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Cultural Literacy in the 21st Century

Abstract

E.D. Hirsch's curricular concept of "cultural literacy," first popularized in his 1987 book *Cultural Literacy: What Every American Needs to Know*, has had quite an interesting history in the more than three and half decades since that book's release. Since day one, cultural literacy has been consistently controversial, but where it has been tried, it has produced results in improving reading comprehension, and no contrary studies seem to contradict that. Currently, the ubiquitous Common Core State Standards serve as a practical stand-in for cultural literacy, as the debate over Hirsch's work seems to discourage some from studying it, much less using it by name. Sadly, results of that endeavor are hard to quantify, as its actual implementation has been spotty. As we continue to refine what and how we teach in the 21st century, we might do well to accept the value of Hirsch's ideas and focus on discussing precisely what content we should be teaching together, and how.

Keywords: cultural literacy, E.D. Hirsch, curriculum, Core Knowledge, Common Core

It has been over 35 years since E.D. Hirsch published his landmark bestseller *Cultural Literacy: What Every American Needs to Know*. Hirsch's work was immediately a hot item of controversy on both sides of the partisan aisle, with the right claiming it as a prop to their own ideology and the left calling it a tool of perpetuating inequity. Over the decades, those battle lines have remained fairly stable.

Still, as two entire generations have been through the primary and secondary school systems since 1987, Hirsch's ideas have been not only criticized and debated, but also actually implemented. Regardless of political zeal or scorn, what have been the effects of a focus on cultural literacy? Have Hirsch's claims about his signature work been vindicated, or disproved, or have there been unexpected results altogether?

Has the concept of cultural literacy always been implemented in the same ways, or has it evolved over time? What value, if any, does cultural literacy have as we continue to refine our methods and content for the 21st century?

Hirsch originally defined cultural literacy as “the whole system of widely shared information and associations” needed to function in America by understanding idioms and references in normal communication (Hirsch, 1987, p. 103). That novel definition has remained largely stable, even being adopted by his colleagues; in a tribute to Hirsch's career decades later, Chester Finn and Michael Petrilli wrote:

“Teaching knowledge is teaching reading—and reading will never be mastered beyond the ‘decoding’ stage without a solid foundation of knowledge. Children cannot be truly literate without knowing about the world—about history, science, art, music, literature,

civics, geography, and more is not a value statement about what students ‘should’ study; rather, it reflects decades of cognitive science and reading research. Once children learn to decode the words on a page, greater literacy is attained only through greater knowledge. Reading comprehension, and thus learning by reading, depends on knowing something about the content of the passage at hand.” (Finn & Petrilli, 2014, p. 2)

Bernard Schweizer is a college professor who used to disregard Hirsch’s cultural literacy claims, but who now embraces them, wrote of seeing the effects of cultural illiteracy in his classes, then notes the connection, obvious to him, between cultural literacy and social mobility:

“Absent a serious re-evaluation of cultural literacy, I’m afraid, we’ll end up in a society

where a large part of the people will only know how to talk to their immediate in-group in a stripped-down, simplified argot. This will seal them off from most opportunities open to those members of society who command a more solid grasp of shared cultural

knowledge.” (2009, pp. 55-56)

Schweizer shares a concern that Hirsch originally expressed, namely, that cultural literacy is not a means of perpetuating a status quo, but of empowering any and all students to flourish fully in the public world:

“The benefit could be very great indeed—the achievement of significantly greater social and economic equity [...] The reforms are meant to raise the reading levels of all students and to break the cycle of illiteracy that persists from parent to child under our current school curriculum.” (Hirsch, 1987, pp. 143-144)

Still, despite the apparently reasonable nature of Hirsch's claims, strong opposition remains, and it remains in largely the same terms in which it has been expressed since the mid 1980's.

Consider this critique from 2020:

“‘Powerful knowledge’ and ‘cultural literacy’ dominate education and education policy[....]Approaches based on ‘powerful knowledge’ in the study of literature cannot address the student's own experience of literature, crucial for the discipline, nor the values which orient any understanding of literature, nor the central role of critical judgement.” (Eaglestone, p. 5)

It doesn't sound much different from this criticism leveled back in 1991:

“Critically literate readers must learn to distinguish the sources of the concepts they use to make inferences and most importantly must understand the logic of those concepts [....] Hirsch seems oblivious of this essential insight, of this necessary discipline.” (Paul, pp. 531-532)

Even aside from the polemical skirmishes of the education cohorts, an interest in the concept of cultural literacy is no doubt strong in our country in general; consider, for example, the trend of videos claiming to reveal the ignorance of the young or the “common man on the street.” The point of such “gotcha” sidewalk interviews is to laugh at some stranger's alleged lack of cultural literacy. Though such humor segments go back at least as far as Jay Leno's tenure as host of The Tonight Show, even within the past few years one YouTuber has had multiple viral videos with this format: a 2022 video titled “INSANE: Young Americans Don't Know ANYTHING!” garnered 3.8 million views (Fleccas Talks). Obviously, there is a significant segment of society that values the concept of cultural literacy.

Appraising Cultural Literacy: Success or Failure?

Therefore, after three and a half decades of argument and experiment, with public interest in the concept still running high, what can evidence tell us about the value of Hirsch's cultural literacy curriculum?

One study of the validity of Hirsch's claims for cultural literacy curricula was performed by applying a 115-item cultural literacy test to 1,343 community college students, presenting data that "supports the validity of the CLT and the general construct of cultural literacy" (Pentony, 2001, p. 95), concluding with this: "It has been illustrated in this study an research by others (Pentony, 1992, 1996, 1997) that students who are culturally illiterate do not do as well in courses that require reading as students who express cultural literacy. Students and others who are culturally illiterate, and therefore do not read as well, should be identified and helped as soon as possible" (Pentony, 2001, p. 96).

That was just one of ten studies correlated by the Core Knowledge Foundation, a non-profit organization founded by Hirsch in 1986 to advance the work of cultural literacy, to provide a holistic overview of "research showing that Core Knowledge can help lift student scores and close the gap between the more and less disadvantaged students" (Core Knowledge Foundation, 2004, p. 1).

A more recent reappraisal of Hirsch, using a survey of research results, came to similar conclusions about the basic validity of cultural literacy as a useful pedagogical concept:

"[...] a group of teachers in Texas developed and taught units based on Hirsch's 'core knowledge curriculum.' In their adoption of core cultural schemata, the teachers who participated in this project and who were advised by the education faculty at Texas Tech

University, considered interest (students' and teacher's interest) an important factor in their deliberations and ultimately selected units on Shakespeare, colonial America, the Civil War, the Middle Ages, and the Aztec history with success in a school where the majority of students came from the minorities, that is, '65 percent were Hispanic, and 25 percent were African American.' (p. 260) They were also flexible in terms of assessment and allowed their students a choice as to how to show their knowledge of the units taught. 'The teachers were impressed with the content that their students engaged and with the sophistication of their oral and written expression.' (p. 268) This study/project demonstrates and corroborates Hirsch's contention that cultural literacy can be successfully adopted and it does, in fact, enhance student knowledge and engagement, particularly minority and marginalized students, if it is adopted and incorporated into the curriculum in a sensible way that takes account of students' interest and motivation." (Shamshayooadeh, 2011, p. 275)

Shamshayooadeh not only supports the essential ethos of Hirsch's work, but even takes educators in a practical direction for optimal implementation!

One looks in vain for any studies showing the inclusion of cultural literacy in an ELA curriculum to be unhelpful at all, much less detrimental. Indeed, nary such a study is to be found at all, much less a body of work such as that which Hirsch's Core Knowledge Foundation trumpets. Why this dearth of literature on the subject, especially if cultural literacy curricula is as manifestly bad as its critics assert?

Paul G. Cook theorized that the animosity was largely borne of a misperception that Hirsch's work was proscriptive rather than descriptive, that critics were not seeing the pragmatic skill set forest here for the apparently didactic trees: "However, these critiques indicate a recurring

critical emphasis on the latter part of Hirsch's project, what I call the *what* of cultural literacy, as opposed to the *how*" (Cook, 2009, p. 489) and "What Hirsch advocates as cultural literacy is not docile enculturation in some monolithic, stable knowledge-entity but is something like a heuristic for rhetorical invention that stresses the relevance of being merely familiar with certain cultural *doxai*, opinions, attitudes, or values" (Cook, 2009, p. 493).

Ironically, even when some scholars criticize Hirsch, they end up essentially agreeing with him and repeating his ideas. In "Knowledge, Literacy, and the Common Core," Cervetti and Hiebert endeavor to promote a knowledge rich curriculum, but hasten to add that "although we refer to knowledge or information, we are not referring to discrete factual knowledge. The kinds of knowledge that have the potential to support reading comprehension and generally enrich students' lives cannot be reduced to a list of facts, as has occurred in some interpretations of knowledge building" (Cervetti & Hiebert, 2015, p. 257), then name checking Hirsch. As an example of what they mean, they later cite a study showing that young readers exhibited better comprehension of passages about the Vietnam War if they "were provided with knowledge pre-training" (Cervetti & Hiebert, 2015, p. 259). It should be noted that Hirsch's *The New Dictionary of Cultural Literacy* has an entry about the Vietnam War (Hirsch, 2002, p. 778).

Cervetti and Hiebert also mention that "writers, especially writers of complex texts, assume their readers will be able to fill in gaps and make connections [...] writers assume that readers will draw on a schema related to the topic and, using this schema, will use relevant knowledge" (Cervetti and Hiebert, 2015, pp. 258-259). This echoes something that Hirsch himself said in the book that Cervetti and Hiebert are contending against:

"Knowing about prototypes is essential for understanding how we apply past knowledge to the comprehension of speech [...] We are able to make our present experiences take

on meaning by assimilating them to prototypes formed from our past experiences....Researchers who have been relating these mental entities to reading, particularly R.C. Anderson and his associates have chosen the word schema for them.” (Hirsch, 1987, p. 51)

Still, Cervetti and Hiebert make an interesting and useful point, even if their dismissal of Hirsch is flawed. They say, “In line with the CCSS, we mean the kinds of disciplinary understandings that support reading and learning within content areas. We use the term *knowledge* because it is the term selected by the CCSS to represent discipline-relevant learning and also because much of the relevant research uses this term” (Cervetti & Hiebert, 2015, p. 257). Perhaps they see Hirsch as privileging a body of content area literacy, where they want to focus more on disciplinary literacy. If so, they are part of a welcome and wider conversation about the flexible nature of what constitutes the material to be promulgated to the next generation; as Schweizer said,

“I am certainly in favor of debate regarding what needs to be covered in a shared national curriculum. There’s no doubt about the need to negotiate what should be included under the heading of ‘the great tradition,’ the canon, and all the rest. But while we should be mindful about the limiting effects of every defined body of knowledge, let us not throw out the baby of a modern education with the bathwater of cultural literacy [...] How local, popular, and ethnic forms of knowledge can co-exist with a more formal kind of cultural literacy is the real question, not whether or not cultural literacy has a place in national education.” (Schweitzer, 2009, p. 56)

Even researchers whose work supports Hirsch’s conclusions voice this reservation about Hirsch’s notorious list: “One does not have to entirely adopt Hirsch’s arguments; for example, it is feasible to agree with the notion of cultural literacy as an indispensable pedagogical tool while

take issue with the extensive, core cultural list that Hirsch proposes in his book”

(Shamshayooadeh, 2011, p. 277).

Indeed, Hirsch himself said much the same thing in his original work: “DNA and quarks, now part of cultural literacy, were unknown in 1945. In short, terms that literate people know in the 1980s are different from those they knew in 1945, and forty years hence the literate culture will again be different” (Hirsch, 1987, p. 29).

One could note that it has now been thirty-six years since that statement was made and, indeed, the cultural landscape has changed a great deal. Perhaps an updated concept of cultural literacy would remove potentially obsolete references like Johnny Appleseed or the Pony Express, and add more recent fodder for allusions, like Lin-Manuel Miranda’s musical Hamilton, the Covid-19 pandemic, or “doom scrolling” social media.

Preliminary efforts in that direction have already been made. In a reevaluation of Hirsch’s work, Eric Liu wrote:

“For one thing, the list for our times can’t be the work of one person or even one small team. It has to be everyone’s work. It has to be an online, crowd-sourced, organic document that never stops changing, whose entries are added or pruned, elevated or demoted, according to the wisdom of the network.

“Everyone should make his or her own list online. We can aggregate all the lists. And from that vast welter of preferences will emerge, without any single person calling it so, a prioritized list of ‘what every American needs to know.’” (Liu, 2015, p. 61)

Thereafter, Liu presents an ad hoc update including such new material as “whiteness,”

“nativism,” and “DARPA” (Liu, 2015, p. 62).

Cultural Literacy Persists Under Other Names, But Ambiguity Endures

Since some researchers appear reluctant to mention Hirsch at all, much less agree with him, there is another way to measure the effectiveness of his ideas. In an essay for a volume in honor of his career, Hirsch noted that he is a big fan of a recent innovation whose worldview bears an uncanny resemblance to that of cultural literacy: Common Core. “When I’m asked if I support the new Common Core State Standards (CCSS), I give an emphatic ‘yes.’ They constitute the first multi-state plan to give substance and coherence to what is taught in the public schools. They encourage the systematic development of knowledge in K–5. They break the craven silence about the critical importance of specific content in the early grades” (Hirsch, 2014, p. 80). With its emphasis on a universal curriculum reflecting America’s distinct zeitgeist, Common Core may be the best realization of cultural literacy to date.

Thus, Common Core can be a surrogate for cultural literacy in the 21st century. If we want to see how successful a cultural literacy curriculum is, we can assess the merits of Common Core.

For example, one study of how the federal writing standards have been integrated into classroom instruction championed ideas very similar to Hirsch’s, without ever using the name “Hirsch” or the term “cultural literacy.” Mo et al. noted how “students in most grades are expected to attend to topical information or subject matter when they write and to provide elaborative details that illustrate, illuminate, extend, or embellish general content” (Mo, 2014, p. 449). They likewise mention that “students are expected to master the structural elements and information that are canonical to the narrative genre (e.g., plot, dialogue, setting, characters) in third grade and beyond...”, then recommending “text models” of genre details (Mo, 2014, p. 450), all of which is essentially synonymous with aspects of cultural literacy.

Even here, though, in what may seem a fairly clear cut area for analysis, are detours and cautions. For one, Hirsch is skittish about the high-stakes testing component of how Common Core has been implemented:

“So far, I am leery of both sets of official tests for the Common Core, at least in English language arts (ELA). They could endanger the promise of the Common Core. In recent years, the promise of NCLB was vitiated when test prep for reading-comprehension tests usurped the teaching of science, literature, history, civics, and the arts—the very subjects needed for good reading comprehension.

“Previously, I wrote that if students learned science, literature, history, civics, and the arts, they would do very well on the new Common Core reading tests—whatever those tests turned out to be. To my distress, many teachers commented that no, they were still going to do test prep, as any sensible teacher should, because their job and income depended on their students’ scores on the reading tests.” (Hirsch, 2014, p. 82)

Hirsch is far from alone in this hesitation about what may be a dangerous downside to his approach to schooling, though some who also worry about high stakes testing seem to be equally concerned about how it might include the concept of cultural literacy itself:

“Despite the transformative changes underway, federal and state mandates, including high stakes testing, have caused many English teachers to focus more intensely on what some call ‘the basics.’ In other words, teachers of secondary English need to account for the dramatically changing contemporary realities in the textual landscapes of their students, but at the same time they also need to attend to expectations that their classrooms will deliver instruction in ‘common culture’ texts that have been canonized in the secondary curriculum and in the disciplinary apparatus.” (Lewis, 2011, p. 77)

Failure to give cultural literacy curricula a shot is one thing, but a newer difficulty in measuring its value has been the struggle to fully implement the similar Common Core standards adequately, despite their formal adoption in the vast majority of states.

For example, Tortorelli et al. found a disturbing lack of actual usage of the Common Core writing standards in a way that reflected the balance and priorities of those imperatives:

“The early learning standards across states varied considerably in how well they aligned with the Common Core for the early elementary grades (K–2). Early childhood standards rarely asked young children to create their own texts, whereas the Common Core includes expectations for composing in multiple genres. Early learning standards provided little guidance for comprehensive writing instruction that integrates writing skills across domains, and indicated potential misalignment in how writing is conceptualized and taught in preschool and elementary contexts.” (Tortorelli, 2021, p. 729)

If writing standards are so haphazardly applied as recently as 2022, we could reasonably worry about the quality of classroom Common Core instruction in other, cultural literacy-related areas of the English Language Arts, as well. This puts something of a damper on the researcher who would investigate the efficacy of Hirsch’s ideas in general across America.

Thus, then, we might see cultural literacy as the pedagogic equivalent of religion, akin to G. K. Chesterton’s famous quip: “The problem with Christianity is not that it has been tried and found wanting, but that it has been found difficult and left untried” (Chesterton, 1910, p. 48).

Conclusion

This survey finds that cultural literacy has been useful...when and where it has actually been tried, and could continue to be so, depending on the context and quality of implementation, whether as “cultural literacy,” “powerful knowledge,” or “Common Core.” As 21st century

literacy certainly demands a mastery of judicious critical thinking about sources and curricular materials at all times, this may be more of a feature than a bug. Our classes will contain some manner of cultural content. What factual information our students learn will depend not just on what checklist of nouns we accumulate, but also on how we teach them to become discerning evaluators of what matters most. Ultimately, students replace their teachers, so it is in our best interest to engage them in the discussions that we've been having for decades now: what do young people most need to know, and how do we best instill that knowledge in them?

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**Re-visioning writing: Preservice teachers' learning of transmediation and
multimodal composing**

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Introduction

Technology is ubiquitous in schools and classrooms. From platforms such as Google documents to Microsoft products, teachers and students have a wealth of technological tools to employ in writing classrooms. Researchers have explored how these technological advances are reshaping our ideas about genres and the ways students compose. For example, research has documented how students engage in composing multimodal memoirs, ipoeetry, and fanfiction (Batchelor, 2018; Curwood, Magnified, & Lammers, 2013; Curwood & Cowell, 2011; Padgett & Curwood, 2016; Pytash, Kist, & Testa, 2017; Smith, 2017). Furthermore, scholars have also explored how digital composing can easily allow student writers to engage in transmediation, defined as the “translation of content from one sign system into another” (Suhor, 1984, p. 250). And yet, while research document the rapidly changing notions of how writing is conceptualized and how it functions, “much of what counts as good writing in schools does not reflect evolving notions of texts” (Hudley & Holbrook, 2013, p. 500).

Ultimately, students’ writing experiences are directly shaped by teachers’ beliefs about writing and writing instruction (Morgan & Pytash, 2014). As writing teachers and researchers, we know that teachers’ early experiences as writers and teachers of writing influences their instructional decision making (Morgan & Pytash, 2014). Therefore, we are especially interested in the experiences preservice teachers need when learning to teach digital writing and multimodal compositions. In this article, we detail how preservice teachers taught and reflected on lessons focused on transmediation in an 8th grade classroom during a field experience and provide implications for how the teaching of multimodal writing is taught to preservice teachers.

Related Literature

Research has documented that out of 50 universities teacher preparation programs, 75% did not offer a methods course focused on the teaching of writing (Myers et al., 2019). And yet, when an intensive writing methods course is offered, researchers note that salient course experiences are important in contributing to learning to teach writing (Daisey; 2008; Daisey 2009; Pytash, 2012, Pytash, Testa, & Nigh, 2015). However, writing methods courses serve as only one site when PSTs learn to teach writing, as K-12 schools serving as field experience sites are an important space for learning to teach writing (Meyer & Sawyer, 2020; Pytash, Morgan, & Testa, 2023). Research has demonstrated that during field experiences, PSTs specifically learn about the writing process that students use when composing, in addition to how students are positioned during the writing process (Colby & Stapleton, 2006; Kelley, Hart, & King, 2007; Meyer & Sawyer, 2020; West & Saine, 2017).

Evidence supports that PSTs who demonstrate deep understandings about how to teach writing have engaged in field experiences linked to their methods coursework (Pytash, et al., 2023). This work demonstrates that PSTs need to experience explicit connections between theories of teaching writing and the teaching practices that should be enacted. After examining 82 studies focused on PSTs' learning to teach writing that were published between 2008 and 2018, Bomer and colleagues argue that more research is needed "that look across contexts (e.g., university and field placement teaching, university preparation and early career) and provide more insight into the ways ideas are taken from coursework into PTs' future teaching." (13).

Furthermore, Bomer et al. (2019) argue that PSTs need additional learning in order to "expand their understandings of writing to include digital or multimodal text composition (e.g.,

Hundley & Holbrook, 2013). In methods courses, preservice teachers need a range of composing experiences that allow them to compose in various formats (Hundley, Smith, & Holbrook, 2013; Johnson & Smagorinsky, 2013; Rish, 2013; Werderich & Manderino, 2013). Much of the research investigates how preservice teachers engage in digital writing in university methods courses during specific course assignments, such as multimodal poetry (Johnson & Smagorinsky, 2013), multimedia memoirs (Werderich & Manderino, 2013), digital “This I Believe” compositions (Rish, 2013), and literary analysis (Hundley, et al., 2013).

Multimodal Composing

In their large-scale study of 20 middle and high schools from five states, Applebee & Langer (2011) found, “that technology seems to be reinforcing traditional patterns of teacher-centered instruction rather than opening up new possibilities” (p. 23) as technological tools were mostly used for word processing, rather than reconceptualizing writing and the teaching of writing. The discrepancy between teachers’ access to technology in classrooms and how they teach with technology elicits a response from teacher educators. In particular, teacher educators must understand how preservice teachers develop the ability to integrate technology into their teaching practice to determine the necessary experiences preservice teachers need to bridge this discrepancy (Bomer et al., 2019; Pytash & Testa, 2016).

It is critical that preservice teachers have opportunities to learn how to implement research-based writing pedagogy that integrates technology into instruction and positions students as designers, creators, and meaning-makers. Multiliteracies recognizes that “meaning-making occurs through a variety of communicative channels” (Perry, 2012, p. 58), including audio, visual, spatial, gestural, and other modes of representation (The New London Group, 1996). Stemming from social semiotics theory, multimodal literacies foreground the

relationships between modes and their multiple affordances, for both conveying meaning and representing ideas (Jewitt & Kress, 2003; Kress, 2003; Vasudevan, Schultz, & Bateman, 2010). From this viewpoint, text is not solely print-based, but rather embodies other semiotic resources (Gee, 1996; Lankshear & Knobel, 2003; New London Group, 1996). Often multimodal compositions are rooted in remix theories, when media content is re-appropriated for new purposes and contexts (Bezemer & Kress, 2008; Hocks & Kendrick, 2003; Hull & Katz, 2006; Knobel & Lankshear, 2008).

Suhor (1984) originated the term transmediation to define the “translation of content from one sign system into another” (p. 250). To explore this during classroom instruction, Batchelor (2015, 2018) investigated how middle school students engaged in transmediation during writing units while revising. Students were asked to transmediate their original pieces into new modes to “translate their thinking,” by creating sculptures, drawings, paintings, and other written genres (Batchelor, 2018, p. 345). Students used this process to “re-see” their writing, as they continued working on their final original writing pieces. Batchelor found that through the process of remaking their ideas into another medium, young writers could re-imagine the messages or mechanics of their written works in profoundly new ways.

Knowing that writing multimodally and the act of transmediation are powerful points of instruction in classrooms, we wonder how preservice teachers might guide students through the process of transforming a selection of original writing and what that meant for preservice teachers’ learning to teach writing. As Bomer and colleagues (2019) noted, missing from the research about how PSTs learn to teach writing is an examination of what happens when preservice teachers leave their methods courses and implement digital writing in field experience classrooms. The purpose of this research is to explore pedagogical practices in digital

composing, while exploring how preservice teachers are prepared to meet these expectations (Hundley & Holbrook, 2013). Two research questions guided this study:

- (1) How did preservice teachers implement a series of lessons engaging students in transmediation?
- (2) What did preservice teachers report learning from their experiences with transmediation?

Methodology

The Instructional Context

This study took place with 24 preservice teachers enrolled in an integrated Language Arts program designed to prepare undergraduate candidates for licensure in grades 7-12. As part of the program, preservice teachers took the course *Teaching Language and Composition*, focused on theories and research-based practices related to language and the writing process. Lisa was teaching the *Language and Composition* course, while Kristy was researching how preservice teachers learn to teach writing. The course had a field experience at James Middle School, a suburban school with approximately 552 middle school students (the school and all names are all pseudonyms). According to the state report card, James Middle School's student population is 3.9% Black, Non-Hispanic, 2.0% Asian or Pacific Islander; 2.0% Hispanic, 4.7% Multiracial, 87.2% White, Non-Hispanic. Students with Disabilities contributed to 14.2% of the student population. Economically Disadvantaged youth comprise 24.1% of the student body.

Preservice teachers spent eight weeks at James Middle School working with Lisa and the 8th grade teacher, Jane, who frequently used mentor and model texts, conferences, and instructional supports, such as scaffolding, to develop her students as writers. The goal of the field experience was to provide preservice teachers opportunities to work directly with Jane and

Lisa to conceptualize and implement writing instruction. The field experience took place one day a week, over ten weeks. Each class period was 80 minutes. Preservice teachers were divided into teaching groups (typically 3-4 to a group) and worked as a group to plan and implement instruction for one of the days. The other days, preservice teachers observed other preservice teachers teach.

For the focus of this study, we selected three preservice teachers, Jennifer, Sammi, and Noah. We documented the instruction they received about transmediation in their methods course and then we investigated their implementation of two lessons to a class of 8th grade students who went through two rounds of transmediation during the writing process. We selected these three preservice teachers because we thought their teaching and reflections offered unique understanding about how preservice teachers learn to teach transmediation. Additionally, a close analysis allowed for an in-depth examination into their decision-making practices providing insights into the issues and opportunities that preservice teachers have when learning to teach writing with technology.

Data collection and Analysis

During the methods course and the field experience, field notes were taken. The field notes allowed for the documentation of what occurred in the methods course when preservice teachers were learning about transmediation, as well as, how they implemented their lesson. In addition, immediately after teaching, preservice teachers were asked to provide a written reflection in response to prompting questions. Prompts were used to serve as scaffolds for reflection and guides to important course topics. These reflective writing responses were analyzed using constant comparative analysis (Strauss & Corbin, 2008). Two codes emerged

from the reflective writing responses: (1) developing students as writers, and (2) the affordances of composing with digital tools.

Findings

The following sections document the instruction on transmediation that preservice teachers experienced in their writing methods course. We then detail how preservice teachers first taught the 8th grade students to write flash fiction. We then explain how preservice teachers taught students to reduce their flash fiction pieces to hint fiction, stories that are typically 25 words or less. We detail how preservice teachers engaged the students in another round of transmediation by revising their pieces into multimodal compositions using Animoto. Finally, we provide the preservice teachers' reflections as a way to gain insight into their understandings of teaching writing.

In the University Methods Course

Lisa introduced preservice teachers to the transmediation unit that they would be teaching, specifically (within or in) the three genres: flash fiction, hint fiction, and multimodal composition. Lisa guided preservice teachers through deconstructing model pieces of each genre in order to create a list of essential elements of the genre. This led to conversations about each genre's purpose and audience. Through whole class and small group discussions, preservice teachers created a list of noticings that were developed to guide original pieces of writing.

Lisa also shared with the preservice teachers the literary techniques that were important for writing each genre. She did this by writing in front of preservice teachers and modeling how these techniques worked for the genre. Finally, preservice teachers wrote original pieces. They wrote a flash fiction story and then were asked to re-vision their original flash fiction pieces into hint fiction and then multimodal compositions. The goal was to provide preservice teachers

opportunities to understand the process a writer would have to go through to effectively compose each genre and re-vision their original pieces into new pieces.

Lesson One: Teaching Flash Fiction

During their time at James Middle School, preservice teachers taught a Flash Fiction unit to the 8th grade students. In order to introduce students to Flash Fiction, preservice teachers opened the first lesson by having the students read the beginning sentence of “Bath,” by Amy Lowell. Next, they had the students read the opening lines of “Currents,” by Hannah Bottomy and “Accident,” by Dave Eggers. As students read, Jennifer, one of the preservice teachers, asked students, “what is engaging about these leading sentences?”. She followed up the students’ responses by asking them if they would be interested in continuing to read any of these stories based on the opening sentences. As students responded positively, Jennifer explained that each of these stories starts in the middle of the action so that within the first few sentences, the reader should be able to identify the setting, situation and characters of the story. This creates a source of tension and builds an interest to hook the reader.

Next, Sammi, a preservice teacher, asked students to provide as many synonyms as they could for the word “flash.” As she fielded responses, she directed them to conclude that flash means fast, exciting, and dynamic. She then segued into a definition of flash fiction including a description of the technique’s writers use to compose flash pieces. These included holding back information, flashbacks and flashforwards, unusual format, dialogue, a telling title, and playful point of view. Sammi directed the students to silently read the mentor text “Avoidance,” a flash fiction piece written by another preservice teacher in the cohort. When they were finished reading, Sammi organized students into groups of four and asked them to reread the piece

together to annotate the clues and techniques that make it flash fiction. Each group shared their findings and Sammi was able to reiterate the techniques as the groups shared what they noticed.

At this point in the lesson, Sammi transitioned to photographs. She projected images of people in street scenes and asked questions to stimulate their thinking while noticing the details in the images including the characters in the images, their emotions, their body language, and the way the photographer framed the image. She shared an image she had used to prompt her to write a flash fiction piece and read her piece to them aloud. Then she directed students to choose an image and begin to write their own flash fiction pieces, using the techniques they had just explored. Over the course of the flash fiction unit, students peer reviewed one another's pieces and continued to read other mentor texts to further internalize the techniques of flash fiction.

Lesson Two: Teaching Transmediation

After students had a final piece of flash fiction written, Jennifer, Sammi, and Noah asked the 8th grade students to re-vision their original flash fiction pieces into hint fiction and then multimodal compositions. The lesson began with Jennifer reading three pieces of hint fiction to the 8th grade students with the goal of introducing students to the genre. Following her reading of each selection of hint fiction, preservice teachers asked students, "what do you notice about these three texts?". The goal of this question was to foster students' critical reading and thinking, as well as to provide students with an avenue for initial discussions and interpretations of the texts.

Following this introductory activity, Jennifer read her original flash fiction story that she had written. Jennifer, Sammi, and Noah then led the class in a discussion about how Jennifer's story could be revised to the genre hint fiction. Noah led the discussion and focused primarily on the following questions:

- What keywords or phrases are most important?
- What parts or elements are absolutely integral to the story as a whole?

During this time, Noah annotated Jennifer's flash fiction, following students' suggestions about the key words or most important parts of the story that would need to be conveyed even in a shorter form. Sammi took notes to document the class discussion. Throughout this process, the preservice teachers worked with the 8th grade students to re-vision Jennifer's flash fiction story into a hint fiction story. After, students were asked to independently revise their original flash fiction pieces into hint fiction stories. Preservice teachers workshopped with students by providing individual writing conferences.

Once students completed composing and sharing their hint fiction stories, preservice teachers focused students' attention to the idea of transmediation, which occurs when there is a change in or across modes (Bezemer & Kress, 2008). Using "Play Ball," the hint fiction that Jennifer read aloud at the beginning of the lesson, Sammi used the video platform, Animoto, to re-vision the piece into a multimodal composition. Sammi and the 8th grade students collaboratively selected images, music, and design features that would represent "Play Ball," as Sammi modeled her understanding of how this story, told through multiple modes, conveyed the message of the story. Students then independently composed Animoto multimodal compositions based on their original hint fiction pieces. Once again, preservice teachers used this workshop time to individually conference with students to provide support during the composing process. For example, as the preservice teachers viewed students' videos, they commented on their use of juxtaposition of images, their musical choices, the format of the video, and other principles and elements of design.

Preservice Teachers' Reflections

Following each lesson, preservice teachers were required to reflect on their learning. Jennifer, Sammi, and Noah each submitted written reflections as they considered the process of helping writers develop and their insights into teaching composing in different modes.

Preservice teachers all used the word “revision” to describe the process that the students went through. They reflected that revising a piece of writing can be a difficult process for students. For example, Sammi explained this within the complexity of moving students through the writing process. She explained “students like what they wrote originally and I think it is harder for them to grasp revision. I never realized that revision needs to be discussed and taught to students.” Noah followed this thinking when he explained:

Once they get started writing, the ideas seem to come a little easier. With revision, though, they've already written, so now it's no longer about getting the flow. It's more about really working out the kinks and making the work as good as it can be. It's a deceptively difficult writing exercise, but not impossible.

Within this process of revision, preservice teachers noted that the act of transmediation eased the process by allowing creativity. Jennifer shared, “revision is a process and recomposing the pieces into new genres encourages creativity in that process.” She continued by explaining students were taking a “second, third, and at times even a fourth look” at their compositions, which allowed them to “produce and critique their compositions to make them the best they could be.” Similarly, Sammi reflected:

I really loved being able to watch them compose their work in a different mode that brought their flash fiction pieces to life. I think teaching in different modes is so crucial to a student's creativity and imagination; I think it helps them expand in their critical thinking skills as well as being able to see their work from a different perspective.

Noah reflected specifically on the multimodal compositions when he stated, “I think for students who do not like English or to write enjoy the different modes as it allows them to be creative and they do not feel like they are making mistakes. English is so much more than essays and books and different modes help represent and show this.” Finally, Jennifer interpreted the multimodal composing process as an avenue for students to do more in-depth thinking and take ownership of their writing. She explained, “the students were able to pick songs and images that intentionally conveyed the tone of their piece. Crossing modes was a really interesting way to allow students to own and explore their texts.”

Preservice teachers specifically reflected on using Animoto during the writing process. They shared that the 8th grade students seemed most engaged in their composing processes while using the digital tool. Noah noted that “students really seemed to like using Animoto” and Sammi noted that students thought that lesson “was the most fun.” Jennifer noted, “using Animoto enabled them to think of different possibilities for their stories. They were learning multiple modes for writing and I was seeing how essential the revision process is to developing strong, independent writers.”

Interestingly, Sammi, Jennifer, and Noah all mentioned that they wished they had been more prepared to teach using Animoto, even though they had experiences using the tool as writers. For example, Noah noted that the students were more “familiar with Animoto” than he was. He reflected, “students are very eager to work with technology and use tools within the classroom, and I as a teacher need to be familiar with these tools so I can ensure students are producing strong work with the tools I have assigned.” Additionally, Sammi recalled that she felt like she needed to “ask students to show me how they were using Animoto” during the lesson.

Discussion and Implications

Adolescent writers have access to more digital composing tools than ever before. By skillfully appropriating these tools, student writers may learn to convey complex and nuanced meanings across modes. However, as great as this potential may be, writers need teachers to model and mentor them in the processes of multimodal composition. Therefore, while this study focuses on three preservice teachers' during a field experience, this study has broader implications for literacy teacher education.

First, preservice teachers must develop sophisticated understandings of the processes of multimodal composition before they enter field experiences. In their methods course, preservice teachers wrote and revised their own flash fiction pieces into hint fiction stories then into Animoto compositions. It was during their own attempts at transmediation that they became aware of the techniques most critical to this process, such as locating key words and important elements of genre which they then related to elements of design. These findings support the literature that suggests methods courses offer important opportunities for PSTs to understand the complexity of the composition process and need opportunities to consider the decision making that occurs during the writing process (Bomer et al., 2019; Pytash, et al., 2023;). When it came time to teach these concepts, preservice teachers drew upon their experiences as learners. This gave them the background that allowed them to model their thinking in front of students. We believe this progression is important because it allows preservice teachers to learn “the process of writing from the inside, that is, what the teachers themselves as writers experience” (NCTE, 2016). Successful modeling of multimodal compositions depends upon the teacher mining his or her own composing processes for examples during teaching.

Second, there are important learning benefits when the methods course is explicitly aligned to field experience. Preservice teachers were comfortable using Animoto during their

writing process within the methods course as they were learning the foundations of writing pedagogies. However, when they entered the classroom, they were nervous about using the digital tool and believed the students were more capable users than they were. Being in the field experience allowed them the opportunity to implement digital technology and the instructional approaches they learned in methods. Preservice teachers started to think through using technology, not through the lens of a student user, but through the lens of a teacher who had to not only understand the tool but understand how to implement the tool effectively. Embedding the writing course within Jane's classroom provided salient course experiences that are valuable in preservice teachers' development as teachers of digital writing (Pytash & Testa, 2016). This finding contributes to the research that PSTs need opportunities to "approximate the practices, approaches, and theories they learn about in coursework... to guide PTs' subsequent interactions and make clear connections to theories" (Bomer, 2019). It was the alignment between the methods course and the field experience that supported both the learning of theoretical perspectives of teaching writing with technology and the implementation of the teaching practices.

Finally, critical to preservice teachers' learning of writing instruction was the opportunity to engage in transmediation as an approach to teaching revision. It is likely that the idea of moving a story from a written to an audio-visual form was not new to most of the middle school students. What may have been novel was the intermediary step of reducing the original text to a much shorter piece. By requiring the students to take this step, preservice teachers highlighted the importance of revision. Students were able to receive one-on-one encouragement to take the time to re-see their pieces. The preservice teachers mentored the students, coaching them through the decisions they were making about what parts of their original pieces to keep and helping

them articulate their reasonings. Preservice teachers saw the affordances of this process as students were engaged in exploration and interpretation during the revision process. This is important because as Noah mentioned in his reflection, revision “is a deceptively difficult writing exercise.” Demystifying the process by providing modeling followed by mentoring allowed students to build capacity for ways of re-seeing their own pieces, which would be tested further as they transformed their written pieces to video.

Research notes that PSTs need to understand students’ complex composition processes and their decision making as digital writers (Colby & Stapleton, 2006; Kelley, Hart, & King, 2007). Since revision is often confused with editing, it is important for preservice teachers to learn the affordances of transmediation as a tool to slow down the revision process by relating each composing decision from one mode to another. For example, when traditionally teaching revision, teachers may use acronyms that refer to common decisions writers make to improve a piece, such as, A.R.M.S., add, remove, move, or substitute. These mnemonic devices are useful, but fall short when the revising we are teaching crosses modes. Therefore, it may be helpful for teachers to broaden their conceptions of revision to include elements and principles from visual design, including contrast, repetition, alignment, proximity, color, shape, form, space, and texture. In the lesson teaching transmediation, preservice teachers’ comments during conferences expanded from the language of traditional revision. While they sometimes suggested adding and moving design elements, they also commented on the appropriateness of students’ choices of image and the positioning of the images. They commented on the use of music and sound and how these elements work in tandem with the images to convey mood and tone. These principles and elements of design easily relate to conversations about written modes of communication. When teachers make these choices to embrace the additional elements of design when they teach

composition, they are providing the kind of additional insights students need to become successful composers in multiple modes.

Conclusion

How writing is taught is shaped by teachers' beliefs about writing and the role of technology. Therefore, it is imperative for preservice teachers to have experiences using technology for their own writing. This is an important first step as it allows preservice teachers to experience issues and affordances that they will need to address when teaching. Second, preservice teachers need opportunities to implement technology during field experiences so that they gain the confidence and know-how to effectively plan and implement writing instruction integrating technology. The close examination of Jennifer, Sammi, and Noah's learning provides insights into the unique experiences and challenges preservice teachers face when learning to teach writing using technology, and how they come to see technology not just as a platform for writing, but as an avenue for transforming the writing process. These experiences are important for teacher educators to consider in order to prepare preservice teachers to integrate digital tools into their writing instruction in thoughtful, purposeful ways.

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Learning to Use App Book Features During Buddy Reading

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Abstract

To understand how children learn to activate digital features through social interactions, we explored how 10 kindergarten peer buddies and digital features shaped the Zone of Free Movement (what is available in the learning environment) and Zone Promoted Action (what attempts to draw learners' attention in the learning environment) across 15 buddy reading sessions to support a shift from a buddy's Zone of Proximal Development (what they are ready to do with support) to their new Zone of Actual Development (what they can newly do independently—i.e., learning) for activating digital features in the app book. Emergent coding and constant comparative methods were used to develop codes and identify patterns. Buddies employed four actions to mediate their buddy toward effective use of the app book features: (1) verbal mediation and pointing; (2) modeling feature use; (3) both 1 and 2 and (4) physical support for activating a digital feature.

Keywords: Buddy reading, app books, digital books, electronic features, digital features, Zone Theory

1. Introduction

Technological progress has created an educational opportunity for children to use interactive, multimodal digital texts both at home and in school (Blackwell et al., 2015; Kabali et al., 2015; Rideout, 2017; Shuler, 2012; Wang et al., 2019). Interactive, multimodal app book reading is distinguished from reading traditional texts due to its multimodal features (e.g., sounds, animation, hotspots) that can be activated by children's touch. An app book is an interactive, multimodal, digital book accessed via tablet or phone via an app. Unlike traditional books, app books incorporate dynamic features such as animations, sounds, and interactive hotspots that can be activated through touch, offering a more engaging reading experience by combining visual, auditory, and tactile elements (Kucirkova et al., 2017; De Jong & Bus, 2003). In contrast to traditional text reading, app book features create new and more complex pathways of engaging children in reading (Geist, 2014; Marsh et al., 2015).

Digital features in these books can potentially assist children in making meaning (Wang et al., 2019). Thus, children's ability to use these features is important (Blackwell et al., 2015; Kabali et al., 2015; Rideout, 2017; Wang et al., 2019). However, while research has explored how children learn to engage in collaborative meaning-making while buddy reading with app books (Christ et al. 2018), it has not explored the more basic question of how children learn to use the digital features in app books. In prior research on app book buddy reading, the emphasis has largely been on understanding how young peer buddies contribute to each other's comprehension through meaning-making processes (Brown, 2016; Christ et al. 2018; Simpson et al., 2013; Wang et al., 2019). Recognizing the potential of digital features in these app books to enhance comprehension, this study undertakes a fine-grained, microgenetic analysis of the kindergarten peer buddy reading context to understand how both a child's buddy and the app

book features themselves potentially mediate a child's learning to use a digital feature. This study can inform improved design of peer buddy reading learning contexts and app book features.

1.1 Theoretical Framework

From a sociocultural perspective (Vygotsky, 1978), young children acquire knowledge via interactions with others and through the use of cultural instruments such as multimodal interactive app books (Plowman et al., 2010; Stephen, Stevenson, & Adey, 2013). The digital features, such as hotspots, navigation, etc., have the potential to mediate children's world through creating interactive media environments that support children's meaning-making experience (Kucirkova, Sheehy, & Messer, 2015; Marsh, 2016; Neumann & Neumann, 2014). Additionally, the digital buddy reading environment is replete with collaborative exploration and practice (e.g., sharing ideas, explanation). This environment could also assist students' experience of reading as a sociocultural phenomenon (Javorsky & Trainin, 2014).

To better understand how both digital features and buddies may mediate young children's learning to use digital features, this study adopted Valsiner's (1987) Zone Theory to undertake a microgenetic analysis. Inspired by Vygotsky's notion of Zone of Proximal Development, Valsiner (1987) introduced interactive zones as a developmental model by conceptualizing two more zones, the Zone of Free Movement (ZFM) and the Zone of Promoted Action (ZPA), which support or constrain a child's development. The ZFM refers to the boundaries, constraints, and restrictions that are applied to the context (Lightfoot, 1988; Blanton et al., 2005). For example, ZFM considers what digital features are available in the book, and what functions they allow. The ZPA refers to the "set of activities, objects, or areas in the environment" (Valsiner, 1987, pp. 99–100) that are used to convince a child to act in a certain way (Blanton et al., 2005). For

example, ZPA considers how a digital feature might light up, encouraging a child to touch it; or a buddy might suggest pressing a feature. The ZFM and ZPA could potentially support a student to shift from their Zone of Proximal Development (i.e., when they need support to use a digital feature effectively) to their new Zone of Actual Development (i.e., when they can newly use the digital feature effectively and independently; see Figure 1).

Further, since both buddies and features can potentially shape the ZFM and ZPA during interactive app book peer buddy reading, we adapt Valsiner's Zone Theory by creating subcategories that reflect this: Zone of Free Movement shaped by a buddy (ZFM-B), Zone of Free Movement shaped by a digital feature (ZFM-F), Zone of Promoted Action shaped by a buddy (ZPA-B) and Zone of Promoted Action shaped by a digital feature (ZPA-F; see Figure 2).

1.2. Research Question

Our research question is the following: How do kindergarten peer buddies and digital features shape the Zone of Free Movement (what is available in the learning environment) and Zone of Promoted Action (what attempts to draw learners' attention in the learning environment) during interactive, multimodal buddy reading to support development from their Zone of Proximal Development (what they can do only with support) to their new Zone of Actual Development (what they can do independently) for activating digital features in the book?

2. Literature Review

Buddy reading offers a social atmosphere in which emerging and beginning readers may collaborate to engage with text (Christ et al., 2014; Flint, 2010). Broadly, buddies' patterns of interactions during app book reading impact to what extent the buddies support one another's engagement with the text (Christ et al., 2015). Young children have been observed engaging in the following patterns during buddy reading: (a) parallel functioning where each buddy works on

their own without interacting with the other buddy; (b) collaborative interactions through which buddies interactively engage with the text; and (c) tutor-tutee interactions where one buddy instructs the other buddy about how to engage with the text.

More specifically, studies have shown specific impacts of children's interactions during buddy reading with digital books. For example, a case study by Erdemir and Brutt-Griffler (2020) underscored the importance of social interactions that provide language feedback for English Language Learners' vocabulary learning during app book buddy reading. Likewise, a series of studies by Shamir and colleagues showed that interaction between buddies during CD-ROM book reading supported their book comprehension (Shamir, 2009; Shamir & Korat, 2007; Shamir, Korat, & Barbi, 2008).

Further, studies of buddy reading with digital books have demonstrated that specific interactions support children's learning outcomes. For example, the social interactions between buddies engaged with e-readers or app books abound with monitoring behaviors, such as asking questions, drawing attention, and meaning negotiation that support deeper comprehension (Christ et al., 2018; Brown, 2016). Likewise, Christ et al., (2019) studied 53 kindergarteners' app book buddy reading interactions and observed that buddies supported one another's better inference, critical thinking, and vocabulary meaning generation by asking questions, drawing attention to book content, debating, or negotiating. Additionally, Brown (2016) qualitatively explored second graders' interactive e-book reading and found that buddies provided verbal support to help one another navigate the e-book.

Across previous app book buddy reading studies, the focus has been predominantly on buddies' meaning-making processes to improve their comprehension (Christ et al., 2018; Brown, 2016; Simpson et al., 2013; Wang et al., 2019). However, since using digital features can support

their comprehension process, it seems warranted to also explore how children learn to use digital features through app book buddy reading as well. Exploring this is the focus of the present article.

3. Methods

We employed a case study approach (Yin, 1984, p. 23) which provided an in-depth exploration of how buddies and digital features mediated both the Zone of Free Movement (ZFM) and the Zone of Promoted Action (ZPA) in ways that canalized buddies' movement from their Zone of Proximal Development (ZPD; i.e., when they need support to use a digital feature effectively) to their new Zone of Actual Development (ZAD; i.e., when they can newly use the digital feature effectively independently).

The data used in this paper were collected as part of a broader study (Christ et al., 2018, Christ et al., 2019) in which children across four classrooms engaged with 12 app books. For each book, the teacher first read it aloud and modeled activating the digital features while projecting it on a screen using a document camera (so children could see finger touch and swipe movements). Then, afterward, children were given two opportunities in the same week to read the modeled book with a same-aged buddy. This paper focuses on a subset of the buddy reading data to explore how children successfully supported one another to learn to use the digital features.

3.1. Setting

This paper focuses on data from two classrooms in a Midwest suburban school. These two classrooms' data were chosen because the video-recordings best showed children's finger movements while interacting with the app books (videos for the other two classrooms were more difficult to see and interpret). The school was chosen for the broader study because its students

were diverse ethnically, linguistically, and socio-economically. The kindergarten classrooms were chosen based on teachers in the school who allowed their students to participate in the study.

3.2 Selection of Focal Data from the Prior Study

The first author viewed all 253 buddy reading videos from the two focal classrooms that were part of the larger dataset. Videos to be included in this study were chosen if they had an example of (a) one child initially unable to use a digital feature, and (b) the second child somehow mediating that first child's activation of the digital feature, which resulted in (c) the first child successfully using the digital feature. All videos that did not meet these criteria were excluded from the study. Selecting this subset of data allowed us to focus on how buddies successfully mediated one another's learning to use digital features while reading the app book together. In all, 15 focal videos were identified for analysis.

3.3 Participants

The 19 children who appeared in the selected focal videos were included as participants in this study. Of these, 10 were female and nine were male. Five children were Black, three were Asian, and 11 were White. All children were between 5 and 6 years old. All names used in this study are pseudonyms to maintain the confidentiality and privacy of the participants.

3.4 App Books

Across the 15 selected focal videos, eight app books out of the 12 from the broader study were represented. Table 1 presents the names of the app books that were included in the analysis and their interactive features.

3.5 Data Collection Procedures

The 15 selected focal videos were part of the broader study's 253 buddy reading videos. In the broader study, before buddy reading, children were told to "read with your buddy" and "help your buddy read the book." The sessions were video-recorded to capture the details of buddies' interactions with one another and the app book. Across the 15 videos, 225 minutes of buddy reading interactions were analyzed.

3.6 Data Coding and Analysis

The unit of analysis was the interactive turn each buddy took during collaborative reading. A "turn" started when one child spoke or touched and ended when the other child began talking or touching. Sometimes turns overlapped somewhat as both children talked/touched simultaneously.

We began coding with a sample of three of the focal videos, across which children showed different kinds of interactions related to using the digital features. Initially, the first author determined which Valsiner's Zone Theory construct (ZFM, ZPA, ZPD, or ZAD; Valsiner, 1998) seemed to correspond with each turn from the video data. Next, the first and second authors used emergent coding and constant comparative analysis (Corbin & Strauss, 2014) to generate codes that described how the turn was addressing that theoretical construct (e.g., a child addressed the ZPA by modeling how to touch and use a hotspot in the book). We discussed and honed the codes over time and across the three sample focal videos through a process of separately applying the codes, meeting to discuss coding discrepancies, and then developing consensus and refining the codes or their definitions to align with our developed understandings. This process yielded clearer definitions for each code. Through this process, the codes related to ZFM, ZPA, ZPD, and ZAD emerged (see Table 2) and were used for coding. After the final codes were developed, a sample of five additional sessions from the data pool were coded by two

coders. Inter-coder agreement was 93.1%. Once we had established the reliability of the codes, the remaining seven sessions were coded by just one coder.

Table 2

Zones, constructs, definitions, and codes

Finally, to identify patterns that depicted how the ZFM and ZPA turns were related to the canalization of a child's movement from their ZPD to ZAD regarding the use of a digital feature, we used constant comparative methods (Corbin & Strauss, 2014). Four patterns were found and are presented in the findings section.

4. Results

We found four patterns that described ways buddies mediated each other's shifts toward effective use of electronic features: (1) Children verbally mediated their buddy's digital feature use (i.e., telling them how to engage with the feature) and also pointed out the digital feature (without activating it); (2) Children mediated their buddy's digital feature use by modeling digital feature use; (3) Children mediated their buddy's digital feature use by integrating verbal mediation, pointing out the digital feature, and modeling digital feature use; and (4) Children mediated their buddy's digital feature use by physically supporting them to use a digital feature.

4.1. Verbal Mediation and Pointing Out Digital Features

Buddies used verbal mediation and pointing out digital features to guide their partner's feature use after they were initially unable to use the digital feature independently. Verbal mediation provided oral instructions about how to use a digital feature and pointing showed where the digital feature was located on the page (without activating it). The following excerpt was from a video of Thiago and Sarah (pseudonyms) engaging with the app book, *The Artist*

Mortimer. The page that they discussed in this excerpt had navigation features, such as turning the pages backward or forward, which was activated by touching the upper left or right part of the page.

Line	Student	Transcript	Code	Theoretical construct
A1	Thiago	[the iPad is between the children so that both buddies have easy access]	Share the device	ZFM-Buddy
A2	Thiago	Do you want to turn the page?	Buddy asks question	ZPA-Buddy
A3	Sarah	OK [trying to turn the page, but not finding the right spot to activate the page turn]	Developing ability to use the digital navigation feature (but not yet successful)	ZPD
A4	Thiago	No, come up here [showing the right corner of the screen] or up here [showing the left corner of the screen]	Buddy provides verbal mediation and points to show where the digital feature is located on the page (without activating it)	ZPA-Buddy
A5	Sarah	[Sara followed the successfully turns the page forward by touching the right corner of the iPad]	Developed ability to use the digital navigation feature (activated it)	ZAD

In this example, Thiago framed the Zone of Free Movement by sharing the device (line A1) and Zone of Promoted Action by suggesting his buddy turn the page (line A2). Sarah was unable to turn the page, showing that her ability to effectively use the digital navigation feature was still developing (Zone of Proximal Development, line A3). Thiago mediated Sarah's developing ability by providing a verbal mediation and pointing to show where the digital feature was located on the page (line, A4). This mediation provided enough support to canalize Sarah's developing ability into a developed ability to use the digital navigation feature (line A5). Figure 3 visually presents how movement in the zones interact to canalize learning in this example. The items in the figure numbered A1-A5 correspond with the transcript lines A1-A5.

In another video-recorded buddy reading session, Abby and Kate read the last page of the app book *Pat the Cat*. On this page, buddies could select a menu to start the app book. The following interactions occurred between the buddies while they were preparing to read the book together.

Line	Student	Transcript	Code	Theoretical construct
B1	Abby	[Takes control of the iPad]	Turn taking/controlling device	ZFM-Buddy
B2	Abby	[Tries to go to the menu page, but unsuccessfully]	Developing ability to use the digital navigation feature (but not yet successful)	ZPD
B3	Abby	How can I find menu?	Request information	ZPA-Buddy
B4	Kate	[Takes control of the iPad]	Turn taking/controlling device	ZFM-Buddy

B5	Kate	[Finds the icon that goes to menu] You press this [showing the icon]	Buddy provides verbal mediation and points to show where the digital feature is located on the page (without activating it)	ZPA-Buddy
B6	Abby	[Takes control of the iPad]	Turn taking/controlling device	ZFM-Buddy
B7	Abby	[Presses the menu icon and successfully use the digital menu feature]	Developed ability to use the digital navigation feature (activated it)	ZAD

In the above example, the Zone of Free Movement-Buddy was framed by Abby taking control of the iPad (line B1). She demonstrated developing ability (ZPD) to use the digital menu feature when she tried unsuccessfully to activate it (line B2). Then, she requested help from her buddy (line B3), which shaped the Zone of Promoted Action-Buddy. Kate provided verbal mediation for Abby (“you press this”) and also pointed to show her where to activate the menu on the page (line B5). This mediation helped to turn Abby’s developing ability to developed ability in using the digital menu feature (ZAD). Figure 4 visually presents how movement in the zones interact to canalize learning in this example.

4.2. Modeling Digital Feature Use

In another form of mediation, buddies physically modeled how to use the digital feature after their buddy tried unsuccessfully to use it. This mediation physically showed the buddies how to use the app book’s features without articulating any verbal hints. The following excerpt is from an interaction between Ann and Tanner as they read the app book, *A Shiver of Sharks*. The

app book read the words aloud, highlighted words as it read them, and had hotspots. The hotspot on the page they were reading was a shark that moved and showed its teeth when activated.

Line	Student	Transcript	Code	Theoretical construct
C1	Ann	[Shares the iPad]	Share the device	ZFM-Buddy
C2	Ann	[Tries to activate the shark hotspot] How its [shark's] teeth come out?	Developing ability to move the hotspot (but not yet successful)	ZPD
C3	Tanner	[Touches the shark's head to activate the hotspot. The shark's moves and shows its teeth.]	Buddy models digital feature use to activate the hotspot Developed ability to move the hotspot	ZPA-Buddy ZAD
C4	Ann	Watch its teeth [successfully touches the shark's head to activate the hotspot]	Developed ability to move the hotspot	ZAD

The interaction started with Ann shaping the Zone of Free Movement (ZFM-Buddy) by sharing the device with her buddy (line C1). Immediately, Ann wanted to activate the shark hotspot; however, she was unsuccessful, showing that her ability to activate the hotspot was still developing (line C2, Zone of Proximal Development). To mediate her developing ability to use the hotspot, Tanner created the Zone of Promoted Action by modeling how to activate the hotspot (line, C3). This mediation helped to bridge Ann's developing ability to developed ability to use the hotspot independently (ZAD; C4). Figure 5 visually presents how movement in the zones interact to canalize learning in this example.

Likewise, in another buddy reading session, Vivian and Kyla read the app book, *Being Global*. On the page they were reading, there were two automatically animated color circles that could also be reactivated as a hotspot. The content along with the color circles explained the concept of *Globe* to the children.

Line	Student	Transcript	Code	Theoretical Construct
D1	Kyla	[Kyla holds the iPad closer to herself, but so that the buddy can still reach it, while the book reads aloud.]	Turn taking/controlling device	ZFM-Buddy
D2	Vivian	[Two automatically animated color circles catch Vivian's eye while the text is reading aloud.]	Automatic animations	ZPA-Feature
D3	Vivian	[Vivian touches the color circles, which re-activates them]	Developed ability to move the hotspots	ZAD
D4	Kyla	[Kyla is tapping outside the circle on the screen to try to change the circle's color, but she is unsuccessful because she is not tapping directly <i>on</i> the spot to change the color of the circles.]	Developing ability to move the hotspots (but not yet successful)	ZPD
D5	Vivian	I hit it [the color circles] they both blue. [Shows Kyla how to re-activate the color circle hotspot by tapping <i>on</i> the color circle.]	Buddy models digital feature use to activate the hotspot Developed ability to move the hotspot	ZPA-Buddy ZAD

D6	Kyla	No, they are not [activated because of you. Kyla thinks she is re-activating the color circle, but she is still not activating them.]	Developing ability to move the hotspots (but not yet successful)	ZPD
D7	Vivian	Now, they both blue [tapping on the color circles several times to re-activate them and make them both blue again.]	Buddy models digital feature use to activate the hotspot	ZPA-Buddy
D8	Kyla	[Kyla figures out that she has to tap <i>on</i> the color circle to change the color, and does so successfully.]	Developed ability to move the hotspots	ZAD

Vivian framed the Zone of Free Movement-Buddy by taking control of the iPad and moving it closer to herself, but still allowed her buddy access (ZFM-B; line D1). Then, the color wheel automatic animation focused the Zone of Promoted Action by catching Vivian’s attention (ZPA-feature; line D2). Kyla unsuccessfully attempted to re-activate the color wheels, demonstrating her ZPD (line D4, D6). Then, Vivian further focused the ZPA by modeling the digital feature use by re-activating the color wheel hotspot by tapping on them (ZPA-buddy; lines D5, D7). This mediation helped to bridge Kyla’s developing ability to a developed ability to use the hotspot independently (ZAD; line D8). Figure 6 visually presents how movement in the zones interact to canalize learning in this example.

4.3 Integrated Verbal Mediation, Pointing, and Modeling Digital Feature Use

Buddies also integrated the use of verbal mediation, pointing, and modeling digital feature use to assist their buddies in effective use of the app book features. The following excerpt

is from a video of Nina and Quinlan engaging with the app book, *The Artist Mortimer*. The book had hotspots and read aloud to the children as each page was turned.

Line	Student	Transcript	Code	Theoretical Construct
E1	Nina	[Places the iPad in the middle where both buddies have close access]	Share the device	ZFM-Buddy
E2	Quinlan	Where do you press to turn the page?	Request information	ZPA-Buddy
E3	Nina	I don't know [begins pressing different spots on the screen, trying to figure this out]	Developing ability to use the digital navigation feature (but not yet successful)	ZPD
E4	Quinlan	[Simultaneously pressing different spots on the screen, also trying to figure this out]	Developing ability to use the digital navigation feature (but not yet successful)	ZPD
E5	Nina	[Finds the spot to turn the page, and turns the page]	Developed ability to use the digital navigation feature (activated it)	ZAD
E6	Quinlan	[Asks again] Where do you press to turn the page?	Request information	ZPA-Buddy
E7	Nina	Here [Points to the spot to activate the digital navigation feature]	Buddy provides verbal mediation and points to show where the digital feature is located on the page (without activating it)	ZPA-Buddy

E8	Quinlan	Oh [Presses the digital navigation feature, and the page turns backward]	Developed ability to use the digital navigation feature (activated it)	ZAD
E9	Nina	[Turns the page forward and backward to show Quinlan]	Buddy models digital feature use (particularly how you can turn the page both forward and backward)	ZPA-Buddy
E10	Quinlan	[Activates the digital navigation feature to turn the page forward]	Developed ability to use the digital navigation feature (activated it)	ZAD

By sharing the device, Nina created the Zone of Free Movement-Buddy where both buddies had access to the device (line E1). When Quinlan asked about how to turn the page, he focused on the Zone of Promoted Action-Buddy (line E2). Then, both buddies demonstrated actions in their Zones of Proximal Development, as they investigated (unsuccessfully) how to use the digital page-turn feature (lines E3-E4). When Nina figured out how to press the correct spot to use the page-turn feature, this represented her transition from a developing (ZPD) to developed ability to use this feature (ZAD; line E5). After this, Quinlan asked again for help activating the page-turn feature, further focusing the Zone of Promoted Action-Buddy (line E6). Therefore, Nina mediated Quinlan’s developing use of the page-turn feature both verbally (“here”), by pointing to the place to activate the page turn (line E7), and by modeling the digital navigation feature uses (line E9). This mediation supported Quinlan’s transition from developing (ZPD) to developed use of this digital navigation feature (ZAD) (lines E8 and E10). Figure 7 visually presents how the context was microgenetically framed to effectively canalize the buddies’ developmental process in acquiring app book page turn skills.

Likewise, the same pattern is illustrated in the following excerpt of Stella and Jayden reading the app book, *The Going to Bed Book*. The page they read had star hotspots that twinkled when activated.

Line	Student	Transcript	Code	Theoretical Construct
F1	Jayden	[Places the iPad in the middle where both buddies can access it]	Share the device	ZFM-Buddy
F2	Stella	I am popping [activates the star hotspots by tapping them]	Buddy provides verbal mediation (“I am popping”) Buddy models digital feature use (activating stars hotspot) Developed ability to move the hotspots	ZPA- Buddy ZPA-Buddy ZAD
F3	Jayden	[Jayden is rubbing his finger on the screen, trying to activate the stars to make them twinkle, but this is the wrong action and does not activate them.]	Developing ability to move the hotspots (but not successful yet)	ZPD
F4	Stella	[Stella shows Jayden how to <i>tap</i> the stars to activate them.]	Buddy models digital feature use	ZPA-Buddy
F5	Jayden	[Taps finger on the screen and successfully activates the stars.]	Developed ability to move the hotspot	ZAD

In this example, the availability of the device for both buddies framed the Zone of Free Movement (line F1; ZFM-Buddy). Initially, Stella demonstrated a developed ability to activate the star hotspots (line F2; ZAD). She verbally explained what she was doing to Jayden and

pointed to the place on the screen to activate the hotspot (line F2), which framed the Zone of Promoted Action (ZPA-Buddy). However, this mediation did not result in Jayden being able to use the hotspot (line F3; ZPD). Thus, Stella modeled how to activate the hotspot for him (line F4). This modeling helped to shift Jayden’s ability to activate the hotspot from his ZPD (line F3) to his ZAD (line F5). Figure 8 visually presents how movement in the zones interact to canalize learning in this example.

4.4. Physical Support for Activating a Digital Feature

One kind of physical support for helping a buddy enact digital feature use occurred when a student took their buddy's finger and moved it on the screen to show them how to effectively use the electronic feature. The following excerpt occurred between Adena and Jasper while they were reading the app book, *Barnyard Dance*. The app book read the text aloud, highlighting the text as it read it, and had hotspots. One hotspot made a cow play a violin when activated.

Line	Student	Transcript	Code	Theoretical Construct
G1	Adena	[Turns the page]	Navigating throughout the app	ZFM-Buddy
G2	Adena	[Tries to activate the feature to make the violin play, but was unsuccessful.]	Developing ability to move the hotspots (but not successful yet)	ZPD
G3	Jasper	[Tries to activate the feature to make the violin play, but was also unsuccessful.] We	Developing ability to move the hotspots (but not successful yet)	ZPD

		are doing it together [i.e., trying to activate the hotspot].		
G4	Adena	[Tries multiple ways to activate the hotspot--taps, touches, then runs finger back and forth on screen. When she runs her finger back and forth on screen, this activates the hotspot.]	Developed ability to move the hotspots	ZAD
G5	Adena	Now you try. [Takes Jasper's finger moves it back and forth on the screen to activate the violin hotspot.]	Buddy enacts the motion for their partner	ZFM/ZPA-Buddy
G6	Jasper	[Independently moves his finger back and forth to activate the violin hotspot.]	Developed ability to move the hotspots	ZAD

The interaction was initiated with Adena framing the Zone of Free Movement for her buddy (ZFM-Buddy) by navigating to the page with the cow playing the violin hotspot (line G1). At first, both buddies explored how to use the hotspot, which showed developing knowledge (ZPD; lines G2-G3). Adena figured out how to use the hotspot first (ZAD; line G4), and then tried to support her buddy, Jasper, by moving his finger over the screen in a back-and-forth motion to activate the hotspot (line G5). Her focus on the violin hotspot reflected the Zone of Promoted Action (ZPA-Buddy). Her control of Jasper's finger, by restricting his movements to activate the hotspot, reflected the Zone of Free Movement (ZFM-Buddy). Mediating both zones

bridged Jasper's developing ability to use the hotspot (ZPD) to a developed ability (ZAD, line E7). Figure 9 visually presents how movement in the zones interact to canalize learning in this example.

Another kind of physical support for helping a buddy enact digital feature use occurred when a child prevented their buddy from doing a certain action. The following interaction between Kevin and Mia occurred while they were trying to record their voice by touching a recording icon programmed in the *Pat the Cat* app book. The color of the voice recording icon changed from green (when it was ready to be pressed and start recording) to red (when it was already recording and should not be pressed until the recording is complete). That is, tapping on the green or red icon turned it on and off, respectively.

Line	Student	Transcript	Code	Theoretical Construct
H1	Kevin	[Takes control of the iPad while the text reads aloud]	Turn taking/controlling device	ZFM-Buddy
H2	Kevin	[The green recoding icon is flashing, and catches his eye.]	Voice recording feature	ZPA-F
H3	Kevin	[Taps on the green icon, then the red icon, then the green icon, etc. several times.]	Developing ability to activate the recording feature	ZPD

H4	Mia	You have to wait [after you press the green icon.] [Holds his hand to keep him from touching the red icon]	Buddy restricts their partner to provide prompt	ZFM/ZPA-Buddy
H5	Kevin	[Stops to see what happens.]	Developing ability to activate the recording feature	ZPD
H6	Mia	[Reads the text in order to be recorded] CAT...	Developed ability to activate the recording feature	ZAD
H7	Kevin	[Listens to Mia's recording. Then presses the green icon and begins to read to begin his own recording.] CAT...	Developed ability to activate the recording feature	ZAD

The interaction started when Kevin took control of the iPad and placed it in front of himself, which created the Zone of Free Movement- Buddy (ZFM-Buddy; line H1). The recording voice feature itself created the Zone of Promoted Action (ZPA-Feature) by flashing to grab Kevin's attention (line H2). Kevin showed that his ability to use the recording feature was at the developing state when he pressed the feature several times in succession without recording, which is not how the feature was intended to be used (ZPD- line H3). Mia mediated Kevin's use of the recording feature in two ways (lines H4 and H6). First, Mia's focus on the recording feature reflected the Zone of Promoted Action (ZPA-Buddy). Second, her restriction of his finger movements (so he would not stop the recording feature prematurely), reflected the Zone of Free Movement (ZFM-Buddy). Mediating both zones canalized Kevin's learning from

developing the ability to use the recording hotspot correctly to a newly developed ability to do so (line H7). Figure 10 visually presents how movement in the zones interact to canalize learning in this example.

5. Discussion

5.1 What We Can Learn from Our Application of Zone Theory

Using Zone Theory allowed us to trace the buddies' development using a microgenetic process, which revealed that verbal mediations, modeling, and physical mediations were employed to improve effective activation of app features. However, for this development to occur, the digital features needed to be within the Zone of Free Movement (i.e., the buddy was physically able to interact with the book, and digital features were available in the book), and buddies needed to share a focus in the Zone of Promoted Action (e.g., working on activating a specific hotspot together). Using Zone Theory showed not only the mediations that were necessary to canalize learning, but also the context in which this learning could occur (i.e., Zone of Free Movement) and the canalization process (i.e., moving from not being able to activate the digital feature independently [ZPD] to being able to effectively activate it independently [ZAD]).

Further, our findings expanded how Zone Theory has been applied to data analysis. For example, while previous research focused on how another person expanded or constricted the Zone of Free Movement (Blanton et al., 2005; Hussain et al 2012), our study also considered how technology itself sometimes plays this role (e.g., buddies were restricted based on the digital features that were available on each page of the app book). Particularly in this digital age, exploring how digital features expanded or constricted the possibilities for children's engagement seemed important. Moreover, while previous research focused on how another person shifted the Zone of Promoted Action (Blanton et al., 2005; Hussain et al 2012), our

findings demonstrated that digital features did this as well (e.g., automatic animations that attracted their attention to a hotspot). Therefore, we were able to explore two ways that the Zone of Free Movement and Zone of Promoted Action were shifted to support canalizing a child's learning to effectively activate a digital feature.

5.2 Extensions and Insights about the Mediation of Buddies' Digital Feature Use

Our findings underscore the importance of the social and interactional context of buddy reading for supporting learning on how to effectively use digital features, and that there are multiple ways to mediate this learning (i.e., verbal mediation and pointing out digital features, modeling digital feature use, integrated verbal mediation, pointing, modeling digital feature use, and physical support for enacting digital feature use). While previous research explored buddies' use of digital features as part of the meaning-making process (Christ et al., 2019; Korat & Falk, 2017; Xu et al., 2020), their focus was not on how children learned to effectively use the features themselves. Our research extended these studies by exploring this aspect. For example, while prior studies showed that automatic animations garnered children's attention (Christ et al., 2018; Smeets & Bus 2014; Verhallen & Bus, 2010), our study showed how this attention was used to canalize children's learning to use these hotspot features. Likewise, previous studies demonstrated that children struggled to navigate app books effectively when reading individually (Plowman & McPake, 2013; Kelley & Warburton, 2011; Sung et al., 2019a); however, our research extended this by showing how buddies' mediations supported learning how to use the navigational features—e.g., Buddy provides verbal mediation and points to show where the digital feature is located on the page (without activating it) (E7). Finally, while previous research identified the use of verbal mediations and modeling to support app book meaning-making (Javorsky & Trainin, 2014; Wang et al., 2014), our findings also showed that buddies use

physical mediations (e.g., moving their buddy's finger to swipe) to mediate one another's use of digital features. Buddies used these physical mediations to both create a narrower Zone of Promoted Action (e.g., Transcript G) and Zone of Free Movement (e.g., Transcript H).

5.3 Implications for Practice

Our results suggest important implications for early childhood classroom practices. First, it is clear children need to share access to the iPad (i.e., the Zone of Free Movement needs to include both buddies having access to the book). Without sharing, they cannot engage in any shared focus (i.e., the Zone of Promoted Action), which is needed to canalize learning.

Second, our findings showed a shared focus can be accomplished two ways—via programmed digital features that jointly draw buddies' attention to a feature, or one buddy drawing the other buddy's attention to said feature. Therefore, choosing app books with digital features that draw children's attention, and encouraging children to help their buddy use the features while reading, are two ways to support a shared focus. Further, app book programmers should consider the design of app features in terms of drawing children's attention to them.

Third, our findings suggest that teachers should encourage children to engage in the following effective mediation behaviors to support their buddy's learning of how to effectively activate a digital feature: (1) verbal mediation and pointing out digital features; (2) modeling digital feature use; (3) integrated verbal mediation, pointing, and modeling digital feature use; and (4) physical support for enacting digital feature use.

5.4 Limitations and Suggestions for Future Research

There were three important limitations of our study, and each suggested a direction for future research. First, the findings in this research were limited to an exploration of kindergarteners who were mostly in the emergent stage of reading. Future research might explore

app book buddy reading with children at other ages and stages of development. Second, our study focused on buddies' interactions with one another and the app book. Future research might compare these findings with the kinds of mediations provided by a teacher or parent who is supporting children's learning to use digital features. Third, we took a microgenetic look at the canalization process within short episodes of buddy reading interactions. Future research might trace these processes for children across time.

6. Conclusion

This study microgenetically traced the learners' development of their ability to use digital features in the context of collaborative app book buddy reading. Findings showed that learners provided (1) verbal mediation and pointing out digital features; (2) modeling digital feature use; (3) integrated verbal mediation, pointing, and modeling digital feature use; and (4) physical support for activating a digital feature to support their buddy's digital feature use. These mediational moves canalized buddies' learning process, shifting from their developing ability to use a digital feature into a developed ability. Teachers should promote buddies' use of these mediational moves during app book buddy reading.

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Table 1
App Book Features

App book	Automatic animation	Navigation features	Hotspots	Other
Barnyard Dance	Images in illustrations move (e.g., rocking boat)	Page turn	When hotspots in illustration are pressed, animations are activated	None
Going to Bed Book				
Artist Mortimer			• 60% to 80% congruent	
X is for X-Ray	Images in illustrations move (e.g., monkey swinging on a vine)	Page turn and menu	When hotspots in illustration are pressed, animations are activated	None
Being Global				
Shiver of Sharks			• 100% congruent	
Hop on Pop	Panning is used to focus the readers' attention to the pages	Page turn and menu	When hotspots in illustration are pressed, the word appears and is read aloud	None
	Images in illustrations move		• 100% congruent	
Pat the Cat	Images in illustrations move	Page turn	None	Users can record their reading and play it back

Table 2*Zones, constructs, definitions, and codes*

Zones	Constructs	Definition	Codes
Zone of Free Movement (ZFM)	ZFM-Buddy	The availability and accessibility of the device	<ol style="list-style-type: none"> 1. Turn taking/controlling device 2. Share the device 3. Request to share the device 4. Turning the page 5. Navigating throughout the app 6. Buddy enacts the motion for their Partner 7. Buddy restricts their partner to provide prompt
	ZFM-Feature	The availability and accessibility of features in each page	<ol style="list-style-type: none"> 1. Navigation 2. Highlight text 3. Read aloud text 4. Congruent hotspots 5. Incongruent hotspots 6. Automatic animations 7. Voice recording feature
Zone of Promoted Action (ZPA)	ZPA-Buddy	The actions and behavior that support the other buddy's development	<ol style="list-style-type: none"> 1. Request information 2. Buddy asks question 3. Buddy provides verbal mediation and points to show where the digital feature is located on the page (without activating it) 4. Buddy models digital feature use to activate the hotspot

			<p>5. Buddy provides verbal mediation</p> <p>6. Playing the recorded voices</p> <p>7. Buddy enacts the motion for their Partner</p> <p>8. Buddy restricts their partner to provide prompt</p>
	ZPA-Feature	The electronic features that attract the buddy's attention	<p>1. Navigation</p> <p>2. Highlight text</p> <p>3. Read aloud text</p> <p>4. Congruent hotspots</p> <p>5. Incongruent hotspots</p> <p>6. Automatic animations</p> <p>7. Voice recording feature</p>
Zone of Proximal Development (ZPD)	ZPD	The buddy shows their developing ability regarding the use of the digital features	<p>1. Developing ability to use the digital navigation feature (but not yet successful)</p> <p>2. Developing ability to move the hotspot (but not yet successful)</p> <p>3. Developing ability to activate the recording feature</p>
Zone of Actual Development (ZAD)	ZAD	The buddy shows their developed ability to use the digital features	<p>1. Developed ability to use the digital navigation feature (activated it)</p> <p>2. Developed ability to move the hotspots</p> <p>3. Developed ability to activate the</p>

recording feature

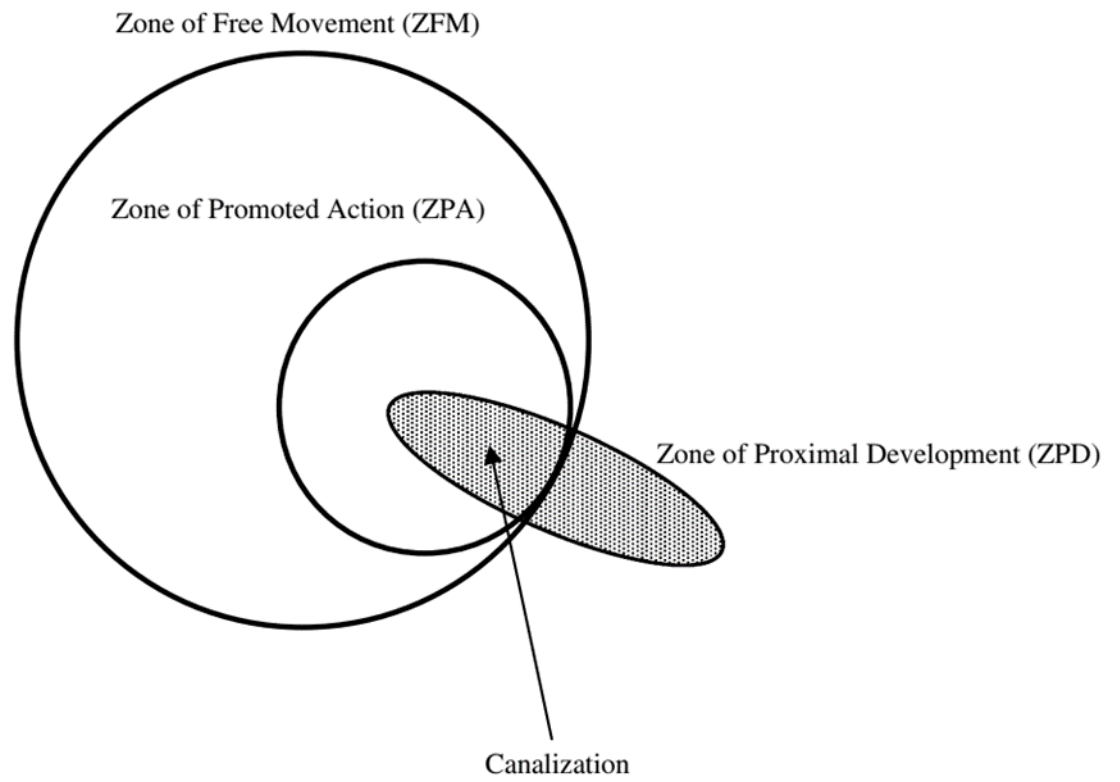


Figure 1.

The Interconnection between Zones (Blanton et al., 2005)

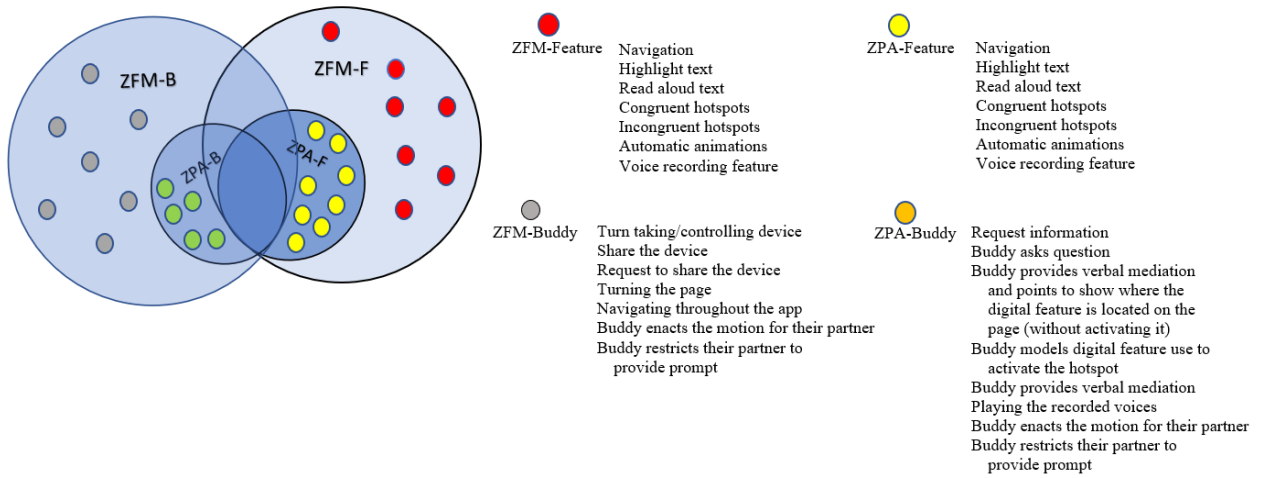


Figure 2.

The Adapted Version of Valsiner's Zone Theory

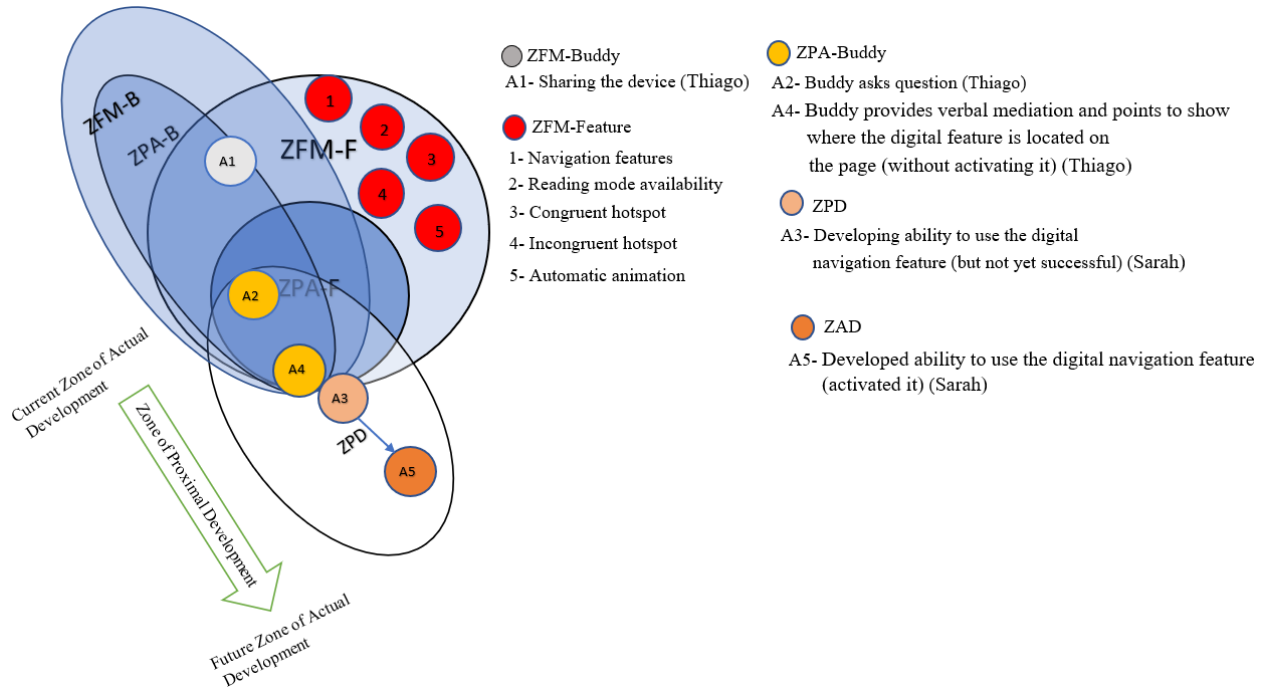


Figure 3

Visualization of Zones for Verbal Modeling in Transcript A

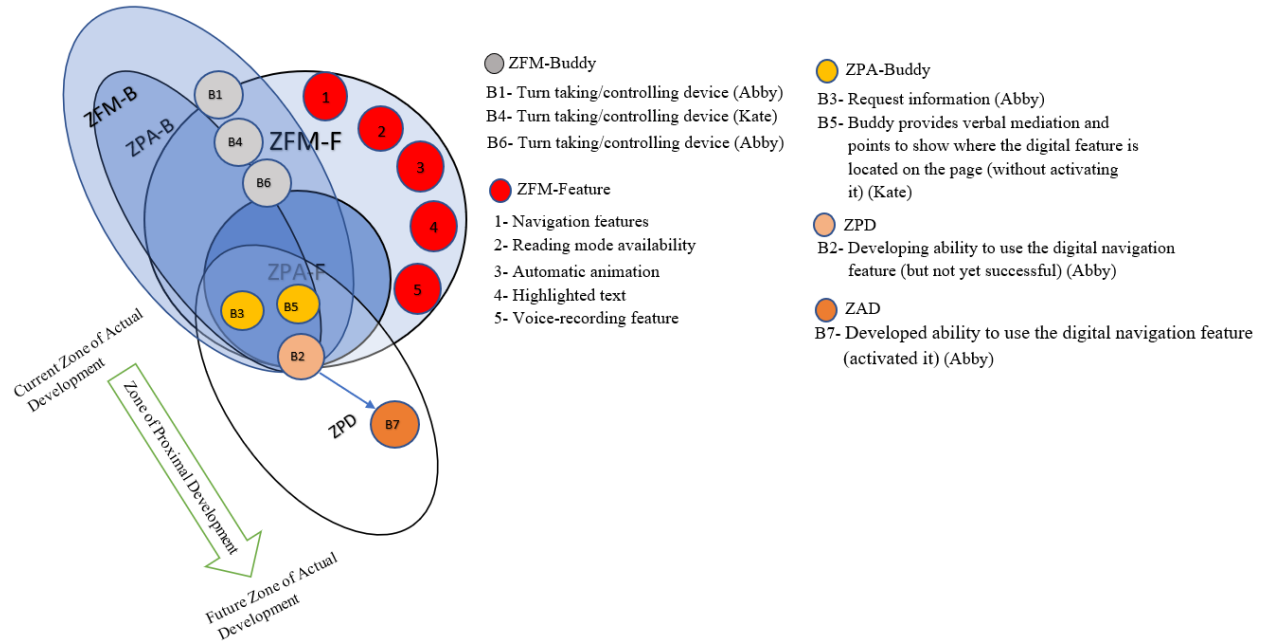


Figure 4

Visualization of Zones for Verbal Modeling in Transcript B

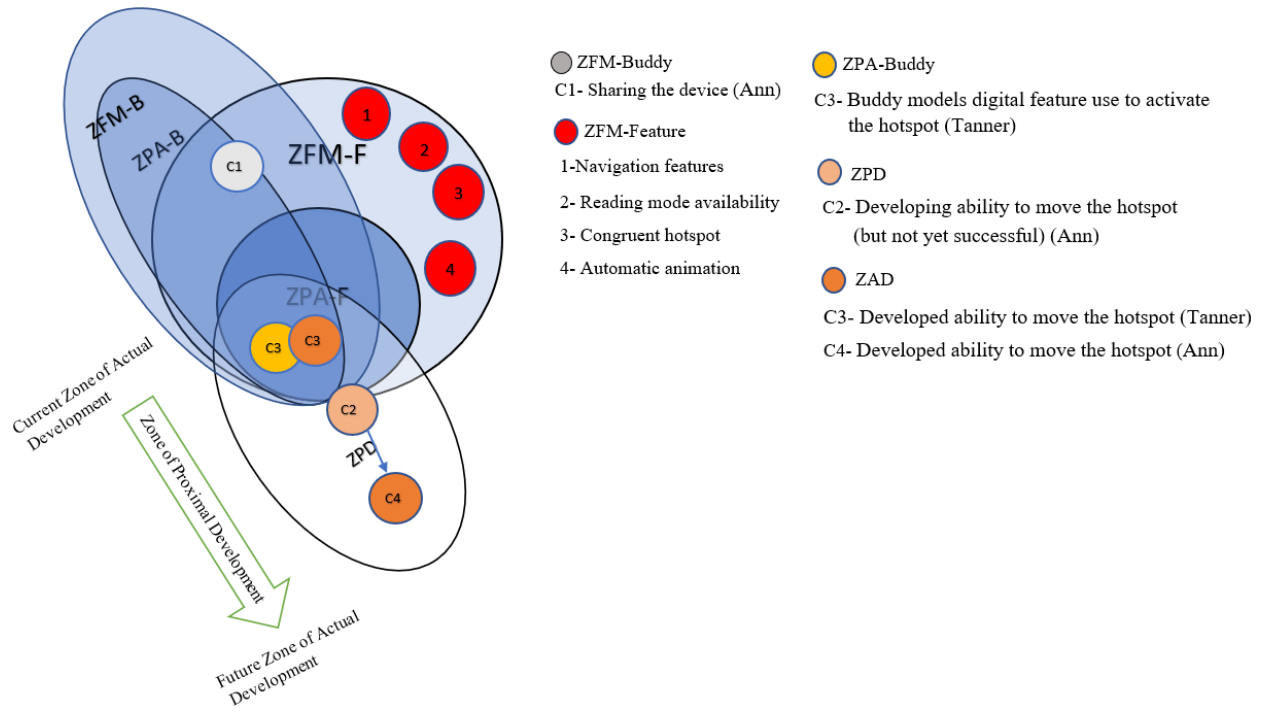


Figure 5
Visualization of Zones for Physical Modeling in Transcript C

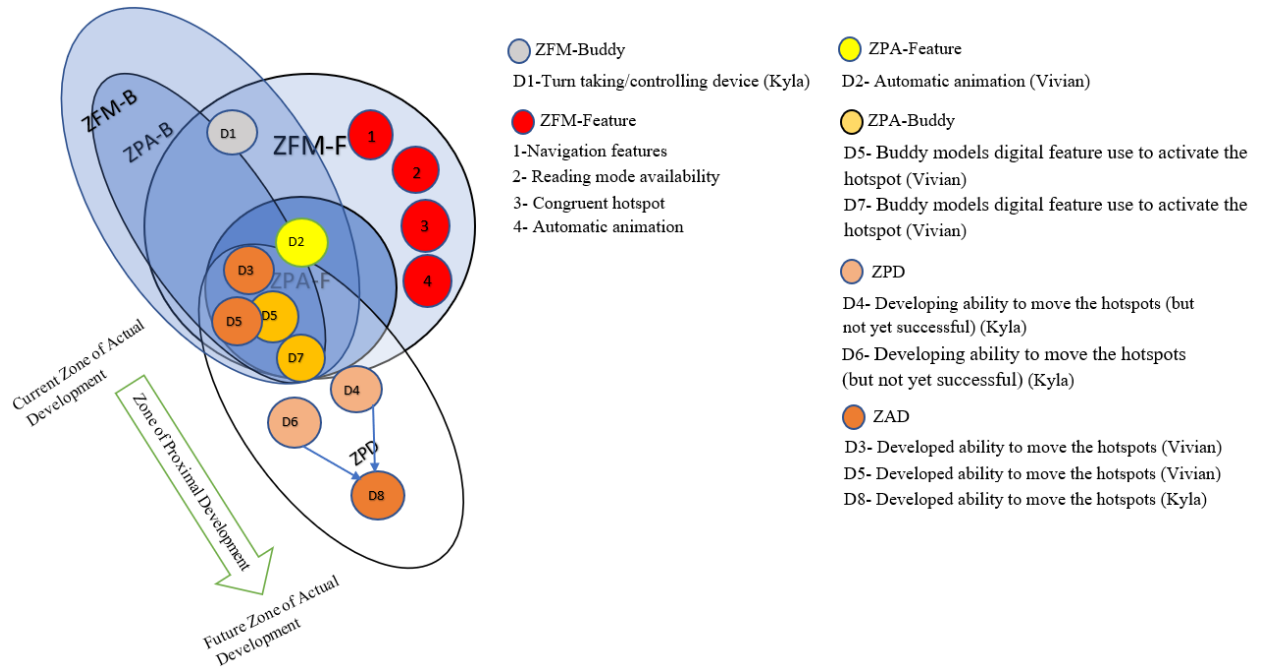


Figure 6

Visualization of Zones for Physical Modeling in Transcript D

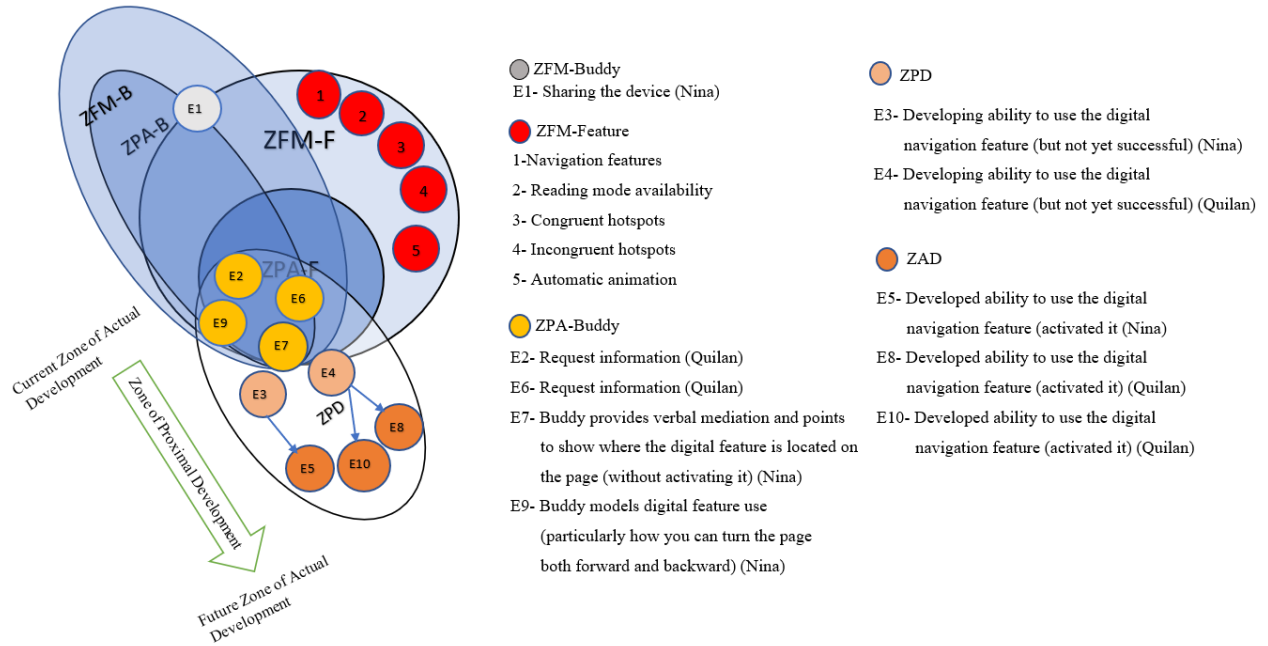


Figure 7

Visualization of Zones for Integrated Verbal-physical Mediation in Transcript E

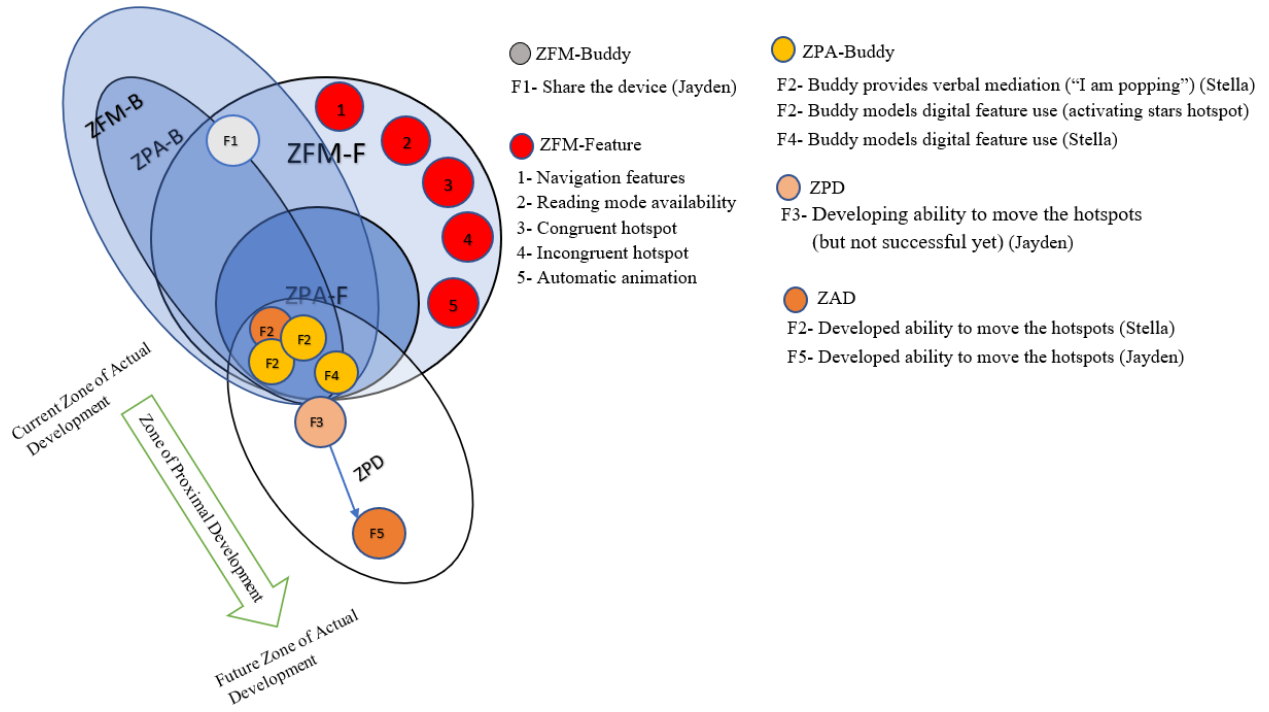


Figure 8

Visualization of Zones for Integrated Verbal-physical Mediation in Transcript F

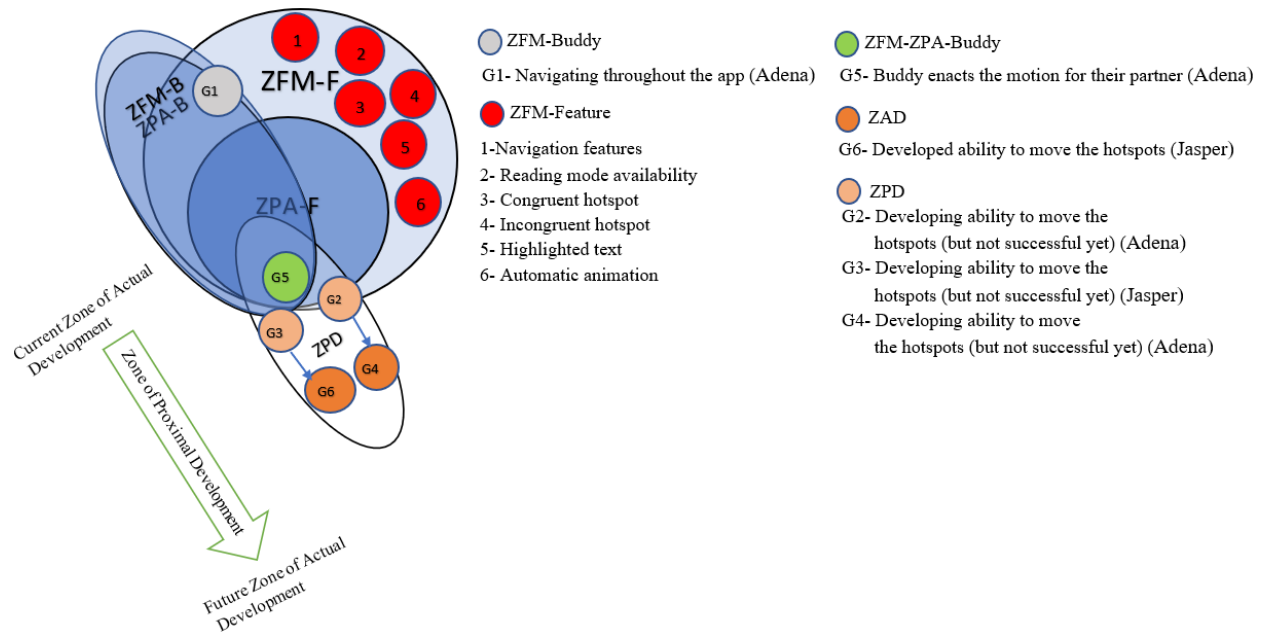


Figure 9

Visualization of Zones for Physical Enacting Mediation in Transcript G

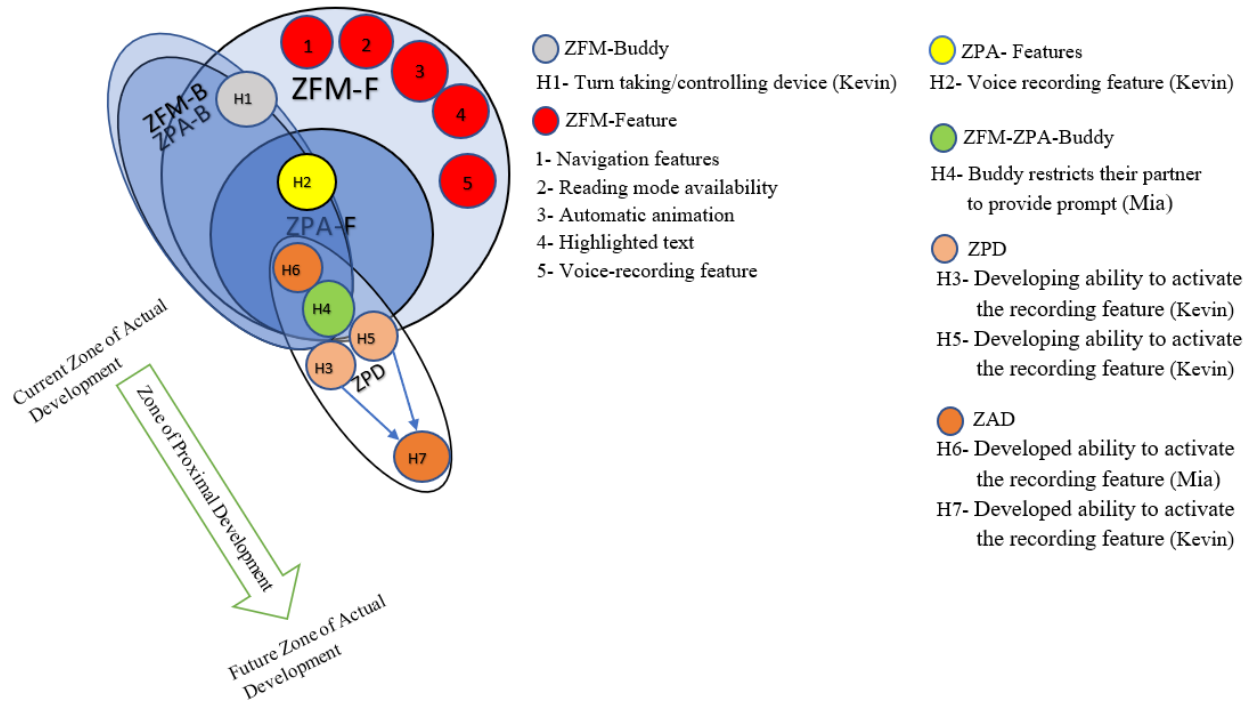


Figure 10

Visualization of Zones for Physical Enacting Mediation in Transcript H