



## Pedagogical “Hands and Eyes”: Embodied Learning and the Genesis of Ethical Perception

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*Drawing from a range of ethnographic information gathered within a participatory design project on after-school learning and educational justice, this paper describes the new ways of seeing and relating that emerged when researchers and educators “examined the obvious” (Erickson 1973/84) and closely analyzed the embodied—physical, gestural, artifact-mediated—dimensions of learning interactions. As participants co-analyzed field notes, photographs and video recordings of educator–student interactions during making and tinkering activities, they began to notice the forms of embodied assistance that cultivated or stifled rich forms of joint activity and consider the subjective meanings this layer of experience held for participants. This emergent lens was shared through various forms of professional development and gave life to a sustained practice of intentionality and reflective intuition among educators. Our analyses contribute to prior research on embodiment by tracing the emergence of “hands and eyes” (as it was referred to by participants) as a form of ethical perception and considering how educators learned to revise their embodied actions to organize more generative learning experiences with children. [Embodiment, Learning, Pedagogy, Educational Justice]*

When I first started...I had my hands on it, I would do it for them...[now] I’ll like come in and like give them some advice or I’ll kinda like explain it to them like: oh I had this same problem and then this is how I fixed it. And they’ll go off of that, but they’ll make this awesome new idea of it. And it’ll be like, I would never have thought of that...

And now, the way I actually think is like their creativity is more than mine. Seriously, like their minds just like come up with so many awesome things. Why would you want to stop that creativity that they have?...I feel like at the beginning when I was brand new to this, I wouldn’t allow them to do any more than what I knew how to do. (Interview, Oct 2014)

-James<sup>1</sup>, Young adult educator, Tinkering Afterschool Program

### Introduction

James was sixteen when he described the growth he experienced as an educator after joining the pedagogical team of the Tinkering Afterschool Program at age fourteen: from

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doing things for children and worrying that they might move beyond his own capabilities, to offering guidance, engaging in shared thinking, and stoking their minds and creative capacities. James also reflected on shifts in embodied forms of assistance, how he moved from having his “hands on it” and “doing it for them” to enacting a lighter pedagogical touch (DiGiacomo and Gutiérrez 2016) that opened space for new ideas he “would never have thought of.” How did these shifts emerge?

This paper draws on multiple forms of ethnographic information to analyze how a group of adults and young adults (James among them) intentionally worked to shift their embodied actions to better support children’s learning. Although all learning is “embodied,” our use of this term foregrounds the physical, gestural, and artifact-mediated dimensions of educational activity. It also attunes us to the symbolic qualities of gesture and movement, the kinds of ethical and pedagogical values embodied therein. Consider: a teacher carefully using their hands and words to offer students the “feel” of working with a new tool (Rose 2005, 151), a student shifting her body so that her friend can better observe how she is approaching her project, or a young adult explaining a mechanism while intentionally keeping the artifact close to a child’s eye level (Vossoughi et al. 2020). Moments like these—quotidian, seemingly small but experientially significant (Erickson 1982)—illustrate how embodied actions can support the generative distribution of expertise, and the cultivation and experience of capability. We are interested in how such “skilled performances” (Kendon 1990) come to be.

Research on embodiment has established the consequential role of gesture, proximity, spatial configurations and face work to human interaction (Goffman 1967; Goodwin 2003a; Hall and Nemirovsky 2012), and considered embodied actions as both culturally organized and improvised in situated activity (Erickson 2004; McDermott and Raley 2011; Rogoff 2014). Less prevalent, however, are analyses of the ways people intentionally work to reflect on and revise their embodied actions to organize more expansive experiences for learners, such as those described above, or how this layer of everyday activity—what Manning (2016) refers to as the generative though often neglected mode of the “minor gesture”—presents an important domain of teacher learning. Our analysis offers a window into what this process looked like within one educational setting and specifically examines how shifts in embodied action emerged from new ways of perceiving learning interactions. These new ways of seeing attuned educators to the political and ethical dimensions of embodiment—readings of real-time activity that created new pedagogical openings and responsibilities.

This paper is part of a broader project on embodied action in the Tinkering Afterschool Program (TAP), a partnership between the Exploratorium and the Boys & Girls Clubs of San Francisco (hereafter BGC). Participants in the program were primarily children (K–5) and young adult educators (ages 14–20) from working-class communities of color, many of whom attended the clubs themselves as children. The focal club highlighted in this paper served Mexican, Central American, African American, Chinese, Vietnamese, and Filipina/o/x children and families. All program staff and researchers were also from immigrant and diasporic backgrounds.

TAP was developed in the context of the growing “Maker Movement,” which promotes project-based activities that live at the intersections of science, art, and technology. Questioning both the narrow outcomes that increasingly define learning in schools and the tendency to focus on individual learning within the Maker Movement (Vossoughi et al. 2016), TAP privileged the relational dimensions of learning and worked to ground scientific and artistic practices in the developmentally rich context of play and everyday

activity. Thus, in contrast to the tendency to position "hands-on" making environments as necessitating "hands-off" teaching, TAP educators, youth, and children came together in a weekly workshop setting to jointly design and co-create artifacts such as musical instruments, wearable circuits,<sup>2</sup> and wooden pinball machines. Our research on TAP sought to document pedagogies that are responsive to students' needs and capabilities; question dominant definitions of learning, intelligence and science; and expand our understandings of where and how learning takes place (Banks et al. 2007; Medin and Bang 2014).

This paper asks: How did attention to "hands and eyes" develop as a way of perceiving learning interactions? How—if at all—did this mode of perception shift pedagogical practice? As will become clear through the examples, educators used the phrase "hands and eyes" to refer to their growing awareness of the pedagogical and ethical saliency of their own embodied actions, as well as those of children, particularly with regard to gesture and gaze. Our analysis is organized to bring the reader into these locally developed ways of seeing by retracing their emergence over time. We argue that how this group of educators learned to see (methodology) was closely tied to what we learned to see (axiology) and how we learned to move based on that perception (pedagogy). Attending to the meanings associated with various configurations of hands, eyes, and voices emerged as a way to wrestle with recurring pedagogical tensions (such as the "pendulum swing" between adult and child centered models of learning [Paradise et al. 2014]) and the ways these tensions intersect with broader social inequities (Vossoughi et al. 2021).

However, new ways of being and working with children did not emerge directly from discussing pedagogical tensions. As evidenced below, these shifts were animated by new forms of perception developed through particular anthropological practices: collaborative data construction and analysis, and processes of partnering across educators and researchers that allowed for research to meaningfully inform pedagogical praxis (Bang and Vossoughi 2016). Over time, embodied interactions that opened up generative forms of learning were treated as works of art, a stance that privileged questions of value and meaning, invited multiple interpretations, and positioned pedagogical practice as rooted in improvisation and artistry. Bang and colleagues (2015, 1-2) define axiological innovations as "the theories, practices, and structures of values, ethics, and aesthetics—that is what is good, right, true, and beautiful—that shape current and possible meaning, meaning-making, positioning, and relations in cultural ecologies." We consider the genesis of "hands and eyes" as a local axiological innovation with wider implications for the anthropology of learning.

### Theoretical Landscape and Tools

Our analysis extends prior research on embodiment by examining a case in which people explicitly worked to shift their embodied actions in service of fostering generative learning interactions; investigating the political and ethical meanings conveyed through subtle embodied actions in the context of educational activity; and encouraging greater attention to these subtleties within research on teacher noticing.

Building from the work on teacher noticing (Sherin et al. 2011)—and resonant with research on professional vision (Goodwin 1994) and disciplined perception (Stevens and Hall 1998)—Hand (2012) argues the need to consider "what teachers who are teaching equitably notice while teaching" (2012, 236). Such ecological accounts of skilled practice push us to consider how a person watches, listens, and feels as they work (Ingold 2011, 135). Although not inattentive to the role of gesture and embodied action, much of the work on skilled noticing in the context of teaching has emphasized the ways teachers

interpret and respond to student talk. Our work aims to deepen our understandings of what equitable teachers “watch, listen, and feel” as they engage in embodied interactions with children and how these forms of noticing develop.

Anthropological research on embodied learning has deepened our understandings of cognition and action as situated, distributed phenomena, highlighting the range of semi-otic tools people use as they work together to make meaning and the ways talk and gesture become coordinated (Bremme and Erickson 1977; Goodwin 2000; Hall 1996; Jurow 2004; Ma 2017; Marin 2020; Stevens 2012). This work has demonstrated “how gesture is consequential to the organization of action in human interaction, and how participants other than the gesturer (e.g. addressees and other kinds of hearers) are central to its organization” (Goodwin 2003b, 11). These “other participants” may be interlocutors in the immediate scene (e.g. through the ways listening behaviors influence talk [Goodwin 2000]), or they may be distal others who have developed cultural routines and norms that shape embodied actions (Goodwin 2003a; Rogoff 2003).

Cross-cultural research has highlighted the heterogenous repertoires of practice that shape embodied action and the interactional tensions that can emerge across difference, particularly when people are in positions of asymmetrical power (McDermott and Raley 2011; Mohatt and Erickson 1981). Most cultural analyses have focused on the historically and collectively shaped dimensions of embodied action or provided comparative analyses, with less attention to how people explicitly analyze and shift their embodied actions. However, research on resurgent educational activity offers a view into the design of axiological shifts and related embodied actions (Marin 2020; Barajas and Bang 2018). Rogoff and her collaborators (2003) have also identified how European American educators found it challenging to recognize and alter normative, control-oriented practices of assistance, or move toward a collaborative approach, off the “pendulum swing between adult and child control” (Paradise et al 2014). Our analysis contributes to these dialogues by tracing the genesis of such a shift and considering the relationships between how educators perceive and reorganize embodied interactions.

From ethnomethodology (Garfinkel 1967 and others) we also gain the understanding that people “are not just socialized to follow conventions/rules, but that they conduct situated assessments of the circumstances they find themselves in” (Erickson personal communication). People “create their worlds with each other in real time” (McDermott and Raley 2011). Erickson (2004) extends this perspective to consider how people contest and subvert hegemonic discourses within everyday discourse. Our study considers what becomes possible when such sense making—and its connections to transformative activity—are made explicit and deliberately used to support the development of educators’ practice.

This work requires a view of embodied actions as public expressions with political and ethical content. In this vein, educational anthropologists have studied the role of verbal and nonverbal interaction in the social construction of “success” and “failure” in classroom settings (McDermott 1977) or the ways informal judgments of students’ interactions shape teachers’ decision making (Bremme and Erickson 1977). Critical, feminist, and decolonial theorists have similarly attuned to the ways bodies are implicated in social reproduction and resistance. As Cruz (2001, 664) asks, “How does a regime of a given society become inscribed onto the bodies of our youth?” How, for example, are teacher perceptions of student behavior demonstrably racialized? McAfee (2014) draws attention to the ways racial patterns and hierarchies emerge through the accumulation of ordinary, everyday interactions, arguing the need for a “kinesiology of race” in educational research.

Responding to the literature on teacher noticing in mathematics, Louie (2018) similarly draws attention to the cultural and ideological dimensions of when and how teachers notice as tied to challenging deficit views of students from nondominant communities.

Building from these perspectives, we are primarily concerned with the ways assumptions about students' intelligence and capabilities are communicated through subtle pedagogical gestures and actions, manifest and/or interrupt broader systemic inequities, and shape the experiential quality of relations enacted in the moment. We consider what it looks like for educators to utilize these lenses to read, interpret, and shift their practice.

## Methodology

Because our focus is on tracing the genesis of "hands and eyes" as a form of perception and action, our analysis foregrounds the methodological decisions that were integral to how this story unfolded. Here, we briefly contextualize our methodology, our relationships as co-authors, and the corpus of data from which we are drawing.

Our documentation of TAP was rooted in models of participatory design research (PDR) that emphasize the sociopolitical and relational dimensions of collaborative inquiry (Bang et al. 2015; Engeström 2011; Erickson 2006; Gutiérrez and Vossoughi 2010). Problems of practice jointly identified by researchers and educators formed the basis of our research (Penuel et al. 2013), and the insights gained through research (such as the focus on "hands and eyes") provided real-time resources for ongoing design and professional development. In contrast to linear or top-down models of design experimentation, our collaboration was organized as an open system that oriented toward contradiction and reflective praxis as progenitors of change (Gutiérrez and Vossoughi 2010), understood here as the everyday transformation of social institutions and their relations, wherein people become more intentional historical actors (Espinoza 2009; Gutiérrez and Jurow 2017). Relevant to our focus, PDR treats equity as both ideal and pragmatic, a stance that brings together historicity (e.g. ways of seeing educational activity historically), design principles that support the early detection of inequities (Gutiérrez and Jurow 2017), and close attention to the ways people work to engender possible futures in here-and-now activity (Bang and Vossoughi 2016). This includes the ways participants "face a problematic and contradictory object," in our case, less productive and potentially inequitable forms of embodied action, which they analyze and expand by constructing a novel concept, such as "hands and eyes," "the contents of which are not known ahead of time to the researcher" (Engeström 2011, 606). Engeström also highlights the role of identifying emergent positive models from within the setting itself as "evidence of unacknowledged potentials (Sannino 2008)" (623), a practice that aligns with our approach to teacher learning.

Shirin was the lead researcher on the project, and Meg was the program director from 2012–2019. Walter also served as a lead educator and designer within the setting, and the team routinely conferred with Manuel about their research as tied to his ethnographic work in related settings. Routine practices of collaborative research across this team included shared analysis of audio-video recordings; co-design of curriculum and professional development; and co-authorship of research questions, field notes and codes. Over a three-year period, we gathered the following sources of information:

70 hours of **audio-video recordings** of learning interactions

30 full-length **field notes**, approx. 15–20 pages each

15 audio-recorded **interviews** with focal participants, parents, and staff

40 audio-recorded post program **debriefs** with teen and adult educators  
200 **photographs** of interactions and student artifacts

Though our analysis in this paper draws from all of these information sources, we concentrate on a nine-month period that includes the time just before, during, and following the development of “hand and eyes” as an interpretive lens and pedagogical tool (Erickson 1982). We navigate the challenge of how to determine the starting point of this genetic process by analyzing multiple starting points, one of which is traced back to before the program’s inception. This approach speaks to our interest in understanding the conditions that fostered new ways of perceiving and organizing embodied interactions.

**Analysis**

Our findings proceed in three phases: first, we illustrate how particular forms of ethnographic experimentation, coupled with axiological and pedagogical commitments, gave rise to new ways of seeing embodied action. Second, we describe the subsequent professional development (hereafter PD) intervention as an effort to develop and share this newfound perception toward a collective re-mediation<sup>3</sup> of pedagogical practice. Finally, we consider how new ways of perceiving embodied interactions shifted educators’ practice, sometimes in unanticipated ways. James’ trajectory as a young adult educator serves as an anchor throughout. We oscillate between a telescopic view of process, which provides wholeness, and a microscopic view of salient details. Coupled with a humanist description of the persons populating the context, we aim to craft a tale of learning with dimension.

**Beginnings: Experiments in Ethnographic Representation**

This section illustrates how the decision to begin including visual information and educator reflections within weekly ethnographic field notes, coupled with an ongoing effort to identify and expand rich forms of assistance, opened up novel views of embodied action. These new visions sharpened the need for re-mediating the routine practices of the setting and helped us glean material for what such an intervention might look like from within the setting itself.

The seed for “hands and eyes” was initially sown through a methodological shift toward including visual imagery in ethnographic field notes. Shirin’s practice of field note writing involved drawing from raw notes jotted down during the program, the video records collected on that day, and the audio-recorded debrief sessions among educators to craft a narrative of play-by-play activity that included her own interpretive commentary (presented here in italicized text with the author’s initials [e.g. SV] preceding). These documents (typically 15–20 pages) were shared with lead educators prior to their next workshop and used as resources for iterative design.

At first, the field notes documented talk and interaction through written prose. This began to shift during a light painting activity where students used small LED lights to trace shapes in the air, which were cumulatively captured by a camera with a long exposure. As Shirin wrote the field notes, she sensed that it would be fruitful to pair descriptions of children’s moment-to-moment activity with the images they had created. Educators commented that they appreciated the inclusion of the photographs as a way to “bring them back into the moment” and to notice the ideas students were working with in their creations. We continued with this practice in subsequent field notes and



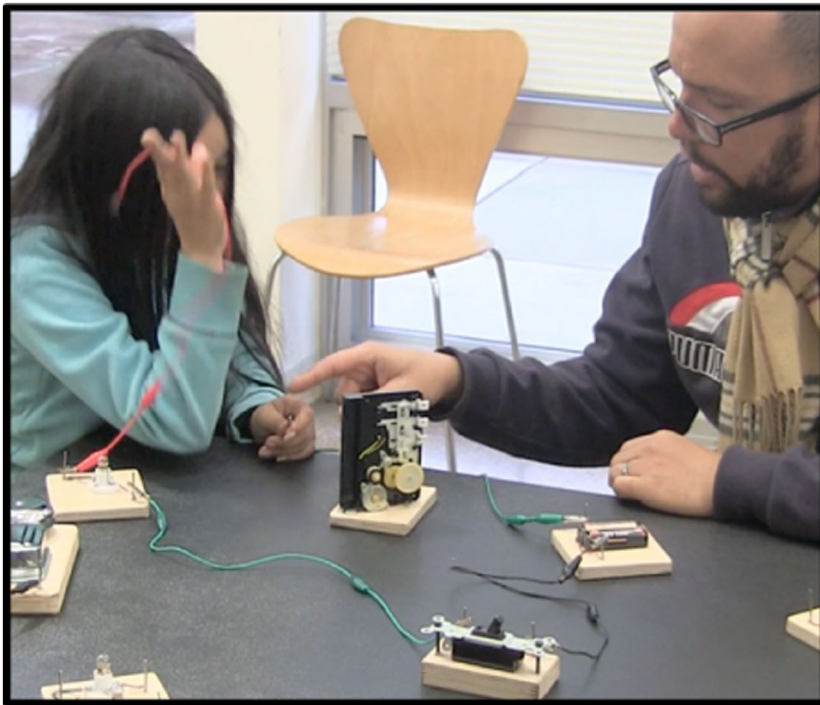
began to interweave images of the interactions themselves. This swift widening of perspective (from images of the artifacts to images of the interactions among participants) was spurred by an ongoing critical discussion among the team about the emphasis on individually created objects—over and above social relations—within the growing "Maker Movement" (Chachra 2015).

The following excerpt is drawn from the first field note where images of interactions were included. This perspective brought newfound attention to the role of the body, including how participants investigated the materials through their actions, when and how educators and students used their hands and eyes, and how the artifacts (in this case circuit boards) were positioned within the work-space. A key perceptual opening was forged:

#### Excerpt 1: Field Note 03/03/14<sup>4</sup>

Walter and Stefanie had the Walkman in front of them and Walter moved away the extra materials so that Stefanie could have a clear space to work. After she connected everything, Stefanie leaned in to get a closer look and also started touching the gears. It looked like the gears were not turning. Walter allowed her time to consider what was going on.

Stefanie leaned over toward the switch and turned it off and on, looking at the light bulb to see if that made a difference. (*SV: Testing*) Walter turned the switch on and off, and checked each of the connections with her. He suggested that they try a new battery pack and brought one over. Stefanie switched the wires and the gears still didn't move. She said, "I don't think so."



Stefanie then took the wire clips off the Walkman, and Walter suggested that she try touching the two ends together. (*SV: This would complete the circuit without the Walkman as another way to identify the problem, deepening understanding of circuits.*) She said, "these?" After she had the clips touching

she leaned over, turned on the switch, and looked at the lightbulb, which now lit up. She turned the switch on and off, and the light went on and off. Both her and Walter were looking at the light. Stefanie then sat down, pointed to the Walkman and said, "Maybe that's the problem" (SV: *Problem identification by changing one variable at a time*).

Here, vacillating between written descriptions of action and the visual image of the pedagogical scene allowed for a greater understanding of the questions and ideas pursued through children's physical interactions with the materials (such as Stefanie's use of the switch as a way to test the circuit) and the forms of embodied mediation that were consequential to how the exchange unfolded (such as Walter's decision to encourage Stefanie to touch the ends of the two clips together). The visual modality also offered a window into what participants themselves were seeing in the immediate scene.

Alongside the inclusion of interactional images in field notes, a second form of ethnographic experimentation emerged at this time. Shirin asked the lead educators if they would consider contributing their own interpretive comments in writing within the field notes. This invitation originally emerged out of a desire to include the insights they were sharing verbally after reading the field notes as part of the ethnographic record, though it also opened up new possibilities for joint pedagogical reflection. In line with PDR (Bang and Vossoughi 2016), the shift toward multivocal observer comments also helped to trouble normative divisions of labor with regard to analysis by including educators as co-authors of ethnographic information.

The establishment of these two perceptual channels—visual imagery of embodied interactions and multivocal observer comments—began to train our collective eyes and ears on the specific qualities of generative and constraining interactions, and surfaced problems of practice in new ways. For example, the subtle differences between pedagogical stances that supported joint activity and those that reverted to more didactic models were an ongoing point of dialogue (Vossoughi et al. 2021). As seen in the following excerpt, collective attention to embodied actions offered new insight into how this tension manifests and the ways pedagogical moves involving the body may support or contradict the intent of verbal assistance.

Here, Shirin documented Anthony's (young adult facilitator) interactions with Aiden (eight years old). Aiden was working on a wearable circuits project and encountered a step that required him to strip wire. Anthony proceeded to strip the wire for Aiden, at which point Aiden momentarily turned away from the interaction. Alongside Shirin's comments, Meg added her reflections (ME<sup>5</sup>):

**Excerpt 2: Field Note 03/10/14**

Aiden was working on stripping a wire and Anthony tapped the tool and said, "that one's already stripped." He started working on the other end. Anthony took it out of his hands and started stripping it for him. Aiden then looked straight ahead (not in Anthony's direction—contrast with when Marlene was stripping Robert's wire and he was closely observing) (SV: *This made me think it would be good to do some more training around all the teaching and learning opportunities like these, including supporting the kids to do things like strip wire—perhaps using the Lianna and Rosa clip*).

Also, after this moment I noticed that when Anthony gave Aiden the wire back stripped, he waited a moment and then grabbed the wire stripper. I didn't see what he did with it but thought he may have been equally interested in using the tool. (SV: *investment in the process/experience not just the product? I also want to be careful in how I represent Anthony's decision here in that it was likely coming from a place of care and support to strip the wire for him*.) (ME: *This is a good way of communicating why it's a good idea to not do things for kids—because using the tools is half the fun! It seems like facilitators might relate to that and it could help them remember to try and involve the kids more in the process*.)



If we imagine co-authored field notes layered with a newfound sensitivity to the role the body as a kind of interactional infrared, what were we starting to see here? What became pronounced and called for an ethical response? First, we noticed that when educators did something for rather than with a student, the student often looked away—in contrast to moments when they involved students in the task in ways that invited their close observation (this includes peer–peer support, as in the case referenced above when Marlene stripped the wire while Robert observed closely). Our perceptual antennas were also becoming increasingly sensitive to how students responded to particular embodied actions. Aiden's subsequent use of the wire stripper indexed how students asserted their capability in response to moments when it may have been subtly diminished.<sup>6</sup>

Second, we were learning to calibrate our lenses such that observed problems could be discerned as potentialities for repair and as indicators of the kinds of apprenticeship that cultivate the growth of a setting. The observation that Aiden's engagement shifted when the wire was stripped for him was immediately followed by the suggestion of doing a training around the opportunities for learning that emerge in these seemingly small moments, perhaps drawing on the clip of Lianna (tinkering educator) carefully involving Rosa in the threading of a needle. Meg offered additional ideas, such as inviting young adult educators to recall their own excitement in using new tools as a way to encourage intentionality with how they approach these moments with kids. These suggestions reflect a disposition toward novice educators as learners, paired with a responsibility on the part of elders in the setting to offer meaningful models and support. Meg later shared, "We were responsibly bound to not only wag our finger but help that person change. We could just correct, but we saw them as students too and needed to find ways to help them into it. That's what made it heavy; we weren't responsible just to the kids but to the facilitators."

The emergent need for strong positive examples from within the setting itself (Engeström 2011) further propelled close attention to embodied interactions within our field notes. Later this day, Shirin documented a generative interactional sequence between Meg, Tania, and Robert:

### Excerpt 3: Field Note 03/10/14

Tania seemed to be struggling to bend the wire so Meg held parts of the headband and wire down to make it easier for her.

Meg was narrating as she held these parts for Tania. At one point she said, "Nice" and tucked one of the pieces under. Tania's eyes were on the headband. Tania then stood up said, "I just need help getting this closed."

As Meg helped her with the piece, Robert [another child] turned around and watched intently for a few moments. Meg narrated what she was doing, "then it's like crossed, then it squishes" (smashing down the wire). (*SV: Throughout this field note I've been thinking about the small but important moves educators make when they do have the artifact in their hands to involve the kids and make it a meaningful learning moment—narrating while doing, holding it close to the kid's line of sight, inviting them to notice.*)

Our hunches about the qualities of generative and constraining interactions were becoming substantiated through the documentation and naming of specific kinds of embodied action (such as *narrating while doing*). Though these "minor" layers of practice (Manning 2016) may be subtle and swift enough to be overlooked in real-time observations, we began to see them as foundational to the experience of assistance, particularly when we consider their accumulated densities over time. Attending to the multiple



moves Meg was making also laid a foundation for describing the *range* of generative ways joint activity can be organized, an approach that was more effective than simply telling novice educators what “not to do” and one that helped honor pedagogical work as improvisational rather than prescriptive.

At this point, a third ethnographic resource helped to solidify the form of perception that was coming into being. In 2011, Manuel spent time at the museum as an ethnographer, working with another youth program organized around making. When Shirin revisited the documents Manuel had shared with her upon his departure, she found a strong resonance between his keen attention to the pedagogical and ethical dynamics of embodied interaction and the forms of perception that were emerging within the TAP team. Consider the following:

**Excerpt 4: Analytic Memo (Manuel Espinoza) 07/30/11**

Here are the modes that I have observed, know about, and heard rumors about. In what follows, the order matters. It is a kind of spectrum, from “weaker” to “stronger.” I don’t have a more adequate language at the moment, but in another week I think I will. The “I” in what follows can be thought of as the traditional steward of power in a setting, the person who gets to decide what happens in settings and situations more than anyone else. In language and in human relations they are “first” person. The “you” is the flesh-and-bone, meaning-oriented other (from Rommetveit) whom the “I” faces. The relations, of course, can possibly switch. But in an educational setting, they tend to endure though this does not necessarily mean that the relation is poisoned or doomed from the outset. The age difference between participants in educational settings, especially when working with children and adolescents, gives the educational task a built-in and insurmountable set of differences. It is within those differences that pedagogical and ethical relations must be sculpted. We are all “I,” and we are all someone else’s “you,” and potentially (in Martin Buber’s sense of the terms) someone else’s “thou.”

In a sense, this is a memo about the coordination of the following:

### Languages–Eyes and Limbs–Artifacts–Tools–Meanings

Maybe attention to this quintet of things can help us theorize how meaning-oriented persons assemble/make artifacts in concert with one another and create selves and objects more than the sum of their parts.

The key thing here, as in all educational settings: How do we transcend the limitations of our skin and become a "we"? What does this look and sound like empirically?

This framing was followed by an emergent typology of twenty-three acts and inter-acts. Here we share three that help illustrate the interactional phenomena Espinoza was describing (see Table 1, below).

The hunches we had been pursuing were corroborated by Manuel's exegesis of embodied actions and their potential meanings. Manuel had also similarly contrasted moments when educators took over for students, leading to a shift in gaze and attention (what he termed the "stare off") with the interactional qualities present when educators meaningfully involved students in the task. In response to this framing, Meg and Shirin had the following verbal exchange:

**Meg:** How to describe, ethically, the problem space that this comes from. The stare off is a way to do that.

**Shirin:** Sometimes when the artifact's not working, the interaction's not working.

**Meg:** The answer is not in the hands and eyes. The answer is in whatever it takes for two people to become a "we."

Here we see again how new ways of perceiving embodied action emerged from problems of practice, ethical commitments, and ethnographic experimentation: the "stare off" became an empirical indicator of interactional constraints that hindered the "formation of a we." Manuel's theoretical vocabulary offered fresh language with which to notice and reorganize such interactions, and the notion of "forming a we" helped clarify the interactional ends toward which educators might aspire. Shirin began using this framework to describe interactions, such as the following between James and a student he was working with:

#### Excerpt 5: Field Note 03/24/14

*SV: It felt a little like she would pull back from the piece during transition points but would engage when there was something specific for her to do. As an observer, this made me feel like she was not quite "in it" with James. To use Manuel's language, like the "we" between them was struggling to be established.*

As with the inclusion of visual imagery and multivocal observer comments, Manuel's ethnographic analysis offered new impetus to look for moments when a "we" was being formed (or not). As we elaborate in the following section, it also acuminated our sensitivity to the ways dignity was at stake within these interactions (Espinoza and Vossoughi 2014).

#### 2. Re-Mediating Pedagogical Activity

How were these new ways of seeing shared and used to reorganize pedagogical activity? Though the idea of doing a PD session on the topic of "hands and eyes" was germinating within the field notes, the training itself was actualized when the need for collective re-mediation became pressing. Once we began documenting generative forms of embodied pedagogical action, interactions that stifled agency or overlooked capability became more starkly visible and signaled the need for new pedagogical tools and ways of

seeing, particularly among more novice educators. Of significance, all of the documented instances of constraining moments attuned us to the ways students who were the recipients of narrow forms of assistance (tasks were done for them, or instruction was more step by step [Stone and Gutierrez 2007]) consistently worked to assert themselves within the interaction. To Manuel's typology, we added the observations depicted in Table 2, below.

Our analysis of such interactions prompted a number of key realizations. First, generative forms of assistance were not equally distributed among students. Rather, there was a small number of students who received less expansive forms of assistance and thus fewer opportunities to share and develop their ideas. This emergent pattern was out of sync with the value the program sought to place on multiple ways of knowing and in this case reproduced inequities with regard to who gets to engage in more complex intellectual activity (McAfee 2014). The students represented in Table 2—all Black, Latinx, and/or Asian American—tended to be constructed pejoratively by their schools, either because they were not seen as “on task” or because reticence was misinterpreted as inattention. Though the team recognized their mistreatment in school as tied to racialized disciplinary structures, we had not fully attended to the subtle but significant ways deficit ideologies were reemerging in the afterschool setting. Considering that the students who were receiving more expansive forms of assistance were also from minoritized backgrounds, our naming of the racial dimension to these practices is not contingent on racial differences in who was receiving which kinds of assistance *within* the setting but premised on persistent relationships between race, assumptions about intelligence and capability, and behavior that is read as nonnormative. The assistance practices and the assumptions tied to them can be racialized even if other students with shared racial identities received more generative forms of support. As an immediate response, Meg and Walter began working with these students more often.<sup>7</sup> But a more expansive solution was needed, one that aligned with our commitment to treating young adult educators as learners.

Second, as evidenced in Table 2, students did not respond passively. Their palpable assertions of knowledge and capability can be seen as refusals of the messages conveyed through the embodied interactions described above, and—in line with research on teacher noticing and equity—as “meaningful responses to a particular social reality” (Hand 2012). It is also possible that these students witnessed some of their peers receiving more expansive forms of assistance, such as the opportunity to try tools from which they were restricted. These realizations led us to reframe embodied actions not only as rich or constraining forms of assistance but as contexts within which assumptions about students' capabilities were being conveyed and contested. This perspective resonates with O'Loughlin's (1998) attention to the ways embodied movements can relay derision or respect but also privileges the agentic responses of those on the receiving end.

Prior to this point, our goals for the PD had included sharing the emerging perception of “hands and eyes” as a key medium of pedagogical activity, alongside examples of generative practice. However, our sharpened sense of the ways inequities were emerging within the setting added a new goal: cultivating a collective sensitivity to the ways particular responses on the part of students may serve as indicators of the need to reorganize the interaction (Hand 2012). We also sought to take the characterization of students as “disengaged” or “not paying attention” (comments that had been made during staff debriefs) *off the table*, to be replaced by an analysis of the interaction itself. Our challenge was to do so in ways that abstained from enacting a deficit orientation toward the youth educators. To this end, we thought about the working assumptions they might hold about the program goals or about how they themselves are being evaluated (such as the pressure

to help a child finish a project more quickly as a perceived indicator of their own pedagogical abilities) and how we might clarify these in ways that support being present in the moment. Within debriefs and trainings, Meg began to emphasize that "we are all learners" in the space as a way to normalize pedagogical reflection and iteration. We also became more intentional with the ways we supported young adult educators during program activity itself.

The following excerpt captures a moment when Shirin was recording James' interaction with Tania at the soldering station. This day was just prior to the roll out of the PD session on "hands and eyes," the content of which was fresh in Shirin's mind. Here she documented James' careful efforts to support Tania (who was nervous about the heat of the soldering iron), as well as her own guiding interventions:

#### Excerpt 6: Field Note 03/31/14

James was soldering Tania's paper circuit while she watched. I reminded him to move his hands back on the solder because it gets hot. I then said, "Maybe Tania can feed it next time." James handed Tania the soldering wire. He then put the iron down on the copper while Tania brought forward the solder. Tania hesitated and said, "I'm scared." James placed his hand under hers and guided it forward, saying, "it's ok."

James and Tania prepared to do the next one. She seemed to hesitate again, and he put his hand on hers to guide the solder and do it together.

James said, "don't be scared" and then "there we go." When they finished, he turned around and I responded, "I liked that move."

Returning to our central argument—that revisions of embodied action grew from new ways of perceiving learning—the pedagogical sequences documented in Tables 1 and 2 were not seen as mere "happenings" within the setting but as action potentials for which all were responsible. James did not need much prompting here. He immediately took up Shirin's suggestion ("Maybe Tania can feed it next time") and did so in ways that reflected a careful approach to assuaging Tania's fears: placing his hand on hers, saying "It's ok," and gently completing the soldering together. This artful "formation of a we" emerged through an intergenerational effort to shape the interaction in ways that





**Table 1.**  
**I, Inter-act, you/we**

"I"	Inter-act	"You/We"	Commentary
I take artifact in my hands and do not talk aloud about what I am doing.	I transform the artifact in some way.	You watch or stare off.	Disregard of a potential interlocutor. Splicing into the thing itself.
I do	I undo as you observe and perhaps ask questions	You re-do	A kind of "we" is formed.
I do the first half (my hands only on the thing)	You wait, observe, and listen for instructions	You do the second half, our hands simultaneously on the thing	A kind of "we" is formed

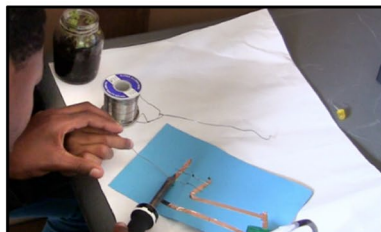
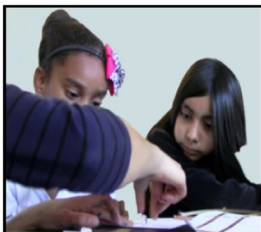
**Table 2.**  
**I, Inter-act, you/we**

"I"	Inter-act	"You/We"	Commentary
I complete the next task on the project	You lean over to see what I am doing	You say, "I know how to do it!" and a few moments later: "You know I can sew..."	Disregard of student's capability
I tell you it is time to go solder.	You ask what soldering is. I don't explain. I tell you to have Walter solder for you.	You say, "I want to solder!"	Missed opportunity to distribute knowledge and enact intellectual respect.
I tell you the next step.	You respond hesitantly and I tell you we need to "get to work." I proceed to do the next step.	A few moments later, you announce that you are starting another project.	Narrow forms of assistance that diminish student's ownership and agency.

distributed valuable know how while safeguarding the vulnerabilities of both Tania and James. We also read James' reorganization of the interaction as a rechanneling of the care he was expressing by soldering for Tania (considering her expressed fears) but in more pedagogically fruitful directions. Shirin's final "I like that move" positioned James' real-time shift in embodied action as a valued practice. These exchanges, coupled with the subsequent PD session, may have contributed to James' exclamation during staff debrief the following month: "I had a cool hands and eyes moment!"

A few days later, Shirin and Meg conducted the "hands and eyes" PD for the first time. We began asking the team how they perceived injustices in their own schooling experiences. In addition to naming the inequitable distribution of resources across schools and neighborhoods, this led to a discussion of academic tracking and the hyperdisciplinary practices routinely directed toward Black and Brown students. Chico, a Salvadorian youth educator, was involved in city-wide efforts to enact a policy of "Solutions not Suspensions" which aimed, in his words "to stop the racial profiling of students being suspended." James described the ways he had contended with pressures to assimilate as a Black student at a predominantly White school. Meg and Shirin then wove in the discussion of "hands and eyes" by asking the group to consider how these inequities can emerge in seemingly small interactions with children and our role as educators in working to interrupt and transform them.

We then presented a series of images that illustrated a range of potentially rich configurations: educators offering verbal guidance while kids' hands were on a project, kids leaning over to gain insight from a friend's investigation, adults having one hand on a drill while kids held the tool with both hands, and participants working together such that both their hands and eyes were on the artifact. Some of the images shared are depicted below. For each image, we discussed the pedagogical affordances of the configuration, asked the educator who was present to contextualize the interaction, and considered what this type of assistance might feel like for the kids. This helped us move away from narrow binaries (adult vs. child-centered learning) or maxims ("students should have their hands on the project at all times"; Vossoughi et al. 2021). Instead, the photographs and conversations helped us identify a more nuanced range of assistance practices and to elevate the generative forms of embodied action already present within the setting (Engeström 2011). We also talked about when these interactions might be constraining. For example, depending on the cultural context and the sense of camaraderie among participants, working to solve a problem while an educator is observing might feel supportive or evaluative. This confirmed the need to treat the natural history (Erickson 1973; McDermott and Raley 2011) of the interactions as primary and to frame pedagogical decisions as sensitive to



the moment. Though the focus here was on highlighting possibilities for action, Shirin and Meg were also explicit about the practices that ought to be avoided: taking over for a child, doing something on their project without explaining it, and prioritizing finishing over learning.

Following the collective analysis of visual images, the group analyzed three video clips: one depicted Lianna's careful efforts to support Rosa to thread a needle, another illustrated Walter's patient support as Arthur spent three full minutes working to get a small battery out of its packaging, and a final video showed Chico holding a wire while verbally guiding Marlene through the task of wire stripping. All foregrounded the role of the body in pedagogical interaction. After each clip we discussed what people noticed about the educator's actions and about how the students responded. There were some jovial reactions to the extensive time Walter waited for Arthur to get the battery out of its package, an example that seemed to drive home the point about treating even seemingly mundane tasks as opportunities for learning. This example also prompted a view of tool use and skill-building as desired experiences of competence on the part of the child. The movement between analyzing still images and video had the perceptual effect of accentuating brief interactional moments that may have otherwise gone unnoticed and of making visible the extent to which a range of configurations can emerge within a short period of time. The tone of the conversation was celebratory, with people giving each other praise for key moves evident in the video.

This collective discussion provoked a key expansion in perception: subtle forms of embodied action could be re-envisioned as opportunities for reflection and intentional mediation, as stages for the re-enactment or disruption of educational indignities and as occasions for beauty (Espinoza et al 2020). The aesthetic qualities of the images offered a window into the aesthetics of the experiences themselves (Greene 2001)—a view that can alter the presence of mind and action enacted towards others in real time. The object of pedagogical activity was also shifting: from helping students finish their projects to mediating *process*.

### 3. *The After Lives of "Hands and Eyes:" Palpable and Unanticipated Shifts*

In this final section we describe the palpable changes and ongoing tensions that emerged following the "Hands and Eyes" PD through a focus on James' trajectory of assistance as well as shifts in language and practice among adult educators. One key outcome involved the ways educators' reflections in post-program debriefs and journal entries<sup>8</sup> increasingly described the *interactions* they were a part of rather than an account of what the individual student/s had said and done. This created the opportunity to collectively discuss the role of the educator in how the interaction unfolded. Within these reflective debriefs, attention to "hands and eyes" also became prominent. During the program session immediately following the PD, almost all of the staff referenced "hands and eyes" in their debrief journal entries without prompting—an indicator that new perceptual channels were at work. Daryl, an adult educator, wrote:

I noticed the "Eyes" "Hands" concept today when gluing. I held her project for her so that she can get a better angle to glue. I also noticed that when she didn't have her "eyes," I'd draw her attention before speaking. (Debrief Journal Entry, 04/12/14)

James wrote:

Today was a new day with new challenges. I came in thinking about letting the kids have more time to figure things out. I felt as if what I saw in the video, these kids can accomplish a lot...So today I was working with Lara, and she really had trouble with making the box structure so after a while of her trying she kind of gave up and called herself dumb. And I was like no, this is really hard for us. So then we started to work on it together. I held up the corner piece while she taped, then we got to making the cam...." (Debrief Journal Entry, 04/12/14)

James explicitly referenced the video from the PD as having expanded his assumptions about what the children were capable of. He also described the exchange in interactional terms, a shift from his (and other's) prior tendency to focus on what the student/s said and did. James' response to Lara's comment about her own capabilities was also reflective of a practice explicitly discussed within program debriefs: to respond to moments of self-deprecation by recognizing the difficulty of the task and including oneself in the challenge at hand ("No, this is just really hard for us"). The language of "we" toward the end of his entry illuminates James' efforts to reorganize the interaction as a joint activity and alludes to ongoing challenges: would intervening earlier have led to a different outcome? Was James interpreting the push to not "take over" as an invitation to be hands off? Similar tensions were noted in Shirin's description of James' facilitation in a workshop that followed the PD:

#### Excerpt 7: Field Note 04/14/14

*James was making what felt like real shifts on this day alongside moments when testing and other relics of school seemed to become the default. Engaging in alternative practices may feel like swimming upstream and shouldn't be treated as a simple or easy shift.*

How do bodies learn to move in new ways? Here we interpret pedagogical movements that might be seen as contradictory as a kind of aperture into processes of change. In this view, the dialectic tension between constraining and more generative interactions is not located in *James* as an individual educator; instead, such tensions can be attributed to conflicting activity systems (default modes of schooling and testing, in contrast to the models of possible activity the collective was aspiring toward) whose side-by-side existence may limn the forms of struggle and labor that mark rebirth.

James actively contemplated these interactions throughout the weeks that followed. During one debrief, he described how the process of collective reflection gave him pause when a student began creating a rainbow with unconventional colors:

*At first she put green as the first color, and I was kind of like thinking to myself, "that's not how a rainbow goes." But then I was thinking back to last week's conversation about how we shouldn't shoot down their ideas and try to change their ideas. **We should kind of let them roam.** So I let her do her own thing and it turned out pretty good. (Debrief Journal Entry, 04/14/14)*

In another instance, James made the decision to turn the research camera lens so that it would record an interaction between himself and a student who was learning how to drill.

In contrast to the initial configuration of soldering discussed in Excerpt 6, here James seemed intent on fully involving the student in the task. He organized a fluid division of labor, allowing her an experience of the "whole activity" (Cole and Griffin 1983) of drilling. He held the wooden piece in place while she turned the clamp handle to make it tight and held the tool with her while she drilled. He also narrated while she drilled (saying things like "more pressure"), a shift from facilitating in ways that sometimes overlooked children's capabilities to grow into the task in real time.

Both of these examples—James' efforts to form a "we" while drilling and the live reorganization of his initial response to the students' desire to create an unconventional rainbow—highlight how new ways of seeing learning created conditions for new forms of mediation that then established an interactional context for recognizing children's ideas and capabilities. Consider James' commentary on his own trajectory that appeared at the outset of our paper. Six months after the "hands and eyes" PD, James reflected on his

initial reluctance to let students do more than what he knew how to do and his growing sense of their ingenuity and insight. As he stated, “Why would you want to stop that creativity that they have?” The tone of this question suggests that James not only experienced an evolution in his own thinking and practice, but that these shifts may have provoked a broader desire to advocate for more just and humanizing pedagogies. Indeed, when Meg was working to apprentice a new group of youth facilitators, James insisted that she do the “hands and eyes” PD for them as well. Walter commented on James’ trajectory as follows:

I was surprised at how quickly [“hands and eyes”] was taken up and shifted [James’] understanding of what he was doing. It’s like the sculpture where someone put a placard that said, “It took someone 35 years to make this.” That placard shifted engagement more than telling people not to touch it. This felt like one of those moments: it felt like a strategy to try something, but the result was much richer. (Data Analysis session, September 2015).

Though the initial PD was organized by adult educators as a way to share emerging insights on embodied learning with younger members of the team, adults also described the effects of this newfound perception on their own practice. Shirin and Meg recounted how the PD had the effect of “slowing down time” when they were working with children, leading them to notice their own actions more clearly and take more time to decide how to respond. Walter described how having practices that felt intuitive to him highlighted as productive models within the videos led him to trust his capabilities more. As he stated, “The more you lead an examined pedagogical life the more your instincts become refined” (Debrief Journal Entry, 10/03/14).

Perhaps one of the most meaningful and unanticipated channels through which “hands and eyes” lived on was the way the examination of embodied action became a routine aspect of pedagogical reflection. A few months after the initial PD, Meg did the “hands and eyes” workshop with staff at the Boys and Girls Club. In a subsequent debrief of a costume making activity, Walter and Samantha (the clubhouse education director) discussed their experiences helping students make their costumes using sewing machines:

**Samantha:** I think I was very conscious about the presentation you guys did, about the hands and eyes thing...I was like very conscious of: where are my hands right now?

**Walter:** I ended up doing a lot of like distanced guiding, where my hands would start where the input needed to be on the sewing machine, and then her hands would go in and I’d encourage her to put her hands to guide like where, and then she still didn’t have mastery of like how to aim it so then my hands would be further back but still on the material, and then as I moved it, she could feel the way it was moving but she still had her hands sort of close to the needle and in control, and then I’d make a big gesture every time we needed a correction, and then she’d take it for a while...

**Samantha:** Yeah because I know with [Paula (child with whom she was working)] I was doing the whole like my hands were over her hands, same thing, it was a guiding thing...and then if she would get like nervous...my hand would go back in.

**Walter:** I find that when my hand goes away too, my voice goes in, you know, so if I stop guiding with my hands I start being much more descriptive

**Samantha:** They have the support still  
(Debrief recording, October 2014)



Samantha and Walter's exchange reminds us to resist framing shifts in embodied action as the "outcomes" of the hands and eyes PD, as such a frame risks treating as finished or still processes that are necessarily in motion. We prefer to inquire into the ripples beyond initial moments of perceptual revelation that contain within them new questions, tensions, and possibilities. Here we see Samantha describing what it felt like to interact with students after such a moment of conscious reflection, including the kinds of caution and intentionality she was working to enact. We also see that this intentionality had an ethical direction: subtle movements of the hand were aimed at offering students a sensory experience of competent engagement with the tool and a relational experience of solidarity and support. Though these movements can be seen as models of the kinds of generative interactions the "hands and eyes" PD was aimed at expanding, we also notice the inquisitive, searching tone present in the exchange. Samantha and Walter express a kind of curiosity about their own and one another's processes that portends an ongoing commitment to learning—not learning *what to do* with their pedagogical hands and eyes but learning how to read these interactions in ways that open up their relational, axiological and developmental potentials.

## Discussion

For Erickson (1982, 159), a key criterion of adequacy in anthropological accounts of learning involves "describing specific change in individual-environment interaction across time, from *before learning*, through *during learning*, and *after having learned*." We have illustrated how a group of researchers and educators moved from identifying problems of practice to working with rich ethnographic and aesthetic material to open up new forms of ethical perception. Think of James' reflective pause when confronted with the unconventional rainbow as tied to his subsequent comments regarding children's expansive creativity, or Walter's carefully attuned description of his interaction with a young sewer: "she could feel the way it was moving but she still had her hands sort of close to the needle and in control, and then I'd make a big gesture every time we needed a correction and then, she'd take it for a while."

We have also argued that these new ways of seeing mediated significant shifts in embodied action. Within co-authored field notes, the surfacing of tensions (such as doing tasks for rather than with children) was consistently coupled with proposals for ways to support novice educators to see and move with greater intentionality. The "hands and eyes" PD was an experimental attempt to share an emergent view of embodied action that foregrounded questions of intellectual respect and dignity. As exemplified above, the material effect of the PD was immediate and transformative: educators' interactions with children, and their reflections on those interactions, displayed a growing sensitivity to the ethical and power-laden dimensions of the processual experiences they were mediating.

At the same time, James' non-linear trajectory and Samantha and Walter's exchange remind us to be careful about how we define "transformative" and interpret the relationships between new ways of seeing and shifts in embodied action. Rather than having *transformed* the setting, we see the "hands and eyes" intervention as initiating an ongoing transformative process that introduced new forms of reflection, deliberation, and activity. The idea that "hands and eyes" helped educators slow down or take more time to develop a response in the moment speaks to this living praxis and raises questions about the relationships between ethics, professional vision and expertise. Though one may assume that experts in a practice can move through particular decisions more quickly, Ingold's push to consider what skilled practitioners "watch, listen, and feel," and the analysis we

have developed here, suggest that noticing when experts *slow down* or what they see as deserving of greater deliberation may reveal a refined intuition about what matters in the relational work of teaching and learning. This emphasis on *ongoing movement* between perception and embodied action resonates with work on teacher noticing as a sustained, justice-oriented practice (Hand 2012; Louie 2018) and cautions against treating new ways of seeing as something one gains on the road to “best practices.” To this end, we have foregrounded the importance of supporting teachers to notice the meanings embedded in children’s embodied actions (such as subtle forms of contestation) and treating the pedagogical body as a sphere of responsiveness equally significant to talk.

Framing the ethical perception of embodied actions as ongoing also helps support the local adaptation—rather than application—of “hands and eyes.” While apprenticing young adult educators in another making program, Meg was not partnering with a researcher and, therefore, didn’t have images of the youth themselves to share as models. She decided to share the images from the original “hands and eyes” PD, but also asked a few of the young people to take turns with a camera during program, looking for any moments of joint activity where hands, eyes, and voices were co-mingling. When educators were writing in their journals after the program, Meg quickly reviewed the photographs and chose a set of images that would elicit rich discussion. The group described what they noticed in the images, what the histories and subsequent futures of those moments were, and how they related to the value of joint activity. In line with Engeström’s discussion of the ways “new concepts may be used in other contexts as frames for the design of locally appropriate new solutions” (2011, 606), collecting their own, locally meaningful photographs allowed the group to build an emic view of embodied practice within their own setting. It also helped novice educators attune their observational sensibilities toward the subtler embodied actions and positionalities of children in the setting.

Additional design implications for teacher learning and noticing include the ways pedagogical elders came to recognize opportunities for revising embodied actions in ways that propelled in-the-moment apprenticeship of novice educators, the sensibilities that infused the prompts used to discuss photographs and video recordings (e.g. What are the pedagogical affordances of this configuration? What is the history of the interaction? What might this type of assistance feel like for the kids?), and our inquiries into the working assumptions and motivations of educators when they engaged in more constrained practices as a means to develop more responsive apprenticeship.

We have offered the story of “hands and eyes” as a way to think about how bodies unlearn ways of being that can reproduce structures of indignity, and how researchers and adult and young adult educators supported one another to envision and practice new forms of movement—“local attempts at transformation in the interactional and pedagogical order” (Erickson 1982). We have also emphasized the role of ethical perception within such local attempts, attunements to embodied interaction that call forward generative forms of pedagogical responsibility and solidarity.

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## Notes

1. The names of adults, youth and children are pseudonyms (when possible, selected by participants). The educators who are co-authors on this paper have elected to use their real names.

2. Wearable circuits involved using LED lights, small batteries, and various materials such as colored wires to create necklaces, glasses, headbands, rings, and so on.

3. In contrast to remedial approaches, which tend to focus on changing the individual, remediation involves a reorganization of the entire ecology for learning and a shift in the way that mediating devices regulate coordination with the environment (Cole and Griffin 1983).

4. Although we have annotated images in other papers on embodied action, here we chose to maintain the original images. Because the field notes were being read and commented on by educators, we felt that fidelity to the original images allows the reader to see what educators were seeing. The images were slightly adjusted to improve lighting and in some cases altered to protect the anonymity of participants.

5. Our practice of co-authored field note writing involved each educator/researcher picking a different color font to use for their observer comments, leading to multicolored texts that reflected the pluri-vocality of data construction and interpretation. Because it was not possible to use multiple font colors in publication, we have used the system of initials and italics to represent such co-authorship in observer comments.

6. In some cases, doing a task for a student may be productive within the context and history of the interaction. The measure, however, lies in the quality of the experience for the child.

7. It is also important to note that students who received the narrow forms of assistance depicted here also encountered more respectful pedagogical interactions. When the student who was asking about the meaning of soldering arrived at the soldering table, Walter proceeded to elicit her knowledge about soldering and support her in ways that allowed her to experience the "full" activity. We read these moments as reflecting the complexities and potentials of the setting, and as windows into the ways the collective was also working to repair itself.

8. Following the children's departure from the workshop space, educators routinely took about ten minutes to write in their journals about the day (who they worked with, key moments, struggles, questions, etc.), followed by a collective debrief (usually lasting thirty minutes).

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