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Being "Someone Actually Doing This" Work: Consequential Learning by Youth Through the Travel of People, Knowledge, and Practices

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Abstract: This study examines mechanisms of consequential learning by tracing the "travels" of people, knowledge, and practices across contexts. Drawing on sociocultural perspectives, we analyze the experiences of three high school students who engaged in tackling interdisciplinary, data-intensive environmental justice issues. Through qualitative case studies, we explore how travel—both literal and metaphorical—enabled students to connect disciplinary knowledge with real-world problems, navigate tensions between knowledge systems, and develop agency and aspirations. Findings highlight travel as a mechanism that fosters authentic engagement and consequential learning that are transformative for learners. This study advances the consequential learning literature and contributes to equity-oriented educational research by surfacing practical pathways for bridging disciplines, communities, and identities, as well as obstacles to making these learning opportunities even more authentic and meaningful.

Introduction

Contemporary educational paradigms are increasingly challenged to reimagine learning as a deeply contextual, socially embedded process that transcends traditional classroom boundaries. Despite growing recognition of learning as a fundamentally social and cultural phenomenon (Lave & Wenger, 1991; Nasir et al., 2020; Rogoff, 2003), most educational systems continue to prioritize decontextualized knowledge transmission over transformative experiences that position young people as active knowledge producers and community agents.

The disconnect between formal learning environments and meaningful real-world engagement represents a critical challenge in contemporary education, creating disinterest among learners in school curriculum. In the learning sciences, pedagogical models such as Knowledge Building stress the need to center on students' real ideas and epistemic agency as they build knowledge about authentic problems (Scardamalia & Bereiter, 2022). Models of connected learning intentionally link academic content with students' personal interests, peer cultures, and broader societal contexts (Ito et al., 2013). In computer science education, computational thinking is expanded to computational participation, which emphasizes collaboration, creativity, and social engagement to broaden the scope of computer science to make it more meaningful and relevant to learners (Kafai et al., 2014). These approaches challenge traditional boundaries, suggesting that learning is most powerful when it becomes an agentic, generative, participatory process deeply rooted in learners' lived experiences and social commitments.

A growing body of literature on *consequential learning* is taking this argument further. Consequential learning is a concept that focuses on how learning leads to significant and lasting changes for individuals and their communities. It emphasizes the broader impacts of learning experiences, beyond the acquisition of knowledge or skills, by considering their implications (Hall & Jurow, 2015; Jurow et al., 2016). For learning to be consequential, it necessitates movement within and across activity systems in different spaces (Gutiérrez, 2023), so that students' identity, agency, and perceptions of the world can be transformed (Wei et al., 2023). Such consequentiality of learning has been highlighted as an important outcome. However, significant theoretical and empirical gaps remain in further articulating what consequential learning could mean in different contexts, and how consequential learning can be facilitated.

This study addresses these gaps by examining the complex processes of consequential learning among high school youth participating in environmental justice projects. By closely tracing the "travels" of learners, knowledge, and practices across diverse social, spatial, and temporal settings, we aim to uncover the intricate ways young people engage in meaningful learning experiences. This work seeks to advance sociocultural perspectives on learning by analyzing how learners actively navigate and transform knowledge across varied contexts. We position youth not as passive recipients of information but as dynamic agents of knowledge production and social change, equipped to tackle real-world challenges with creativity, critical insight, and deep commitment. Central to our analysis is the tracing of their movements and the travels of knowledge and practices they lead, revealing the mechanisms behind both consequential and inconsequential learning.

In the sections that follow, we first review the relevant literature on consequential learning, which informs our research questions. We then outline the research methods, present key findings, and discuss the broader implications of this study.

Consequential learning

Rooted in situated and sociocultural views on learning, consequential learning is conceptualized to include three dimensions (Hall & Jurow, 2015; Jurow & Shea, 2015; Jurow et al., 2016). The first dimension emphasizes the historical contingency of what is valued as learning. This dimension indicates that what is considered useful knowledge, practices, and ways of knowing depends on the sociohistorical contexts a learner is embedded in. The second dimension attends to the developments of a learner's participation in a community of practice. As the result of consequential learning, the learner gains access to certain activities and is able to meaningfully contribute to those activities. The change is also reciprocal. As the learner changes their practices and forms of participation in a community of practice, the community of practice and its practices also change. The third dimension focuses on the social, spatial, and temporal scales of a learner's participation in activities. The social scale consists of resources (e.g., people and tools) a learner interacts with. The spatial scale refers to the setting(s) in which a learner participates. The temporal scale includes a learner's participation in the present as well as their imagined participation in the future. For consequential learning to occur, "pathways on which people and practices can travel" must be created (Jurow et al., 2016, p. 219).

Drawing on this conceptualization, groups of researchers have studied consequential learning with youth in different contexts. Birmingham et al. (2017) explored consequential learning in science, which the youth described as "science that matters." The concept of consequential learning was enriched by centering the youths' commitment to their community in their scientific pursuits. During their pursuits, the youth developed and implemented practices to bridge the boundaries between science and their community as well as to challenge normative views related to their race, gender, class, and age. These "bridging practices," in which the youth leveraged personal areas of expertise in conjunction with their developing scientific to take action in their community (Birmingham et al., 2017, p. 838), relate to the first and second dimension of consequential learning. The youth's strong expression of hope for what formal science learning could look like and embodiment of urgency to address the environmental and economic issues in their community relate to the third dimension of consequential learning.

Consequential learning was also examined in engineering. Calabrese Barton and Tan (2019) extended consequential learning with the notion of rightful presence, which is defined as "legitimate and legitimized membership in a classroom community because of who one is (not who one should be)" (p. 4). It calls attention to empowering youth to make their experiences with marginalization in school visible and to use engineering practices to address these injustices, which relates to the first and second dimension of consequential learning. Jordan et al. (2021) elaborated on consequential learning with the principle of "real work with real consequences," which positions youth as producers of knowledge and designers of solutions for and with their community. Experiencing the realness of disciplinary work allowed the youth to form an emotional connection to their projects and to encounter "pain points" in consequential learning, such as facing setbacks, feeling discouraged, and being constrained by systems of power.

Building on this body of theoretical and empirical work, we attempt to elaborate the mechanism of consequential learning by zooming into a dynamic process in which learners and their knowledge and practices "travel" across space and time. Examples of travel include when learners bring a familiar practice from its original space (e.g., home) to another context (e.g., school) and when they partake in a new practice in one setting and utilize it in a different setting. When learning opportunities are consequential, learners are positioned as active participants who pursue endeavors that they and their community care about and find meaningful. During these endeavors, they may literally travel across different spaces, leading to the travel of knowledge and practices across these spaces. Various factors may enable or constrain the possibility for learners to gain access to different spaces. They may also encounter challenges when developing disciplinary knowledge about relevant topics, reconciling tensions between different knowledge and practices, or taking action in real world contexts based on their learning. As a result of engaging in such consequential learning, learners may develop changes in identity and beliefs in relation to oneself (e.g., sense of competency or agency), the discipline or profession (e.g., career aspirations), and society (e.g., civic engagement).

The aim of this study is to investigate mechanisms of consequential learning by tracing different types and pathways of "travels" when youths work on interdisciplinary, data-intensive projects while being plugged into external organizations working on environmental justice issues. The research questions that guided this study include: *What types of travels did youths participate in? To what extent did these travels contribute to consequential learning?*

Methods

A qualitative case study approach was employed as it pertains to our goal of developing "an intensive, holistic description and analysis of a bounded phenomenon" (Merriam, 1998, p. xiii). Each youth is treated as a case, bounded by the surrounding learning environment including their teacher, curriculum, technologies, and external organizations. The qualitative case study approach allows us to focus on particular situations of learning and generate rich descriptions of these situations to answer our research questions (Merriam, 1998).

Context and participants

Three high school youths, all girls, are the focal cases of this study. Two youths, Lucy and Olivia (pseudonyms), are from the Midwestern United States and participated in a semester-long environmental justice (EJ) program at their school that engaged them in working with local community partners to address EJ issues. In the program, the youth are positioned as "changemakers" and work in groups to create a project that can positively impact their community partner and/or the larger community. We partnered with the program director to curate curricular resources on data science to support the youths' projects. The third youth, Michelle (pseudonym), is from the Northeastern United States and was taking an AP Environmental Science class at her school. She did not work with a local partner but participated in a remote research opportunity offered by a large public university in the upper Midwest where she was able to learn about EJ issues and work hands-on with data.

Data and analysis

The primary data sources for this study were (a) interviews with students and (b) their project artifacts. Each student interview was conducted at the end of the semester over Zoom and lasted between 45 minutes to 75 minutes. Project artifacts included students' final project reports, research notes, posters, e-portfolios, an op-ed article, an online petition, and presentation slides.

Data analysis was an iterative, meaning-making process that "[involved] consolidating, reducing, and interpreting what people have said" and created (Merriam, 1998, p. 178). This process, guided by our conceptualization of consequential learning, employed the constant comparative method to allow for the emergence of new codes and relations from the data. We started by carefully reviewing Lucy's interview and artifacts based on codes found in the literature and writing memos to document emergent codes. Afterward, we followed the same steps with Michelle's data and compared it to Lucy's data to revise the codes. We then repeated the procedures with Olivia's data, which was compared to Lucy and Michelle's data to further refine the coding scheme. We continuously re-visited the data to compare the codes within and across the data until reaching theoretical saturation. Triangulation and member checks were incorporated to enhance internal validity of findings. Thick description of each case is provided with enough detail to increase the credence of our interpretation (Merriam, 1998).

Findings

In this section, we present the three cases of consequential learning. An overview of the cases is provided in Table 1. These cases highlight diverse opportunities (and constraints) for consequential learning at the intersection of disciplinary engagement, data investigations, and youth-driven critical action. These opportunities were made possible through coordinated efforts that facilitated the travels of people, knowledge, and practices, centering on youth and extending from schools to communities both near and far. Below, we first present the girls' cases in detail. Next, we discuss mechanisms of consequential learning evident in their cases with a focus on travels.

Lucy

Lucy's project focused on lead poisoning in her city. She, along with three classmates, worked with the founder of a local architecture firm to investigate the use of fungi to decontaminate architectural waste and soil with lead content. As students and newcomers to the firm, she expressed that they did not have much scientific expertise they could offer to their community partner. With this limitation in mind, Lucy and her group mates sought to leverage their expertise as "teenagers growing up in the social media landscape" to help increase the firm's online presence. For their project, they made infographics and short-form videos (see Figure 1a) to showcase the firm's work in "engaging, accessible, and digestible ways" to the public. To create the content of the social media posts, Lucy conducted a literature review about lead poisoning to understand its history in her city and its negative health effects as well as about mycelium to learn about its role in nature and application in architecture. Besides reading about the two topics, Lucy deepened her knowledge about them by speaking with two community members whose children were exposed to lead and interviewing their community partner about the firm's development of mycelium-based housing materials. To spread the word about the firm's projects in a different format, she and a

group mate contacted an environmental justice podcast and published the interview with their community partner as a special episode of the podcast. These aspects of the project demonstrate the ways in which her personal knowledge about social media traveled to the project context and was utilized alongside disciplinary knowledge.

Table 1
Overview of Student Cases

Student case	Lucy	Olivia	Michelle
EJ topic	Lead poisoning	Air pollution	Deforestation
Disciplinary work	Reviewed literature on the EJ topic; Collected soil samples; Conducted soil experiments	Reviewed literature on the EJ topic	Agricultural methods
Data work	Only received final experimental results from community partner; Analyzed data from own experiment	Collected air quality data	Collected geospatial data of cashew plantations; Corrected output of ML algorithm
Critical action	Interviewed local community members; Conducted social media outreach	Created an op-ed, a petition, and a poster	N/A
Travel of people, knowledge, and practices	Physically went to local neighborhoods and the community partner's lab	Physically went to the city's Division of Air Quality and the statehouse	Virtually visited a West African country
	From personal life and community to project (knowledge of social media)	From personal life to project (artistic skills)	From classroom to project (scientific knowledge)
	From project to classroom (scientific practices)	From classroom to project (knowledge of advocacy methods)	
Outcomes (Changes)	Career aspirations; STEM identity; Climate hope	Career aspirations; sense of agency; Climate hope	Career aspirations

In addition to their project, Lucy and her group mates contributed to the firm's experiment on using liquid mycelium to remove lead from soil. They engaged in data collection by selecting and driving to several urban and suburban neighborhoods in their city and taking soil samples from each neighborhood. One neighborhood they selected was where one of the community members they spoke with lived. After collecting the samples, she and her group mates brought them to their community partner's lab. Here, their community partner provided them with lab attire to wear and guided them through the experimental procedures. Lucy assisted with the procedures by measuring and placing 50 grams of soil from each sample onto petri dishes, operating an autoclave to sterilize the samples, and inoculating the samples in the test group with liquid mycelium. Their community partner then sent the prepared soil samples to another lab to be tested for lead and later relayed to them that the mycelium-inoculated soil samples had low levels of lead content, whereas the control samples had high levels of lead content. Lucy described the data analysis process as "a little bit over our heads" because they "weren't actually able to see the direct numbers" of the results from the experiment. Through this experience, she was able to engage in authentic scientific practices but was not able to engage in data practices.

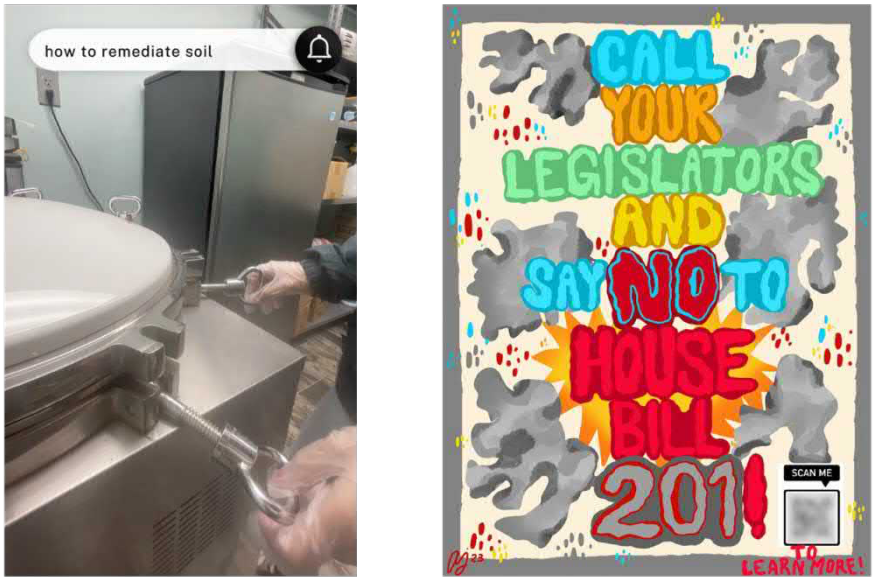
The scientific practices Lucy developed from participating in their community partner's experiment traveled with her to the classroom and influenced how she approached her own soil experiment. After seeing an

abundance of spores produced by reishi mushrooms growing in their community partner's lab, she wondered whether adding mushroom spores to soil would affect the growth of radishes. To answer this question, she collected the spores and planted 12 radish seeds in regular gardening soil as her control group and another 12 seeds in regular gardening soil mixed with a teaspoon of the spores as her test group. Several days later, she found that all seeds in the test group sprouted, whereas only seven of the seeds in the control group sprouted. Of all the sprouts, she observed that the ones in the test group were taller and grew more leaves than those in the control group. At the end of the week, she discovered that no sprouts in the test group died, while two of the sprouts in the control group had died. These results motivated her to deepen her scientific knowledge about the effect of mushroom spores on the soil and to understand the potential applications of using mushroom spores in restorative agricultural methods.

Lucy revealed several insights from her time working on "official and tangible" projects for and with their community partner. She noted that before the semester, she felt "a little bit helpless" with respect to climate-related efforts. However, during the semester, she became more hopeful and felt more capable to contribute to these efforts as she learned about and participated in the firm's design and research of "empathetic and sustainable solutions" that positively impact her city. In relation to the discipline and profession, Lucy expressed that the semester program helped her "regain passion for STEM related pursuits" and inspired her to pursue environmental law in her future career.

Figure 1

Project Artifacts Include Lucy's Short-form Video (a) and Olivia's Poster (b)



(a) (b)

Olivia

Olivia's project concentrated on air pollution in her city. In collaboration with two classmates, she worked with the leader of the local chapter of a national climate change organization. Like Lucy, she conducted a literature review to understand the prevalence of air pollution in the country as well as its contributing factors, negative effects on health, and various pollutants (e.g., particulate matter 2.5 [PM2.5]). She also looked into the disproportionate level of air pollution that people from communities of color and low-income neighborhoods are exposed to and breathe. In addition to her independent research, Olivia gained first-hand insight into the processes in which air quality data were collected and analyzed through the class field trip to their city's Division of Air Quality. During the visit, she had the opportunity to walk around downtown with an air quality sensor, which enabled her to "see the actual levels and data of the different ranges of air quality" in real time. She later went to large air quality monitoring sites, where she "actually saw the machinery and data and tech they actually use for collecting the broad spectrum of air quality and air pollution." Additionally, she and her group mates were able to speak with a representative from their city's Department of Public Health and learn about the ways the city was working toward addressing air pollution. Through this experience, the knowledge she gained about air pollution became more concrete to her.

Following the field trip and discussions with their community partner and teacher, Olivia and her group mates decided to "strike at the political level" for their project because they wanted to "try and make change where it will actually be enacted." As the group reviewed state legislation that would impact air pollution, they came across a House bill that aimed to prohibit their state from adopting California's vehicle emission standards requiring new commercial vehicles to be zero emission by 2035. After learning about California's regulations, Olivia wondered, "Why not adopt a bill [from California] that would be a benefit for the community?" When she and her group mates asked people in their community about their thoughts on the bill, they discovered that most of them did not know about it in the first place. This motivated them to center their project around raising awareness about the bill in their community and advocating against it because "people cannot care about something they have no knowledge of."

Olivia's knowledge about advocacy methods that was gained in the classroom traveled to the project context and inspired all three components of their project. The first component was a collaboratively written op-ed, which introduced the House bill in simpler terms, described the harmful effects of air pollution on health, and provided information about the negative impact of gas-powered vehicles on climate change. The second component was an online petition, which they aimed to send to their local representatives to demonstrate opposition to the bill. The third component was a poster, which was used to spread the word about the bill in a visual way (see Figure 1b). Olivia's artistic skills traveled from her personal life to the project context to design the poster. To increase the reach of their project, she and her group mates published their op-ed in a well-known newspaper in their city, emailed people at their school to sign the petition, and put up posters in various locations in their community (e.g., coffee shops). Through these efforts, they gathered over 500 signatures on their petition in less than two months.

Toward the end of the semester, their community partner brought Olivia and her class to the statehouse, where she and her group had a chance to speak with a senator who represented their district. One highlight from their conversation was when the senator recognized that they were taking action with their project and gave them the contact information of other officials that they could send their op-ed to. Unfortunately, they did not receive any responses from those officials, and the House bill was later passed in the state senate and signed into law by the governor. Despite feeling disappointed and discouraged about these unfavorable outcomes, she noted that meeting with the senator gave them "more hope… and reassurance that we can accomplish big things."

Olivia discussed multiple takeaways about her experiences in the semester program. In relation to her own sense of agency, she realized that she as a young person can have a positive impact and create change in her community. She expressed that prior to the semester, she "always wanted to do work like this, but just never knew how." She explained that the program gave her "an outlet to be able to address my concerns and address what I knew and express it through actual work." In relation to profession, Olivia noted that she had previously considered criminal law as her future career, but now, is considering environmental law.

Michelle

Michelle's project centered on deforestation in a West African country. In her project, she contributed to the development of a machine learning algorithm that aimed to identify cashew plantations and investigate the amount of land that has been deforested for the plantations by "actually teaching the machine." She was responsible for mapping out plantations in certain areas of the country using satellite images from Google Earth and sending the geospatial data to the university researchers, who used it to train the algorithm. When she first started, the researchers demonstrated how to use the mapping tools in Google Earth, provided examples of mapped out cashew plantations in different areas, and explained the machine learning workflow. After the researchers tested the algorithm with new areas of land, Michelle received its output and corrected any errors. Then, she sent the corrections to the researchers, who used them to continue to train and improve the algorithm. During this process, she participated in the data collection process, learned about the procedures for developing a machine learning algorithm, and was able to "do actual research for an actual paper that [the researchers] will publish."

Michelle highlighted several instances in which the scientific knowledge she gained in the classroom traveled with her to the project context. For example, she explained that learning about various biomes and modes of energy production around the world served as "background information" that helped her understand the contrasting ways developed and developing countries function. She noted that "seeing [the contrasts] in class is different from actually seeing it on Google Earth… and actually analyzing these systems" in the project. Another example is when she learned about slash-and-burn agriculture in the classroom, she recognized that it is an approach that people in the West African country were using to clear the land to grow more cashew plantations. From her experiences in the research project, Michelle was able to see first-hand real-world examples of what she learned in the classroom.

Michelle shared some reflections from working on the research project. She had initially expected the research project to mirror her class projects, where she would "go sit down, make a project, and that's it." However, she realized that it was instead "something much bigger… and achieves a great purpose." She expressed a strong desire to "actually see" the West African country for herself and planned to apply to a school-sponsored program that brings students to Africa to build schools for children in the following year. In relation to profession, Michelle explained that she originally intended to pursue interaction design as her future career, but now, is focused on environmental science research. She noted that her research experience can help her in the future when she becomes "someone actually doing this research, actually writing the paper, and actually helping a younger student with this project."

Cross-case comparison: Travels as a mechanism for consequential learning

There are several similarities and differences among the three cases. One similarity is that all youth indicated that they engaged in "actual" disciplinary work, data work, and/or critical action. Their learning was characterized by the movement of people, knowledge, and practices across contexts, which enabled them to connect their academic learning to broader societal and environmental issues. For instance, Lucy leveraged her disciplinary knowledge and personal expertise in social media to engage with community members and contribute to her partner organization's public outreach. Similarly, Olivia combined her knowledge of advocacy methods learned in the classroom with her artistic skills to create compelling materials for community engagement, while Michelle applied her understanding of scientific concepts to analyze data for the research project. In these situations, they also gained access to new knowledge practices—testing soil for lead contamination, collecting air quality data, tagging geospatial data—that were local to non-school organizations. These practices traveled with students to other contexts. As a result, they experienced identity shifts, such as developing a stronger sense of agency, career aspirations, or a commitment to addressing environmental challenges. Together, these cross-case similarities underscore the importance of creating pathways for students to engage in authentic, interdisciplinary work that connects their personal interests with larger social and environmental concerns.

Despite these commonalities, key differences in the nature and extent of travel emerged across the three cases. One difference is the extent to which they engaged in disciplinary work, critical action, and data work: Lucy primarily engaged in disciplinary work, Olivia in critical action, and Michelle in data work. Another difference is the role of mentorship and access to resources in shaping their learning journeys. While Lucy and Michelle's mentors facilitated the transfer of disciplinary knowledge through guided instruction, Olivia's mentor supported her physical travels to places like the statehouse and her community's Division of Air Quality, enabling her direct engagement with political advocacy. Additionally, the directions of travel varied: Lucy and Olivia drew on their personal expertise for their project and Michelle and Olivia brought disciplinary knowledge from the classroom to their project. Lucy was the only one who took the disciplinary practices from her project and applied them in the classroom. These variations illustrate how the mechanisms of travel are shaped by the unique intersections of learners' contexts, interests, and opportunities, highlighting the diverse ways consequential learning can unfold.

General discussion

Our findings reveal travel as a profound mechanism for consequential learning, demonstrating how knowledge, practices, and learner identities dynamically move and transform across social, spatial, and temporal boundaries. Consistent with sociocultural learning theories, we observed that learning is not a static, contained process, but a fluid, multidirectional journey of participation, creation, and identity formation (Wenger, 1998).

The three case studies we present illuminate distinct yet interconnected pathways of travel that made learning consequential. Lucy's experience powerfully illustrates how scientific practices learned in one context (the community partner's laboratory) could travel with the learner to another (her independent soil experiment), leading her to regain passion for STEM related pursuits. Olivia's trajectory demonstrates how her personal skills and classroom-learned advocacy methods could be leveraged to support the community partner's pursuit of critical action, highlighting young people's capacity for sophisticated social engagement. Michelle's experience shows how data practices in geospatial tagging traveled with her and triggered her to discover new meaning of agricultural methods discussed in her classroom. In these cases, students traveled across spaces and brought knowledge and practices from different settings to meaningfully solve problems in front of them, challenging traditional boundaries between school learning and professional/community practice. Critically, these travels consistently enabled students to develop more expansive understandings of disciplinary knowledge, professional identities, and their potential for meaningful social engagement.

Our study extends prior conceptualizations of consequential learning (Hall & Jurow, 2015; Birmingham et al., 2017) by foregrounding travel as a generative mechanism of learning. We demonstrate that consequential

learning is facilitated through dynamic "pathways" that allow people, knowledge, and practices to move, interact, and transform across different contexts. Broadly speaking, this perspective resonates with sociocultural approaches that view learning as fundamentally about participation and becoming, rather than individual knowledge acquisition (Rogoff, 1995). It also adds to a push to intentionally design educational experiences to better connect with personal interests, youth cultures, and broader societal contexts (Ito et al., 2013).

More specifically, this study responds to the call for "consequential learning ecologies in which youth are free to move beyond the constraints on their lives as learners" (Gutiérrez, 2023, p. 95). The mechanisms of travel we identified suggest promising directions for educational design. By creating novel structured opportunities for knowledge movement and supporting students in bridging different contexts, educators can foster more meaningful, consequential learning experiences. This approach requires reimagining educational spaces as fluid, permeable environments that intentionally support students' agency, creativity, and social engagement.

Future research could further investigate the nuanced dynamics of travel across even more diverse learning contexts and seek to link various pathways of travel with consequential learning outcomes. Research could also examine the role of socio-political contexts in shaping the availability and impact of travel opportunities, particularly for historically marginalized communities. Additionally, longitudinal studies could trace how travel experiences influence learners' trajectories over longer timespans, including their academic choices, career aspirations, and civic engagement. Another promising avenue is to investigate the role of "external" people and organizations in facilitating travel, identifying strategies to better support learners in navigating and bridging disciplinary, cultural, and institutional boundaries. These directions would deepen our understanding of the mechanisms and outcomes of travel, while informing the design of equitable, impactful educational interventions.

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