 2014) like science and theatre. It is also possible that he was going through psychologically difficult time that had nothing to do with the Program.

Implications about Youths' Inbound/Peripheral Learning Trajectories

Both Zeke and Rashida ended Session 3 on inbound learning trajectories, while Richmond ended Session 3 on a peripheral learning trajectory. Interestingly, Rashida and Zeke had markedly different experiences in terms of their access to material, relational, and ideational resources throughout each Session, yet still managed to stay on inbound learning trajectories. All three youths' experiences speak to the idea that learning trajectories can fluctuate over time (Nasir & Cooks, 2009); it was barely obvious at the of Session 1 as to whether Zeke was on an inbound or peripheral learning trajectory, while Richmond went from being on an inbound learning trajectory at the end of Session 1 to

such a stark peripheral trajectory at the end of Session 3 that he transferred into a new strand of College Bound. Not all three identity resources are accessed in the same way by different youth in a learning environment (Nasir & Cooks, 2009).

Though literature cites the ways in which experiences like those experienced by Zeke, Richmond, and Rashida in the Art Science Program can have formative impacts on youths' general identities and senses of self for the future (Kinney, 1993), and can have particularly significant impacts on their choices to pursue STEM studies, specifically (Gasbarra & Johnson, 2008), it is important to remember that learning trajectories are not fixed and can evolve over time (Nasir & Cooks, 2009). This suggests that there is still room for these three youths' practice-linked identities to grow, diminish, or develop in entirely unknown ways within and outside the context of the Art Science and College Bound programs.

9

Discussion

Middle school is a pivotal time for learners' identity formations, and learners' views about themselves — both the current and future selves — have implications for learners' desire to continue engaging with STEM fields (Gasbarra & Johnson, 2008; Brown et al., 2016). This is particularly salient for learners from underrepresented backgrounds who may, for a multitude of reasons, decide that science is “not for them” (Tawfik et al., 2014). Scholars have identified the arts as a unique medium for learners, particularly those from underrepresented populations, to grapple with their questions pertaining to identity formation, and challenging them to explore different “selves” (Halverson & Sheridan, 2014). Learning environments that fuse science education with theatre education, in particular, may help youth grappling with their science identities to reimagine what it means for them to participate in and enjoy science (Long, 2014) by pushing them to establish connections between the scientific material and their own lives

(Ødegaard, 2003). Therefore, this study aimed to understand the extent to which learners' practice-linked identities (Nasir & Hand, 2008; Nasr & Cooks, 2009) formed and evolved in a particular Art Science program.

In this study, I explored the following questions:

1. How might participation in an Art Science program impact learners' practice-linked identities in relation to science, theatre/art, and "science-theatre"?
2. How do learners' practice-linked identities evolve over the course of an Art Science program, and what is responsible for those changes?

In this chapter, I discuss the primary findings that arose from the grounded-theory-like coding process carried out in this study (Charmaz, 2006; Saldaña, 2015) and the individual and cross-case analyses of the learners documented here. In each of the sections that follow, I introduce one of the findings and explain how it answers one of the research questions above. I then draw connections to the existing scholarly literature, particularly Nasir and Cooks' study on practice-linked identities (2009) and Wenger's work concerning learning involving the "whole person" (2006), and show where the findings contribute to the literature.

These findings make several new contributions to the literature. First, the findings draw connections between face-saving (DiSalvo et al., 2014) and practice-linked identities (Nasir & Cooks, 2009; Nasir & Hand, 2008). Second, they link concepts of possible selves (Markus & Nurius, 1986; Oyserman & Fryberg, 2006) to practice-linked identities. Lastly, they demonstrate that participants in the Art Science program were able to identify a variety of ways in which people other than themselves could engage in practices of science, theatre/art, and "science theatre."

Finding 1

Access to identity resources impacts learners' identity trajectories, and also their practice-linked identities related to science, theatre/art, and “science–theatre”.

The way in which learners actively engaged with material, relational, and ideational resources was based on the extent to which these resources were made available to them on a day-to-day basis throughout the Art Science Program — either through mentors/teachers granting (or inhibiting) this access, or through learners being open to engaging with these resources themselves (or not). This engagement — or access to identity resources (Nasir & Cooks, 2009) — had profound impacts on the strength of the three learners' specific practice-linked identities in relation to science, theatre/art, and “science theatre,” and identity trajectories in the Art Science Program. Figures 11, 12, and 13 provide a breakdown of how each participant accessed material, relational, and ideational resources throughout each Session, and the extent to which positive and negative interactions ultimately set them on inbound or peripheral learning trajectories at the end of each Session.

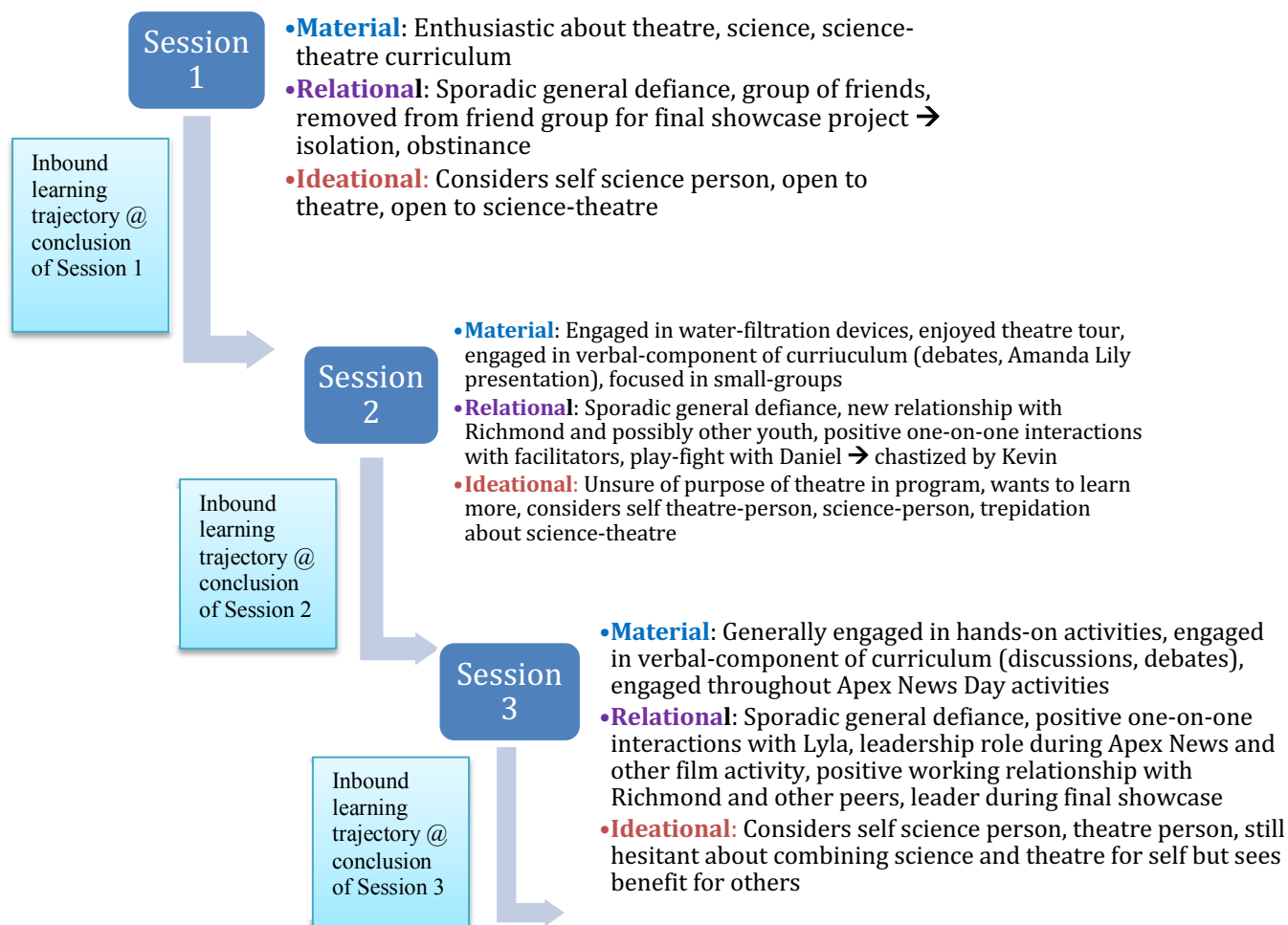


Figure 11: Breakdown of Zeke's access to material, relational, and ideational resources throughout each Session.

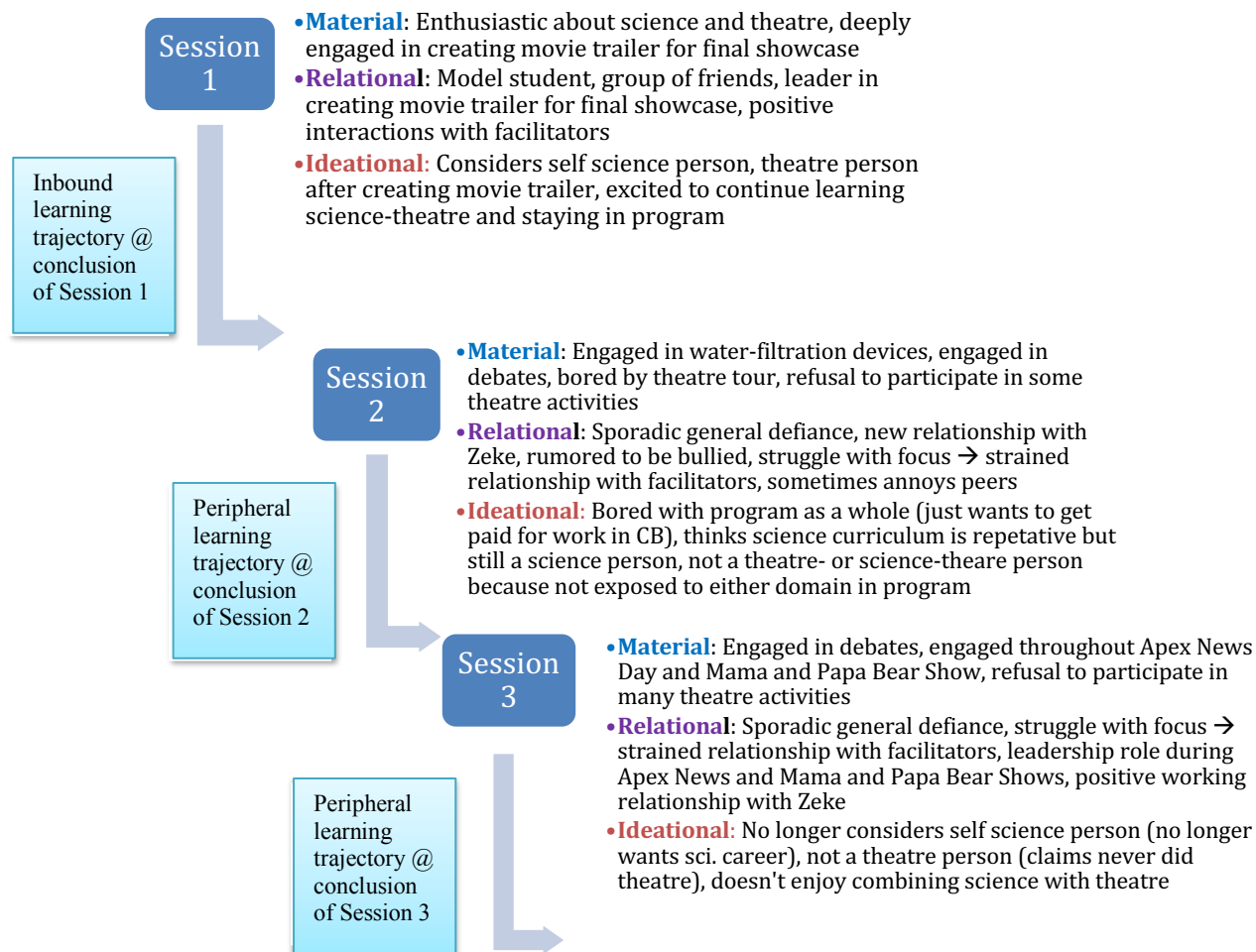


Figure 12: Breakdown of Richmond's access to material, relational, and ideational resources throughout each Session

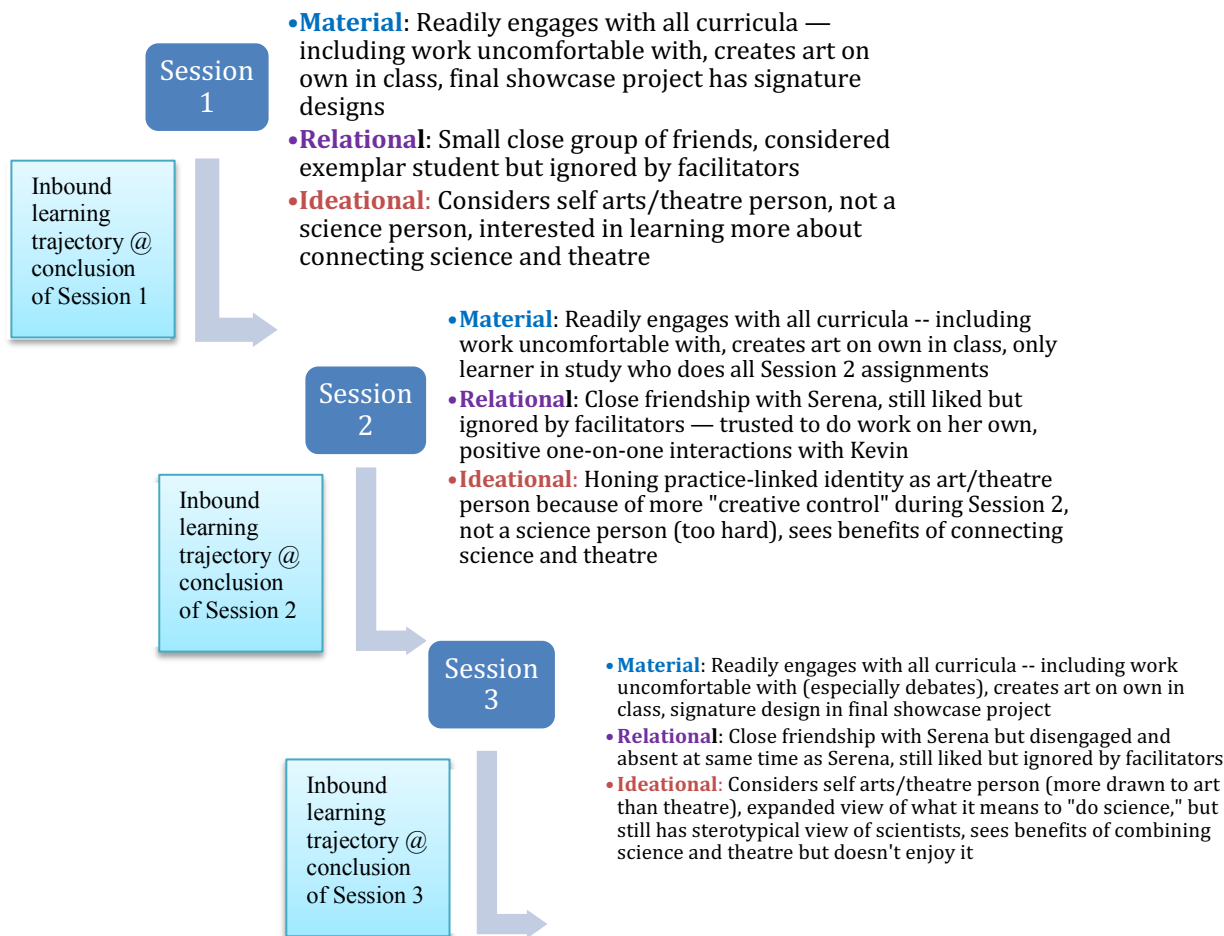


Figure 13: Breakdown of Rashida’s access to material, relational, and ideational resources throughout each Session.

The extent to which the three learners were on inbound or peripheral learning trajectories were dynamic and nuanced. As made evident by Richmond throughout Sessions 2 and 3 — when he was on a peripheral learning trajectory — his disengagement and frustration with the Art Science Program were not all-consuming; he made significant contributions to the Art Science Program’s community of practice by

being a central and active participant in classroom debates, appeared to create and maintain positive working and social relationships with Zeke and other learners, and made significant contributions to the Apex News and Mama and Papa Bear activities as a “filmmaker” leader. Though his science, theatre/art, and “science-theatre” practice-linked identities were not particularly robust at the end of Session 3, they were informed by and developed through both the positive and negative experiences Richmond had throughout the program.

The way in which the three learners engaged with the Art Science Program over the three Sessions reflect the dynamic nature of *peripherality* — which “suggests that there are multiple, varied, more- or less-engaged and -inclusive ways of being located in the fields of participation defined by a community” (Lave & Wenger, 1991, p. 35). They also reflect the dynamic nature of learning trajectories and practice-linked identities as a whole. Nasir and Cooks argue that learning trajectories can fluctuate over time (2009), as can one’s full participation in a community of practice (Lave & Wenger, 1991). This leads to moments in the lifespan of a learning environment where a learner can be on one trajectory (for instance, Richmond was on an inbound learning trajectory throughout and by the end of Session 1) and then transition to another (Richmond began and remained on a peripheral learning trajectory throughout Sessions 2 and 3, and transferred out of the program entirely after Session 3). Similarly, Rashida was on an inbound trajectory throughout Sessions 1, 2, and 3 of the program, but according to other design team members still with the project, she still has moments where she struggles to remain engaged with the program (confirmed with other researcher). It was unclear to what extent Zeke was on an inbound or peripheral learning trajectory throughout the program,

to the extent that — with the support of Program administrators — he transferred out of the Art Science Program at the end of Session 3 into a different College Bound program, but then transferred back into the Art Science Program at the beginning of the fall 2019 academic year (confirmed with Principal Investigator).

This finding directly answers research question 1 by identifying that access to identity resources are, in fact, the precise factors that impact learners' practice-linked identities. The more identity resources that contribute to a particular practice-linked identity a learner is able to access in a particular learning environment, the stronger that particular practice-linked identity will be.

This finding also helps to answer research question 2 by identifying that practice-linked identities evolve based on a learner's access to identity resources over time in a particular learning environment. Access to identity resources over time are directly responsible for changes in the evolution of a learner's practice-linked identity — either in terms of strengthening or weakening a practice-linked identity over time based on access to identity resources. This speaks to the non-linear nature of middle schoolers' identity formation. Although the identities youth embody during the middle school years can impact their attitudes and experiences later on in life (Kinney, 1993), these attitudes begin taking shape during the middle school years (Barton et al., 2013). Therefore, the experiences learners have in learning environments, and the ways in which they access identity resources in those environments, will impact their practice-linked identities — even if it only impacts the early stages of their identity development.

Finding 2

Face-saving behaviors impact practice-linked identities by inhibiting learners' access to identity resources

Observational and interview data from this study indicate that the three learners may have engaged in face-saving practices (DiSalvo et al., 2014; Goffman, 1956) at various points throughout each Session of the Art Science Program. This includes instances of participants adopting a “cool pose” (DiSalvo et al., 2014) in order to project a certain image of themselves to their peers or as a means of *disidentification*, actively rejecting education or its institutions, which results from cultural bias or stereotypes (DiSalvo et al., 2014; Osborne, 1997).

These face-saving practices may have stymied learners' access to material, relational, and ideational resources, which may have impacted their learning trajectories (inbound vs. peripheral) and practice-linked identities in specific ways. First, the defensive posturing projected in a “cool pose” reflects an individual actively rejecting the institutions that they feel actively reject them (DiSalvo et al., 2014; Majors & Billson, 1993). It is possible that part of this rejection of institutions includes a rejection of specific curriculum. For instance, both Richmond and Zeke had instances where they projected that they were “too cool” for theatre around the times when they were in conflict with members of the design team (Artifacts 21-24, entirety of Session 3). Rashida appeared to be aloof, and may have even intentionally skipped the final showcase, in the same instances during class-time as her friend Serena did (Artifacts 21 and 24, beginning and end of Session 3). The defensive posturing these three learners engaged in may have actively hindered their access to all three identity resources —

specifically, by actively not engaging with the curriculum (material resources), by irritating or deliberately not interacting with other learners or facilitators who learners felt somehow rejected or did not like them (relational resources), and generally feeling that they were potentially “above,” or did not belong anywhere within the domains of science, theatre/art, or “science theatre” (ideational resources). These examples, drawn from this particular study, highlight the ways in which a learner deliberately rejecting — whether this be through an active rejection or merely appearing aloof or “too cool” — prevent them from accessing identity resources that could help strengthen their practice-linked identities.

This finding helps to answer the two research questions. A learner’s practice-linked identity can be strengthened over time in a particular learning context – even practice-linked identities in their nascent stages – when access to identity resources are not blocked by a learner’s face-saving behavior. With respect to research question 1, in particular, a program like the Art Science Program could have more of an impact on learners who are not actively engaging in face-saving practices, because those learners wouldn’t be impacted by the moderating factor of face-saving, at least as far as their own engagement is concerned. If a learner believes that a program is inherently racist by virtue of engaging in racist tactics (DiSalvo et al., 2014), and feels impacted by that racism, that learner will not participate in the program as much as they would otherwise (DiSalvo et al., 2014). Therefore, participating in the program as a member of the program’s community of practice might have no, or even a negative impact, on that learner’s practice-linked identities if they are electing to not participate at all in the program.

This finding helps answer research question 2 as well because it demonstrates that the development of practice-linked identities is moderated by face-saving; however, because this is true for some learners and not others, it shows how the program might impact the participation of some learners, but not others. The extent to which a learner chooses to engage in face-saving tactics over the course of a program will impact the strength of their practice-linked identities. For instance, if a learner does not engage in face-saving tactics at the start of a program, but eventually does over time, their practice-linked identities will ultimately be impacted over time because face-saving tactics inhibit, or outright prevent, learners' full access to identity resources. Therefore, face-saving tactics would impact the evolution of a learner's practice-linked identity over time. This study has indicated that a learner's access to identity resources are directly responsible for the evolution of their practice-linked identities over time; however, engaging in face-saving tactics can outright negatively impact or prevent learners from fully accessing identity resources, therefore impacting their practice-linked identities over time.

Finding 3

The development of practice-linked identities parallels the development of possible selves.

Analysis of the three focal participants seems to confirm Nasir and Cooks' findings that plentiful access to all three identity resources is necessary for developing strong practice-linked identities, and that different learners access identity resources in a variety of ways in the same learning environment (Nasir & Cooks, 2009). This

contributes to our understanding of the links between the development of possible selves (Markus & Nurius, 1986; Nurius & Markus, 1990; Oyserman et al., 2006) — including academic possible selves (Oyserman & Fryberg, 2006) — and practice-linked identities. In particular, this finding speaks to our understanding of the link between ideational resources and possible selves. For instance, although both Zeke and Rashida engaged in the same activity where learners collected and tested the water quality of a nearby reservoir and then wrote a spooky story inspired by the reservoir, Zeke accessed more ideational resources during that activity that contributed to his practice-linked identity as a science person, whereas Rashida accessed more ideational resources that contributed to her practice-linked identity as an arts/theatre person. The ideational resources these two particular learners accessed — though different from each other — may have contributed to their possible selves, with Rashida envisioning herself studying art in the future (Artifact 10, end of Session 3) and Zeke envisioning himself going to MIT and pursuing a career in science (Artifact 9, end of Session 3).

Ideational resources constitute one's ideas about oneself, one's place in and relationship to the practice and the world at large, and general conceptions of what is “good” or valued (Nasir & Cooks, 2009). Possible selves are the positive and negative selves we envision becoming in the future (Oyserman et al., 2006). *Academic possible selves* are specific to academic contexts (Oyserman et al., 2006). Both ideational resources and the concepts of possible selves and academic possible selves speak to ideas of imagining one's place in the world and within a specific practice. Though none of the learners explicitly mention “possible selves” in their interviews, and neither did I, the three learners all mentioned their future selves in both positive and negative lights in

relation to practicing science, theatre/art, and/or “science-theatre” as career paths, specifically, or in life in general. For instance, Richmond expressed frustration in his interview with the science curriculum throughout Sessions 2 and 3 (Artifacts 6, end of Session 2; Artifact 8, end of Session 3). He also claimed during his interview in Session 3 that he used to want to pursue a career in science, but no longer, since he now found science boring (Artifact 8, end of Session 3). This highlights how Richmond both struggled to access ideational resources pertaining to his science identity throughout Sessions 2 and 3, while also struggling with evolving notions of his science-related possible self.

Interestingly, within the context of this particular study, all three learners could conceptualize and articulate nuanced, deep understandings of what it means to engage in practices of science, theatre/art, and “science-theatre” for others and the world at large, but not necessarily for themselves. This observation is reflected in the literature on minority youth and adolescents’ conceptions of their possible selves. According to Oyserman and Fryberg, “when minority youth imagine what is possible for them, performed images in these domains are likely to be highly accessible” (2006, p. 8). For minority youth, shared concepts surrounding belonging, who one is, and what is possible are reflected in culturally-significant stories, symbols, and images (Oyserman & Fryberg, 2006). These shared ideas are molded by their contact with American society and norms, and contain implicit and explicit messages about what youth within these groups can or cannot do (Oyserman & Fryberg, 2006).

Within the context of the Art Science Program, it is possible that the three learners had opportunities to engage in practices of *active identity*, or the ability to try on

various roles and identities without a commitment (Erikson, 1968). These opportunities may even have functioned as a mechanism for role-playing identities they were traditionally uncomfortable or unfamiliar with (Halverson & Sheridan, 2014). It is possible that even when engaging in these practices of active identity (Erikson, 1968), the youth were unable to see themselves within these practices, yet were able to see how others could fit into these roles. Considering that all three learners are minorities, societal messages about what these youth can or cannot do may have impacted the practice-linked identities they struggled with.

This finding helps answer this study's two research questions in that the Art Science Program provides students with the opportunity to try on different identities, which allows them to explore even the nascent stages of their practice-linked identities and possible future selves; as previously stated, these identities begin to take shape during the middle school years (Barton et al., 2013). The exploration of possible future selves in this type of learning environment allows these learners to "step into those shoes" (Halverson & Sheridan, 2014, p. 632) of those possible future selves, and that is one mechanism by which the program can give learners the opportunity to form even nascent practice-linked identities related to the practice of science, theatre/art, and "science-theatre." Therefore, the Program may impact practice-linked identities by providing learners with the opportunity to try on these different identities, and explore the nascent stages of their future possible selves.

Finding 4

The extent to which a learner is able to engage fully in their learning as a “whole person” (Wenger, 2006) is correlated with whether a learner will remain on an inbound or peripheral learning trajectory

As Wenger stated, understanding, activities, and tasks do not exist in a vacuum in a singular learning environment; rather, they are part of a broader system of what a person relates to (2006). Learning, according to Wenger, involves the “whole person, including our bodies, minds, emotions, and social relations” (Wenger, 2006, p. 56). Learning involving the “whole person” contributes to an understanding of the connection between learning and identities in practice, reframing learning as an “in-the-head phenomenon to a matter of engagement, participation, and membership in a community of practice” (Nasir & Cooks, 2009, p. 42).

The concept of learning as a “whole person” is particularly relevant in the context of this study in connection to the learners’ inbound or peripheral learning trajectories. Consider, for example, Richmond’s peripheral trajectory and his feelings of being bored with (what he viewed as) the repetitive nature of the science curriculum throughout each Session. Richmond’s case may reflect a broader trend among learners who consider themselves to be “science people” and are placed in non-traditional science education programs like the Art Science Program. Richmond’s claimed boredom with the science curriculum, in particular, raises the following question: if this particular learner relates to and loves science as it has traditionally been presented to him in school, in the media, and throughout life, how could he be helped to become fully engaged in a program like the Art Science Program that is intended to shift his thinking about what constitutes

“science” and encouraged to rethink what it means to enjoy “science” when he already loves it? Richmond cannot abandon his already-established love for science and therefore remove what he already relates to (Wenger, 2006) when he enters the Art Science Program. This helps explain why he and other learners like him who are enrolled in programs that may not suit their previously constructed identities (Bricker & Bell, 2012) ultimately remain on a peripheral learning trajectory.

The disconnect between Richmond’s previously-held beliefs and feelings about science and the goals of the Art Science Program has implications for whether science-minded learners like Richmond, who are enrolled in programs like the Art Science Program, will primarily be on inbound or peripheral learning trajectories during their experience in that program. This disconnect also has implications for whether these types of learners should be invited into programs like the Art Science Program in the first place; if they are, it should be established how their needs will be addressed in this kind of learning environment.

The ways in which the learners previously established themselves may lead to struggles with what Wenger describes as three distinct modes of belonging: (1) *engagement*, active involvement in shared processes of negotiating meaning with learners who relate to science differently from them; (2) *imagination*, seeing connections from their own experiences as “science people” to those who do not identify as such; and (3) *alignment*, organizing activities and energies in order to fit within the larger structures and confines of a learning environment (1998).

Wenger’s concepts also help explain why learners like Rashida might ultimately come to view themselves differently in relation to science, even if they still feel hesitant

about the domain (Artifact 10, end of Session 3). Because the Art Science Program is oriented towards a learner like Rashida (someone who struggles with connecting to science in school) and her previously-constructed identity, it is no wonder that she remained on an inbound learning trajectory. This speaks to the connections between students' motivations to learn and overall engagement (Nasir & Hand, 2008) and whether they will remain on a peripheral or inbound learning trajectory in a particular learning environment.

This finding helps answer this study's research questions in that, similar to the case of face-saving, if the program doesn't fully mesh with a learner's existing identities, then the particular modes of engagement defined by the Art Science Program's curriculum might not actually be what that student needs in order to get the identity resources that will lead to new practice-linked identities. The notion of engaging as a "whole person" in a learning activity – namely, the notion that learning includes "our bodies, minds, emotions, and social relations" (Wenger, 2006, p. 56) – means the extent to which a learner is engaging with the identity resources available to them in that learning environment. This full (or not) engagement with identity resources impacts whether a learner will remain on an inbound or peripheral learning trajectory, which impacts the evolution and strength of their practice-linked identities. The extent to which a person engages in their learning as a "whole person" is impacted by their experiences in an Art Science Program (which is impacted by their access to identity resources), which impacts their practice-linked identities based on whether they remain on inbound or peripheral learning trajectories.

This finding helps answer research question 2, specifically, in that the extent to which learners access identity resources over time impacts the extent to which they are learning as a “whole person.” This effects whether they stay on an inbound vs. peripheral learning trajectory, which has consequences for the evolution of their practice-linked identities. Therefore, learners’ practice-linked identities evolve over time based on the extent to which they are learning as a “whole person,” and the extent to which learners are accessing identity resources impacts any changes they may experience over time in terms of learning as a “whole person.” This, therefore, influences the development of their practice-linked identities.

Finding 5a

Learners may fail to form new practice-linked identities despite robust access to identity resources because that access is motivated by a desire to comply with the program’s design and teachers’ expectations

Students may fail to form strong practice-linked identities despite many instances of accessing identity resources made possible by the Art Science Program because they are driven to access those resources. This is because they may have other motivations for accessing those resources, such as the desire to be a good student — or to merely appear as a good student (Woolley, Strutchens, Gilbert, & Martin, 2010). Links exist between teacher practices and expectations with student motivation, particularly for African American students (Woolley et al., 2010). For instance, pedagogical practices, teacher expectations, and student initiative to learn are particularly important for the school

success of historically marginalized learners (Paul, 2005; Silver, Smith, & Nelson, 1995; Woolley et al., 2010).

Rashida — who consistently remained on an inbound learning trajectory throughout Sessions 1, 2, and 3 — was not constantly enthusiastic and engaged throughout the entirety of the Art Science Program; she had moments of disengagement, boredom, and even expressed her own levels of discontent and frustration with the Art Science Program in her interviews. Like Richmond, her learning trajectory — though inbound, not peripheral — at the end of Session 3 was also informed by and developed through both positive and negative experiences she had throughout the Art Science Program.

Finding 5b

Learners may succeed in forming new practice-linked identities despite lack of significant access to identity resources because the identity resources that they do access provide a strong hook into a new, nascent practice-linked identities

The effect of the Art Science Program on practice-linked identities is not fully captured by simply adding up the individual positive and negative instances of accessing identity resources during the program. Rather, particular instances where somebody accesses just the right identity resources that help them find their niche can help them form strong practice-linked identities, even if on balance they didn't access many of the resources provided by the program, and overall felt negatively about it. We see this dynamic in the case of Richmond, who had abundant access only to a narrow range of material

resources, but resources that allowed him to develop his practice-linked identity as a filmmaker during shorter, more sporadic periods of time throughout the program.

Lave and Wenger (1991) define *legitimate peripheral participation* as the idea that learners “inevitably participate in communities of practice” (p. 29). The authors argue that, by virtue of being a member of a community of practice, there is no such thing as an “illegitimate peripheral participant” — all learners in a learning environment are considered legitimate, regardless of their levels of engagement and participation (Lave & Wenger, 1991). In this sense, *peripherality* “suggests that there are multiple, varied, more- or less-engaged and -inclusive ways of being located in the fields of participation defined by a community” p. 35). The authors argue that peripherality is dynamic in nature and provides ways for learners to gain access to practices through a growing involvement in a community of practice.

Findings 5a and 5b help answer research question 1, specifically. These combined experiences – both negative and positive – are impacted by the extent to which a learner participates in the program (whether they remain on inbound or peripheral learning trajectories) – which is determined by the extent to which they are accessing identity resources. Therefore, the combined negative and positive experiences that ultimately impact whether a learner remains on an inbound or peripheral learning trajectory that they experience from having participated in an Art Science program impacts their practice-linked identities.

These two findings also help answer research question 2. Learners evolved over the course of the Art Science Program based on their combined negative and positive experiences that impacted whether they are on inbound or peripheral learning trajectories.

The negative and positive experiences are impacted by learners' access to identity resources.

10

Conclusion

This study documented the three Sessions of the pilot year of an Art Science Program. It explored the ways in which the program impacted three learners’ science, theatre/art, and “science-theatre” practice-linked identities (Nasir & Cooks, 2009) and how those practice-linked identities evolved over the program’s three Sessions. It examined the ways in which each learner accessed three identity resources — material, relational, and ideational resources (Nasir & Cooks, 2009) — and how the learners’ access to those resources affected their inbound or peripheral learning trajectories (Nasir & Cooks, 2009) at the end of Sessions 1, 2, and 3 of the Art Science Program.

Findings from this study indicate that (1) access to identity resources impacts learners’ identity trajectories, and also their practice-linked identities related to science, theatre/art, and “science–theatre”; (2) face-saving behaviors impact practice-linked

identities by inhibiting learners' access to identity resources; (3) the development of practice-linked identities parallels the development of possible selves; (4) the extent to which a learner is able to engage fully in their learning as a "whole person" (Wenger, 2006) is correlated with whether a learner will remain on an inbound or peripheral learning trajectory; (5a) learners may fail to form new practice-linked identities despite robust access to identity resources because that access is motivated by a desire to comply with the program's design and teachers' expectations; and (5b) learners may succeed in forming new practice-linked identities despite lack of significant access to identity resources because the identity resources that they do access provide a strong hook into a new, nascent practice-linked identities.

Implications for Practice

In light of the findings from this study, presented in both the Discussion and Analysis sections, there are a number of implications for practice (IfPs) for program designers seeking to create alternative science programs that provide young adolescents with opportunities to explore science in ways that differ from the ways science is traditionally taught and presented in schools in the United States. Therefore, the following section of this study will discuss implications for how the design of future learning environments can support the different ways in which youths' practice-linked identities and overall learning can flourish in entirely different ways. As both this study and Nasir and Cooks (2009) have suggested, it is important to honor the different experiences of different youth, and account for the many ways in which learners' practice-linked identities can develop within the context of one learning environment.

What works for one learner may not work for another, and it is important to consider how the design of a learning environment can impact the experiences of all learners:

IfP 1: Given the variation of experiences and learning trajectories derived from the learners' access to material, relational, and ideational resources throughout the three Sessions of the Art Science Program, future program designers would do well to design learning environments and activities that allow for significant amounts of student choice.

Providing significant student choice could increase learners' opportunities to engage with topics, concepts, and activities that they find most exciting. Maximizing chances for student engagement would allow learners to access the greatest possible number of identity resources in the learning environment. This would, hopefully, promote the creation of a robust community of practice and keep learners on inbound learning trajectories in the learning environment, while developing their practice-linked identities. This is highlighted by the learners' success and engagement with (or lack thereof) in the final showcase project from Session 1. Both Rashida and Richmond were provided with the freedom to choose what artistic medium they wanted to present their ideas through for the final showcase, and thrived — both in terms of their enjoyment and engagement with the project, and the quality of work they produced — when engaging in their respective projects (Richmond taking on a leadership role as a filmmaker, and Rashida spearheading the creation of a graphic novel-type poster about climate change). In contrast, Zeke was not given a choice about who he could work with for this project (he worked by himself) and the project he would work on (he was encouraged to write a letter). He was both unhappy when working on this project, and his letter was not reflective of the creative,

thoughtful work he was capable of creating — as demonstrated through other activities and instances throughout the Art Science program.

With this in mind, it is also crucial for these learning environments and activities to support learners on their journeys towards recognizing their own talents, interests, and expertise. When the three learners were provided with opportunities to delve into activities and engage with artistic media they enjoyed, they all acknowledged the various ways in which they learned and grew from the activity — for instance, both Richmond and Zeke discovered how much they both loved filmmaking, and Rashida surprised herself in her ability to strengthen certain drawing skills when she was given the opportunity to draw.

Designing learning environments that lend themselves to plentiful opportunities for student choice would also (1) increase learners' opportunities to engage deeply in learning experiences that are personally meaningful to them and help strengthen their practice-linked identities relative to what they are doing in a community of practice, and (2) increase opportunities for learners to have positive experiences that would allow them to remain on inbound learning trajectories within that community of practice. This was made particularly evident in all the instances where Richmond had the opportunity to create films and design television shows. During these occasions and activities, Richmond's identity as a "filmmaker" was strengthened, and he automatically took on leadership roles during these activities — even during Sessions 2 and 3, when he was on a peripheral learning trajectory. These instances showed that, despite Richmond's increasing disengagement with the Art Science program as a whole over time, he was

consistently engaged with and enthusiastic about activities where he was provided with opportunities to choose to create films.

IfP 2: In addition to making sure teachers and facilitators in such programs have the expertise that is needed, it is important that all of them buy into the pedagogical goal of allowing learners to explore what is most meaningful to them.

Facilitators who respect learners' needs to explore what is most meaningful to them will need to guide learners towards resources they require for learning, but a bigger need in programs that are aiming to help learners develop interests is to help learners in the context of their own interests and passions. For instance, the "Science-Theatre Program" evolved into the Art Science Program, reflecting facilitators' acknowledgement that the learners in the program's interests extended beyond theatre into other artistic media.

Rather than forcing the learners to simply engage with practices of theatre (which was the original aim of the Program), the facilitators allowed learners to engage with forms of self-expression that was most meaningful to the learners, and ultimately iterated on the goals and future direction of the program based on the learners' engagement. This was particularly evident throughout Sessions 2 and 3, when the teachers aimed for the final showcase project at the end of Session 3 to reflect what the learners wanted to create, rather than a pre-conceived idea from the facilitators about what they wanted the learners to create for this showcase.

IfP 3: Designers should be “designing for face saving” (DiSalvo et al., 2014, p. 313), being mindful of the ways that some learners feel that learning and the development of identity may sometimes conflict with their cultural values (DiSalvo et al., 2014).

As the data and analysis have indicated, all three participants in this study engaged in some form of face-saving throughout their time with the Art Science Program. Though unsubstantiated from the data available from this study, it can be speculated that their reasons for saving face ranged from feeling the need to adopt a “cool pose” (hooks, 2003; Majors & Billson, 1993) as a means of self-protection, as was (or may have been) the case for Richmond; potential rejection of “uncool” subjects (art) (DiSalvo et al., 2014), which Zeke may have done in his moments of defiance throughout the three Sessions; or the need to present “different faces” (Juvonen, 2000) to peers and teachers/facilitators for the sake of self-preservation, as Rashida may have done when she was working by herself (engaged with her work, and possibly presenting this type of “face” to the facilitators) versus when she spent time with Serena (often appearing aloof, and perhaps presenting this particular “face” to her friend).

DiSalvo, Guzdial, Bruckman, and McKlin found that, in designing a programming learning environment that supported face-saving tactics, “participants could come in each day and learn programming without becoming a geek” (DiSalvo et al., 2014, p. 310). They therefore encouraged other designers to respect learners’ current attitudes when entering a program, the need for learners to impress their peers, and facilitate an ongoing community that maintains a feeling of belonging and community that allows them to feel safe (DiSalvo et al., 2014). The findings from this study echo these authors’ call for future designers to design Art Science programs with these principles in mind. Doing so may allow for learners who do not feel like “science people” or “art people” within a

particular context — as Zeke, Richmond, and Rashida may have ultimately felt when they engaged in face-saving practices in the Art Science Program — to find their place within a program, even those they may struggle to engage with. This would hopefully increase opportunities for learners to maintain feelings of belongingness, remain on inbound learning trajectories in these types of programs, and develop more robust practice-linked identities.

Epilogue

The Art Science Program has changed substantially since its pilot year; it is now open to both middle- and high-school-age students, is an opt-in program (as opposed to youth being assigned to the program), and explores a variety of social-justice-related topics through both artistic and science-based media. It is also run by a new set of teachers, with one primary science teacher who is particularly passionate about STEAM education, one theatre-oriented arts teacher, and one visual-arts-oriented arts teacher. Student choice is a major component of the updated curriculum, and the majority of learners appear to be on inbound learning trajectories in the program. It is heartening to know that, beginning in Session 1 and continuing to today, the program designers of the Art Science Program have been open, mindful, and perhaps humble enough to both pay attention to and speak with learners directly about their experiences throughout the program, reflect on those experiences, and iterate accordingly in order to maximize the chances of learners having the most meaningful, personalized, and engaging experiences possible. Future designers would do well to follow the lead of the Art Science Program's design team and see the value and power of iteration when designing alternative, arts-based science programs for young learners intended to shape their practice-linked identities and future selves.

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Interview Questions

**Interview 1, Session 1 (Summer 2018): Administered during the first week of
Session 1**

1. What is your name?
2. What grade are you in?
3. Let's talk about some questions that will get me to know you better as a person
(OR: will get Ariella and the teacher to know you better). If you had to describe yourself to someone as who you are, how would you describe yourself?
 - a. Why would you describe yourself that way?
 - i. You're describing yourself as _____. Can you describe for me some of the things that you do that allows you to express who you are?

- b. How do you think others see you? Who are these “others” (friends, family, teachers)?
 - i. Why do you think they would describe or see you as that?
- 4. So this summer, we’ve shifted CB to have this science-theatre strand. You’ve been put into it. You’ll be coming up with a skit about science, and exploring other stuff about science through theatre and art. I know you don’t know much about it yet, but are you looking forward to continuing this science-theatre program (does it seem interesting, scary, exciting to you)? Why or why not?
- 5. Do you think of yourself to be a “science person?” Why or why not?
 - a. Can you explain to me who you think a “science person” is?
- 6. Do you consider yourself to be a “theatre person?” Why or why not?
 - a. Can you explain to me who you think a “theatre person” is?

Interview 2, Session 2 (Summer 2018): Administered during the last week of Session

1

- 1. Can you say your name?
- 2. What grade are you in?
- 3. How have your feelings about science changed over this summer?
- 4. How have your feelings about theatre changed over this summer?
- 5. Do you think your perception of yourself as a “science person” has changed over the course of the camp? Why or why not?
 - a. What is it about the act of “doing science” or “doing theatre” that has caused this change in your perception of yourself, or no change at all?

- b. Is there something about this particular learning environment/camp (teachers, structure of the day, learning materials, etc.) that has caused this change, or no change at all? Why or why not?
- 6. Do you think your perception of yourself as a “theatre person” has evolved/changed over the course of the camp? Why or why not?
 - a. What is it about the act of “doing science” or “doing theatre” that has caused this change, or no change at all?
 - b. Is there something about this particular learning environment/camp (teachers, structure of the day, learning materials, etc.) that has caused this change, or no change at all? Why or why not?
- 7. How, if at all, do you think your own views on who you are (how you identify, what you like to do, not like to do, or your general feelings) have changed over this program? If there has been no change, why do you think that is?
 - a. What is it about the act of “doing science” or “doing theatre” that has caused this change in your perception of yourself, or no change at all?
 - b. What is it about the act of “doing science” or “doing theatre” that has caused this change in your perception of yourself, or no change at all?
 - c. Is there something about this particular learning environment/camp (teachers, structure of the day, learning materials, etc.) that has caused this change, or no change at all? Why or why not?
- 8. Is there anything else you’ve learned about yourself from this program? In what ways does that relate to what you did throughout this camp?

9. How is the way you “do science” or “do theatre” in this camp different from what you do in school? How is it similar?
 - a. Do you prefer “doing science” or “doing theatre” one way over another?
Why?
10. Would you consider yourself to be a “science-theatre” person after having done this program? Why or why not?
11. Is there anything else that you’ve done, or generally do, in this program that has impacted your perceptions of science, theatre, or yourself?

**Interview 1, Session 2 (Fall 2018): Administered over the course of the first four
Saturdays of Session 2**

1. Do you remember anything we did this past summer in our science-theatre camp?
Can you tell me about that?
 - a. How did you feel about this last memory? Why does this stand out for you?
2. Can you think of any moment since this past summer — either with friends, family, or in school — that made you think about something you did, thought about, or learned this past summer with the science-theatre program?
 - a. Can you tell me about that moment, or what happened?
 - b. Why did that make you think of the science-theatre program?
3. We made some decisions this summer about how to structure the program — we had separate time for science and theatre time. Did you enjoy that? Why or why not?

- a. Were you able to see any connections between science and theatre?
- 4. What would an ideal science classroom at College Bound look like to you? Why?
- 5. What would an ideal theatre classroom at College Bound look like to you? Why?
- 6. What are you hoping to do or accomplish in this science-theatre program this year? Why?
 - a. What are you hoping to do or accomplish in the theatre portion of the program? Why?
 - b. What are you hoping to accomplish in the science portion of the program? Why?
- 7. The next couple of questions are about what you do in science and theatre/performing arts in school, compared to what you do here.
 - a. How would you describe what you do in science at school?
 - i. Do you like it? Why?
 - b. How would you describe what you do in science here?
 - i. Do you like it? Why?
 - c. How would you describe what you do in theatre or performing arts at school?
 - i. Do you like it? Why?
 - d. How would you describe what you do in theatre here?
 - i. Do you like it? Why?
 - e. How would you describe what you do in science here?
 - i. Do you like it? Why?

8. Are you beginning to see any similarities, or anything in common between science and theatre?
9. Now that you've been in the program for a little bit, I'm curious about the following things:
 - a. Would you consider yourself to be a "science person" since doing the camp this past summer? Why or why not?
 - i. What does it mean to you to be a "science person"?
 - b. Would you consider yourself to be a "theatre person" since doing the camp this past summer? Why or why not?
 - i. What does it mean to you to be a "theatre person"?
 - c. Would you consider yourself to be a "science-theatre" person after having done this program? Why or why not?
 - i. What does it mean to you to be a "science—theatre person"?

**Interview 1, Session 3: Administered over the course of last four Saturdays of
Session 3**

1. The last time we spoke was before winter break. I'd love to go over how you're feeling in the science—theatre program.
 - a. What is something you've done in the science—theatre program so far that you're really proud of?
 - i. *If need prompting, press students (this could be anything...):* Is there anything that made you feel good — or strongly one way or another (particularly happy, sad, mad, etc.?)

- b. What is something you've done where you've surprised yourself during science time? Why did that surprise you?
 - i. How about during theatre time? Why did that surprise you?
 - c. What is something you'd like to learn more about in the science—theatre program? Why?
- 2. Let's shift gears for a second: what do you think we're doing, in general, in the science—theatre program this year? Why do you think we're doing what we're doing?
- 3. Let's talk about the science—theatre program as a whole. What are some things that are working for you — or you like — in the science portion of the day at CB? Why?
 - a. What are some things that are not working for you — or that you don't like — in the science portion of the day at CB? How might we change it?
- 4. What are some things that are working for you — or you like — in the theatre portion of the day at CB? Why?
 - a. What are some things that are not working for you — or that you don't like — in the theatre portion of the day at CB? How might we change it?
- 5. Over the summer, I asked you about your feelings about connecting science with theatre. Do you think your feelings or thoughts have changed about why we would connect science with theatre?
 - a. Do you think it's useful for us to be doing science and theatre together, or do you think we should be doing one or another? Why or why not?

6. (*Take out students' individual maps that they completed in the past*) A while back, we asked you to do a theatre relational map, where you put words on a map that you thought were related, or not related, to doing science and theatre.
- a. Walk me through the science part of your map. Why did you put _____ (**go through each individual word**) where you did on the map? Where would you put them now?
 - b. Walk me through the theatre part of your map. Why did you put _____ (**go through each individual word**) where you did on the map? Where would you put them now?
7. Has this program, so far, changed the way you think about science in your daily life, outside of CB (at home, in school, or with friends)? Why or why not?
- a. *Be prepared to break this down...*
8. Has this program, so far, changed the way you think about theatre in your daily life (at home, in school, or with friends)? Why or why not?
- a. *Be prepared to break this down...*
9. Would you consider yourself to be a science person? Why or why not?
- a. What does it mean to you to be a “science person?”
10. Would you consider yourself to be a theatre person? Why or why not?
- a. What does it mean to you to be a “theatre person?”
11. Would you consider yourself to be a science—theatre person? Why or why not?
- a. What does it mean to you to be a “science—theatre person?”
12. Is there anything else you'd like to add about what you've learned about yourself or what you like to do in this program that we haven't talked about yet?



Science and Theatre Relational Maps

The following science and theatre relational maps were created during science—
theatre class and are referenced in Interview 1, Session 3.

Directions: Wave 1 — Science Map

- We're going to ask you to place words on this map to show how important these words/ideas/skills are to science.
- We're going to start with a given group of words and then we'll ask you to pick some of your own words.

Part 1: Predetermined words

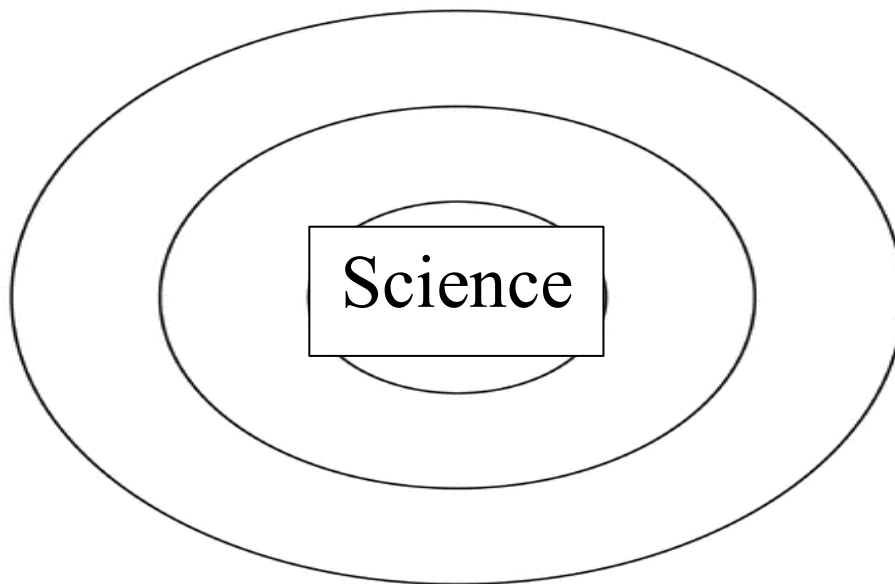
- Place the cards on the map to show how important these things are to science.
- Note: The farther away you put the items from the center labeled “Science”, the less important they are in science. You can even put the words outside of the circle if you would like. There are no wrong answers.

1. creativity/imagination
2. teamwork
3. empathy
4. storytelling
5. making mistakes
6. trying new things
7. identifying problems and coming up with solutions
8. making observations
9. being curious/ asking questions
10. getting feedback and adjusting **(have a conversation with kids about what this means so they’re not confused)**
11. **(Ask teachers if they would like to add a word)**

Part 2: Student-generated words

- Now, we’re going to give you some blank cards to fill out with words/drawings that you think are important to science. Place the cards on the map to show how important these things are to science.
- *If they need prompting:* Your words/phrases could be related to:
 - **ideas** (that are important in science)

- **things you do** (like something you do at home or outside of school, or in school that is important in science)
- **Values or things** that are important in science
- Or something else



Directions: Wave 2 — Theatre Map

- We're going to ask you to place words on this map to show how important these words/ideas/skills are to theatre.
- We're going to start with a given group of words and then we'll ask you to pick some of your own words.

Part 1: Predetermined words

- Place the cards on the map to show how important these things are to theatre.
- Note: The farther away you put the items from the center labeled “Theatre”, the less important they are in theatre. You can even put the words outside of the circle if you would like. There are no wrong answers.

1. Creativity/imagination
1. Collaboration
1. Communication
1. Empathy
1. Storytelling
1. Uncertainty
1. Making mistakes
1. Trying new things/risk-taking
1. Asking questions
1. Defining problems
1. Designing solutions
1. Researching and learning from others
1. Making observations
1. Tinkering
1. Curiosity
1. Critiquing (ideas, explanations, designs)
1. Constructing (ideas, explanations, designs)
1. Using models
1. Interpreting information

1. Experimenting

Part 2: Student-generated words

- Now, we're going to give you some blank cards to fill out with words/drawings that you think are important to theatre. Place the cards on the map to show how important these things are to theatre.
- *If they need prompting:* Your words/phrases could be related to:
 - **ideas** (that are important in theatre)
 - **things you do** (like something you do at home or outside of school, or in school that is important in theatre)
 - **Values or things** that are important in theatre
 - Or something else



Observational Protocol

A note about the observation protocol

Observational protocols were used and shared jointly by myself and Megan McKinley on each day of the Art Science Program throughout Sessions 1, 2, and 3. Since we were documenting the experiences of different learners for our respective studies, our notes tried to capture a holistic view of what was going on during each session.

Megan would typically take observational notes during “theatre time,” when I was typically assisting with or teaching the theatre curriculum, and I would typically take observational notes during “science time” for corresponding reasons. We would switch-off taking notes during “science-theatre time.”

Observational Protocol

Date			
Observer:			
Teacher:			
Class/Period			
Student Names			
Time	Ethnographic note-taking: What did students do? What did teachers do? Focus primarily on student interactions.	Potential Codes	Personal notes

Summary/Reflections

Megan's	

reflections/notes	
Ariella's reflections/notes	

D

List of Artifacts

Interview Transcripts

Session 1

1. Zeke, Session 1, Pre-Interview (Summer 2018)
2. Richmond, Session 1, Pre-Interview (Summer 2018)
3. Zeke, Session 1, Post-Interview (Summer 2018)
4. Richmond, Session 1, Post-Interview (Summer 2018)
5. Rashida, Session 1, Pre-Interview (Summer 2018)

Session 2

6. Richmond, Session 2 (Fall 2018)

7. Zeke, Session 2 (Fall 2018)

Session 3

8. Richmond, Session 3 (Spring 2019)
9. Zeke, Session 3 (Spring 2019)
 - a. Zeke, Relational Map Transcript (Spring 2019)
10. Rashida, Mashup (amalgam of questions from Sessions 1, 2, and 3)

Observational Notes (created and shared between Megan McKinley (other researcher) and me)

Session 1

11. 7.10.18 Shared Observation Protocol
12. 7.11.18 Shared Observation Protocol
13. 7.12.18 Shared Observation Protocol
14. 7.16.18 Shared Observation Protocol

Session 2

15. 10.6.18 Shared Observation Protocol
16. 10.20.18 Shared Observation Protocol
17. 11.3.18 Shared Observation Protocol
18. 11.17.18 Shared Observation Protocol
19. 12.8.18 Shared Observation Protocol

Session 3

20. 2.2.19 Shared Observation Protocol

- 21. 2.9.19 Shared Observation Protocol
- 22. 3.30.19 Shared Observation Protocol
- 23. 4.6.19 Shared Observation Protocol

Science—theatre relational maps

- 24. Zeke science—theatre relational map
- 25. Rashida science—theatre relational map
- 26. Richmond science—theatre relational map

Miscellaneous student work

Includes written work and art created in class within individual student journals and elsewhere, photos from the classroom environment, etc.

Session 1

- 27. Zeke graphic novel poster (“I hate art”) (art)
- 28. Zeke Boston climate change architecture project (art)
- 29. Rashida summer graphic novel doodle (art)
- 30. Rashida Boston climate change architecture project (art)

Session 2

- 31. Whole-class: science—theatre class expectations, Session 2
- 32. Whole-class: what is theatre list
 - a. Whole-class: theatre definition
- 33. Whole-class: water graffiti, 1 (on whiteboard)

- 34. Whole-class: water graffiti, 2 (on whiteboard)
- 35. Zeke: journal entry (“I hated this activity”)
- 36. Zeke: journal entry (“Gd doesn’t exist”)
- 37. Zeke: journal entry (“America is killing the water”)
- 38. Rashida: garbage public service announcement
- 39. Rashida: science-theme ideas (journal)
- 40. Rashida: 10.20.19 spooky reservoir story (journal)

Session 3

- 41. Whole-class: science—theatre class expectations, Session 3
- 42. Whole-class: Apex News strategy doodles, 1 (whiteboard)
 - a. Whole-class: Apex News strategy doodles, 2 (whiteboard)
 - b. Whole-class: Apex News strategy doodles, 3 (whiteboard)
- 43. Whole-class: Apex News signage/poster (art)
- 44. Zeke: rap about water filtration (journal)
- 45. Zeke: “water should be free but regulated” (journal)
- 46. Rashida (in small-group with non-participants): “why should we care about water?”
(whiteboard)
- 47. Zeke: “the US pushed out the Mexican territory” (journal)
- 48. Rashida: agree-disagree activity (journal)
- 49. Rashida: water poem (journal)
- 50. Rashida: Devin short story (journal)
- 51. Rashida: Devin x Noah freewrite (journal)
- 52. Rashida: “rely on it” water PSA (journal)

53. Rashida: “the water belongs to everyone” notecard (miscellaneous)

Final showcase pieces (includes individual, small-group, and whole-class pieces)

Session 1

54. Zeke: final showcase letter to politicians and painting (art)

55. Rashida: final showcase graphic-novel poster (art)

56. Richmond: TATOVENGERS Climate Wars Trailer (art)

Session 3

57. Whole-class: Session 3 final showcase whole-group game board components, 1
(photos)

- a. Whole-class: Session 3 final showcase whole-group game board components,
2
- b. Whole-class: Session 3 final showcase whole-group game board components,
3
 - i. Whole-class: Session 3 final showcase whole-group game board
components, 4
- c. Whole-class: Session 3 final showcase whole-group game board components,
5
- d. Whole-class: Session 3 final showcase whole-group game board components,
6
- e. Whole-class: Session 3 final showcase whole-group game board components,
7

- f. Whole-class: Session 3 final showcase whole-group game board components,
8
- 58. Whole class: Session 3 final showcase prep picture, 1 (photos)
 - a. Whole class: Session 3 final showcase prep picture, 2 (photos)
- 59. Zeke, Richmond, and other Art Science learners at final showcase (photo)

Videos

- 60. Whole-class: Apex News video, 1 (video)
 - a. Whole class: Apex News video, 2 (video)
 - b. Whole class: Apex News video, 3 (video)
 - c. Whole class: Apex News video, 4 (video)
- 61. Whole class: Mama and Papa Bear Show video (video)
- 62. Whole class: video from Session 3 final showcase, 1 (video)
 - a. Whole class: video from Session 3 final showcase, 2 (video)
 - b. Whole class: video from Session 3 final showcase, 3 (video)
- 63. Zeke: video from Session 3 final showcase, presentation to College Bound audience
(video)
- 64. Zeke: video from Session 3 final showcase of him and Kevin doing stage-combat
together (video)

Facilitators artifacts (includes schedules and curriculum plans)

Session 1

- 65. Summer 2018 (Session 1) schedule (includes curriculum overview for each day and materials needed) (planning document)
- 66. Summer showcase awards list

Session 2

- 67. Fall 2018 (Session 2) schedule (includes curriculum overview for each day and materials needed) (planning document)
- 68. Art Science Program goals

Session 3

- 69. Spring 2019 (Session 3) schedule (includes curriculum overview for each day and materials needed) (planning document)
- 70. Instructions for science—theatre relational maps

E

Daily Schedules and Goals

This Appendix includes a breakdown of planned daily schedules and activities throughout Sessions 1, 2, and 3 of the Art Science Program, included materials needed for each of these activities. They largely functioned as lesson plans (or at least guideposts) for the facilitators (teachers, myself, and Megan). Due to classroom management challenges, sometimes not all of these activities were implemented.

Session 1

Day 1: 5.5 hours
Day 2: 3.5 hours
Day 3: 3.5 hours
Day 4: 5.5 hours

18 hours week x 3 = 56 hours total

Day 1: Monday, July 9		Materials
9-11:30am Community building & intro to science-theatre	Schedule- All CB students: <ol style="list-style-type: none"> Students who come early (between 8:00 am - 8:30 am) will get started on paperwork 8:30 am - 9 am is breakfast 9 am Initial Welcome and Introduction of new staff/instructors, Community Guidelines of Engagement activity/icebreaker 9:30 finish paperwork (this portion may take an hour, last year it took two hours) 11 am pre-survey : <ol style="list-style-type: none"> Use bitly link: http://bit.ly/PreSciTheater https://bostoncollege.co1.qualtrics.com/jfe/form/SV_0JpeXGWsnYEJU21 11:30 lunch 	<ul style="list-style-type: none"> pens/pencils notecards post-its Large paper Markers
11:30-12:30	Lunch & break	
12:30-3:30 Sci-Theatre	<i>Move to science/theatre room:</i> <ul style="list-style-type: none"> 12:30-1pm: Graffiti/brainstorm activity (on poster paper): <ul style="list-style-type: none"> Ss write what they know a/b science and theatre (4 posters) Gallery walk and commenting/marking Discussion/share-out (synthesis/reflection time) 1pm-1:15pm: Small-group movement (tableaux) illustrating one item/concept per group from the brainstorm results. Followed by observation and commenting. 1:15-2:15pm Science lesson 2:15-3:30pm theatre time 5 min: Overview of general schedule (science time, theatre time, reflection time) Interview two students for 30 min each (4 total) <ul style="list-style-type: none"> 	Science materials

Day 2: Tuesday, July 10		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> 9-9:25am <ul style="list-style-type: none"> Ice breaker game Review shared expectations Break: 9:25-9:30am 9:30-11am Science lesson 11-11:30am theatre time 	Post-its Large paper
11:30-12:30	Lunch	
12:30-2:30pm	MS Purpose session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> Theatre time <ul style="list-style-type: none"> Interview two students for 30 min each (4 total) 	
3:15-3:30pm	Reflection time	

Day 3: Wednesday, July 11		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> 9-10:45am Science time 10:45-11:30am Theatre time 	
11:30-12:30	Lunch	
12:30-2:30pm	MS Career session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> Theatre time Interview two students for 30 min each (4 total) <ul style="list-style-type: none"> 	
3:15-3:30pm	Reflection time	

Day 4: Thursday, July 12		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> Science time 	
11:30-12:30	Lunch	
12:30-3:15	<ul style="list-style-type: none"> <i>Theatre space reserved</i> 	

Sci-Theatre		
3:15-3:30pm	Reflection time	

Week 2 Schedule

Day 5: Monday, July 16		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> Science time <ul style="list-style-type: none"> 9:15-9:30: Ariella, Megan, and Deborah talk to kids (Deborah starts and takes lead) <ul style="list-style-type: none"> Ariella is going to be leading the arts program in the afternoon for the summer, and then we'll do different stuff in the fall 9:30-11:30: go to science lesson as planned <ul style="list-style-type: none"> 10:45: break 	-Ariella will prepare slide show -graphic novel -videos of rap vs. spoken word (reshow science one) -find some cool shadow puppet video (google America's Got Talent)
11:30-12:30	Lunch	
12:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> 12:30pm-1:00pm: Mike gives guest lesson 1:00pm-1:10pm: break 1:15pm-1:45pm: introduce afternoon arts assignment (introduce what the projects are) <ul style="list-style-type: none"> -- Ariella leads <ul style="list-style-type: none"> Show them slides/videos with examples of each one Rest of class: begin to work on what they're doing (individually) <ul style="list-style-type: none"> Check for understanding, have them run ideas by us, make sure science stuff is right 	
3:15-3:30pm	Share-out time (what kids are working on)	

Day 6: Tuesday, July 17	Materials
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9-11:30am Sci-Theatre	<ul style="list-style-type: none"> • 9-11am Science time • 11-11:30am Theatre time 	
11:30-12:30	Lunch	
12:30-1:30	<ul style="list-style-type: none"> • <i>Changemakers teaching presentations</i> 	
1:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> • Theatre time 	
3:15-3:30pm	Reflection time	

Day 7: Wednesday, July 18		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> • 9-10:45am Science time • 10:45-11:30am Theatre time 	
11:30-12:30	Lunch	
12:30-2:30pm	MS Career session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> • Theatre time <ul style="list-style-type: none"> ◦ Let them know that what they're working on today and yesterday they'll present at the final showcase 	
3:15-3:30pm	Reflection time	

Day 8: Thursday, July 19		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> • 9:00am-9:15am: Science (observing experiment -- bring kids up at (9:00am sharp) • 9:15am-11:30am: Theatre <ul style="list-style-type: none"> ◦ If no guest speaker, extra 20 minutes of science 	
11:30-12:30	Lunch	

12:30-2:30pm	MS Purpose session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> 2:30pm-2:45pm: Break 2:45pm-3:15pm: Science 	
3:15-3:30pm	Reflection time	

Week 3 Schedule

Day 9: Monday, July 23		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> 9-10:30 Science time Break 10:30-10:45 Work on science-theatre projects (maybe theatre games) 10:50-11:30am 	
11:30-12:30	Lunch	
12:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> 12:30pm-1:00pm: theatre games (maybe work on projects) 1:00-2:30: Guest Speaker (worst case scenario: all theatre -- keep working on projects) 2:30-2:45 -Break 2:45-3:30- Theater -- work on science- theater projects 	
3:15-3:30pm	Reflection time	

Day 10: Tuesday, July 24		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> 9-10:30am (or 1.5 hours from start-time): Science time <ul style="list-style-type: none"> Ariella interviews students for her study) 10:30am-10:45am: Break 10:45am-11:30am: Theatre time <ul style="list-style-type: none"> Practice presentations in small groups -- give/do feedback forms (Week 3 GoogleDrive folder) 	

	<ul style="list-style-type: none"> • Interview kids 	
11:30-12:30	Lunch	
12:30-2:30pm	MS Purpose session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> • 2:30pm-3:00pm: Break • 3:00pm-3:30pm: Finish practicing presentation, have students finish minor tweaks to their projects (if time) 	
3:15-3:30pm	Reflection time	

Day 11: Wednesday, July 25		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> • 9-9:30 Science Observation • 9:30-11:30 Prepare for showcase (students will finish work -- finishing touches on their projects) • Interview students 	
11:30-12:30	Lunch	
12:30-2:30pm	MS Career session (teacher planning time)	
2:30-3:15 Sci-Theatre	<ul style="list-style-type: none"> • Theatre time <ul style="list-style-type: none"> ◦ Teachers help students prepare their practice talks for the showcase ◦ Students will present their projects to the class 	
3:15-3:30pm	Reflection time	

Day 12: Thursday, July 26		Materials
9-11:30am Sci-Theatre	<ul style="list-style-type: none"> • 9:30am-10am: Megan will visit Heights room and plan where each group will be stationed for presentations • 9:15-9:30: Post-survey (~15 min): <ul style="list-style-type: none"> ◦ bit.ly/SummerConverge-post • 9:30-10:15: practice presentations again: 	

	<ul style="list-style-type: none"> ○ 9:30-9:35/9:40: each group read through the comments they got yesterday (teachers pull out mean things in advance). <ul style="list-style-type: none"> ▪ Each group picks 2 changes they want to address from the pile ▪ Write down: 1 thing have learned about connection between science and art, OR 1 interesting thing about their project that they didn't include in their presentation/sheet. ○ 9:35-10:15: each group will get up, say which changes they're addressing from the cards, and give their presentation again. Say 1 thing have learned about connection between science and art, or one interesting thing about their project that they didn't include on their sheet. Take 1-2 questions from the audience ○ 10:15-10:30: break ○ 10:30-10:45: finish "what is theatre?" slides ○ 10:45-11:15: charades 	
11.15 am to 12.15 pm	<ul style="list-style-type: none"> • Lunch in Cushing 209 • Send CB summer interns to Heights Room with some type of sign for parents and other visitors who might arrive early 	
12.15 pm to 1.00 pm	<ul style="list-style-type: none"> • Walk all students over to the Heights Room • Prep tables, A/V, equipment, and presentations 	
1.00 pm to 3.00 pm	<ul style="list-style-type: none"> • Summer Institute Showcase in the Heights Room: <ul style="list-style-type: none"> 1.00 - 1.15: Opening and Keynote(s) 1.15 - 1.45: Changemakers Roundtable Presentations (with A/V) 1.45 - 2.15: Science-Theatre Roundtable Presentations 2.15 - 2.45: High Tech Hydro Roundtable Presentations 2.45 - 3.30: Cake and Award Ceremony 	
3.30 pm	<ul style="list-style-type: none"> • Students leave for bus from Heights Room and the bus will pick them up in front of St. Ignatius Church • Interns and Food Justice Leaders will be staying after the CB students leave to help clean up Heights Room, move symposium equipment back to makerspace and Higgins 270, clean up the rooms around Higgins 270 	

	(265, 275, 280) and move all the equipment from these rooms back into Higgins 270	
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Day 12: Thursday, July 26

9.15 am to 9.30 am	<ul style="list-style-type: none"> • Post surveys <ul style="list-style-type: none"> ◦ Each strand does their own post survey once they are in their classrooms in the morning after breakfast <ul style="list-style-type: none"> ▪ Science-Theatre: Cushing 335 ▪ Changemakers: Higgins 275 ▪ High-Tech Hydro: Makerspace (Service Building, 211)
9.30 am to 11.15 am	<ul style="list-style-type: none"> • Prep time (equipment / presentation) for students • Each strand will be taking their students to the Heights Room to practice in the morning: <ul style="list-style-type: none"> ◦ 9.30-10.00: Science-Theatre (kids will practice in room -- 4 rotations (5 min + 1 min for audience transitions): read off their sheet, say something about connection between science and art/something fun about their poster -- be ready to explain) ◦ 10.00 - 10.30: Changemakers ◦ 10.30 - 11.00: High Tech Hydro
11.15 am to 12.15 pm	<ul style="list-style-type: none"> • Lunch in Cushing 209 • Send CB summer interns to Heights Room with some type of sign for parents and other visitors who might arrive early
12.15 pm to 1.00 pm	<ul style="list-style-type: none"> • Walk all students over to the Heights Room • Prep tables, A/V, equipment, and presentations
1.00 pm to 3.00 pm	<ul style="list-style-type: none"> • Summer Institute Showcase in the Heights Room: <ul style="list-style-type: none"> 1.00 - 1.15: Opening and Keynote(s) 1.15 - 1.45: Changemakers Roundtable Presentations (with A/V) 1.45 - 2.15: Science-Theatre Roundtable Presentations 2.15 - 2.45: High Tech Hydro Roundtable Presentations 2.45 - 3.30: Cake and Award Ceremony

3.30 pm	<ul style="list-style-type: none"> • Students leave for bus from Heights Room and the bus will pick them up in front of St. Ignatius Church • Interns and Food Justice Leaders will be staying after the CB students leave to help clean up Heights Room, move symposium equipment back to makerspace and Higgins 270, clean up the rooms around Higgins 270 (265, 275, 280) and move all the equipment from these rooms back into Higgins 270
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Overarching goals by week

Week 1	Theatre <ul style="list-style-type: none"> • Objectives: <ul style="list-style-type: none"> ○ Help Ss answer the following questions: <ul style="list-style-type: none"> ▪ Why is theatre a unique vehicle for telling stories? ▪ Why is theatre a unique vehicle for telling stories you care about related to climate change in Boston? • Use theatre [games] as a tool for connecting science and theatre: <ul style="list-style-type: none"> ○ Perception of climate change in the media ○ Personal perception of climate change ○ Tableaus depicting past, present, and future of climate change from the vantage point of _____ (stakeholders, bees, media, etc.) ○ Nonverbal theatre games • Build ensemble • Ss (or at least Leslie): have a clear sense of whether students will be moving in the playmaking or playwriting direction
	Science: <ul style="list-style-type: none"> • Objectives: <ul style="list-style-type: none"> ○ What's Boston's climate change story (past, present, future)? Start with a present story to get them hooked ○ How is climate change playing out in Boston today? (Provide Ss with basic overview of potential climate change issues - as related to Boston - that they could choose to focus on in their plays and explore in-depth later) Rough plan: <ul style="list-style-type: none"> • Boston's climate change story (start with the present, then look at past and future) • Climate issues/topics that Ss could explore in-depth later after choosing their play topics <ul style="list-style-type: none"> ○ <u>Water:</u> <ul style="list-style-type: none"> ▪ Sea level rise over time and water quality (land area change over time) ▪ Changing water availability/weather patterns (flooding, droughts)

	<ul style="list-style-type: none"> ○ <u>Rising temperature:</u> <ul style="list-style-type: none"> ▪ Impact of temperature on life today in Boston (ex: changing species, heat islands, etc.) ○ <u>Human impact</u> <ul style="list-style-type: none"> ▪ Water ▪ Temperature ▪ Carbon footprint - deforestation, fossil fuels, farming ○ <i>Other ideas?</i> <ul style="list-style-type: none"> ▪ Back up: Ocean acidification • Start running experiments- <i>which ones? See list</i> <ul style="list-style-type: none"> ○ One experiment per topic (Tues, Wed, Thurs) - Ss do these all together <p>Questions:</p> <ul style="list-style-type: none"> • To what extent do we want to narrow students' focus of what they could be talking about/exploring in their plays? What concepts, exactly, do we want the students to know?
Week 2	<p>Theatre</p> <ul style="list-style-type: none"> • Objectives <ul style="list-style-type: none"> ○ Help Ss answer the following questions: <ul style="list-style-type: none"> ▪ What components are necessary for writing/creating an engaging piece? (Characters, plot line, etc.) ▪ What story(ies) do they want to tell? ○ End of the week: Ss will have some components of what they'll be writing about for their final pieces <ul style="list-style-type: none"> ▪ Some agreed upon elements for their "final" piece ○ Will have started building some elements that they need: <ul style="list-style-type: none"> ▪ Exploring how those elements function in the context of their work <p>Science</p> <ul style="list-style-type: none"> • Objectives <ul style="list-style-type: none"> ○ Ss pick climate change topic for their plays (from one of the issues that we explored in week 1) and explore this in more depth ○ Multi-day experiment/project ○ Small groups - stations with materials set-up (e.g., online simulation) and a teacher table (one-on-one time with teacher) ○ Share-out findings in "lab meeting": alternate between small and large group • Journal or so some sort of concluding activity that asks Ss to think about how what we did can connect to what they're thinking about with their plays?

	Questions <ul style="list-style-type: none"> • What are science experiments or activities that students could do that relate to all of the students, regardless of what their plays will be about? • How much advanced planning can we do with theatre, without knowing where students will do? How will the current plan differ from playmaking pieces vs. 10-minute plays, etc.
Week 3	Theatre <ul style="list-style-type: none"> • Objectives <ul style="list-style-type: none"> ○ Students will share out a staged reading of what they will be working on during the school year ○ Students will talk about connections they've seen between science and theatre
	Science
	Questions <ul style="list-style-type: none"> • What are the science goals?

Session 2

Session 1: 1.5 hours

Session 2-4: 2.5 hours x 3 = 7.5 hours

Session 5: 0 hours (SJ and career day)

Session 6: 5.5 hours (excluding lunch)

Total hours: 14.5 hours with students

Session 1: Saturday, October 6 (Lyla, Kevin, Jennifer)		Materials
9:00am-9:45am: Theatre (45 min)	Theatre Goals: <ul style="list-style-type: none"> community building, ensemble building (intros, who is everyone, do theatre games to get them excited and comfortable), adding shared expectations Story-map (collage/heartmap?): who are you in this world? Lyla: bring in sample of writer's notebook 	Markers Pencils 9bx12 piece of paper for each kid (18x24 is fine too) Composition notebooks for each kid (college-ruled) Magazines, glue, scissors, and mod podge (clear - gloss) decorating notebook
9:45am-10:00am	Break	
10:00am - 10:30am : Science (30 min)	Science goals: <ul style="list-style-type: none"> Build on collage activity: where does water fit in? <ul style="list-style-type: none"> What do we know about water? Connect to water in everyday products What are your experiences with water? Water footprint - structure this as a game (Kahoot game) <ul style="list-style-type: none"> Get at how much water it takes to make everyday items: 	Small plastic jars (2-3 per student) Chart paper, markers

	http://waterfootprint.org/en/resources/interactive-tools/product-gallery/ <ul style="list-style-type: none"> Homework <ul style="list-style-type: none"> Small jars→ bring water samples from school, home, somewhere near your house 	Kahoot game
10:20am - 10:30am	Reflection <ul style="list-style-type: none"> Map of your life and turn and talk 	

Session 2: Saturday, October 20 (Lyla, Kevin, Jennifer) * Lyla leaves @ 10		Materials
Interviews	8:30/8:45am-9am	
9am-10:15am: Theatre	<p>*Megan and Ariella: get the kids to the classroom by 9am sharp!</p> <p>Storytelling (Nature Walk)</p> <ul style="list-style-type: none"> Intro in Classroom/Check-In (9-9:20) Walk to Reservoir (9:20-9:30) Collect water samples from reservoir (9:30-9:45) Scary Story @ Reservoir (9:45-10:00) Walk to classroom (10:00-10:10) Return to classroom to write (10:10-10:30) Share out scary stories (10:30-10:40) 	<p>Large plastic jars for water sample (with tape on them),</p> <p>Notebooks, pencils/pens, markers</p>
10:30am-11:20am: Science	<ul style="list-style-type: none"> Personal experiences with water- Ex. When I was younger I loved water but couldn't swim How much water it takes to make everyday items, need for clean water: -use cue cards, keep it short- Students will be given index cards with an everyday item on it, on the back they will guess how much water is involved in making that product. We will then see who guessed theirs correctly. http://waterfootprint.org/en/resources/interactive-tools/product-gallery/ Water testing- Mini-lesson, what are the natural levels? (what should and shouldn't be in water) <ul style="list-style-type: none"> Map: Buildings with lead - individual students can come and enter their address. Test Different samples of water (Ss bring in different samples from home and school, 	<p>Water testing materials (8 kits - each pair shares)</p> <p>Data table 10 copies (one per pair)</p> <p>Class Data Table (project on board)</p> <p>Liter bottles to show sizes</p>

	<p>Charles, harbor, BC reservoir, bottled water, storm runoff)</p> <ul style="list-style-type: none"> ▪ Bacteria ▪ Lead ▪ Chlorine ▪ pH <ul style="list-style-type: none"> ○ Test for different pollutants (e.g., pH, lead) 	Index cards (2 per student)
11:20am-11:30am	<p>Reflection: Jennifer-</p> <p>How did your personal experience help you to engage in today's lesson?</p> <p>How is storytelling used in science?</p> <ul style="list-style-type: none"> • Does water have a story? • Water samples look the same but they are very different, each have their own story • Why is telling stories about water important? <ul style="list-style-type: none"> • Why could it be important to tell the story of where water comes from for different people? 	

Session 3: Saturday, November 3 (Kevin, Jennifer) <ul style="list-style-type: none"> • Ariella and Megan will pull individual kids for interviews 		Materials
9am-10:15am: Science	<ul style="list-style-type: none"> • Water and health • Waterborne illnesses- Ashley Rose Story (watch 9:28-17:30) https://www.pbs.org/video/deadly-sins-wjjaj0/ <ul style="list-style-type: none"> ○ Discuss this story - why is storytelling important in science • Intro filters <ul style="list-style-type: none"> ○ form 3 groups, 1 for each filter • Test some filters → how effective are they at cleaning water? <ul style="list-style-type: none"> ○ Go over units (ppm) ○ Review steps ○ Compare data to: 1. Zeke and Richmond baseline data and 2. EPA limits • Data Table • Analyze results: how effective was your filter? Why? Evidence? 	<p>Megan</p> <ul style="list-style-type: none"> - 3 water filters (tablets, LifeStraw, Brita) - 3 water testing kits - Charles River water sample (over 2.5 gallons) - bucket for P& G tablet group (2.5 gal) - Extra vials (3 groups, 3 vials per group) - Waste bucket - Distilled water - Print data table for water test results

	<p><i>If we have time?</i></p> <ul style="list-style-type: none"> • Use microscope to examine water from the Charles Rv • Finish testing water from last time (lead & pesticide - 10 min, bacteria - 48 hours) 	Digital microscopes (2) & slides
10:15am-10:30am	<p>Break</p> <ul style="list-style-type: none"> • card sort activity (bring treats) 	<p>Ariella</p> <ul style="list-style-type: none"> -Bags with pre-determined and blank cards (1 for each student) -Double-sided tape -Sturdy Poster paper (needs to have indiv. relational maps drawn in advance) - one side is science, other side is theatre -MAKE SURE STUDENTS WRITE THEIR NAMES ON POSTERS -Get munchkins in advance (many munchkins)
10:30am-11:20am: Theatre	<p>Guerilla Street Theatre (be more physical)</p> <ul style="list-style-type: none"> • To be able to define guerrilla theater: <i>politically active public performance as a revolutionary tool for social change. Walk outs, die ins, Every 28 Hours, viral video??</i> <ul style="list-style-type: none"> ◦ Talk about flash-mob, and if anyone has been a part of that • To explore power and image dynamics through theater of the oppressed games (Tangles and knots, Tableau tag, Theatre of the oppressed revisionist history, meme culture, <ul style="list-style-type: none"> ◦ Based off of games we just did, how can we use our findings from science to impact Guerilla theatre? • To explore ways to spread awareness of health and access to clean water 	<p>Poster board</p> <p>Stuff to make signs (paint stirrers)</p>

	<ul style="list-style-type: none"> • If we have time: Plan and demonstrate flash mob guerilla pieces 	
11:20am-11:30am	<p>Reflection- Kevin (CONSIDER SETTING AN ALARM ON PHONE TO WRAP-UP!)</p> <ul style="list-style-type: none"> • Reflection can focus on using your voice to incite changes <ul style="list-style-type: none"> ○ What are innovative PSA's you've seen in your neighborhood -- or other important ways to spread info about what's happening? ○ How do YOU spread information about things that are important to you? ○ Where do you get your information from? 	

Session 4: Saturday, November 17 (Lyla, Jennifer) -- GO TO RIVERTOWN CHILDREN'S THEATRE		Materials
8:30-9am	Interviews	
9am-10:15am: Science	<p>Surveys @ 9am (10-15 min) - http://bit.ly/CBScienceTheat-fa18sp19</p> <p>Science</p> <ul style="list-style-type: none"> • Data analysis- did our filters work? <ul style="list-style-type: none"> ○ Bacteria test results • Public service announcement: <ul style="list-style-type: none"> ○ How to clean water (Jamaican commercials): https://www.youtube.com/watch?v=pGkqjT2Yflc ○ If time: ad for lifestraw, etc.: https://www.youtube.com/watch?v=A6bVCXdBuD0 • Take apart filters→ how do they work? • Man-made filters vs. filters in nature (wetlands, plants) • Design a water filter: <ul style="list-style-type: none"> ○ Folder: Water filter activity ○ Design paper 	<p>Laptops - surveys posted on Google Classroom</p> <p>Cut - Brita and Lifestraw</p> <p>Print design sheet</p> <p>Display water filter materials for students to look at</p> <ul style="list-style-type: none"> • Activated

		carbon • Cotton balls • Coffee filter • Sand • 2 types of gravel
10:15-10:30am	<ul style="list-style-type: none"> • Bus ride to RCT 	
10:30am-11:20am: Theatre	<ul style="list-style-type: none"> • Tour RCT • Vignettes/Sketch (RCT Visit) <ul style="list-style-type: none"> ◦ PSA/Commercial 	Journals Markers Pencils
11:20am-11:30am	Reflection: Lyla <ul style="list-style-type: none"> • Maybe do this on the bus-ride back from RCT, or while still at RCT? 	
11:30am-12:00pm	Lunch at RCT (in studio)	
12:00pm-12:15pm	Bus picks everyone up from RCT -- arrive back at College Bound by 12:30pm	

Session 5: Saturday, December 1 - Social Justice/Career Day (No science-theatre session)	
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Session 6: Saturday, December 8 - All day Science-Theatre (morning + afternoon sessions) (Kevin, Jennifer, *Lyla if needed)		Materials
9am-10:15 am: Science	<ul style="list-style-type: none"> Create a water filter: Water filter activity Discuss pricing- how much would your water filter cost to make? Test water filters Iterative design process Evaluate using criteria for effectiveness <p>Possibly give out various awards (the cleanest water, the highest flow rate, the most cost effective filter, most persuasive presentation on the product, etc.)</p>	<p>Video equipment and wireless mics</p> <p>Filters (Brita & LifeStraw) - saw open</p> <p>Charles River Water Samples</p> <p>Filter materials: cotton balls, coffee filters, rubber bands, sand, gravel - 2 types, 8 x 2L bottles, 8 large containers, activated charcoal</p> <p>- Water testing materials (8 kits - each pair shares)</p> <p>Design criteria*</p>
10:15 am-10:35 am	<ul style="list-style-type: none"> Ariella: Theatre Relational Maps 5 min break 	Relational map supplies
10:35 am-11:30 am:	<p>Videos - Water access and control-</p> <p>Give them 1-2 questions to think about while watching videos</p>	

Theatre	<p>Guiding questions- (3 min explanation and video intro)</p> <ol style="list-style-type: none"> 1) How much should water cost and who should pay? 2) Is water a ‘renewable’ resource? 3) Does water belong to everyone or is it a commodity? <p>Skip videos in red</p> <ul style="list-style-type: none"> • Where does <i>your</i> water come from? <ul style="list-style-type: none"> ◦ Quabbin Reservoir Video (0:00-3:47): https://www.youtube.com/watch?v=2SBMETX4rgM&t=364s • Who owns water? (18 min) with pauses in between to discuss - 25 min <ul style="list-style-type: none"> ◦ Explained episode (Netflix)- The world’s water crisis (18 min) 2:00-9:00 ◦ CBS Newscip - Nestlé faces backlash over collecting water from drought-hit California (0:00-3:14): https://www.cbsnews.com/news/backlash-bottled-water-nestle/ ◦ Water Protection/Activism - against Nestle corporation (0:00-7:28) <ul style="list-style-type: none"> ▪ Video: https://storyofstuff.org/movies/our-water-our-future/ ▪ See article for more: https://storyofstuff.org/blog/who-owns-the-water/ ◦ Water and Power: The California Heist (Netflix) <ul style="list-style-type: none"> ▪ 7:19-10:12 water inequities (between civilian use of water and agriculture corporations) ▪ 10:12-12:13 brief history of water wars in California <p>Science Discussion- 27 min</p> <ul style="list-style-type: none"> • Break out groups where they take an aspect of the video and define the problem, explain any solutions (given or what they've thought of) and discuss the applications <ul style="list-style-type: none"> ◦ Should we be taking water from aquifers? ◦ Should water be privatized? ◦ How should we balance agricultural and personal use? <p>10 minutes to discuss, 3 minute each group share-out</p>	
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	<ul style="list-style-type: none"> Whole-group discussion (using video guiding questions as a starting point) (7 min) <p>Additional resources</p> <ul style="list-style-type: none"> Capetown: https://www.theguardian.com/world/2018/may/04/back-from-the-brink-how-cape-town-cracked-its-water-crisis Bangalore water crisis: https://www.bbc.com/news/world-asia-india-43252435 11 cities most likely to run out of water - https://www.bbc.com/news/world-42982959 Teen used nano-technology to solve water problem - https://www.nytimes.com/paidpost/google/how-teens-are-using-tech-to-solve-some-of-the-worlds-biggest-problems.html?cpv_dsm_id=191153286&sr_source=lift_morein&tbs_nyt=2018-nov-nytnative_morein 	
11:30-12:30	Lunch	
12:30-3:20	<p>Rap-a-Thon (Workshop with Kevin)</p> <ul style="list-style-type: none"> students will reflect on the areas of study from the past sessions Students will explore different methods of brainstorming and drafting Students will explore A/B rhyme scheme thru puzzle method Students will have time to edit their 8, 12, or 16 bar verses on steam topic of choice Students will practice over instrumentation and share Ensure students have time to create their storylines for next semester <ul style="list-style-type: none"> By Dec 8 students have created... <ul style="list-style-type: none"> Character list Synopsis of what their play is going to be about (local, national, global reference) Setting (place/time) Give them a binder with all of their work (basically an outline of their play)- talk with Kevin about what this could look like. Do we need this? 	<p>Ariella</p> <ul style="list-style-type: none"> -Kevin needs whiteboard/blackboard -Ask Kevin: can we film some of the rapathon stuff? -When would be a good time for cake/pie with the kids

	<ul style="list-style-type: none"> ○ They will continue to work on their plays (script) in spring. • Fill in a break whenever appropriate 	
3:20-3:30	<p>Reflection (5 minutes for writing, 5 minutes for share-out)</p> <ul style="list-style-type: none"> • We've done a lot this year so far related to understanding the experiences people have with water, and how a lot of those experiences are negative -- whether it has to do with inequitable access to water or unclean drinking water <ul style="list-style-type: none"> ○ What have been some things that stood out to you over the semester? • Equity and water access • Empathy: perspective-taking (putting yourself in someone else's shoes) <ul style="list-style-type: none"> ○ Why is it important for scientists to feel empathy, or to put themselves in someone (or something) else's shoes when doing science? Think of some examples related to the work we've done with water this year ○ Why is it important for theatre artists to feel empathy, or to put themselves in someone (or something) else's shoes when doing theatre? Think of some examples related to the work we've done this year • Closing: you've been engaging in empathy/perspective taking this semester 	<p>Ariella -- set up the following:</p> <ul style="list-style-type: none"> • Print sheets with questions and bullets • Relational map and supplies (for earlier) • Prepare past work paperclipped into binders • Provide writing utensils for rapathon

Why water? Where does it come from? Who controls it?

- Why should we care?
 - Where does your water come from?
 - Why are we worried about water? (water access and scarcity)
 - Why can't we swim in the Charles River?
 - Different water sources in the area and who has access?
 - We originated in water; we are made of water

Access to Water

- **Power: Who controls it**→ who makes that decision on where your water comes from
- Look at other countries' access to water (taken for granted in the US)
- Limited resource and overpopulation
- Consumerism: Water footprint - story of a water droplet (here or in another part of the world)
 - Look at water footprints here and across the world (create some sort of game)
 - Water calculator <https://www.watercalculator.org/>
- Ocean pollution→
 - plastic islands
 - Effects on fish and effects on communities that depend on fish
- Water protectors (Native Americans who are fighting against gas companies to protect water; how are we complicit in this?)
- Who has control of rivers→cutting off water access (America cut off water access to Mexico) - look up documentary on this?
- Future of water

Water Quality/Pollution

- Experiment
 - Different samples of water (Ss could bring in different samples from home and school, Charles, harbor, BC reservoir, bottled water, storm runoff)
 - Test for different pollutants
 - Test for lead
- How did the pollutants get there (could lead to research later)
-

Connection to People

- How to clean your water (Jamaican commercials)

<https://www.youtube.com/watch?v=pGkqjT2YfIc> Jamaican water quality infomercial
- Water-related illnesses
- Malaria
- Look up: Flood in Hyde park? Contaminated water - Related to cancer? Jennifer will follow up with Ashley Rose on this research - Ashley Rose is interested in coming to speak to the students- also referred us to the PBS stories from the stage episode: 7 Deadly sins: <https://www.pbs.org/video/deadly-sins-wjjaj0/>
- <http://www.wbur.org/news/2011/05/22/ma-superfund-sites>

Activities

- Water testing -
 - look at water under microscopes
- How to clean your water
 - Build a water filter - discuss limitations (how do you kill bacteria)

Theatre Sessions (draft)

Session 1: Breaking the Ice and Ensemble Building

Session 2: Storytelling (Nature Walk)

Session 3: Guerilla Street Theatre

Session 4: Vignettes/Sketch (RCT)

Session 5: no class

Session 6: Rap-a-Thon

Session Ideas (brainstorm)

Storytelling/Theatre Styles

- Improvisation

- Vignettes/SNL style short scenes)

- Rap/Hip Hop/Poetry/Spoken Word

- Movement (mime/dance) vs Tableau (frozen pictures)

- Multi-Discipline Story Telling (writing inspired by art) (i.e. create your own, find art that already exist and connect it to a written piece for performance)

- Voice over/radio play/podcast

- Melodrama

- Farce/Satire

- Film

- Guerilla Street Theatre

*how to we help them bring their experience in their own communities into their work (i.e. community walks, physical Instagram posts of important neighborhood sites)

*life map ice breaker (potential connection here to STEM/Career mapping in the STEM career sessions?)

Theatre Flow

Part 1: Activity (i.e. Story Map, Nature Walk) Group Experience

Part 2: Storytelling Style Intro (Teacher Led)

Part 3: Putting it together (Student work)

EarSketch Music between scenes

Field Trip Options

Nov 17th Watertown Children's Theatre

SPRING The Strand Theatre Dorchester

SPRING BCA

Test kits to order?

<https://www.amazon.com/Drinking-Water-Test-Kit-Pesticide/dp/B01DMF8SH6>

Water footprint

<http://waterfootprint.org/en/resources/interactive-tools/product-gallery/>

<https://www.watereducation.org/post/food-facts-how-much-water-does-it-take-produce>

<https://www.treehugger.com/clean-technology/how-many-gallons-of-water-does-it-take-to-make.html>

Cool infographics about water

<https://www.seametrics.com/blog/water-infographics/>

Who owns the water?

<https://storyofstuff.org/blog/who-owns-the-water/> (this was quite good) - the movie:

<https://storyofstuff.org/movies/our-water-our-future/>

They also have a good video on bottled water: <https://storyofstuff.org/movies/story-of-bottled-water/>

The future of water: 3 part video

<https://www.netflix.com/title/80114499>

One idea is that we could have kids test different filters for getting lead out of water...

Good water filter activity:

<https://extension.usu.edu/waterquality/files-ou/Lesson-Plans/Homemade-water-purifier.pdf>

Just information for research on water quality:

<https://www.safewater.org/water-quality-information/>

The water project:

Getting clean water into areas around the

world: <https://thewaterproject.org/resources/lesson-plans/>

Youtube water protectors:

https://www.youtube.com/watch?v=Wz8kDZ_a-8I

Where my water comes from?

<http://www.mwra.com/04water/html/watsys.htm>

Boston's lead water

map: http://www.bwsc.org/COMMUNITY/lead/leadmaps.asp#TOP_PAGE

Is Boston's water safe?: <https://newbostonpost.com/2016/03/09/how-boston-gets-its-water-and-how-its-treated/>

Can you drink Boston's water?: <https://tappwater.co/us/can-you-drink-boston-tap-water/>

Session 3

Session 7: 2.5 hours
 Session 8: 5 hours (excluding lunch)
 Session 9: 2.5 hours
 Session 10: 3 hours
 Session 11: 2.5 hours
 Session 12: 2.5 hours
 Symposium day: 1 hour prep
 Total hours = 19 hours

Session 7: Saturday, February 2 (Theatre & Science) 9-11:30am	Materials
<p><i>Check-in Circle</i></p> <p><i>Goal/ Norm Setting- Decorating norms and signing- Respect- Vulnerability (create a communal mural with norms)</i></p> <p><i>Ice-breaker/ Game- what are your interests (questionnaire style but movement) - frame this as we want to get an idea on what you're interested in for the final product</i></p> <ul style="list-style-type: none"> <i>What are your skills:</i> <i>Movement Questions:</i> <ul style="list-style-type: none"> <i>Which form of art excites you the most? Visual Arts- Drawing, Video/ Animations, Slides, Dance-Movement, Music- Rap/ Poetry, Theatre- Making things with your hands, Speaking</i> <i>Which are you most afraid of?</i> <i>What do you know the least about?</i> <i>What is the thing mom wishes you would do more/ less of?</i> <i>Put your hand on the shoulder of someone who you think is: funny, want to get to know more about, good leader, is really kind</i> <i>Journal Questions:</i> <ul style="list-style-type: none"> <i>What do you like most about science?</i> <i>What do you like most about theatre?</i> <i>What do you wish you knew more about?</i> <p><i>Nominate: One Youth Advisory Board member</i></p>	
<p>What have we learned so far, what do we remember- pop quiz-kahoot?</p> <p>What's important to you around water?</p> <p>Summary of theme and knowledge we should have- Processes- Data use</p>	

	<ul style="list-style-type: none"> For reference, here are our goals (connections between science, engineering, and theatre practices) 	
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Session 8: Saturday, February 9 (All day session - both Science and Theatre) 9-11:30am & 1-3:30		Materials
9-11:30am &	<p><i>Opening circle/check-in (9-9:30)</i> <i>Review norms</i></p> <p><i>Gallery walk- pictures of SJ issues related to water (9:30-9:38)</i></p> <p>Pictures and articles</p> <p><i>Groups (9:38-10:15)</i></p> <ul style="list-style-type: none"> <i>Which picture speaks to you, join that group, read and dissect article* -facts and data (headline-and blurb)-</i> <ul style="list-style-type: none"> <i>Guiding questions for the article - how is water affecting this community?</i> <i>Write your <u>reactions</u> (multimodal- draw, write)</i> <p><i>Presentation scaffold- Topic, Medium... (10:15-10:45)</i> <i>Share out to group- What do we need to know?</i></p> <p><i>Modes to choose from:</i></p> <ul style="list-style-type: none"> <i>Visual art (drawing)</i> <i>Verbal explanation</i> <i>Story</i> <i>Poem, spoken word</i> <i>Dance, movement</i> <i>Acting</i> <p><i>Presentations (10:45-11:20am)</i></p> <p><i>Reflection question to think about over lunch:</i></p> <p><i>How can art (visual art, dance, songs, etc.) communicate [ideas, messages, opinions,</i></p>	<p>Pictures</p> <p>Articles (or short excerpts)</p> <p>Reflection maps</p> <p>Ariella:</p> <ul style="list-style-type: none"> Copies of blank materials list (for them to put in request for materials) 5-6 extra consent and assent forms

	<i>feelings...] about science and social justice issues in our everyday lives?</i>	
	<p>After lunch: start with town-hall meeting</p> <p>Check-In Meeting Game</p> <p><i>Examples: social-justice-driven STEAM</i></p> <ul style="list-style-type: none"> • <i>Discuss trigger warning</i> • Aisha Fukushima (Catherine Wong's friend): • <i>Share video:</i> https://www.youtube.com/watch?v=jCHoE-RQsGQ <p><i>Visual Art examples</i></p> <ul style="list-style-type: none"> • https://theculturetrip.com/africa/south-africa/articles/how-cape-towns-water-crisis-is-inspiring-its-artists/ <p><i>Social-justice-driven STEAM: Review Examples</i> <i>Poems, Monologues, installation related to situation</i></p> <ul style="list-style-type: none"> • <i>PBS Poem Link</i> https://www.pbs.org/newshour/arts/poetry/these-young-poets-show-theres-more-to-flint-than-a-water-crisis <p><i>Thinking about the art pieces you just experienced - how are science (or engineering) and theatre embedded in these pieces? (How are science & engineering skills used in art & theatre? How are theatre & art skills used in science?)</i></p> <p>Broad stroke overview of the final project Students decide how they want to contribute to the final project→</p> <ul style="list-style-type: none"> • Group them by art discipline→ make groups within each disciplinary group • Each group makes materials list <p>Break into smaller groups and start planning?</p>	
3:20-3:30pm	Reflection:	

- 3 students - 1 nominated by Ss, 2 nominated by instructors; Ss can nominate themselves;
- additional stipend \$100
- Meet during bfast or lunch → voice moving forward

Summer availability: CB Summer Camp (July 8-25th, Mon-Thurs @ 8:30am-3:30pm)

Session 9: Saturday, March 16 (Afternoon Session - Theatre Day) 1-3:30		Materials
	<i>Check-In / recap norms</i> <i>Recap last week</i> <i>Game</i> <i>Review what everyone has decided what they wanted to do; confirm choices (one switch... "I don't know" = original choice)</i> <i>Break (1:45-2:00)</i>	<p>Copies: Permission slips (Field trip on 4/27) -- Ariella will make copies (housed in agenda for 3/8/19)</p> <p>6 copies of consent/assent forms (MAKE SURE WE GIVE THEM OUT)</p> <p>Paper Markers Colored pencils [+ materials Ss request]</p>
	<i>Independent work time with instructor supervision</i> <i>Small group share time (explain your goal/project idea, what you've accomplished so far, what questions you have, your next steps, etc.)</i>	
3:20-3:30pm	Reflection (Megan): <ul style="list-style-type: none"> • Show video: Movie trailer • Prepare wordbank w/ 11 skills • Ss will put words into: https://www.sli.do/ 	<p>Slides w/ video and wordbank</p> <p>Devices</p>

Session 10: Saturday, March 30 (Afternoon Session - Science Day) 12:30-3:30pm	Materials
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<p><i>Check-In / recap norms</i></p> <p><i>How to communicate scientific information: Water infrastructure graph example, visuals, graphs, data (knowing what it means- what story does this data show?) Staying true to facts- tone, misinformation</i></p> <p><i>Activity: Tile Graph Activity (see Data Mosaics)</i></p> <p><i>Giving feedback- Liz Lerman (Critical Response Process - focuses on neutral, and non-evaluative feedback)</i></p> <p>https://lizlerman.com/critical-response-process/</p> <p>How to use statistics to make a point</p> <ul style="list-style-type: none"> • 2016 lead testing in BPS Schools (From Boston25News) • Charles River Water Timeline • Lead buildings: Map of Boston 	<p>Pick up: Permission slips (Field trip on 4/27)</p> <p>Laptops (13)</p> <p>Canvas or tiles</p> <p>Sharpies (all colors)</p> <p>Data sheets (see folder)</p>
Topic and 3 facts about the topic. Why does it matter to them and what could they do to spread awareness or how to correct it.	
Reflection:	

Session 11: Saturday, April 6 (Theatre Day) 9-11:30am		Materials
	<p><i>Check-In / recap norms</i></p> <p><i>Share-out- Give/ Get feedback</i></p> <p><i>Giving feedback- Liz Lerman (Critical Response Process - focuses on neutral, and non-evaluative feedback)</i></p> <p>https://lizlerman.com/critical-response-process/ -Review</p> <p><i>Individual Work time</i></p>	
11:20-11:30am	Reflection:	

<p>Session 12: Saturday, April 27 (Symposium Prep Day) 9-11:30am</p> <ul style="list-style-type: none"> • Kevin available 	Materials
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	<p>Water Respect & Responsibility See Lyla's notes from Session 11</p> <p>Groups of 3 working on:</p> <ul style="list-style-type: none"> • Game • 30 second ads • News hour • Posters (PSAs) • Cartoons 	<p>Materials for Game</p> <ul style="list-style-type: none"> *large coin *Scenario cards (notecards) *role cards (5 colors - each role is a dif color) *lego figures (game pieces) * sturdy cardboard posters for gameboards *props for each role??? <p>Materials for Posters, 30 sec Ads, PSAs:</p> <ul style="list-style-type: none"> *video equipment *posters *tiles <p>Flyers: Kevin's show on May 4th at 8pm (free): This Place/Displaced</p>
11:20-11:30am	Reflection:	
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CB Youth Symposium: Saturday, May 4th (TBD)	Materials
<ul style="list-style-type: none"> • Lyla out (double shows) 	
<p>Go over draft schedule for May 4th</p> <p>Morning: finalize and practice for their presentations in the afternoon</p> <ul style="list-style-type: none"> • Afternoon: present 	<p>Symposium materials (e.g., board games, posters, markers)</p> <p>Voting papers - summer strands</p>

Dates to remember

- Feb 5, 2019 Lyla's show-
- May 9th: Jennifer is presenting at the Boston Ed Talk (<http://www.bostonedtalks.org/>)

Reminders

- T-shirt design (CB science-theatre t-shirt)