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Preparing UTA students for careers in research and teaching since 1990
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This year’s class of McNair Scholars is now the first to complete their experience at the newest Tier One National Research University in the State of Texas. Just weeks ago, the University of Texas at Arlington became fourth in the state to accomplish this goal since the Tier One process began. This achievement recognizes our highly qualified student body, our distinguished faculty, our high research productivity, and our doctoral education programs. The Tier One distinction in the State of Texas is similar to the national distinction that UTA earned a few years ago: being named a Carnegie R1 University, one with very high research activity.

Our designation as a Tier One University brings tangible benefits of access to funding from the State of Texas that will be invested into our research enterprise to benefit students and faculty across the campus. The intangible benefits are more important. The degrees that McNair Scholars earn at UTA are now more valuable, certifying that our students have studied and succeeded at a preeminent institution under the guidance of esteemed faculty.

Becoming a Tier One Research University took UTA many years, and the work of many students, staff, and faculty went into this accomplishment. The process led us to develop a strategic plan and an intentional approach, focusing on academic excellence. We did this while maintaining our historical accessibility to the population of the Dallas-Fort Worth region, and while attracting one of the most diverse student bodies in the country. We have come to understand and value our identity as an institution of both access and excellence. We are an urban-serving, minority-serving, and veteran-serving institution that is also an emerging powerhouse of research, scholarship, and innovation. Only a handful of other universities in the U.S. share these characteristics.

The McNair Scholars Program is an important part of what UTA offers to students, and it is an ideal match for what we have become. The McNair Program emphasizes recruiting students from low-income/first-generation or under-represented backgrounds and providing the mentoring and support needed for them to become outstanding scholars, on their way to doctoral studies and beyond. The McNair Scholars at UTA already know that this institution provides every opportunity for excellence and achievement, but now there is enhanced State and National recognition of this fact. McNair Scholars can wear the Maverick colors with pride while working towards completing their degrees and taking the next steps in their studies and their careers. They are prepared for leadership, innovation, and impact.
NOTES

FROM THE DIRECTOR

Kenyatta Y. Dawson, Ph.D.

The heart of a Tier One Research University is the interaction of research faculty and students through mentorship and authentic scholarship. This showcase is an embodiment of that heart. We are grateful to many of our students who, despite having to make tremendous adjustments to their new learning environments, have risen to these challenges and worked hard to not only ensure that their work be represented, but also accessible to audiences.

The McNair Scholars program is a national initiative that bolsters students to earn their doctorate through undergraduate experiential learning and assistance with applications to graduate programs. It serves undergraduates from first-generation/low-income and/or underrepresented ethnicities. The 2021 edition of The University of Texas at Arlington McNair Scholars Research Journal includes five complete manuscripts and eight abstracts by this year’s summer researchers.

In conclusion, we would like to thank Interim President Dr. Teik Lim, the Interim Vice President for Research Dr. James Grover, and the Dean of the Library Rebecca Bichel. Similarly, our faculty mentors, supervisors, and staff have shown immense support and commitment to our students – learning even as they themselves are adjusting. Our students have benefited from our faculty, staff, and peers in ways that we cannot easily measure, but are extremely appreciated. On behalf of The Office of Undergraduate Research, we hope that you enjoy reading!
The McNair Scholars Program (officially known as the Ronald E. McNair Post-Baccalaureate Achievement Program) came to the campus of The University of Texas at Arlington in 1990. Created by the U.S. Congress in 1988, it is named after Dr. Ronald E. McNair, who perished with his fellow astronauts on the space shuttle Challenger two years earlier. The McNair program endeavors to assist talented undergraduates – either first generation and low-income or underrepresented students – to prepare for graduate study leading to the Ph.D. and the professoriate.

Since its beginning at UT Arlington, the McNair program has encouraged and assisted over 400 scholars in various majors. Currently, it works with 34 students each academic year, providing seminars and classes on topics related to graduate school and the GRE, a May institute to heighten scholars’ understanding of the culture of research, and a summer research internship. The program also provides guidance with the graduate school application process and travel funds to participate in conferences and visit prospective graduate programs. UT Arlington McNair graduates have subsequently earned masters and doctorates not only from their alma mater, but also from an impressive array of universities including Harvard, Indiana, Rice, and Southern Methodist, among others.

The McNair Scholars Program enjoys strong support from the UT Arlington administration and greatly benefits from the expertise and enthusiasm of both faculty and staff. Faculty members who serve on the McNair Selection Committee and those who act as mentors to McNair interns deserve special recognition. Members of the 2021-2022 Selection Committee include the following UTA faculty and staff: Dr. Karishma Chatterjee (Communication Studies), Dr. Kenyatta Dawson (Office of Undergraduate Research), Dr. Joe Jackson (the Graduate School), Dr. Qing Lin (Psychology), Dr. Cesar Torres (Computer Science and Engineering), and Dr. Debra Woody (Social Work).
SCHOLARSHIPS

Friends of UTA Libraries

Calyha Brown (English) and Caroline Carter (Microbiology) are the 2021 winners of the Friends of the UTA Libraries Scholarship for McNair Scholars based upon the excellence of their papers and presentations. Their papers will be published in the UTA McNair Research Journal along with the work of two additional scholars who were also awarded by the Library for their excellence in research: Kalvry Cooper (Psychology) and Perla Rodriguez (English). Ana Segovia (Physics) was also recognized for her paper and presentation but is not publishing her research at this time.

The scholarship recipients were determined by this year’s Friends McNair Scholarship Committee: Alessia Cavazos, Undergraduate Success Librarian; Milaun Murry, Experiential Learning Librarian; and Katherine Williford, Learning Resources Librarian and Interim Director of Open Educational Resources. A heartfelt thank you to Yumi Ohira, UTA’s Digital Publishing & Repository Librarian, and her team for producing the journal and publishing on UTA’s ResearchCommons! The McNair Scholars Program congratulates its 2021 scholarship winners and thanks the UTA Library for their continued support.

Kathryn A. Head

The Kathryn A. Head Scholarship was awarded in Summer 2021 to Honors student Allison Fenske (INTS/Construction Management) for her outstanding mentor recommendation and commitment to the goals of the McNair Scholars Program. Allison’s work this summer focused on researching green methods of construction, namely concrete composites with recycled plastic. Allison recalls facing new challenges during the summer research internship including pouring concrete for the first time, in Texas heat nonetheless, and preparing a graduate-level research manuscript. She says Scholars have to be “tougher than concrete” to succeed.

The Kathryn A. Scholarship is funded by an endowment, which honors the life and legacy of Kathryn Head who served UT Arlington students in many roles from 1978-2009. This year’s Selection Committee was comprised of Scholarship Chairperson Natalie Stephens, M.Ed., McNair Scholars Program Coordinator; Kenyatta Dawson, Ph.D., Office of Undergraduate Research Director; and Fidel Zapata, M. Ed., Upward Bound Math and Science Coordinator.
Exemplary Senior Scholar

The Office of the Vice President for Research provides support for McNair Scholars in a variety of ways, including, but not limited to, scholarships for summer research as well as scholarships to help defray the costs associated with making the transition to graduate school. Outstanding senior scholars who apply to begin graduate school the fall immediately after finishing their undergraduate degree receive a UTA scholarship from the Office of the Vice President for Research. Congratulations to all of our graduates, including the following recipients of the 2021-2022 Exemplary Senior Scholar scholarship: Calyha Brown, Caroline Carter, Kalvry Cooper, Allison Fenske, Archit Jaiswal, and Ephrem Kejela.
African American Vernacular English (AAVE) is a logical rule-governed dialect that is spoken by many people of African descent within America. Within the education system in America, we see that “standard” English is heralded above other languages and dialects. English curriculum has been geared toward mastering this form of “acceptable” English in order to succeed within academia. Within Texas these curriculum standards and practices are regulated by the Texas Education Agency and monitored through the distribution of state-wide formal assessments. This research sought to uncover the status of AAVE within the Texas education system despite its deviation from “standard” English. The study utilizes a combined approach of deductive analysis and thematic content analysis. Seven participants from varying educational occupations and backgrounds within our targeted geographical location were interviewed. The data revealed that due to the institutionalized racism prevalent within the Texas education system, many educators feel the need to uphold state-mandated standards in order to best navigate students through academia, despite the fact that their pedagogy may neglect other dialects, such as AAVE. Institutionalized racism has inevitably impacted students’ literacy engagement and is the source of the stigma placed upon AAVE within the Texas education system.
INTRODUCTION

Increasingly, educators are attempting to incorporate antiracist principles into their teaching, but the path forward is not always clear. Teachers who believe they have been working toward racial equality may learn that from an antiracist perspective their practices actually reinforce white normativity. For example, a well-intentioned educator who has worked for years to close the achievement gap between Black and White students might be confronted with the antiracist position that the achievement gap is a myth and that to believe in it reinforces white supremacy. This is in fact the position of Ibram X. Kendi (2019), perhaps the most popular antiracist thinker in the U.S., who points out that the primary measures by which we document the “achievement gap” are standardized tests whose validity are undermined not only by the test-prep industry but also by the knowledge deemed worthy of measuring. Kendi asks:

What if different environments lead to different kinds of achievement rather than different levels of achievement? What if the intellect of a low-testing Black child in a poor Black school is different from—and not inferior to—the intellect of a high-testing White child in a rich White school? What if we measured intelligence by how knowledgeable individuals are about their own environments? (p. 103)

For ELA educators, one “different kind of achievement” that is not measured by literacy tests is fluency in African American Vernacular English (AAVE). Although the National Council of Teachers of English (1974) affirmed AAVE’s equal status with all other varieties of English nearly 50 years ago, it remains unclear how best to translate this position statement into classroom practice.

The most famous controversy in the history of AAVE educational policies reveals that a commitment to racial equality does not necessarily translate into antiracism. On the Sunday after the Oakland Unified School District passed its Resolution on Ebonics in 1996, Jesse Jackson appeared on Meet the Press and called the resolution “an unacceptable surrender, bordering on disgrace” (qtd. in Lewis, 1996, p. B9). From the perspective of Jackson, who had spent his entire career fighting for racial equality, the legitimization of AAVE in majority-Black schools risked exacerbating an achievement gap between White and Black students that he assumed was real. In contrast, the Ebonics Resolution articulated a more strongly antiracist position in calling for “instruction to African-American students in their primary language” for the purpose of “maintaining the legitimacy and richness of such language” (Oakland, 1997, p. 3). Although Jackson quickly reversed course and announced his support for the resolution, this reversal was not a victory for antiracism. Oakland officials mollified Jackson by assuring him that Ebonics would be “used to help students learn to write properly and distinguish among incorrect grammar, slang and standard English,” and Jackson continued to insist that “Ebonics is at best a language pattern. It is not a language” (qtd. in Ferriss, 1996). From the perspective of an antiracist like Kendi (2019), Jackson’s position is “assimilationist,” for it positions a version of English endorsed by the White establishment as “the superior standard that another racial group should be measuring themselves against, the benchmark they should be trying to reach” (p. 29). And Kendi is unequivocal about assimilationism: “Assimilationist ideas are racist ideas” (p. 29).

Given the increased attention to racial justice more broadly and antiracist education specifically, ELA teacher educators must be aware of the status and treatment of AAVE in K–12 institutions and perhaps reconsider the advice we give preservice and in-service teachers about how best to capitalize on AAVE proficiency. In this study, we contribute to recent research (Diehm & Hendricks, 2021; Metz, 2018, 2019; Razfar, Rumenapp, & Torres, 2020;
Wheeler, 2016; Woodard & Rao, 2020) that documents how AAVE is perceived and treated in classroom settings. We extend this work by drawing on a new data source: interviews with experienced Black educators who are themselves fluent in AAVE, have capitalized on this fluency in instructional settings, and who have seen up close how perceptions of AAVE among students, teachers, administrators, and community members affect literacy education for students whose primary dialect is AAVE. We draw on interview data not only to describe the current status of AAVE in schools but also to propose possible approaches to antiracist teacher education on matters of language ideology.

**LITERATURE REVIEW**

Over the past 20 years, researchers have found that all groups of education stakeholders misunderstand and stigmatize AAVE. For example, Razfar, Rumenapp, and Torres (2020) conducted focus groups with 15 administrators at majority-Black schools and found that, while many believed AAVE could be used as an educational resource for connecting with Black students, they also tended to believe AAVE “was a lesser variety of English and had no currency in mainstream U.S. society” (p. 16). Administrator beliefs about linguistic diversity are significant because research suggests they influence teachers’ own beliefs and classroom practices (Blake & Cutler, 2003), and the longer a teacher works within a school culture that marginalizes AAVE, the more strongly that teacher will internalize a negative view of AAVE (Metz, 2019). Indeed, two massive surveys of teachers in Ohio (Diehm & Hendricks, 2021) and Missouri (Metz, 2019) found that even though most teachers reject the assumption that AAVE is inherently inferior to other varieties of English, they do not think it appropriate for classroom instruction. The tension between teachers’ beliefs in the legitimacy of AAVE and their failure to honor it in their teaching has been explored in several case studies (Godley, Carpenter, & Werner, 2007; Metz, 2018; Orzulak, 2015; Wheeler, 2010; Woodard & Rao, 2020). In one such study, Metz (2018) observed five San Francisco teachers, all of whom expressed respect for linguistic diversity, in the context of a unit on *Their Eyes Were Watching God*. Even under such favorable conditions, in which a group of informed teachers introduce a novel that employs AAVE to great effect, all but one teacher drew on “readily available discourses that position S[standard] E[nglish] as unmarked, normal, and correct” (p. 473). Given that teachers and administrators send a consistent message that AAVE has no place in the curriculum, it is perhaps not surprising that students and caregivers whose primary dialect is AAVE often internalize the belief that AAVE is simply inappropriate in school (Baker-Bell, 2020; Delpit, 2006; Kynard, 2013; Ogbu, 1999; Orzulak, 2015).

Complicating research into educators’ perceptions of AAVE is the fact that most teachers and administrators find themselves accountable to state-mandated standards and assessments that they had no hand in constructing and that only recognize “standard English” (Godley & Reaser, 2018; Wheeler, 2016). In a careful examination of the Common Core State Standards (CCSS), Denham (2015) notes that despite the promise of a “Language” strand in the ELA standards, linguistic diversity is addressed only in the context of understanding literary texts that use marginalized varieties of English. Furthermore, Denham demonstrates that published curriculum materials and state assessments narrow the CCSS conception of language to “standard English,” and she concludes that “when assessment is used to evaluate not only students, but also teachers and schools, test creators control the curriculum” (p. 140). In such a high-pressure environment, where everyone’s success depends on cleaving to a single variety of English, teachers’ beliefs about language are largely beside the point. Consider Jacobs’s (2019) study of 10 first-
year teachers who had received extensive training in sociolinguistics and who professed a strong commitment to linguistic diversity. Early in the school year, the teachers validated students’ home language practices and incorporated these practices into instruction and assessment. But as testing season neared, the teachers began to express the language ideology implicit in state assessments and to address students’ home language practices as deficits to be overcome. These teachers had not forgotten their training; rather, as one put it:

I’m stuck, you know? Because when I make assignments where the kids can use AAVE . . . then I worry I’m not preparing them. And my principal worries too, because our charter requires us to do as well or better than public schools on the [state test]” (p. 2).

The marginalization of AAVE in classroom settings represents a missed opportunity. A vast body of research demonstrates that teachers can capitalize on students’ knowledge of AAVE to improve their performance on SE literacy tasks (Craig, 2016; Fogel & Ehri, 2000; Godley & Escher, 2012; Hill, 2009; Johnson et al., 2017; Lee, 2006; Rickford, 1999; Wheeler & Swords, 2006, 2010; Wolfram, 1999). For example, Johnson et al. (2017) increased reading comprehension scores among second, third, and fourth graders by providing them with explicit instruction in the dialectal differences between home and school English. Researchers helped students identify occasions in which they were likely to encounter SE and adjust accordingly, but they also made a point of validating both dialects. Similarly, Wheeler and Swords (2010) increased writing test scores through a program that helped students recognize systematic differences between AAVE and SE and practice code-switching, all without engaging in deficit or correctionist language. Of course, even these well-intentioned programs have come under increased scrutiny from antiracism scholars who argue that teaching students to code-switch puts the responsibility on students to avoid anti-Black discrimination (Baker-Bell, 2013, 2017, 2020; Alim & Smitherman, 2012; Lippi-Green, 2012). In the words of Baker-Bell (2020), “any approach that does not interrogate why students of color are required to code-switch and only acknowledges their native tongues as a bridge teaching to learn W[hite] M[ainstream] E[nglish] perpetuates linguistic racism and upholds white linguistic and cultural hegemony” (p. 9). But while scholars disagree on the question of whether students should learn code-switching, all agree that the stigma attached to AAVE by educators, students, and community members, as well as the monolinguism implicit in state-mandated standards and assessments, perpetuate linguistic racism and fail students whose primary dialect is AAVE.

**METHOD**

Our deductive analysis works in concert with the wording of interview questions to target those obstacles to acceptance of AAVE that have been documented in previous research (i.e., preconceptions among school staff, parents, and students). The thematic content analysis allowed us to identify themes that arose organically from the data. All are educational professionals in Texas who have written or spoken in public, professional settings about the role of AAVE in literacy education. Semi-structured interviews were conducted via video conference.
Educators and Administrators’ Sentiments toward AAVE within Texas Education System

According to the data gathered many educators and administrators do not believe that AAVE is a rule-governed dialect equal to all varieties of English. All the interviewees felt as though AAVE is not respected as a dialect and that it is even looked down upon. London Bay, and advance placement educator in the Oak Cliff area states that the use of AAVE may even be looked at as problematic. Bay states, “But that’s definitely something that’s pushed out to our kids as a whole from the educators on my campus is that anytime they used any deviation from standard American English, is problematic.” Tamara Barns explains how “at least 70% of educators have no idea what that acronym even is or its extent or philosophy, or the education around it…” This data also shows that some teachers agree that there are informal structures at play that do limit the practice of AAVE within the classroom for instructional purposes. One of the educators who agree was Laura Simmons, an ELA content designer for an EdTech company. Simmons explains how there are so called “workarounds.” She states, “I have never encountered, you know, someone saying you can’t use this dialect in your instruction. But I do see the workaround and protocols in written curriculum.” Sara Moore, another educator who taught English for 10 years alludes to this informal structure as well, stating that “[I] have heard a lot that you can’t do. You can’t speak in front of students and use improper English. A lot to where it’s documented on your appraisal, your ratings can be lowered.” Other educators believed that there are not any informal policies, but Tamara Barns admits that she believes this is due to the data that she has produced within the classroom. Barns states, “You know, I’ll say I’m mostly supported. And I’ll tell you why. Because my data reflects that what I am doing with them works, right.” She goes on to explain how her authenticity with the students creates a bond with them and they end up engaging with the curriculum rather than

Table 1. Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
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<tbody>
<tr>
<td>London Bay</td>
<td>AP language educator</td>
</tr>
<tr>
<td>Monica Bone</td>
<td>Teacher Specialist</td>
</tr>
<tr>
<td>Tamara Barns</td>
<td>Literacy development organizer Secondary ELA coordinator Sheldon ISD</td>
</tr>
<tr>
<td>Jade Cathway</td>
<td>ELA teacher for Desoto ISD</td>
</tr>
<tr>
<td></td>
<td>Instructional facilitator for elementary ed</td>
</tr>
<tr>
<td>Dr. Kassidy Jones</td>
<td>Lecturer at University of Houston Activist Literacy consultant</td>
</tr>
<tr>
<td>Sara Moore</td>
<td>Teacher specialist</td>
</tr>
<tr>
<td>Laura Simmons</td>
<td>ELA EdTech content designer</td>
</tr>
</tbody>
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resisting her. It is important to note, though, that many of the teachers that were able to practice the use of AAVE within the classroom were not in predominantly White school areas. In such cases, it is more common for teachers to be aware of AAVE, and the language presences is apparent. When it came down to the informal or formal policies in regard to students’ use of AAVE in the classroom, the interviewees all admitted that once again although there are not formal policies there are informal policies and structures that push students toward standard American English. Simmons explains that “the power is in the curriculum. And that’s how school districts work [their] way into boxing students into speaking proper English.” Within the Texas education system all our interviewees believe that standard English is heralded above all other languages, and this is largely due to the TEKS and formal assessments within the Texas education system, which we will examine in another subsection.

Students’ Beliefs about AAVE

According to the interviews six out of the seven interviewees admit that most K–12 students are aware of AAVE. Although some interviewers highlight that the students may not have the correct terminology for the vernacular in which they speak they are aware of its status and feel strongly about the way that they speak. Dr. Kassidy Jones, a lecturer at the University of Houston and a literacy consultant, admits that “some, I think, at this point, recognize that the way they speak is fine, and that it’s okay.” Simmons says that students will advocate for themselves and that they believe that how they speak is normal because that is mostly what they grew up around. However, she admits that once they go through the “system” the ideology that their language is “good” and “acceptable” changes. Two categories arose when we asked how common is it for students whose native dialect is AAVE to be aware of its social stigma? The first category set was that they were aware of the negative stigma but that their reactions are different, and the second category highlights the consciousness of the stigma due to the demographic in which they are surrounded. The first category points out that many students are rebellious while some conform in order to succeed within the system. Barns explains this truth really well by saying, “You know, so for African Americans, I think it’s more of a movement of resistance. If it is not embraced....” She adds, “But I also think that students have learned because of adults, and how we instruct students, I think they have learned how to switch registers without even knowing they’re switching registers.” This register switch is known as code switching and due to student’s familiarity with the stigma of the use of AAVE they naturally code switch. Jade Cathay, an English teacher for early college high school courses, suggests that African American students are aware of the stigma, “...and that’s why they feel compelled to code switch....” The code-switching element was more apparent, and Bay says that she believes that the negative stigma placed on students begins to come into play in K–12 education. The second category feels that the awareness of the stigma is predominantly based on demographics. Three out of seven of our interviewees admit that in predominantly White areas the negative stigma becomes highly evident and that in predominantly Black areas, though there is more acceptance, school institutions still try to deter students from the use of AAVE to the more acceptable standard English conventions in order to propel them through the Texas education system. Monica Bone says,

“...we know that AAVE is not seen as a dime, if someone shows up speaking that way, compared to someone showing up speaking Standard English, then who are we more apt to listen to? and they associate AAVE language with aggressive behavior, violent behavior, like there’s so many stigmas, and students learn it early on, because of how I speak this is how I’m seen as a person.”
Consequently, this impacts students’ engagement with the literacy education within Texas education. Since literacy education does not acknowledge AAVE students are more inclined to disengage with literacy education. Literacy engagement decreases due to the stigma and neglect of this logical rule-governed dialect, known as AAVE. When asked the question “In your experience, how does this stigma affect these students’ engagement with literacy education?” all teachers expressed a belief that this negative stigma of AAVE can have a harmful effect on students’ literacy engagement. Dr. Jones states:

“Because Standard English is such the rule of the day, right? I have often seen students whose native language is AAVE disengaged in at least class discussions, right? When it comes to answering questions when it comes to, you know, what does the author mean, when he says this? You know, a student who speaks AAVE might have a way they want to say it. But they also know that that isn’t the quote unquote, right way. And so they don’t say anything, right? Or I’ve seen students who they have the answer, but it’s on their paper, but they won’t speak it.”

Barns also adds:

Any literature that doesn’t reflect me or any literature that says, I’m not enough or you are inferior? Or you are less than and you will remain less than? Of course, there’s a wall of Am I going to comprehend it to pass a test? Absolutely. But do I believe in it?
No. So my form of resistance is letting you know that I will pass this test. But don’t ask me anything of this after this school year because I’m not, I don’t plan on retaining it. It has nothing to do with me. Right. And so, I think that other African American students feel the same way.

This shows that the negative stigma that is given to AAVE can be hindersome to students. Bay suggests that there may be a way to combat this issue for students:

...so, I feel like if they are aware of the stigma, but they’re also aware that their native dialect is to be validated and celebrated as well, like, if they understand both, then they’re at a point, I think, where they learn to sort of figure out how to navigate through life, like, how do I code switch in this situation? Or how do I translate what I what I mean, in this situation.

According to this data, it is clear that African American students are aware of the stigma of their native dialect and the negative stigma surrounding their dialect can be a hinderance to not only their literacy education but also their overall performance within academia.

What Are Parents and Community Members Sentiments toward AAVE?

Because the educational environment does not consist only of educators, administrators, and students, we decided that it was essential to also understand the views of parents and community members as well when it comes to the status of AAVE. According to the research collected we have an understanding that parents play an integral role in the way that students view their native language. Six out of seven interviewees believed that parents did not think that AAVE was a rule-governed dialect equal to all other varieties of English, and one interviewee
simply did not know. However, the data we collected clearly shows that it is more common for parents to not be familiar with this language as it relates to literacy education and the education system in general. London Bay points out that most parents are indoctrinated as well. Simmons validates Bay’s point, stating that parents “too have been conditioned to feel that how they speak is problematic.” This evidence leads to the conclusion that many parents become idle in the representation and acknowledgement of the presence of the native dialect within education which is also a supreme hindrance to students as well. When asked if there was a greater awareness among parents or educators, the results and responses did vary; however, the common ground was that overall, there is a lack of knowledge in general.

**What Are the Responses to the TEKS and STAAR?**

Unfortunately, Texas education still adheres to the standardized testing that is exhibited in a lot of education systems across America. Every year students from K–12 are assessed with informal and formal benchmarks. Starting as early as third grade students take a formal assessment called the STAAR test administered by the Texas Education Agency. In addition to this, the Texas Essential Knowledge and Skills, also known as TEKs, are the state standards that public education schools in Texas must follow and are the standards for what students within the education system are supposed to know and be able to do in order to progress to the next grade and to progress within academia. However, according to the data, these tests and standards are problematic and even more so for students whose native dialect is not “standard American English.” Every student that is in K–12 education in Texas will be exposed to both the TEKs and the STAAR test. Now what does this have to do with African American vernacular English?

Well, since we have discovered that this dialect is not respected, acknowledged, or considered a rule-governed dialect within the Texas education system, you could imagine that for the students who speak this language these standards and tests do not suit them well and are not made for their progress at all. When asked what the effect of state mandated content standards and assessments on the use of AAVE for instructional purposes is, many educators responded similarly, and they validated this sad truth. Simmons explains how students whose native dialect is AAVE are penalized. She states,

> [I]t's hard for children to receive the highest scores, if they are not writing in that standard formulaic English, and it is worse even in the classroom... But in the classroom, teachers go in, and they hammer these rules and expectations, like almost to an absurd point, to the point where the kid no longer cares for learning, [the] language or the art of writing, because they’re, they’re so hung up on, you know, that aspect of it.

Educators are aware that the standards dictate the curriculum, and the curriculum is not shaped for all students. Samantha Thomas says she does not like the “arbitrariness” of the TEKs. She also explains that “those state standards drive a lot of the instruction...those standards come into play for scoring and so [it] does push students to veer away from AAVE.” According to this data, the TEKs and the STAAR test are not helping students; instead, these Texas standards are hindering students in their learning and engagement. Barns states,

> And you have to think about a child who’s been failing these tests over and over and over again, by the time they get to middle school, they’re beat down and they don’t even think they’re smart enough, they don’t even think they have the value to bring to this test, because this test keeps telling them No, you’re not good enough.
No, you didn’t make it. So, by the time I get them, it’s truly a form of persuasion.

**Capitalization on AAVE within Educational Setting**

Although the data we collected has revealed that AAVE is not acknowledged nor validated as a dialect within the Texas education system, some of the educators we interviewed have found ways to capitalize on the use of this vernacular within the classroom. Tamara Barns speaks about her use within the classroom and how the authenticity cultivates connections with her students.

I’m not talking in slang and never switching registers, right? This is how I’m pulling them in and connecting with them the same way I would want for instance, if I moved to another country, I would want you to meet me where I’m at as well. Right? So, I just think is honorable is the right thing to do human to human. And so, once I’ve pulled you in, I can introduce you to anything new, right? Because you know that I understand you and I respect you. And so now I can introduce anything to you, which means when I start introducing things that are our state assessments, your mind is completely open. You’re not resisting me, because you know, I respect you, right?

Barns is also responsible for creating a literacy development program called *For the Culture*, where she says she has seen success in capitalizing on the use of AAVE within the classroom. London Bay says she has also seen success by using both languages simultaneously throughout the year in order to drive instruction. She says,

I think the success in the classroom comes from me doing both, like me, me showing them code switching, like, I may teach in AAVE all year, you know, except for those days where I’m intentionally trying to show them standard American English conventions, or here’s how we do this, or teaching them the history of some language or something, some language, teaching them the history of the American language. So again, I just think the success comes from that it comes from modeling doing both.

Some of the educators explained how they have not seen any capitalization of the use of AAVE due to location or lack of support. Barns closes by stating that “as a teacher, I have to figure out how do I scaffold the student up from their language to this language without making that student feel like because I don’t know this standard, I’m inferior to it.

**Educational Demographics within Texas**

As you can see, the figures below display the demographics within Texas education and are relevant to this research.
In addition to the demographics shown in Figure 1, the Texas Tribune gives us an insight into the academic demographics (Figure 2). This source provides data on the graduation rates by race and ethnicity within Texas education. We see that African Americans have the lowest percentile of graduates at 86.2% in comparison to the highest percentile of 96.4%, which represents the Asian population.

From the data collected, we learn that there are ways to scaffold students up to the language and dialect that is desired within K–12 academia. From the data we can see that there is an overwhelming achievement gap. Although African Americans make up the third largest percentile within the Texas education system they are failing at a higher rate. This research reveals that the Texas education system has lingering remnants of assimilation and white supremacy embedded within the curriculum and pedagogy standards.
CONCLUSION

Although it is true that there are pedagogical ways to scaffold students up to mastering the desired language of “standard” English within curriculum, this ideology of placing one language above another and even having a language being heralded within an education system is problematic, stems from institutionalized racism, and completely goes against the mission statement of the Texas Education Agency, which is to “provide leadership, guidance, and resources to help schools meet the educational needs of ALL students and prepare them for success in the global economy (Texas Education Agency, 2019).” The achievement gap could stem from various factors. However, with the research that we have conducted it is clear that the education system is not fostering an environment that is prosperous for African American students. This conclusion can be drawn from the specific examination of literacy within the Texas education system and how something as vital as an African American student’s native language is perceived, it is clear that the stigma against AAVE is hindersome to these students and leads me to question how other students who have different dialects and languages are impacted as well. However, from the data collected and the thematic content analysis, it is clear that there may be more privilege for English language learners than there is for students who speak AAVE. Once again this is due to stigma and institutionalized racism. Although there is still a presence to adhere to standard American English, English language learners within the Texas education system are at least acknowledged. There are specific instructional groups geared toward scaffolding students up to being able to master standard English without neglecting their native language. However, this is not present for students of different dialects. Just because a student has a different dialect or language does not mean that they are any less intelligent than the student to the right or left of them. Implementing this ideology that “standard” English is to be rewarded within academia and that other forms of English are not acceptable to use in order to pass state mandated testing directly impedes the success of marginalized groups. Unfortunately, teachers feel like they cannot stand up for what is right despite their knowledge and reluctant acceptance of these implicit policies. Some educators understand that AAVE is important, however, with their jobs on the line and the fact that the use of AAVE is not seen as logical by many influencers of Texas education, there is not much teachers can do to capitalize on the use of AAVE. So where does that leave students? Deprived of their authenticity and true guidance to success.

Based upon the data collected, there are no formal or informal policies that prohibit the use of AAVE within the classroom; there are implicit biases and policies, or “workarounds” as Simmons calls them, that are used in order to keep teachers, students, and community members indoctrinated with the ideology that “standard” English equates to the “best,” most appreciated, and most accepted form of language within the Texas education system. As educators and administrators in Texas look to enhance the quality of education, it is essential that they try to address this issue. Doing so should consist of a reexamination of the TEKs and also the state-mandated standardized testing in not only English Language Arts but also curriculum standards across the board. One suggestion I have is to take advice from educators like Tamara Barns and London Bay, who stress the importance of authenticity and who have seen success come from the use of AAVE in the classroom. Also, for educators and administrators who question the validity of the dialect, I implore them to seek out the data for themselves. It is inevitable that they will come across data that promotes the use of AAVE within education. It is also important that as educators we do not conform to white normativity and assimilationist views. Bay reminds us that although she understands the ubiquitous limitations that have been placed on educators, “...education is supposed to be radical. [...] it’s supposed to push boundaries. It’s supposed to get people in these vulnerable, uncomfortable situations,
so that we can actually learn, right?” So, I leave that question for educators and administrators to ponder as they continue to mold education. As we further our research, we hope to identify more solutions and try to further abolish assimilationist education standards and policies within Texas.
REFERENCES


PHOTOBIOMODULATION ENHANCES BLOOD OXYGENATION AND TISSUE METABOLISM BY NEAR INFRARED LASER AND LIGHT EMITTING DIODE

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ABSTRACT

**Background:** NASA will launch a mission to Mars in 2024; during the trip Astronauts will experience muscle atrophy from microgravity. To solve this problem, we hypothesize that photobiomodulation (PBM) using laser and light emitting diodes (LED) at near infrared (NIR) wavelength can improve muscle conditions of astronauts.

**Methods:** We used PBM on the human forearm to stimulate its blood oxygenation and tissue metabolism, which were measured by optical NIR spectroscopy. Subjects were measured before, during, and after 8-min PBM and sham conditions with 808-nm and 852-nm lasers as well as an 808-nm LED unit. PBM results were compared between the two lasers and between the laser and LED based on two-sample t-tests.

**Results:** Statistical analysis showed that PBM by the lasers enabled equivalent and significant enhancement of blood oxygenation and tissue metabolism on the human forearm. Also, LED at 808 nm resulted in significant PBM effects on the forearm compared with sham conditions.

**Conclusions:** 8-min PBM induced significant increases of blood oxygenation and tissue metabolism of the human forearm by NIR laser or LED units, indicating that LED-based PBM may have vast potential for mitigation of muscle atrophy caused by long-term spaceflight microgravity exposure.
INTRODUCTION

Background. Launching in 2024, NASA's newest mission, Artemis, will have astronauts experiencing long-term microgravity environments as they travel from the Moon to Mars (Bridenstine, 2020); (Johnson, 2020). With recent developments in long-term exposure, combating the health risks associated with long-term spaceflight is very relevant. Such risks include hypertension, decreased wound healing, muscle atrophy, and cardiovascular disease (Pruitt et al., 2020); (Whelan et al., 2000). While astronauts are in microgravity, they experience muscle atrophy, where the muscles are no longer strained and can start to degrade. Muscle and bone atrophy has been well documented in astronauts. Although minor injuries occur in space, the body is unable to heal until after landing back on Earth. Muscle atrophy has been known to begin within the first hours of space flight. During exposure to microgravity, blood volume shifts from the capacitance vessels of the lower body to those in the face and head (Hackney et al., 2012). Muscles significantly affected include the calves, quadriceps, and the neck and back muscles. While in space, the body perceives itself to not need these muscles. This results in a decrease in muscle mass by as much as 5% a week and up to 20% over time. The muscles used to fight gravity on Earth, such as the calves, are no longer as strong. Astronauts must workout for up to two and a half hours per day, doing low load exercises to combat the effects of muscle atrophy (Hackney et al., 2012); (Johnson, 2020). This can lead to many other inherent risks that prevent astronauts from performing their tasks. For the past 40 years NASA has been exploring the use of laser light therapy due to its portability and its effective, noninvasive nature (Cotler, 2015). Previous studies suggest that the use of an LED blanket device may be useful for the prevention of bone and muscle atrophy in astronauts (Whelan et al., 2000). However, the muscles are localized, which has led NASA to explore novel techniques such as light therapy for a more targeted therapy (Whelan et al., 2000).

Photobiomodulation. Photobiomodulation (PBM) is a novel light therapy that is noninvasive. Currently PBM is being used to treat mental and physical ailments such as muscle atrophy, depression, PTSD, Alzheimer’s, and Parkinson’s disease (Byrnes et al., 2004); (Medrado et al., 2008); (de Andrade et al., 2017); (Combes, et al. 2018); (de Paula et al., 2018); (de Sousa et al., 2018); (Pruitt et al., 2020). NASA believes that the application of light therapy using LED or infrared (IR) can significantly improve the medical care that is available to astronauts for long-term space missions (Whelan et al., 2000). Due to the noninvasive nature of PBM it is able to have multiple treatments on different areas of the body. NASA has previously flown LED arrays on space shuttle missions to study plant growth, and it is currently being used to treat wound healing in microgravity environments (Whelan et al., 2000). PBM is composed of four stages: (1) Light energy is absorbed by cytochrome C oxidase (CCO), triggering several downstream effects; (2) nitric oxide is released; (3) adenosine triphosphate (ATP) is increased; and (4) oxidative stress is reduced (Cotler, 2015); (Pruitt et al., 2020). PBM is used in a wide variety of laser and LED wavelengths, commonly between 600 and 900 nm (García-Delaney et al., 2017). Currently being explored is 1064 nm (McColloch et al., 2021). However, there is an informational gap between the direct comparisons of each wavelength efficiency. We used the forearm as a living model, rather than the forehead, to avoid complications caused by wavelengths passing through the cranium. Further, the forearm is a great source of mitochondria and muscle fibers. This living model can provide us with faster and more efficient data collection than transcranial PBM (tPBM).

Wavelengths. It is necessary to determine which wavelength is most effective among several wavelengths; commonly used are 1064 nm, 808 nm, and newly discovered 852 nm. As the near infrared (NIR) light is scattered throughout the cells, it delivers an amount of energy to the electron transport chain within mitochondria. More [ATP] molecules are created for cellular metabolic activity and consumption, leading to increases of blood flow and
oxygenated hemoglobin. Using optical sensors and monitors, we are able to calculate the amount of oxygenated hemoglobin increased during the PBM session (Pruitt et al., 2020). This study applied sham controlled PBM for the two wavelengths in the same power density. The broadband NIR spectrometry (bb-NIRS) data is collected concurrently to ensure that optimal protocol is followed between each wavelength in order to monitor the effects of PBM by bb-NIRS.

Chromophore change. To monitor each chromophore, the oxygenated hemoglobin (HbO) as well as deoxygenated hemoglobin (Hb) levels in human subjects are monitored (Kashyap, 2007); (Anderson et al., 2015). To monitor cytochrome C oxidase (CCO) levels from the mitochondria in forearms, we used a pre-established methodology with a curve fitting algorithm to calculate the total hemoglobin change (HbT; Wang et al., 2016). This technology is able to monitor each chromophore concentration change in the human arm. A high concentration of mitochondria are typically found in areas of the body with more localization of cells and nerves and, thus, will be able to produce more energy from the mitochondria using the oxygen metabolism (Khakh et al., 2003). NASA has been known to use the forearms, calves, and brain for LED and PBM stimulation. Each area contains high concentrations of mitochondria (Whelan et al., 2000).

Cytochrome C oxidase. PBM comprises the mechanism known as photo-oxidation of [CCO], the terminal enzyme in the electron transport chain, which catalyzes the oxygen metabolism for cellular [ATP] production (Rojas, Julio C, & F. Gonzalez-Lima (2011); (De Freitas et al. 2016). PBM has a greater effect on muscle tissue via the [CCO] oxidation due to the higher mitochondrial density in the muscle fibers (Fluck and Hoppeler, 2003). When muscle fiber mitochondria are stimulated, PBM is able to reduce [CCO] into its oxidized state, labeled [oxi-CCO] hereafter. [Oxi-CCO] is active in a series of redox reactions. This process produces action module into water which can enhance the proton gradient during the electron transport chain in the intermembrane of the mitochondria. This photo-oxidation process of [CCO] accelerates the utilization of oxygen, which allows for a higher production of intracellular [ATP] within the mitochondria (Rojas, Julio C, & F. Gonzalez-Lima (2011). However too much [CCO] can cause oxidative stress, which leads to generation of reactive oxygen species (ROS) during [ATP] production. Once [CCO]'s activity is increased, oxygen consumption is also increased, leading to a higher rate of oxidative phosphorylation (Hamblin, 2017).

Reactive oxygen species. ROS hold an extra electron in their molecular structure, which makes this compound highly destructive, damaging cellular structures and even causing apoptosis in higher quantities (Simon et al., 2000). While a small amount of ROS plays a vital role in boosting cellular functions (Hill and Van Remmen, 2014), oxidative stress occurs when ROS is created faster than the speed at which they can be removed by the natural cellular mechanisms (Leutner et al., 2001). The healthy functioning of oxidized [CCO] is believed to efficiently convert ROS into a chemically steady state without the extra electron. Therefore, having a large concentration of [oxi-CCO] can inhibit the fast accumulation of cellular ROS, which protects the cellular environment (Collman et al., 2007). There is a delicate balance between the time of stimulation and the production of too much ROS buildup in the cells’ mitochondria. To optimize the amount of quickly available oxygen from the electron transport chain, we have to minimize the amount of ROS with the appropriate stimulation time and intensities.

Laser vs. LED. While LEDs are more portable and have fewer safety concerns than lasers when used for PBM or tPBM, the light power densities from LEDs is much weaker than those of lasers. Currently there is no known 852 nm and 1064 nm collimated LED light available at a power wattage that is significant enough to cause quantifiable chromophore changes. This poses an issue of efficiency and is why we are looking at different nm wavelengths at a constant power intensity. We hope to find the optimal chromophore changes for each light source and wavelength
stimulations.

HYPOTHESES FOR THIS STUDY

Aim (i): We tested the hypothesis that there will be no statistical difference in PBM-induced concentration changes of chromophores on the human forearm induced by the two lasers at 808 nm and 852 nm wavelengths.

Aim (ii): We tested the hypothesis that the LED can yield statistical enhancement of [HbO] and [CCO] as compared with sham conditions.

Aim (iii): We compared changes of [HbO] and [CCO] induced by a laser and LED unit at 808 nm for better understanding differences of PBM effects by laser and LED.

This research project was an adaptation of Wang et al. (2016) and Pruitt et al. (2020), in particular Drs. Pruitt and Wang’s published paper (2020), in which all of the methodology and mathematical analysis were the same for Aim (i) and slightly modified to set the scope of our research topic for Aim (ii) and Aim (iii).

METHODS

Participants. 10 healthy volunteer subjects (5 females and 5 males) were recruited from the University of Texas at Arlington (UTA). Exclusion criteria were as follows: (1) diagnosed with any psychiatric disorders, (2) history of brain injury or neurological conditions, (3) currently taking any prescribed medicines or drugs (including nicotine or caffeine within 2 hours), (4) currently pregnant. Eligible participants underwent three separate experimental protocols (sham, 808-nm stimulation, and 852-nm stimulation) at least 48-hours apart using a random number generator to determine which protocol the participant would be receiving for each visit to ensure no bias or cross-effects. The study was approved by the institutional review board (IRB) at UTA and complied with all applicable federal NIH guidelines. IRB# 2020-0094.1.

Experimental protocol. Prior to starting experimental protocols, informed consent was obtained from each participant. In this study, the same bb-NIRS experimental setup, protocol, and procedures were performed (Pruitt et al., 2020) The patient did not receive information on which laser or sham protocol they would be receiving that visit. When the laser system was in use, a warning sign was placed on the door to further dissuade individuals from entering. PBM, LED and sham experiments were conducted in a dark locked room without any reflective surfaces. Protective goggles were worn by all the individuals in the lab room to ensure eye safety for both the participants and operators. As soon as the participants entered the lab, they were asked to sit on an inclined chair comfortably. Operators attempted to maintain these same circumstances for each operation, mimicking sounds and setup. In order for the subjects to not fall asleep, the operators maintained radio talk conversation.

Instruments. Both the placebo and laser treatments were administered with a continuous wave of 808 nm and 852 nm laser provided by Cell Gen Therapeutics LLC, Dallas, TX (Model CG-5000). This laser is an FDA-cleared device for various uses on humans. The area of laser beam from the aperture is 13.6 cm². The laser is well collimated, so the laser beam size did not change significantly between the laser aperture and the stimulation spot on the subject’s forearm. The non-contact delivery distance is about 2 cm with possible variation of a few mm because of the handheld setting. However, such a distance variation did not result in dose fluctuation in laser radiation due to laser collimation.
**bb-NIRS.** The same bb-NIRS system was utilized as in a previous report (Wang et al., 2016). Briefly, this system consists of a tungsten halogen lamp (Model 3900, Illumination Technologies Inc., East Syracuse, NY) as the broadband light source (covering 400-1500 nm light), and a back-thinned cool-down CCD spectrometer (QE-Pro, Ocean Optics Inc.) light detector was set 2 cm apart via 3.5 mm optical fiber bundles in a 3D-printed probe holder. A shutter was used to allow the light source to stay activated between data acquisition periods, without possibly influencing results by illuminating the forearm with broadband light. During data acquisition the broadband light diffused through the forearm tissues to the detector fiber bundle, which was shown as a spectrum via laptop computer (Pruitt et al., 2020).

**Power density.** The power density was experimentally confirmed before each subject’s measurement, in order to quantify the amount of light being transmitted through the subject’s wrists. This was done using a power meter. For the laser treatment, the device was operated at a constant power of 3.4W. The irradiance (or power density) in the beam area is 0.25W/cm\(^2\). The same was used for previous studies to maintain consistency. For the placebo treatment, the same device was operated at a minimal power of 0.1W. The aperture was further covered up by black tapes so that no light came out from the covering tapes. Thus, the actual laser power of placebo was zero. In order to avoid potential skin damage, the laser was set to have a lower power density, similar to that of a class 3B laser. The power density used was 0.25W/cm\(^2\), which we chose because it follows previously successful studies with full IRB approvals. The laser stimulation parameters were calculated as follows: Total laser power = 3.4W; Area of laser beam radiation = 13.6 cm\(^2\); Power density = 3.4W/13.6 cm\(^2\); Time radiated per cycle = 55 s; Total laser energy dose per cycle = 3.4W × 55 s = 187 J/cycle. During sham stimulation the laser was set to minimum power (0.1W) and multiple layers of black electrical tape were used to block all light from reaching the participant. All non-sham protocols had their respective lasers set to 250 mW/cm\(^2\) power density to ensure differences in power density were not impacting the measured bb-NIRS results.

**Experimental setup.** As shown in Fig. 1, this system (created by Pruitt et al., 2020, and Wang et al., 2016) consisted of a tungsten halogen lamp (Model 3900, Illumination Technologies Inc., East Syracuse, NY) as light source and a miniature back-thinned CCD spectrometer (i-trometer, B&W Tek Inc., Newark, DE) as light detector, in the spectral range of 450–1,100 nm. Broadband white light from the lamp was relayed by an optical fiber bundle of 3.5-mm in diameter to a shutter and then to an I-shaped optical probe holder placed on each subject’s right forearm. The diffuse light through the arm tissue was collected by another fiber bundle held by the same probe holder and then relayed to the spectrometer. The distance between the source and detector fiber bundles was 1.5 cm.

![Figure 1. Schematic diagram of the experimental setup, including the broadband NIRS system.](image)
Fig. 2(a) depicts the experimental setup with the human forearm and the necessary equipment. Fig. 2(b) depicts the time of the entire protocol from the baseline of zero to two minutes, the stimulation for 8 minutes, and the recovery time.

![Experimental Setup Diagram](image)

**Figure 2.** Experimental Setup: (a) Configuration of the bb-NIRS probe holder (black I-shape); (b) Paradigm of the PBM/sham stimulation and interleaved bb-NIRS data collection. (Created by Pruitt et al., 2020.)

As shown in Fig. 2, the I-shaped holder contained two optical fiber bundles with a center-to-center separation of 2 cm. One bundle (yellow) was connected to a tungsten halogen light source while the other bundle (blue) was connected to a QE Pro spectrometer attached to a laptop computer with a spectrum readout. The PBM laser stimulation was administered to the left side of the aperture at a power density of 250 mW/cm² (red circle). Each treatment protocol contained one 2-minute baseline (green), eight 1-minute PBM/sham stimulation cycles (red) of 55 seconds laser on, 5 seconds laser off for bb-NIRS data acquisition, and 5 minutes recovery time after the last PBM/sham cycle.

Fig. 3 depicts the I-shaped probe on the subject’s forearm, with laser stimulation conducted. The IR light was only visible through the camera lens. During stimulation the purple circle of light could be seen, causing the gaussian collimated light to be shown. The top of the light was aimed to touch the bottom of the sensors in the middle of the probe. While the rest of the circle remained on the side of the forearm. This allowed for the light to go underneath the monitor, to stimulate the surrounding area of the forearm.
The two wider ends of the holder are firmly fastened on each participant’s right forearm with double-sided skin tape (Fig. 3), as each participant might have slight body movements during the corresponding experiment. This experimental setup minimized potential motion artifacts during data acquisition. The narrow middle section of the holder was approximately 8 mm in width. In both experiments, the laser beam from CG-5000 was administered on one side of this section, alternating between each arm.

Fig. 4 depicts the LED 808-nm wavelength light stimulation on a subject’s forearm. The probe and the visible purple columnated light are shown. This experimental setup was used in Aim (ii) and Aim (iii) of our hypotheses.
Captured experimental spectrums were fitted between 750 and 900 nm to calculate [HbO], [Hb], and [CCO]. [HbT] was calculated afterward by adding calculated [HbO] concentration changes with calculated [Hb] concentration changes to determine the change in total hemoglobin concentration. Methodology and procedures of multiple linear regression analysis to optimally determine PBM-induced concentration changes in three chromophores was followed directly from Wang et al. (2016). A total of 15 data points were recorded for each participant. The first two points recorded before the onset of PBM/sham were regarded as baselines. These were used as references to quantify [HbO] and [oxi-CCO] for the following 13 data points during and after PBM/sham, leading to 13 time-dependent [HbO] or [oxi-CCO] readings in μM for each experimental run. This time-dependent data process was repeated for each participant in both PBM and sham experiments (Pruitt et al., 2020).

Statistical Analysis. Statistical analysis was used to determine if the PBM induced significant changes in hemoglobin and [CCO] concentrations with respect to the sham treatment. A paired two-tailed level \( t \)-test was conducted with \( 0.01 < p < 0.05 \), and \( p < 0.01 \) was chosen to be statistically significant in these tests for each chromophore for every timepoint. Timepoints that were two standard deviations from the mean were removed as outliers. We removed measurement artifacts due to the small number of subjects and inability to collect more data.

Comparisons of changes in [HbO], [Hb], [CCO], and [HbT] induced by LED and sham. Comparison of LED versus sham 808 nm [HbO], [Hb], [CCO], and [HbT] is shown in Fig. 6. PBM stimulation versus sham concentration changes are in micrometers, with measurement from 0 to 15 minutes. The first 3 minutes are baseline pre-stimulation data, then the highlighted area is 8 minutes of stimulation, followed by 5 minutes of post-stimulation data. Subject data \( (n = 10) \) was collected and averaged for each timepoint.
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BY NEAR INFRARED LASER AND LIGHT EMITTING DIODE

Figure 6. Comparison of concentration changes of (A) \([\text{HbO}]\) red, (B) \([\text{CCO}]\) green, (C) \([\text{Hb}]\) blue, and (D) \([\text{HbT}]\) purple as measured in this study from LED 808 nm (dotted lines) and sham (solid lines). The shaded area represents the 8-minute PBM stimulation, and the white area depicts baseline and post-stimulation time. The error bars are the standard errors of mean.

Comparisons of changes in \([\text{HbO}], [\text{CCO}], [\text{Hb}], \text{and} [\text{HbT}]\) Between LED and Laser. Comparison of Laser versus LED at 808 nm for each chromophore \([\text{HbO}], [\text{Hb}], [\text{CCO}], \text{[HbT]}\) is shown in Fig. 7. PBM stimulation versus sham concentration changes are in \(\mu\text{M}\). Measurement is from 0 to 15 minutes. The first 3 minutes are baseline pre-stimulation data, then 8 minutes of stimulation, followed by 5 minutes of post-stimulation data. Subject data \((n = 10)\) was collected and averaged for each timepoint.
FIGURE 7. Comparison of concentration changes of (A) [HbO] red, (B) [CCO] green, (C) [Hb] blue, and (D) [HbT] purple. Measured in this study from LED 808 nm (dotted lines) and Laser 808 nm (solid lines). The shaded area represents the 8-minutes PBM stimulation, and the white area depicts baseline and post-stimulation time. The error bars are the standard errors of mean.

DISCUSSION

In this study, a bb-NIRS data collection system was used to quantify each chromophore change for each respective Aim. Compared were two different wavelengths, 808 and 852 nm for each chromophore: hemoglobin oxygenation [HbO], hemoglobin deoxygenated [Hb], cytochrome C oxidase [CCO], and total change in hemoglobin [HbT]. The LED 808 nm wavelength to sham was compared. And finally, the two light sources, laser versus LED at the same wavelength were compared.

Hemodynamic and metabolic effects of PBM. We concluded that PBM is able to positively affect hemodynamic and metabolic activities. [HbT] was shown to have a positive increase in blood flow when stimulated with laser PBM (Fig. 5D). However, this trend was not seen when [HbT] was stimulated with LED light (Fig. 6D). This comparison can be seen in Aim (iii) (Fig. 7D). [CCO] was shown to have a positive trend when stimulated with laser and LED light (Fig. 7B). Regarding [CCO], no statistical difference was observed when stimulated with 808 nm compared with 852 nm wavelengths (Fig. 5B).

Comparisons of net changes in [HbO] and [oxi-CCO] between two wavelengths. Aim (i) was to test the hypothesis that there would be no statistical difference in PBM-induced concentration changes of chromophores on the human forearm induced by the two lasers at 808 nm and 852 nm wavelengths. We concluded that there was a statistical chromophore change between stimulation and sham for both wavelengths. It was found that 808 and 852 nm wavelengths produce no significant difference in chromophore change when stimulated over 15 minutes (Fig. 5). [CCO] indicates to have a very small statistical difference between each timepoint (Fig. 5B). This trend will need further investigation.

Comparisons of net changes in [HbO] and [oxi-CCO] between LED and sham. We concluded that LED did have quantifiable effects on each chromophore compared to sham. Aim (ii) of the study (LED vs. sham) was
conducted for each chromophore, [Hb], [HbO], [CCO], and [HbT], at the same 808 nm wavelength. A paired \( t \)-test was conducted, and statistical data yielded the standard error for the error bars depicted in Fig. 6. In comparing the LED dotted line to the sham solid lines in each graph, a significant difference between each chromophore is observed. This follows the hypothesis that light stimulation does quantify a change in hemoglobin concentration. For [Hb] there is a significant amount of statistical error depicted in the high standard error bars. While subjects were instructed to stay motionless, motion artifacts were observed. Thus, the upper and lower quartiles may require further filtrating. However, we can conclude that this supports the hypothesis that the LED light stimulation does quantify a response for each chromophore when stimulated at the 808 nm wavelength.

Comparisons of net changes in [HbO] and [oxiCCO] between laser and LED. Finally, quantifiably depicted were the differences of light sources at 808 nanometer wavelength using laser PPM vs LED. Aim (iii) looked at the comparison of the light sources to see whether the source and the power intensity of the light impacted the results or if the wavelength was independent. As shown by Fig. 7, we concluded that the laser (depicted by the solid line), as compared with the LED (shown in the dotted line), does have approximately a 1/2 concentration difference. Both light sources follow the same graphical trend. From this we concluded that the laser PBM and LED did yield the same quantifiable pattern of results. [Hb] did have statistical error from data collection as depicted in the graph with high standard error bars. Further upper and lower quartile filtrating is needed with a larger population size.

CONCLUSION

This study has examined multi-wavelength PBM effects in vivo on a level not seen before in other studies, making it novel and of high value in the scientific community. Data collected from this experiment is significant in that it is the only quantifiable study of the differences between 808 and 852 nm wavelengths in the world. This information can now be used in a clinical setting to help aid PBM systems progression in noninvasive therapeutic treatment for astronauts. “Potential benefits to NASA, country, and civilian populations include treatment of serious burns, crush injuries, non-healing fractures, muscle and bone atrophy, traumatic ischemic wounds, radiation tissue damage, compromised skin grafts, and tissue regeneration” (Whelan et al., 2000). In addition to cosmetic and athletic enhancements, the PBM system has vast potential for mitigation of muscle atrophy caused by long-term spaceflight microgravity exposure.

Limitations and Future Work. The current setup requires the subjects to remain very still for 15 consecutive minutes. In order to eliminate more human-induced error or shorten exposure time, the subject’s motion artifacts will need to be minimized. While this study was able to prove two hypotheses and collect significant results, the sample size was limited due to COVID-19 restrictions on continuing human subject data collection (\( n = 10 \)). Future work includes a larger population size for this study. 808 nm and 1064 nm wavelengths will be compared. In order to further quantify the multiwavelength PBM effects on each chromophore, post-stimulation data will also be collected to see if the peaks and plateaus continue over time. The hope is to determine if, over time, the effects of stimulation sojourn to normal levels. In theory, PBM can help stimulate the muscles and help prevent muscle atrophy in astronauts while in space. Optimally, in-depth PBM clinical research on the brain and muscles will be conducted to find which wavelength is preferable for use in space.
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WILL YOU BE MY SPECIAL CUCUMBER?:
A STUDY OF HUMAN-ROBOT INTERACTION (HRI)

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ABSTRACT

The worldwide population is aging quickly as an individual’s life expectancy has increased past the age of 60. However, there is a shortage of healthcare professionals who are available to help these older individuals. Innovative solutions for healthcare workers/providers are needed. One solution that the healthcare system is examining is the development of social robots as potential facilitators and companions for older adults. This study was originally formulated for in-person interaction but was modified for remote-only interaction among the social robot NAO and the telepresence robot The Beam, older adults from a local assisted living center, and an interdisciplinary research team. This paper examines the use of multiple social robots encouraging exercise and guiding prospective memory cues in an innovative approach to understanding the needs of older adults specifically in a pandemic scenario. The purpose of this research study is to use an exercise platform with older adults and social robots to examine age-related changes in prospective memory and whether reminders given by a care robot may improve memory performance in older adults. The research assistants (RAs) are currently being trained to effectively present study content using the social robots. This research and data analysis is currently ongoing.
INTRODUCTION

Today, there are more Americans ages 65 and older—just over 49 million, according to the U.S. Census—than at any other time in history, and we expect these numbers to grow as more Baby Boomers (individuals born between 1946 and 1964) reach retirement age.” (Hodes, 2021)

According to the 2020 Profile of Older Americans report, nearly 16% of the population were aged 65 and above, which is more than 1 in every 7 people (Administration for Community Living, 2021). This number is expected to increase 5.6% by the year 2040 (Administration for Community Living, 2021). When comparing the generations

Millennials were the largest generation group in the U.S. in 2019, with an estimated population of 72.1 million. Born between 1981 and 1996, Millennials recently surpassed Baby Boomers as the biggest group, and they will continue to be a major part of the population for many years. (Watts, 2021)

Because the total number of Millennials is currently surpassing the number of Baby Boomers in existence, there is an urgent need to create a system that will help not only current older adults but also the younger adults who are quickly approaching 65 and above.

The exponential growth in the aging population has set off a rising total for the number of individuals who are currently living with chronic health conditions (Broadbent et al., 2009). These health conditions cause an increasing need for different and alternative health benefits including exercise interventions. Exercise has numerous benefits; however, a variety of issues significantly impact exercise interventions for older adults. One emerging trajectory of research, conducted by Fasola and Mataric (2012), showed an overall acceptance of socially assistive robots by the elderly population. Human–robot interaction (HRI) between older adults and social robots is an emerging and innovative health and well-being goal for aging adults. In this study, prospective memory cues given during an exercise platform are guided by the social robot, NAO (Softbank Robotics, n.d.; Figure 2). The intervention includes real-time telepresence guidance with researchers and a video intervention for the older adult participants.
This study strives to present new methods for the health and well-being of older adults through interactions with social robots.

Figure 2. Faculty mentor Julienne A. Greer interacting with NAO robot. Source: NAO, n.d.

BACKGROUND

Aging

Aging is a biological process that causes changes in a person’s perception, speed, psychomotor skills, sensory functions, and learning ability. In the current outlook of the human population, the number of older adults (65 and older) is rapidly expanding and is expected to be more than 21.6% of the population by 2040 (Administration for Community Living, 2021). Previous research suggests that as people get older, they have a higher chance that their biological functioning will decrease. One study showed that “Older adults have more limited resources for processing information to perform tasks” compared to younger adults (Park et al., 1997). Because of this, older adults become residents of assisted living centers that are meant to help them obtain the best care for their health. However, there is a percentage of people who are not receptive to the idea of losing their independence. These unreceptive adults would rather “age in place.” Aging in place is defined as “staying in [your] own home so [you] can maintain some form of independence and not be in residential care” (Anderson & Lane, 2020). Unfortunately, there are many problems that can potentially become concerns while an older adult is aging in place. One important factor is the lack of sufficient healthcare options. Specifically, limitations of aging in place have been seen in treating social isolation (Hartt, 2021), BIPOC communities (Croff et al., 2021), and potential falls or injury at home (Anderson & Lane, 2020).
Healthcare

When looking at the current healthcare system, older adults have the potential of receiving numerous benefits that are otherwise not accessible with the aging-in-place scenario. These include but are not limited to a structured exercise routine sponsored by the assisted living facility. “The benefits of exercise and physical activity are well proven, yet many barriers still exist to implementing a culture of exercise and physical activity within the assisted living and long-term care settings. Creative, cost-effective, interdisciplinary solutions are needed, and must have full support from all members of the assisted living administrative and clinical teams” (Fox & Sloves, 2010). The current study with the NAO robot and older adults interacting through an exercise platform may be another alternative to encourage facility-based exercise routines for health and wellness of residents. Fox and Sloves also cite an interdisciplinary approach supporting the UTA interdisciplinary team currently facilitating the study. Another benefit in healthcare for older adults in assisted living centers is the built-in social connection with caretakers and friends. Loneliness and social isolation also continue to be a concern for older adults, and Loizides et al. (2019), as in our study, have determined a digital companion, MyCompanion, may have benefits for adult residents of assisted living facilities. “We present the initial progressive build of a prototype system, dubbed MyCompanion...targeting and alleviating social exclusion and loneliness.... We also port MyCompanion software to an anthropomorphic version inside a humanoid robot for us to be able to give a physical dimension to the digital character” (Loizides et al., 2019). Loizides and colleagues examined the use of a social robot for older adults’ healthcare needs.

Prospective Memory

Prospective memory (PM) is a cognitive ability that is considered essential to everyday processes and is a key function of autonomy and independence, especially as we age (Kliegel et al., 2016). Thus, the question as to whether prospective memory dwindles as we continue to age is of monumental interest (Park et al., 1997). Because PM is an important function of everyday life, it is imperative to maintain this cognitive processing at full capacity as we age. However, recurring health problems in relation to aging endanger the ability to maintain a stable PM. Diseases such as dementia and Alzheimer’s have been shown to inhibit cognitive functioning. Additionally, previous research has shown that these diseases can lead to deterioration of the hippocampus and result in memory ruination (Erickson et al., 2011). A research study conducted by Park et al. (1997), showed that older adults were more likely to perform poorly on time-based prospective memory tasks compared with younger adults. This supports the idea that aging results in the chronic collapse of this cognitive process. However, “research has shown that older adults may outperform younger adults on PM tasks in naturalistic testing conditions” (Aberle et al., 2010). This supports the possibility of older adults maintaining their cognitive processes. One way to prolong this process is through physical activity. Exercise is known to have the ability to enhance learning ability while also improving retention rates.

Exercise

There is a plethora of benefits that are correlated to higher physical activity levels. Some of those benefits are lower chances of hypertension, obesity, cardiovascular disease, and stroke. However, as we age the motivation to exercise may decline. Though elderly people may want to exercise, health problems may be one reason they cannot (Newson & Kemps, 2007). This phenomenon in turn leads to further health complications and contributes negatively to the healthcare access and quality of life aspect of the social determinants of health (SDOH). According
to Healthy People 2020 (HealthyPeople.gov, n.d.), social determinants of health are defined as “conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” Though elderly people have the intention to better their SDOH, they tend to lack a consistent support system that could aid in improving their overall health. While there are certified nursing assistants capable of providing support to the elderly, there is currently a shortage available to help. With this shortage a consideration, a new robotic system was created to provide continuous care and aid with any problems that may arise.

**Social Robots**

Robotic systems may assist older adults in maintaining their independence, reducing healthcare needs, providing everyday assistance, and promoting social interaction. Research has shown that a “Socially Assistive Robot (SAR) could engage, coach, assess and motivate the older adults in physical exercises that are recommended by the National Health Services” (Lotfi et al., 2018). Currently there are assistive robots that were created primarily to physically support older adults with their instrumental activities of daily living that require prospective memory activities such as medical monitoring, managing finances, and medication management (Beer & Takayama, 2011). In healthcare, the social robot is the most accepted robot to provide additional assistance to the certified nursing assistant. A social robot is programmed to do several things, including to personally communicate with humans and to understand social settings/cues. This allows the human to understand the robot under the same conditions and gives humans the ability to empathize with the social machine. A common misconception is that older adults refuse to learn how to navigate updated technology such as this because of the complexity of the machinery. However, this refusal to learn can stem from a lack of knowledge rather than a lack of interest. According to Mitzner et al. (2010), older adults have acknowledged the importance of new technology because it has the potential to assist them in successfully aging in place. In a 2018 American Association of Retired Persons article, it was shown that although older adults had limited knowledge of newer technology, they expressed willingness to use them knowing that it would allow them to have ample amounts of benefits (Anderson, 2018). While it is clear that older adults can benefit from the use of robots in healthcare, however, there is still a disconnect between older adults and new technology.

This research examines a potential for social robot interaction with older adults as an innovative method for older adults to improve their prospective memory. This study team included faculty from Psychology, Nursing, Liberal Arts, and Engineering. The study was funded and awarded by University of Texas at Arlington’s Interdisciplinary Research Program (UTA IRP).

**METHODS**

The research study “Using Arts and Social Sciences to Enhance Social Companion Robots’ Adaptive Abilities to Improve Health Outcomes” was conceived and submitted to the UTA IRP. The interdisciplinary team included faculty from Computer Science and Engineering, Nursing, Psychology, and Theatre Arts. This research study is the basis of this paper. The study was formulated as an in-person interaction with the social robot NAO, older adults from a local assisted living center, faculty from UTA, and student RAs as an interdisciplinary team working toward a research goal. The RAs were hired in the spring of 2021 to assist with the robots, recruiting, and interaction with the older adults. All RAs are listed on the IRB documents and have performed the needed IRB training.
The pandemic of 2020 forced the team to reimagine the study as a remote-only interaction. A remote study included the submission of a new IRB highlighting the safety precautions in place with social robots. This study is currently perfecting a safe, remote interaction for the residents involved. The following information lists the intervention steps that will take place once the remote portion of the study is refined.

This study involved two robots. The Beam (SuitableTech.com) is a telepresence robot by which the student researchers appear remotely but are live streaming to facilitate the prospective memory/exercise intervention with the older adults. The robot NAO leads an older adult through a series of exercises with prospective memory cues built into the video. The intervention is a one-on-one interaction between the RA and the older adults. Each intervention takes approximately 1 hour to complete. The tests used for analysis in this study are: 1) demographic survey, 2) a pre-test SLUMS (St. Louis University Mental Status) examination for assessing cognitive function, and 3) a post-test Godspeed Questionnaire Series for assessing perceptions toward robots. The RAs will administer all tests to the older adults remotely and note the corresponding data.

The structure of the study follows with 1) pre-intervention, 2) recruitment, and 3) intervention steps.

Pre-Intervention

Pre-intervention included complex technology to provide a remote and safe experience for the residents of the assisted living center. It also included RA training on the telepresence social robot, The Beam (Figure 3).

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The Beam provides navigation guidance for the residents once in the apartment at the assisted living center. This specific training was significant for the RAs to make sure The Beam’s navigation path was accessible to the residents as a guidance tool. The telepresence robot was the main source of human interaction with residents.
throughout the research study; the RAs received an intervention study manual to help guide them through their communication interactions with the participating residents. In fall 2021, the study will begin recruitment with the residents and the following actions will take place: 1) follow-up calls to interested residents, 2) contact with residents with recruitment script, and 3) scheduling of intervention (two residents per day).

Recruitment

The recruitment with the local assisted living center would first be made as an in-house electronic bulletin board (a flyer) approved by both the UTA IRB board and given permission by the assisted living center. Interested residents would call the Primary Investigator (PI) Dr. Greer and leave a message. The calls would be returned by Dr. Greer and RAs using the approved recruitment script. Each interested resident would be scheduled for a one-on-one research study, lasting approximately 1 hour.

Intervention Steps

The following will be the chronological steps taken by the RAs on the day of a scheduled study event with a resident. The RAs will log on to The Beam in the entryway of the UTA smart apartment at assisted living center prior to the scheduled time with the resident.

Initial contact will include greeting and welcoming the older adult resident as they enter the room unassisted. Once in the apartment, the RA will recite the greeting script and gain consent to guide the participant through the apartment’s hallway toward the research room. After verbal consent is received, the RA will encourage the older adult to be seated in front of the large screen television monitor. This television will be the primary device to display the NAO robot and exercise and prospective memory content. For the administration of the tests, the RA and older adults will be screen to face, or “facing each other” for the administration of tests. The administration of the tests includes verbal approval of the Informed Consent Document (ICD). After receiving consent, the RA will begin to administer the demographic survey and the SLUMS (Figure 4) examination.

Figure 4. A copy of the St. Louis University Mental Status (SLUMS) examination sheet used for testing current, mild cognitive impairment in participants. (Saint Louis University, n.d.)
The Saint Louis University Mental Status exam is an assessment tool for mild cognitive impairment and dementia and was developed in partnership with the Geriatrics Research, Education and Clinical Center at the St. Louis Veterans Administration Medical Center. (Saint Louis University, n.d.)

The RA will communicate the study script with the participant and inform them that they will have the opportunity to end the study at any time. RAs will start the exercise video and the RA on The Beam robot will facilitate the 22-minute exercise video. When the video is completed, the Godspeed test is administered to the participant. At the conclusion of the test, the RA delivers the exit script and thanks the older adult for their participation in the study. The study ends after the final activity in which the RA uses The Beam to navigate and guide the participant through the hallway to the door.

The interactions of humans and robots are an emerging interdisciplinary science with many helpful solutions being provided from a variety of academic areas. For this research study the disciplines of Theatre Arts, Engineering, Nursing, Psychology were represented. An expansion of the methods structure is provided from the perspective of an RA.

**Anticipated Results**

Although this current study is ongoing, the previous research and current information has led us to hypothesize that the use of social robots with dynamic human/robot interaction abilities will have a positive impact on the exercise goals of older adults. It will also inform future interventions in subsequent research to enhance prospective memory goals in later life through human/robot interactions.

**DISCUSSION**

The main concern about using robots to help older adults was with the speech and intonation of the robot. The nursing faculty was specifically concerned that the resident participants would not be able to hear and/or understand the robot. During a demo in which a non-volunteer [>65] was present in the apartment, the robot NAO’s voice was not clear and the resident non-volunteer struggled to understand the instructions. The engineering faculty was able to replicate a computerized voice of the text in real time and the non-volunteer heard the text clearly. The computerized voice was slowed down 20% from the regular default speed, as was the original robot’s speech. The team, including RAs, were able to clearly assess the positive response of the computerized voice. The RAs also helped in determining the “tone” or “humanizing” of the computerized voice.

Potentially, the lack of face-to-face contact and the inclusion of technology may hinder the bond between the RAs and the participants. The participants seem to be focused on the screen and not the human on the screen.

**Limitations**

The COVID-19 pandemic limited the original face-to-face intervention study with participants, forcing the study to be conducted remotely in order to provide safe study conditions and to maintain the safety of the participants. The technology to make this study remote included complexities that impacted the length of the study.
Conclusion and further study

Though certain diseases do come with age, diseases that people deal with may be caused by many other complex factors. The residents at the assisted living facility in this study were predominantly Caucasian; in future studies, I hope to conduct a similar experiment on BIPOC (Black, Indigenous, people of color) individuals in order to examine the socio-economic issues involved with people of color and their ability to access innovative and emerging health technologies, including social robotics, for their healthcare in comparison with Caucasians. I would also like to incorporate another social robot in our Emotional Robots Living Lab named Pepper. Pepper would be a strong asset to use in this study because he was created with technology that would allow him to be able to identify a human that is speaking to him. Once identified, Pepper refers to the human as his “Special Cucumber.” This helps Pepper better create a personal connection with the human in which he interacts. With this newfound information, would you be willing to be a social robot’s special cucumber?
References


REPRESENTATION, RESISTANCE, AND RECOVERY: CULTURAL TRAUMA IN YOUNG ADULT LITERATURE

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ABSTRACT

Contemporary diverse authors of young adult literature are redefining the limits of literary trauma theory by writing stories about cultural trauma and challenging traditional means of recovery that situate trauma in the past. As realist fiction allows authors to explore nuanced experiences of marginalized youth in the 21st century, I use Elizabeth Acevedo’s Poet X, Sabina Khan’s Zara Hossain Is Here, Matt Mendez’s Barely Missing Everything, Ben Philippe’s The Field Guide to the North American Teenager, Jenny Sanchez’s We Are Not from Here, and Angie Thomas’ The Hate U Give as an archive and frame my reading through an intersectional lens to examine how class, gender, sexuality, geography, etc. affect black and brown youth. The emergence of the cultural trauma novel in young adult literature situates systemic oppression in the present rather than the past by demonstrating how black and brown youth navigate and negotiate means of recovery from migration, gang violence, and police violence through political activism, countering stereotypes, and community building. Since recovery from cultural trauma requires negotiation of limited, or lack of, resources, contemporary young adult literature further presents experiences that fail to see a tangible way out of disenfranchisement or trauma.
INTRODUCTION

Diverse writers are breaking into the mostly white world of young adult literature. Using their experiences and identities as inspiration to create complex characters, diverse authors are contributing to the emergence of adolescent stories that mirror the real world. In fact, #ownvoices, a hashtag created by Corinne Duyvis, has become a popular tool to recognize literature written by underrepresented individuals about underrepresented characters. Given the complexity of identity and experience, #ownvoices authors attest an accurate and empowering depiction of marginalized teens, proving the cultural and literary significance that the young adult genre holds with the emergence of cultural trauma novels. Cultural trauma is a kind of collective trauma shared by members of the same racial or ethnic identity who have experienced oppression, discrimination, or disenfranchisement due to that identity (Herberle 815). Due to the many identities that ethnically marginalized people hold, with intersecting factors of gender, class, and sexuality, young adult literature’s focus on individuality and coming of age allow authors to reflect nuanced, unique experiences of cultural trauma in diverse youth. The ongoing trauma created from witnessing or experiencing violence, stereotypes, discrimination, etc. forces marginalized youth to imagine recovery through the limited resources, if any, that are available to them. Importantly, imagined recovery from systemic trauma encourages authors to envision alternative social worlds and often to pen characters who develop a strong sense of self and social identity to reestablish a sense of agency.

In this paper, I analyze how cultural trauma is presented in young adult fiction, using an intersectional lens to argue that the texts in my archive demonstrate the heterogenous identities of diverse youth in the United States, and represent what living in America in the 21st century looks like in marginalized groups. Additionally, I argue that these texts disrupt the traditional coming-of-age story that focuses on individual maturity and self-reflection by depicting youth developing social awareness and political consciousness. These texts portray how characters navigate and negotiate recovery from cultural trauma. The archive I discuss and analyze consists of six young adult novels written by black and brown authors using their own voices, all published within the past four years. They include Elizabeth Acevedo’s Poet X, Sabina Khan’s Zara Hossain Is Here, Matt Mendez’s Barely Missing Everything, Ben Philippe’s The Field Guide to the North American Teenager, Jenny Sanchez’s We Are Not from Here, and Angie Thomas’ The Hate U Give.

Rather than serving as a homogenous voice for all marginalized groups in 21st century United States, these novels present a facet of something larger, a reality that is molded by the way race, class, gender, and sexuality interact, as well as how authors continue to resist stereotypes and assimilation. Readers, primarily but not limited to adolescents, then witness how individuals of similar or different identities are uniquely affected by and respond to the same systems of oppression that structure their realities. For instance, we can analyze characters in young adult literature by studying how they react to oppression, whether they reject or accept their social identities, and how they redefine their social role in their environment (Glasgow 56). By making these perspectives public through literature, individuals can gain a sense of understanding about social responsibility, which again, is needed to address potential recovery of cultural trauma and envision social justice.

FRAMEWORKS: BEYOND ETHNIC LITERATURE

To analyze/understand the significance of #ownvoices and cultural trauma in the contemporary young adult genre, we need to understand the history of how ethnically diverse youth literature has been studied in the past. As
recent as the late 2000s, literature for youth written by non-white authors in America has been analyzed as “ethnic literature first and as literature for children second” (Atkinson and Stewart 1). Causes for this approach were based on the absence, oversimplification, or inability to recognize a deeper meaning behind context in literature for youth written by authors of color. Ethnically diverse literature must be analyzed beyond the ethnic identity of characters by considering how gender, class, sexuality, geography, etc. intersect and shape personal identity within social systems. In fact, many authors of color reject the idea of their work being labeled as “ethnic” as they do not seek to act as a stand-in of the entire culture or community they are part of (Atkinson 66). Instead, authors of color write from many motivations, including sharing personal experiences. Kimberle Crenshaw, lawyer, professor, and leading scholar of critical race theory, first coined the term intersectionality in the 1970s to introduce resistance to the belief that marginalized people share the same experience based on race by stating the experience of a black woman is greater than the sum of racism and sexism (140). Since focusing on systems of oppression as separate binaries rejects the existence of people who possess multiple underrepresented identities (Crenshaw 140), diverse authors best support scholars’ argument that all systems of oppression work together to produce injustice rather than act separately (Ranft 212). In other words, intersections of identities create nuanced experiences that demand factors such as gender, class, and sexuality be viewed alongside race/ethnicity and not under race/ethnicity. Contemporary diverse novels in young adult literature demonstrate and prove the need for different stories that include the effects of intersecting identities on youth experience.

For this reason, recent scholars of young adult literature now use the term “diverse” to acknowledge the different experiences by people of color that vary depending on gender, class, sexuality, etc. This demonstrates the two significant and interrelated aspects of character representations in #ownvoices young adult literature: 1) multiple identities are accounted for in nuanced depictions of character realities, and 2) (as a result) these representations resist the notion of homogenous minority experience.

**WHY STUDY STORIES ABOUT CULTURAL TRAUMA?**

Cultural trauma manifests differently than traditional forms of trauma due to the nature of the source and possible means of recovery. Traditional forms of trauma are represented as directly experienced by individuals. The source of trauma is most often a specific event or series of events relegated to the past, in which recovery requires a separation from a traumatic past and a safe present, in which the victim can then regain a sense of security to heal. Victims of cultural trauma are aware of the ongoing existence of systemic oppression and do not have the option to situate a traumatic past versus a safe present. Therefore, own voices in young adult literature demand different interpretative lenses, in which identity, social perception, and resources based on class, gender, geography, etc. are analyzed.

Even more, the solutions to cultural trauma cannot be enacted in isolation, for instance, in therapy, but demand a social encounter and movement towards collective consciousness and social change.

In literary trauma studies, cultural trauma runs the risk of being dismissed or trivialized because of the accepted criterion that requires trauma to have a tangible source, usually a past event, in order to be diagnosed. Indeed, acknowledging the presence of trauma when it is based on cultural or socioeconomic identity is complicated as it cannot be identified as a single, past experience. Instead, cultural trauma is an ongoing daily reality for marginalized groups in the form of racism, classism, sexism, homophobia, etc. through discrimination, stereotypes, and state neglect or violence. The common occurrence damages marginalized people’s social identities instead of solely
leaving them unable to function with symptoms that mimic those of post-traumatic stress disorder. As is accepted by psychologists and social workers alike, cultural trauma is collective and intergenerational, meaning it is passed down from a parent to the child (Heberle 815). Cultural trauma is a result of systemic oppression, in which a dominant group subjugates a population through “state-perpetuated violence or state neglect” (Heberle 816).

Literary trauma theories study slavery and genocide, for example, as forms of historical state violence, but state violence can be ongoing, as in the case of police brutality in the United States. Although cultural trauma and intergenerational trauma are often present with each other, they are not completely interchangeable. This is because although the child can share their racial and/or ethnic identity with a parent, they can differ in their identities regarding gender and sexuality. As a result, identity is shaped by cultural trauma that is both intergenerational and not. Scholar Michelle Balaev made the distinction between these experiences, referring to the lived experience of a traumatic event as “personal loss,” while referring to a historical loss experienced by a person’s ancestors as “historical absence” (152). This nuanced vocabulary helps researchers identify and analyze instances of trauma in literary and cultural texts.

Additionally, acknowledging the distinction of the two sources is necessary in understanding how cultural trauma works individually and collectively in texts, especially when studying the intersection of race, class, gender, and sexuality. Cultural trauma in fiction has existed in the young adult genre for a long time, but only recently have modern realist young adult novels shifted in how they explore the existence of marginalized youth. With the ever-present existence of systemic racism, sexism, homophobia, etc., marginalized people have constantly advocated for the value of black and brown adolescent lives. Historically, theories and literary research on adolescence has centered on whiteness, maleness, and middle-classness based on the view that adolescents of color are regressive compared with white adolescents (Owen 237). Categories of age are a social construct that emphasize innocence in children and adolescents, but the implication of innocence rarely extends to adolescents of color (Owen 240). Instead, teens of color are often expected to overcompensate for their “lack” in order to fit into normative standards or else risk being criminalized or dehumanized. In the past, common realist narratives of marginalized youth were didactic as they cautioned readers to be extra aware of their actions and oppressors, a position which placed blame on adolescents rather than on perpetrators of systemic oppression. By taking away the opportunity to make mistakes and grow in adolescence, underrepresented youth are forced to mature more quickly than their white peers. However, recent authors reject “politics of respectability” as their novels “expose the limits of normativity as a standard for valuing human lives (Owen 240). By celebrating the identities and age of diverse youth, authors of color argue that marginalized youth are worthy of living despite how much or little they fit into normative categories, and that marginalized youth should be granted the option to make mistakes and grow. As a result, flawed characters appear on the pages of the novels I discuss. They do drugs, throw punches, trespass, and run from police. However, these actions do not negate their worth and are never portrayed as the sum of a character’s story but instead as acts characteristic of adolescence.

As noted, cultural trauma demands a new form of recovery, one that does not rely on the traditional literary approach where the victim mourns and overcomes the past to regain a sense of agency and safety, but on envisioning social justice and dismantling systemic oppression. As Traise Yamamoto puts it, issues of belonging and safety “extend beyond simple inclusion, representation, or ‘tolerance’”. Black and brown youth need to feel safe, secure, and free to celebrate their identities and overcome cultural trauma. The lack of research on literary cultural trauma in marginalized youth in the West stems from past definitions of literary trauma and the recency of the emergence of cultural trauma novels in the young adult genre. As literary trauma studies acknowledge that
being recognized as traumatized is a privilege, what contemporary realist young adult literature does is advocate for trauma of marginalized youth to be acknowledged (Davis and Meretoja 5). Moreover, the importance of reading and researching trauma stories from authors using their own perspective lies in the fact that the intersection of social identities creates that challenge to traditional notions of trauma and hardship in marginalized groups. The emerging trauma novel in young adult fiction supports the argument of Caruth, a leading scholar of literary trauma, that “history is precisely the way we are implicated in each other’s trauma” (192). As U.S. contemporary authors share stories of the many different experiences diverse youth have in the West, they demonstrate the shift in identities of youth while demonstrating how the same systems of oppression that create cultural trauma affect individuals differently depending on race/ethnicity, class, gender, and sexuality.

**READING CULTURAL TRAUMA IN DIVERSE YOUNG ADULT LITERATURE**

Realist young adult fiction offers authors the opportunity to present nuanced minority narratives that reject the existence of a monolithic experience for marginalized people based on ethnicity. While the six novels in my archive all address trauma, the characters’ experiences and responses vary even when faced with the same stressors, such as migration, gang violence, and police violence, due to differences in gender, sexuality, class, and geography. For instance, in Elizabeth Acevedo’s *The Poet X*, Afro-Latina Xiomara experiences intergenerational trauma due to her mother’s forced migration from the Dominican Republic to Harlem, New York. Xiomara experiences racial sexism through the constant objectification of her body by others and uses poetry as a way to process her guilt and resentment. In Sabina Khan’s *Zara Hossain Is Here*, the presence of financial security and a familial support system create a different experience of generational migration, in this case, from Pakistan to Texas. Instead of poetry, Zara uses activism to understand and process her cultural trauma, which stems from the racism her family faces and their unstable immigration status. On the other hand, Ben Phillippe’s *The Field Guide to the North American Teenager*, which also depicts the migration of a middle-class family, focuses on Norris’s struggles with feelings of racial and geographic otherness as a black Canadian in majority white Austin, Texas. Unlike Zara’s family, Norris’ does not experience legal issues pertaining to immigration status. That is certainly not the case in Jenny Sanchez’s *We Are Not from Here*, which shifts between male and female perspectives to present different experiences of gang violence based on gender, as three teens leave their home in an attempt to migrate to the United States from Puerto Barrios, Guatemala. Departing from issues of immigration, Angie Thomas’ *The Hate U Give* depicts both gang violence and police violence, while offering inside perspectives from ex-gang members and current police officers as Starr uses activism and community building to process her trauma. Finally, Matt Mendez’s *Barely Missing Everything* demonstrates how lack of adult guidance on top of poverty and gang and police violence make it difficult to imagine escaping cycles of generational trauma. Cultural trauma and responses to it manifest differently in each of the novels, so I have organized the next section based on stressors, which include immigration and emigration, gang violence, and police violence. When faced with these stressors, experiences and recovery of cultural trauma vary depending on the presence or lack of familial support/guidance and access to resources based on gender, sexuality, class, and geography.
STRESSORS

Immigration and Emigration

Cultural trauma from migration varies depending on autonomy in migration decisions, the presence of tension between home versus belonging, as well as factors such as race, ethnicity, gender, class, and sexuality. As mentioned, Phillippe’s *The Field Guide to the North American Teenager* and Sanchez’s *We Are Not from Here* present personal migration stories, whereas Khan’s *Zara Hossain Is Here* and Acevedo’s *The Poet X* focus culturally on generational migration. While Zara in *Zara Hossain Is Here* is technically a Pakistani immigrant herself, her declaration of Texas as her home, since she does not remember migrating or Pakistan like her parents do, differs from *The Field Guide to the North American Teenager’s* Norris and *We Are Not from Here’s* Pulga and Pequeña, who call their place of birth their home due to migrating at a much older age. These texts demonstrate the importance of nuanced readings that unsettle any idea of a universal immigrant experience, whether personal or generational.

Autonomy in migration decisions is a main source of the level and nature of trauma that individuals experience when moving countries. Push factors such as gang violence or forced marriage can drive individuals or communities to emigrate, while pull factors like better education and jobs can motivate immigration. Whether the decision to migrate was made of their own accord or influenced by a combination of push and pull factors defines the extent to which the characters experience personal loss, or the lived traumatic experience by an individual (Balaev 152). While trauma should not be defined as a competition of loss, Phillippe’s *The Field Guide to the North American Teenager* demonstrates the most stable and controlled immigration experience compared to the other three novels. As a middle-class teen whose Haitian immigrant mother is a professor, Norris’s immigration experience is mostly defined by his reluctance to leave his home and friends in Canada as well as dealing with the divorce of his parents. Norris does not experience cultural trauma through migration, but rather when he deals with being othered as a Black Canadian in the U.S. and faces racist remarks for playing hockey as a black person. Being in a position where he left Canada because of his mother’s new job and not out of danger, Norris is able to snarkily judge Texan stereotypes without the burden of trauma of forced migration. Instead, the novel depicts intergenerational culture and behaviors that Norris likes to tease, such as his mother’s desire to stay out of political conflict, her Haitian hospitality, and “first-generation nerdy heart” (Phillipe 4, 219, 8). Phillippe’s text demonstrates how migration can manifest with class privilege and cultural capital, differing from the other texts which portray a more traumatic loss and lack of control.

In contrast, Sanchez’s *We Are Not from Here* depicts forced migration in the face of gang violence. Sanchez’s text demonstrates the trauma inflicted on both the mind and body of three young adults as the threat of constant death and violence in their hometown in Puerto Barrios, Guatemala, serves as their motivation and reason to flee to the United States. Without financial security or adult supervision, Pulga, Pequeña, and Chico are forced to take on the journey alone by the train route known as La Bestia, or The Beast, named for its dangerous speeds and heat and known to have killed many migrants, either by dehydration, starvation, falling off the train, or being run over by the train. It is a journey of personal and collective trauma, since the migrants each have their own reason for fleeing their home country yet all share the pain of almost dying and seeing others die. The journey leaves Pulga, Pequeña, and Chico physically malnourished and mentally numb, constantly striving to keep going in fear that the longer it takes, the slimmer their chances are of survival. Chico, the youngest and most vulnerable, gets a concussion after jumping off a moving train and hitting his head, and is unable to recover despite resting
at a shelter for a few days. Consequently, exhausted, Chico falls off the train before being run over (Sanchez 229). Chico’s death creates a turning point for Pulga, as his motivation to keep going becomes constantly disrupted by the traumatic flashbacks of Chico’s bloody, gruesome body. Here, the experience of loss is personal and traumatic. Sanchez’s use of techniques like flashbacks and intrusive thoughts portray how trauma can affect the ability to function.

Moreover, Pulga’s immense guilt for pushing his best friend to continue the journey leads him to convince himself he killed Chico and sealed his fate (Sanchez 251, 275). As if seeing people die, strangers on La Bestia’s route and locals back home, wasn’t enough, Chico’s death represents the lack of security and safety that adolescents like Pulga and Pequeña have, as well as the traumatic violence they cannot escape. They always await bad news even if they don’t know when it is coming (Sanchez 34). The presence of danger combined with the possibility of a safer, more hopeful life force the teens to take a dangerous, risky journey if they want to stay alive.

In her book, Sanchez not only demonstrates personal and collective trauma, but also depicts the heterogenous experience of Latinx migration by writing a story that centers on Guatemalan teens. The forced migration leaves Pulga, Pequeña, and Chico vulnerable to factors such as being robbed, assaulted, or kidnapped as they cross Mexico alone without supervision. Pequeña must negotiate gendered threats, particularly rape. Aware of this, Pequeña bandages her breasts and cuts her ponytail to avoid being recognized as a girl and potentially targeted for sexual violence, while Pulga hides his money in his sock. The experience of migration heavily relies on gender as each teen has to worry about specific dangers while also worrying about each other.

The nuances of migration are further explored as the teens reflect on their relationship to Mexico and what they look like to Mexicans. As the journey leaves them without basic necessities such as food and showers, the three teens wonder what they, and other migrants, “must look like” to local Mexicans, comparing themselves to “corpses” and “animals” as they spend days and weeks malnourished and filthy from the journey (Sanchez 266, 267). The characters further address social perceptions in relation to different nationalities and immigration within the Latinx community when Pulga tells Chico, “we are to Mexico what Mexico is to the states” (Sanchez 153). Through this analogy, Pulga explains the dirty looks given by local Mexicans as well as compares their experience to the discrimination that Mexicans face in the U.S., who are often seen as a burden. However, the teens also find support from the Mexican community due to the collective trauma Latinx migrants share from losing family who have tried to migrate. By experiencing both discrimination and welcoming in Mexico, Sanchez resists the idea of a monolithic experience of migration in Latinx youth. We Are Not from Here depicts the brutal reality of forced migration of some Latinx youth who do not survive to tell their experience or who do survive and do not wish to remember their traumatic experience.

Trauma from forced migration does not have to be experienced by the migrant; it can also manifest through generations. In other words, migration trauma exists not only as personal loss, but also as an intergenerational cycle of trauma. In Acevedo’s The Poet X, Xiomara’s mother continues the cycle of migration trauma by constantly attempting to live through her daughter’s life in an attempt to recover the loss of control she had over her own life. Because moving to America from the Dominican Republic in a forced marriage was a punishment, Xiomara’s mother tries to make Xiomara “the nun she could never be” by forcing confirmation on her, against Xiomara’s wishes (Acevedo 179, 231). Furthermore, she slut shames Xiomara for having curves and blames her for the stares she gets from men and local drug dealers. When Xiomara is caught kissing her crush, her mother verbally and physically abuses her, forcing her to kneel on rice and insisting that she repent and pray for forgiveness while calling her slurs in Spanish. Furthermore, when Xiomara’s mother finds Xiomara’s poetry journal, the only place
she expresses herself, she burns it, silencing her and shaming her for even having her own thoughts. In this way, although Xiomara’s mother works to provide for the family in a new country, she passes down harmful, sexist beliefs, such as not speaking about one’s problems outside the home and holding her daughter and son to different standards. However, Acevedo also explores homosexuality, troubling the idea that boys and men are free from harmful stereotypes. Xiomara hides her boyfriend for the same reason her twin brother hides his boyfriend: the culture that does not allow women to be individuals or let men be anything but heterosexual. Xiomara's mother's unresolved trauma from forced migration through a business marriage results in her continuing a traumatic cycle, drawing in her daughter and son and enforcing some harmful cultural beliefs.

Tensions between home and a sense of belonging also manifest in adolescent immigrants as they navigate issues of racism, classism, and/or homophobia. In Zara Hossain Is Here, Zara and her family struggle to feel like they belong in the United States as they deal with constant instances of racism and islamophobia at school, work, and in their home, despite having lived in Corpus Christi, Texas, since Zara was a baby. At school, Zara is targeted by school bully Tyler, who makes racist remarks and gestures, referring to her as a terrorist (Khan 35). When Zara’s father attempts to plan a meeting with the principal for Tyler to face consequences, Tyler goes unpunished due to his father being a donor (Khan 55). Tyler’s class and white privilege enable him to further his attacks, painting a slur on Zara’s locker as revenge for trying to get him in trouble (Khan 71). Even home isn’t a safe space, as proved when Tyler spray paints “GO HOME TERRORISTS” on the garage door of Zara’s home (Khan 82). It is then when Zara’s father decides to go to Tyler’s house to speak with him about the racist targeting, only to be shot by Tyler’s father again due to his connections and money, refusing to renew his work visa, which is required to continue his green card application, putting their immigration status at risk. Despite these events, which lead to the potential deportation of Zara and her family, Zara states “Corpus is home” because it’s where all her “memories were born even if [she] wasn’t, challenging the notion of home and birthplace (Khan 181). Belonging is a constant negotiation for migrants, no matter how long they have lived in the new country, that exists with the uncertainty of security and safety.

Furthermore, Zara’s sense of belonging and security relies heavily on her sexuality, which she is free to express in the U.S. compared with Pakistan. Unlike her heterosexual parents, Zara faces potential violence and backlash by strangers and family for being bisexual if she moves back to Pakistan and is therefore reluctant to move back, unlike her parents who would be eager to see their family and their home again. The differences in Zara’s and her parents’ identities lead them to feel differently about the places where they can live, but Zara’s family exists as a support system and decides to take into consideration Zara’s wants. Demonstrating the complexity of what home means to diverse youth in the U.S., Khan depicts the issues that immigrant youth, as opposed to their parents, face in the places they identify as their home as Zara contemplates that her parents’ home will always be where they grew up, Pakistan, and not where they chose to migrate to for better opportunities (Khan 196). Through these four texts, diverse authors explore personal and generational migrant experiences, as well as how autonomy and tension between home and birthplace play a role in cultural trauma.

Gang Violence

Gang violence in communities is another source of trauma with complicated, limited means of recovery in diverse realist young adult fiction. The presence of gangs can disrupt feelings of security and safety in low-income communities as well as target youth differently based on gender. While the threatening presence of gangs is
motivation for some youth to flee their communities, such as in *We Are Not from Here*, or avoid interacting with them at all costs like in *Barely Missing Everything*, stories like *The Hate U Give* represent a different view of gangs by providing closer, inside perspectives.

Both *Barely Missing Everything* and *We Are Not from Here* depict gangs targeting the protagonists because they lack protection and are vulnerable, but attacking differently based on gender. In *Barely Missing Everything*, local gang Los Fatherless target Juan and JD in El Paso, Texas, following, teasing, and threatening them with a gun as they establish their rule in the neighborhood. Even the name Los Fatherless hints at youth who lack parental guidance and fall into the traps of gang violence. While none of the characters offers an inside look at the gang, Juan and JD are unable to live comfortably in their neighborhood in El Paso as the possibility of encountering Los Fatherless again haunts them through flashbacks and nightmares. Following traditional rules of literary trauma, Juan’s nightmares show different potential consequences of gun violence, including bloody, gruesome images of JD being their next victim (Mendez 117). However, Juan’s fear and trauma from gun violence moves past Los Fatherless, as he also has flashbacks of his friend Danny shooting his gun in the air (Mendez 238). The presence of guns from gang members and friends complicates Juan’s ability to feel secure anywhere. With no one to protect the kids, since their parents are always at work or absent and/or there is no one to intervene, avoiding either the local gang or the police to stay out of trouble is a constant practice for Juan and JD. Even more, they are read as gang members by local police and troublemakers by school staff. The lack of adult guidance consequently leads Juan and JD to act on their own, often making mistakes, without advice or role models to follow.

In *We Are Not from Here*, characters’ gender inflects experiences of gang violence on top of having no protection due to busy, absent, or dead parents. In fact, the presence of gangs is so apparent that not only did Pulga and Chico meet due to an encounter with gang members Nestor and Rey, but also Chico’s mother was killed by a gang shooting at the market, leaving him parentless and under the care of Pulga’s mother. The absence of law enforcement in Puerto Barrios resulted in no justice for Chico’s mother, proving the extent to which gangs can get away with violence. Pulga and Chico live with the constant threatening presence of Rey and are able to avoid him until the day they become witnesses to the murder of a local man at his store. Despite already having seen many dead bodies attributable to gang violence, Pulga declares that day as the last day they were kids due to the problems that arise afterwards (Sanchez 234). For instance, to secure their silence, Rey forces the two boys into gang activities against their will, threatening to kill them if they don’t comply. The gang members deprive Pulga and Chico from a sense of agency in their lives as their actions become controlled by the threat of gang violence.

Pequeña’s experience, on the other hand, is defined by her being a female and being the girl Rey chose to want as his wife/mother of his child. Feeling disempowered and fearful due to Rey’s threats to kill her, Pequeña learns to dissociate in the face of trauma caused by Rey, including the rape that results in her pregnancy and any time she is touched by him. Pequeña’s dissociative episodes allow her to disconnect from her mind and body as a survival mechanism, searching for support in La Bruja, using spirituality as an attempt to cope (Sanchez 114). Her disconnect from her body and wish to remove herself from the repulsive Rey causes her to reject her child throughout pregnancy and birth. While the women around her encourage motherhood and don’t question the father of the baby, Pequeña remains silent about her rape out of shame and in order to protect her mom from potential conflict. However, the prospect of being forced into marriage with Rey is the factor that drives Pequeña to flee her home with Pulga and Chico, whose lives now belong to Rey as well. In both *Barely Missing Everything* and *We Are Not from Here*, the characters lack a sense of security, protection, and control when it comes to gang violence and community safety and therefore portray diverse experiences in some overlooked, low-income neighborhoods.
On the other hand, *The Hate U Give* outlines the presence of multiple gangs and gang life experiences in fictional neighborhood Garden Heights, where there is protection, guidance, and some level of agency. Despite these factors death is still always present, whether accidental or intended. Starr’s father, an ex-member of local gang King Lords, demonstrates how difficult it is to get out of gang life once you become part of it, as even having gone to jail for the gang leader was not enough to completely remove himself from gang threats even years later. The presence of King, leader of King Lords, and his threats serve as a material reminder of Starr’s father’s past in a gang as he taunts and teases him as he pleases (Thomas 175). Gang violence is not only part of Starr’s father’s past, but also a source of trauma and fear for the entire neighborhood, including Starr, who witnessed her friend die during a drive-by at ten years old. This incident resulted in her having to move to a white-majority school in the suburbs for safety reasons. The rivalry between the King Lords and Garden Disciples creates a constant battle for territory and power, leaving many youth with no option but to join, like Devante and his brother, or Khalil who was forced to sell drugs to pay off his mother’s debt (Thomas 235). Rivalries often result in death, like at the party Starr attends where Devante’s brother is killed by a gang rival. Even those who wish to speak up are targeted for “snitching,” just like how local business owner Mr. Lewis is physically beat after mentioning the presence of gangs on national television. By offering an inside look at adolescent gang members and their reasoning in joining, often by force, *The Hate U Give* demonstrates humanity regardless of labels, mistakes, and stereotypes, as well as the cultural trauma these teens face by having little to no way out. The presence of gangs in communities like Garden Heights are a result of communities taking security and order into their own hands. Gangs not only fight for territory but also make a pact to protect their own members and families. Yet, the personal loss experienced by young adult characters by gang violence in their own communities deprives them of a sense of security and belonging, as in *The Hate U Give*, or even results in forced migration, like in *We Are Not from Here*.

**Police Violence and Law Enforcement**

In low-income predominantly black and brown communities, marginalized youth are not only exposed to possible gang violence but are also targeted by the police as they are seen as threats first instead of as children. Due to the cultural and collective trauma that stems from police violence and racism in law enforcement, marginalized adolescents are driven to not trust the police to protect them and see them as potential danger. *Barely Missing Everything* and *The Hate U Give* present instances of police brutality that result in murder, while *The Field Guide to the North American Teenager* explores collective trauma and being “lucky” that things did not escalate.

In *Barely Missing Everything*, Juan and JD perceive the police as a source of danger and uncertainty, even while doing nothing wrong or illegal. While Juan and JD attend a party full of private school kids at the house of their friend Danny, who is also Latino but more financially secure, the police show up and stop the party. Instead of staying, like the rest of the guests, Juan and JD instinctively run away, not entirely sure why, to which Danny calls “ghetto” while earning Juan an arrest (Mendez 35). The class differences, even if small, demonstrate how Juan and JD feel less comfortable with the police as low-income, brown adolescent males, resisting ideas of a single Hispanic experience.

Later in the novel, while being chased by Los Fatherless and finding Juan’s mother Fabi’s gun in the truck they’re driving, Juan and JD frantically look for a place to hide it since they know “getting caught by the cops with a gun could get you killed” especially as brown males (Mendez 293). Unfortunately, they are proven right; the police show up while Juan is discarding the gun and he runs again and is shot just as he reaches for the truck door. After Juan is shot dead, JD narrates what the officer says of him, calling him a “piece-of-shit gangster,” assuming
he is “probably an illegal,” and lying about pointing the gun at him (Mendez 292). JD scoffs at himself after the fact when he realizes Juan won’t get media coverage because nobody cares about brown lives (Mendez 297). This dramatic end to the novel highlights how poor, young Latino youth are often positioned between gang and police violence without an opportunity to live free from being perceived as easy targets from gangs or threats from police.

In a way, Juan’s experience mimics that of the man he believed was his father, Armando, as he also had his life taken from him by the law by being sentenced to death row for a robbery gone wrong as a child. Tired of poverty, abuse, and wanting money to spend on a trip for his crush Fabi, Armando planned a robbery at a Denny’s with two friends but ended up hesitant when his two friends left him alone in the restaurant. An altercation with a customer, who happened to be a sheriff, ended in a tugging fight for the gun and the accidental shooting of the sheriff. Armando recalls being racially mocked and stereotyped for his clothes, planned robbery, and intelligence, while the sheriff was regarded with respect, despite doing the same thing he did, closing his eyes and pulling the gun back and forth (Mendez 146). The contrast between how teen Armando was mocked in the media while the sheriff was portrayed with dignity and respect demonstrates how brown youth lives are already perceived a certain way to fulfill media bias. The shared experience with law enforcement and being treated as less than is present across generations, whether brown children are armed or not, demonstrating how preconceived notions put brown lives at risk.

Similarly, Starr’s witness of her best friend Khalil’s murder in their own neighborhood Garden Heights in *The Hate U Give* portrays how black youth are seen as threats instead of children and how it consequently makes them feel unsafe in the presence of law enforcement. Although Starr was taught by her father how to “be smart around” the police, or follow politics of respectability to ensure a safe interaction that doesn’t result in murder, following these rules does not ensure everyone survives (Thomas 27). When Starr and Khalil get racially profiled and pulled over, Starr reminds herself of the rules her father has engrained in her head growing up. Wondering whether Khalil has been taught the same rules, Starr narrates as he breaks the rules she has been taught, such as staying still when an officer is facing the other way. Ultimately, Khalil is killed due to the officer mistaking a brush for a gun. In contrast with Khalil, in that she represents children who are forced to learn to “follow the rules” to avoid being perceived as a threat, Starr’s experience as a witness demonstrates how these rules do not ensure prevention of trauma, as she is left to deal with nightmares and flashbacks of Khalil’s dead body, often causing her physical symptoms such as nausea, shivers, and cold sweats. Khalil’s murder depicts how children are not afforded the same opportunities to make mistakes and instead are expected to overcompensate and act in a way that makes white officers feel safe and not the other way around. Both *Barely Missing Everything* and *The Hate U Give* portray how black and brown youth lives are put in jeopardy even when they are unarmed and seen as less than by law enforcement when they do not follow the unequal rules that are expected of them.

In contrast to *Barely Missing Everything* and *The Hate U Give*, the interaction between Norris and a police officer in *The Field Guide to the North American Teenager* demonstrates how altercations where minority youth come out alive are deemed as lucky. After drunkenly bad-mouthing an officer and getting arrested, Norris is yelled at by his mother and called a “statistic waiting to happen” as she cites real life victims of police brutality (Philippe 320). After reluctantly realizing the severity and riskiness of his actions, he wishes to go back to Canada in an attempt to run away from his problems. Worried that Norris doesn’t understand the political climate in the United States, Norris’s mother agrees it’s best to send him with his father back to Canada before Norris decides to take responsibility and work on his word choice and attitude. Although Norris leaves the situation unharmed, the cultural trauma he and his mom share with black Americans reminds him that he is not immune to police violence.
and racism in America.

**RESPONSES TO CULTURAL TRAUMA**

In this section of the paper, I will discuss the responses to cultural trauma (in migration, gang violence, and police violence) and how they affect identity and challenge traditional notions of recovery. Whereas traditional forms of recovery arise from separating the past and reestablishing security and control, cultural trauma does not always offer a direct solution to regain agency. Instead, young adult characters imagine social justice as a way to recover from cultural trauma by engaging in political activism, cultural work, and countering stereotypes.

**Political Activism**

With the rising popularity of discussions about social justice, it’s no surprise that young adult fiction novels are using the platform to empower youth through the role of the teen activist. Both *Zara Hossain Is Here* and *The Hate U Give* allow the protagonists, Zara and Starr, to work through their trauma in witnessing their loved ones attacked and disenfranchised by participating in political activism. In fact, Zara demonstrates a political consciousness throughout the novel even before she uses it for individual purposes by being an active member of a local social justice group focused on diversity and inclusion. On the other hand, in *The Hate U Give*, Starr is aware of racism, but it takes her time to process a response to the murder of her best friend as it spreads across media platforms and reaches her white-majority school in the suburbs. Political activism becomes a way to imagine progress and create a timeline that separates the traumatic past from the hopeful future.

Being the sole witness to Khalil’s murder in *The Hate U Give*, Starr faces pressure from her community to use her voice to resist narratives in the media that threaten to dehumanize Khalil and justify his murder (Thomas 196). Initially, all Starr wants to do is not think about Khalil’s death, using her school in the suburbs as an escape from her accumulating trauma. Khalil’s death catches up to her as her classmates use his death as an excuse to skip class in the name of a protest. When neither of her worlds allow her to continue to suppress her trauma, Starr decides to confront it by using her voice in attending interviews, protests, and rallies for Khalil, and other black youth victims of police brutality. By making real world references to victims such as Trayvon Martin, Eric Garner, Tamir Rice, and many others, Thomas creates a parallel between Khalil and real life victims (Thomas 437). Starr taking on the role of teen activist allows her to reclaim a sense of agency in the middle of a trial she feels she has no say in.

Similarly, Zara also takes on the role of teen activist in *Zara Hossain Is Here*. Even before she experiences the trauma of knowing her father almost died from a racially motivated attack, Zara is an active member of a local activist group called Social Justice Club. In fact, it’s with the help of the club’s coordinator that she is able to get in touch with Senator Delgado, who offers help with her family’s situation regarding their green card application. Although the extent to which she can help is limited, she offers Zara an opportunity to speak at a rally organized by Citizens for Immigration Reform. At the rally, Zara then shares her story and urges a reexamination of immigration rights, explaining how even if you do everything right, something can still go wrong and jeopardize years of process and paperwork (Khan 205). By sharing their personal perspectives and advocating for change, the protagonists of these novels work through the hopelessness they feel in the face of systemic oppression.

Although the trope of teen activist is certainly empowering and hopeful, it’s also important that not every culturally diverse protagonist is forced to feel responsible for their entire community. In these texts, Starr and Zara use political activism as a personal means to process their hardship regarding police brutality and immigration.
law, respectively. In *The Hate U Give*, the officer who murders Khalil escapes justice, but Starr feels hopeful for the future as she knows that she, along with others, will never stop advocating for black lives. In *Zara Hossain Is Here*, Zara’s engagement with politics and activism secures her an opportunity to stay, provided her father works for the senator, but she ultimately decides on a middle ground with her parents to move to Canada. Canada is not the U.S., where her parents feel unsafe, but its also not Pakistan, where Zara would feel unsafe being openly bisexual.

### Countering Stereotypes

In attempts to resist harmful, singular views of marginalized groups, countering stereotypes is a tactic long used in realist fiction, allowing authors to explore intersectional identities (Durand and Jiménez-García 2). While countering stereotypes has its advantages, it also has its limitations, as countering stereotypes enforces a “form of normativity” that shifts “responsibility of racism away from systemic forces” onto marginalized youth themselves (Owen 239). In the face of racial and ethnic trauma, derived from discrimination and stereotypes, many characters in young adult novels actively seek to resist stereotypes by adjusting their behavior and even compromising their wants in situations where their emotions are heightened. Both Norris in *The Field Guide to the North American Teenager* and Starr in *The Hate U Give* find themselves in situations where they fear being labeled as a stereotype by others and wish to act in opposition to what is expected of them.

For example, despite being characterized for being blunt and snarky, when an American hockey player makes racial remarks at Norris for being black and playing the game, Norris does not react because he does not want to be “the black guy who escalated things” (Philippe 274). Instead of bad-mouthing him back, which is at the very essence of his character, Norris pulls an advanced hockey move to embarrass him and show him that he is qualified to play. The resistance to add to other people’s biases leads Norris to reject the character traits that make up his personality, showing how cultural trauma from stereotypes force marginalized youth to see themselves through other people’s eyes and influence them to act accordingly.

Starr, on the other hand, initially code switches between her neighborhood Garden Heights and Williamson Prep, turning off parts of herself, including mannerisms and vocabulary, at school because she “can’t let anyone think [she’s] ghetto” (Thomas 97). However, Starr is simultaneously aware that those rules only apply to her, as she states that slang makes her white friends cool, while it makes her “hood” (Thomas 73). The double standards that she experiences as a black girl in a majority white private school cause Starr to analyze her every action for fear of embarrassment, judgement, and further trauma from her white peers. Later in the novel, when her friend Hailey insults Khalil, Starr once again begins to remind herself that she “can’t go angry black girl on her” but is eventually overcome with emotion when Hailey praises the officer for killing Khalil because he was a drug dealer (Thomas 337). Hailey valuing black lives based on perceived criminality hurts Starr in particular because she was once her best friend. By allowing Starr to physically react, let her emotion out, and defend Khalil’s name, Thomas humanizes Starr without adhering to the limitations of avoiding stereotypes.

### Community Building

Coming together as a community is also an effective mechanism for recovering from cultural trauma, as collective trauma can connect neighbors and/or strangers based on identity and experience. Whether it be providing resources for others or sharing past experiences, communities who have shared trauma can process grief and stress with the help of community support. Community support offers an alternative to a direct support
system that recovery from trauma requires but is not available to many for guidance or protection, such as a family. *The Hate U Give* and *We Are Not from Here* both demonstrate community support as a way to resist further cultural trauma, while *The Poet X* builds community through sharing experiences through poetry.

In *The Hate U Give*, Starr’s father builds community by helping neighborhood youth as well as keeping the only grocery store in the neighborhood open. Starr’s father takes in local youth Devante, who wishes to get out of gang life, showing sympathy as he was able to get out of gang life himself. Acting as someone he would’ve liked to have when he was younger, Starr’s father uses his past to prevent further trauma to current youth who feel trapped by gang life.

Even when Starr’s father’s store is burned down due to gang violence, Big Mav declares he will rebuild it for the sake of the community, not wanting to be a “sellout” and leave his community behind (Thomas 179). By not letting gang violence force him out the neighborhood, Starr’s father, as well as the other local business owners, create a sense of community that not even gang violence can make disappear.

Similarly, in *We Are Not from Here*, families and loved ones of those who have died on their attempt to migrate to the U.S. give back in the form of building shelters or providing supplies to prevent more trauma and death (Sanchez 332). For example, one woman, Soledad, runs a shelter by the train tracks to help youth since her daughter died making the journey. She sees her daughter in girls like Pequeña, and offering aid and shelter to them helps her process her trauma and loss. Another woman, who turns out to be Soledad’s sister, helps Pequeña because she is inspired by her sister’s determination to help migrants and is also dealing with the loss of her niece. Even strangers who make the journey together share smiles and glances at each other that provide encouragement and a sense of understanding of the collective trauma they all feel from the fatigue and malnourishment the trip causes.

In *The Poet X*, Xiomara, living in a low-income neighborhood with few resources, uses her poetry and attends spoken word events to share and process her experiences dealing with misogyny and intergenerational trauma. Often objectified or shamed for her body, Xiomara writes about her religious trauma and being surrounded by depictions of women being punished for their sexuality. Instead, Xiomara finds representation and inspiration in artists such as Nicki Minaj, who make her feel seen and encourage her to embrace her curves (Acevedo 180).

Wanting to spread the message of self-love and acceptance further, Xiomara uses poetry to reject sexist standards and beliefs that hinder women’s empowerment. With the encouragement of her poetry club and English teacher, Xiomara begins to see how her words “turn language,” “connect with people,” and “build community” (Acevedo 287). It is through her poetry, and with the help of the local priest, that Xiomara is able to communicate with her strict mother how she feels and what she wants, accepting that even if they are never friends, they can tolerate each other. Although Xiomara’s mother initially rejects her daughter’s expression, the support of the local priest as well as seeing her daughter perform at events helps her accept that Xiomara’s life is her own and not for her mother to control. Through giving back in material or emotional support, individuals can process trauma by creating a sense of community and aim to break intergenerational cycles of trauma. These texts structure social justice as something achievable and as something that relies factors not outside but within the community.

**FAILURE TO IMAGINE**

While political activism, countering stereotypes, and community building are all valid responses to cultural trauma, there are instances where none of these are accessible options. I conclude with the example of *Barely Missing Everything*, in which there seems little hope or imagination of a future of social justice. As a realist fiction
novel, *Barely Missing Everything* accurately addresses the reality of youth who lack a stable adult support system, which is mostly present in the other novels in my archive. Fabi, who got pregnant as a teen after her mom died, undoubtedly loved Juan and did her best as a mother, but the lack of resources and stable adults in the novel result in youth not having a sense of guidance. This novel depicts how one mistake can lead to the next and result in an intergenerational effect. In fact, in one of Juan’s last moments alive, he tells himself that “his future was knotted with everyone’s past” in “a knot of fuckups that was impossible to untangle” (Mendez 289). In other words, Juan’s mistakes could be seen as a result of not having parental guidance, just as Fabi’s mistakes are seen as a result of not having parental guidance, due to the passing of her mother and emotionally absent father. Searching for emotional support elsewhere, Fabi is a product of her environment who then created a similar environment for Juan, leading to a generational cycle of mistakes, poverty and lack of resources, and the absence of adult guidance.

Instead of seeking inspiration and support from parents, Fabi is inspired by her son’s plans, who did have a plan for himself and his future. Juan looked forward to enrolling in community college and playing basketball but was killed before being given the opportunity. Juan’s proximity to almost breaking the cycle of missed opportunities due to poverty demonstrate how factors beyond individual control affect marginalized people. Systemic issues of class poverty and state violence affect poor brown youth as they are disregarded before being given a chance. Seeing no reason to stay in El Paso after Juan’s death, Fabi decides to enroll in the community college Juan would’ve attended. JD, whose father cheated on his mother while his mother spent all day at work, finds adult guidance in a recruiting officer after wrecking his car. The trauma and loss from witnessing Juan’s death pushes him to make and act on a decision about his future and join the military, fulfilling his mother’s belief that he would abandon them one day (Mendez 298). *Barely Missing Everything* reveals the reality of youth who are overlooked, told they do not matter, and cannot imagine a way out of systemic issues and disenfranchisement.

**CONCLUSION**

Contemporary young adult authors of color convey the diverse identities in marginalized youth in the U.S. through literary realism largely based on cultural and intergenerational trauma. As youth face stressors such as migration, gang violence, and police violence, their sense of identity in relation to their environment changes and demands a new interpretative lens into trauma and recovery. While youth can process trauma in various ways, such as political activism and cultural work, they also face limitations in countering stereotypes. On top of that, there are instances where the path to recovery is not present due to a lack of resources and adult guidance. In combatting cultural trauma, derived from social and government oppression, diverse youth literature represents important social issues that are affecting youth in the real world and provides representation for youth to feel seen and validated. The diverse stories in young adult literature back up the notion that the black and brown youth experience is heterogenous and ever evolving based on factors such as gender, class, sexuality, etc.
REFERENCES


TRANSGENERATIONAL EFFECT OF PREDATOR CUES ON LIFE HISTORY
TRAITS AND PHENOTYPES OF DAPHNIA

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The mechanisms that allow organisms to adapt to changes in environmental stressors have long been a focus of study. However, our understanding of phenotypic plasticity, the capability of an organism to modify their expression of traits following stimuli, and, especially, transgenerational responses that persist for multiple generations is limited. This study evaluates the link between the strength of predator cues, the induction, and magnitude of transgenerational responses in water fleas (Daphnia pulicaria). Multiple clones of Daphnia were hatched from sediment cores from a lake in Wisconsin, USA, and were exposed to contrasting strengths of predator cues for one or more generations. Transgenerational plasticity was quantified by measuring life history traits throughout the duration of the experiment. In general, strong differences were observed between ‘predator’ and ‘non-predator’ treatments in generation 1. For instance, Daphnia that were exposed to predator cues (irrespective of cue strength) in generation 1 produced more offspring and were larger at maturation than Daphnia that were not exposed to predator cues. Yet, such differences generally disappeared thereafter. The results show that transgenerational responses to predator cues were weak and did not depend upon cue concentration. Such results argue that the induction of transgenerational plasticity does not depend upon cue strength.
BUILDING A SCALABLE, HIGH-PERFORMANCE CLUSTER FOR DEEP LEARNING

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Deep learning is a machine learning technique that creates prediction models for various uses. Depending on its level of sophistication, deep learning models can take an extreme amount of computational power to create. The hardware for research with deep learning is incredibly expensive and has only become more so at the turn of the decade. Although they are generally consumer products, a “Graphics Processing Unit” or “GPU” is an essential component of machine learning, employed in the field of physics. Since renting space on the various GPU superclusters worldwide is often outside the budget of most research situations, I set up a GPU cluster for the eventual purpose of exploring the costs of building an amateur supercomputer relative to its benefits with consumer hardware. Although the research is still in progress, this paper is a guide and explanation of my experience building a cluster, as well as the decisions and issues that came up during its assembly. This includes an overview of infrastructural choices and precautions that came up in its physical establishment in a shared lab environment. The paper also includes an exploration and review of the current software available to small clusters.
ANALYZING DIVERSITY IN THE BOOK PUBLISHING INDUSTRY: EMPLOYMENT AND WAGES

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Following the Black Lives Matter movement, the oppression of black, indigenous, and other people of color (BIPOC) is in the public eye. One of the most integral aspects of this oppression is within media like books and television. The research presented investigates the book publishing industry’s employees and their wages to address the lack of BIPOC representation. The book publishing industry favors white employees for jobs and wages, deterring professionals and readers of color. The research suggests that there is not a lack of aspiring BIPOC authors, but there is a lack of accepting them and allowing them to share their stories. This problem of whiteness in the publishing industry has been the topic of discussion for decades, and interviews with current BIPOC professionals in the publishing industry can inform discussion of solutions. The participants needed are BIPOC professionals in the industry: authors, editors, publicists and marketers, literary agents, and other positions. Three to five random samples from each of the 15 industry departments could be chosen for an interview to help encompass most of the diverse voices and issues. The research protocol has been reviewed by the IRB, allowing for future implementation of the interviews and analysis of the results.
MODELING INGESTIVE BEHAVIOR ON FREE-GRAZING THROUGH ACOUSTICS AND ITS RELATIONSHIP TO PH IN THE RETICULUM

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Beef has been an essential food product in many people’s homes. In 2018, 54.6 pounds of beef were consumed per person in US. We research the eating manners and food digestion of cattle. An acoustic system for free grazing cattle has matured and has allowed for individuals to monitor their cattle more efficiently and affordably from free range. Analysis of acoustics has been endorsed as a method to correlating ingestive habits to pH in the reticulum and thus this gives insight on what is the key player in ingestive behavior. We use a system of acoustic analysis to validate its effectiveness and portray a correlation with the digestive anatomy of free grazing cattle through pH in the reticulum. This system allowed us to conjecture a response time between food ingested and pH fluctuation to be 1 minute to simplify the discovery of correlation between pH and ingestion. We conclude that the methodology of acoustic analysis to be of credibility in representing ingestive behavior in the analysis of exterior variables.
The discovery in 2020 of S4714, a star orbiting the massive black hole at the Galactic Center, provides a new window to test general relativity and black hole physics. With its 12-year orbital period and extremely high eccentricity of 0.985, it passes closer to the black hole than any other currently known star. One method of probing general relativity and black hole physics is to understand how a star’s flux is affected by its tidal interaction with the nearby black hole, an effect known as “ellipsoidal variation”. Since S4714 is relatively dim, current telescopes are unable to measure this effect. However, in the next few years, a new class of large, thirty-meter telescopes such as the TMT, GMT, and ELT, will have the technology to observe much dimmer sources in the Galactic Center, and thus may shed new light on the physics in the environment near the black hole. In this paper I present theoretical calculations of the tidal interaction between S4714 and the black hole through the lens of upcoming large telescopes. Our results motivate future work that will more fully assess the ability of these new telescopes to detect the expected flux variations.
Disposal of waste plastic and waste concrete aggregates is a widespread issue across the globe. If not responsibly disposed of, the waste winds up in sensitive ecosystems where it leeches toxins into its surroundings. In an effort to utilize the waste plastic and waste concrete, studies have been done to test if recycled waste plastic can be mixed with fresh concrete and studies have been done to mix recycled waste concrete in fresh concrete. However, none have been found mixing both recycled wastes in the same mix design. This study determines the effects of recycled plastic and recycled concrete on specific concrete properties. Tests performed in this study include slump, compression, modulus of elasticity, and water permeability. This study had an issue with inconsistent results with the compression test, but conclusions were able to be drawn from the three other tests. The slump test showed the recycled concrete reduced the workability while the recycled plastic had little effect on the workability. The batches tested with recycled plastic content performed better for elasticity and the recycled concrete was deduced to have no advantages in terms of improved strength based on the modulus of elasticity test results.
Since language is secondary to culture and necessary to existence as a people, it follows then that the loss of the indigenous Saami Language has massively affected the lives of the Saami people throughout different countries, such as Finland, Sweden, Norway, and Russia. While the experiences have varied in the different countries that the Saami people live in, there have been many similarities due to their lived experiences of mass oppression, forced assimilation, generational trauma, and social stigma. All these factors have affected and still affect the Saami people and their efforts towards revitalizing and reconstructing the endangered and extinct aspects of the language. This paper represents the content analysis of many primary sources and will focus on the history of loss and the hope for revitalization. This study found that the loss of the Saami language was due to the oppressive standards imposed on them by the colonizing forces that overtook the native Saami lands. Future study is needed, including qualitative interviews with native Saami speakers, both to capture their lived experiences and create audio recordings of endangered languages. This will likely be done online due to the pandemic worldwide affecting international travel.
EXPLORING INTERFACE INTERACTIONS BETWEEN PROSTATE CANCER / BREAST CANCER AND HUMAN DERMAL FIBROBLASTS

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Metastasis is a characteristic of aggressive cancer cells that proliferate from a primary site of origin within the body and spread. In this experiment we set out to develop a new cell culture assay for the observation of such malignant cancer cells and their interaction with human dermal fibroblasts (HDFs). The highly tumorigenic cancers observed for this experiment were breast cancer-derived cells (MDA-MB-231) and prostate cancer-derived cells (PC3). The new cell culture assay involved the seeding of the cancer cells in a secluded island formation, while the HDFs were seeded directly outside the space. The temporary space between the cancer cells and HDFs allowed for us to observe the interaction that would take place as the cancer proliferated and eventually hit the boundary of the HDFs. The results from the images taken showed that there were some unique physical properties occurring amongst the cancer cells and between the cancer cells and HDFs. These interactions observed in vitro can provide a better representation of the interaction that occurs in the body at the early stages of metastasis. This model can then be used to gain a more accurate response to cancer treatments before the conversion to in vivo models.