

EIGHT TWEETERS TWEETING:
A MULTI-CASE EXPLORATION OF YOUNG CHILDREN WRITING
IN AN ONLINE SPACE

By

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ABSTRACT

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Information on children's writing in online spaces is scarce. What young writers know or need to know to be effective communicators online can inform elementary writing instruction and technology integration in writing classrooms. This study adds to the nascent research on children's online writing and New Literacies studies by reporting on the writing processes and composition moves of eight second-grade children ("tweeters") when composing short-form writing online for their class Twitter account. With a modified version of the Cognitive Writing Processes Model (Hayes, 2012) as a theoretical lens, I conducted a multi-case study, collecting data from field notes, written artifacts, screen capture, talk aloud transcripts, and video-stimulated recall interview transcripts. Analysis of these data suggests young children's online short-form writing processes include a motivation to tweet, goal setting, in-advance, and in-the-moment planning, and specific writing schema knowledge related to Twitter. Additionally, young children's composition moves of online short form writing are like other writing, situationally specific and unique to Twitter in some ways, and shaped by the curriculum.

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This dissertation is dedicated to
my husband, Bob and our children, Hannah, Bobby, and Benjamin.

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Chapter 1: Eight Tweeters Tweeting

21st century writing technologies are altering the uses of writing largely because of the Internet and the ever-evolving digital technologies that it affords (Leu, Kinzer, Coiro, & Cammack, 2004; Leu, O’Byrne, Zawilinski, McVerry & Everett-Cacopardo, 2009). For example, composing emails, blogs, and webpages (which are typical Internet writing spaces) requires knowledge of unique coding scripts, genres, keyboarding tools, layout designs, touchscreen deftness, and other cognitive, cultural, technological, and social skills. In short, to communicate via digital writing today is quite different from the earliest analog records on clay tablets, both in terms of the tools, skills, strategies, and dispositions, but also in terms of the rapidity with which these tools, skills, strategies, and dispositions evolve. Thus, the evolution of writing, especially in the modern era, has highlighted the need to conceive of writing in broad, technologically deictic and protean terms--especially when it comes to understanding the online composing of so-called “digital natives” (Prensky, 2001).

The communicative use of digital technologies by young people has been of scholarly interest for more than a decade (e.g., Brandt, 2014; Burnett & Merchant, 2015). While consumptive uses of the Internet have garnered much of this scholarly attention related to literacy (i.e., reading, viewing, listening), the creating and designing affordances of the Internet (i.e., writing, speaking, visually representing) have shifted the focus to “the productive side of literacy, [especially] the writing side” (Brandt, 2014, p. 3). In particular, the literature describing the online writing processes of younger children shows signs of development. Two types of studies inhabit this emerging literature: (a) children’s digital writing is compared to paper and pen(cil) writing (e.g., Warnock, 2009) and, (b) children’s eye movements and keystrokes while writing is tracked and logged (e.g. Van Waes, Leijten, Lindgren, & Wengelin, 2011). These

studies, while informative, have limited use for building a more comprehensive view of what happens when children write online. For example, these studies do not take into account what children think as they compose. The absence of scholarship on the writing processes of children writing in the digital medium indicates a need for further study (Harris, Graham, Brindle, & Sandmel, 2009).

To be sure, there are a handful of phenomenological studies that examine the processes children use to compose multimodal digital text, such as email (Burnett & Myers, 2006; Maher, 2010), blogs (McGrail & Davis, 2011) and reports (Mitchell, Thompson, & Anderson, 2017). Generally, the digital writing in these studies occurs in spaces that are not on the open Internet but occur within highly restricted spaces that simulate the Internet. These moves are taken by educators as a safety measure and by researchers as a study-control design measure. As a result, the findings provide one view into young children composing with digital technologies but this lens is insufficient for a comprehensive view (Coiro, Knobel, Lankshear & Leu, 2008).

In sum, the scarcity of information on children writing in online spaces is regrettable because this type of writing will be an important part of a 21st century skills set (Marsh, 2014; Rideout, 2017). What young writers know or need to know to be effective communicators online can inform better ways to teach students. Therefore, this study aims to contribute to the knowledge base by examining the writing processes and composition moves young children use when composing online with Twitter, a microblogging, social-network space on the Internet.

Purpose of the Study

The purpose of this multiple case study was to examine young children's writing processes and composition moves (e.g. development of ideas, revision, editing, awareness of audience) while composing tweets for their class Twitter account. Themes were generated from

observations, written artifacts, and concurrent talk aloud and video-stimulated recall interview transcripts from second grade writers. The analysis focused on the composing process from the generation of an initial tweet idea through the transcription onto an iPad and out into the Internet as a published tweet.

Question

The question guiding the collection and analysis of data for this study was: What are the writing processes and composition moves made by second graders when composing tweets for online publication?

Nature of the Study

A multiple case study design was used for this study to better understand what happens when young children write in one type of online space. Because writing has been conceived of as a complex social phenomenon by a number of scholars (e.g., Graves, 1973; McKee & Porter, 2008), a case study design was selected to examine the “how” and “why” of a complex “contemporary” phenomenon (Yin, 2014, p. 2). And because the work of writers has been conceived of as a personal experience (e.g., Hyland, 2015; Kellogg, 1999) possibly leaving them vulnerable to the criticism of others or themselves (Johnston, 2012), a case study design was selected because I wanted to learn about the personal experiences of writers. For these reasons, a multiple case study approach was best suited to answer the research question stated above.

Five types of data were generated and collected for this case study: screen capture recordings, talk-aloud transcripts, video-stimulated recall interview transcripts, student-written artifacts, and field notes. To identify themes and patterns, the data were analyzed using emic, descriptive codes discovered from the data and *a priori* codes influenced by the 2012 writing process model by John Hayes.

Significance of the Study

This case study is important for several reasons. First, it deepens our understanding of the writing processes and composition moves that young writers employ while composing online. To date, there is limited understanding. Second, the study extends our understanding by identifying new writing processes and composition moves unique to composing online. To date, there is insufficient understanding. Third, the study expands our understanding of the limitations and possibilities of composing online. To date, there is underdeveloped understanding. Finally, this study focuses our understanding young children's composing online. To date, there is nascent understanding.

Overview

This dissertation follows the traditional five-chapter structure. This first chapter briefly describes the continuously evolving nature of writing as a human technology, followed by a brief explanation for the purpose, nature, and significance of the proposed study. Chapter 2 reviews a body of writing research literature, acknowledging the complex and vast nature of writing research, narrowing in on writing research specific to writing processes specific to cognitive theories and models of writing and children writing in online spaces. Chapter 3 describes the methods for answering the research question by establishing the use of case study methodology as appropriate for addressing the specific research question previously established, including a description of data collection. Chapter 4 provides a detailed analysis of the data for each of the eight individual case studies followed by a cross-case analysis and a final summary section. Finally, Chapter 5 provides the discussion of results, limitations and implications of the study.

Chapter 2: Literature Review

My focus on writing processes does not disregard two other important bodies of literature: the online presence and identity dimensions of writing and the social and cultural elements of writing. However, it does value/privilege an “in the head” view of online writing as part of a larger project that will in time examine the many facets of composing digitally through different identities, presences, cultures, and social arrangements. Therefore, this review of literature zooms in on writing research specific to some of the well established cognitive writing process theories and models, identifying a best-fit model as a theoretical framework for this study. This review of literature also addresses the paucity of literature on children’s writing processes *in situ* while composing in online spaces.

Cognitive Writing Process Theories and Models

Theoretical traditions in writing research have developed over time. Early scholars of the writing process, influenced by psychologist Jerome Bruner, thought of writing as a cognitive process (i.e., Emig, 1971; and Moffett, 1968). Wilkinson, Barnsley, Hannah, and Swan (1980) extended that thinking to include the affective, moral, and stylistic aspects of the writing process. And Albert Bandura’s scholarship on social context (Shaughnessy, 1977) expanded thinking to include the sociocognitive aspects of writing (Flower, 1996; Bazerman & Prior, 2005).

In the sections that follow I provide a diachronic review of the cognitive-oriented theories and models in writing research. These theories and models focus on what the writer is mentally doing in moments of composition. The account begins with well-established theories and models of writing, both the process approach and the cognitive process approach theories of writing. Then it continues with the earliest social cognition theory of writing. Next, the account traces writing theories into the 21st century, such as the theory of *developing writers* which proposes a

theoretical possibility for future writing process research. Finally, the section concludes with a theoretic account of the writing process bases for short-form writing and a nominal review of the literature on children writing in online spaces.

Experiential Theory

Early writing research focused on product of writing rather than process, which held a dominant place in the field. Examples of this product-focused view of writing included Hunt's (1965) T-unit and Mellon's (1968) sentence combining. In time, the study of writing moved to focus on the process of writing when Gordon Rohman (1965) examined what writers were doing while writing in school. From his observations of writers, a three-stage linear model of a writing process emerged, which included prewriting, writing, and rewriting. Subsequent research extended and refined Rohman's model by showing that the writing process was not limited to these three stages nor was it a linear process (Emig 1971, Murray 1984, Graves, 1983).

To better understand the writing process, Emig (1971) watched her 12th graders write and asked them to think aloud as they wrote. Her findings invited scholars to question the three-stage linear model of the writing process introduced by Rohman (1965). The result was a more contemporary description of the writing process while still accounting for the three major processes: prewriting, writing and revising/editing. Emig captured the complex and messy reality of writing often described in current literature:

...the writing process is a recursive, idiosyncratic, situation-dependent set of activities we engage in to produce a piece of writing. These activities are embedded within broader categories or phases, the hallmark of the writing process: prewriting, writing, and re-writing (Loc. 1390 of 4954 Andrews and Smith 2011).

While Emig's findings were heralded, in time, her research was criticized for a lack of scientific rigor (North, 1987).

The process approach eventually led to considering the classroom environment and pedagogical moves that might best support writers. Most notable was the writer's workshop (e.g., Murray, 1968, 1985; Graves, 1983, 1994; and Calkins, 1986, 1987). Within the structure of a writing workshop, a single process of writing was not dictated to students. Rather, each writer adopted a process that worked best for him/her based on strategic instruction about what writers do and why they do it. Donald Graves extended and refined work like Emig's through his research observing young children in the act of writing. When asked how he came up with his 1971 dissertation topic about children as writers, Graves admitted,

When I reviewed the research on writing, no one had ever sat next to kids and watched what they did when they wrote. Janet Emig had sat next to 12th graders, but I didn't know it at the time. I was heavy into Piaget. I couldn't believe no one had actually sat down next to kids; so I did it (Routman, 1995 p. 2).

Throughout his career, Graves continued observing kids as they wrote and developed a repertoire of literature for practitioners about children and writing. Graves also built on the work of Don Murray, (a journalist before becoming a teacher of writing) who taught college writing based on what real writers do. From Murray's work regarding adult writers, Graves found that children benefited from writing for an authentic audience and purpose. Graves' commitment to the evidence-based findings that children want to write and can write (if given the time, resources, instruction, purposes, audiences, and independence) framed his legacy. Pedagogical philosophies supporting children as writers championed by Graves have been questioned (see

Graham, 2006). Nonetheless, his work set the stage for subsequent studies that examined in-the-moment cognitive processes of writers.

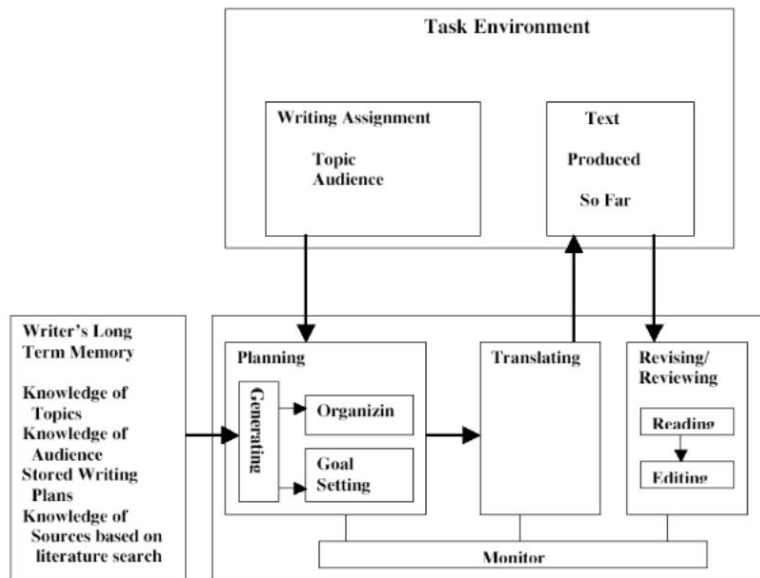
Cognitive Theories

Overlapping the work of Graves and others during the 1980s and 1990s was a strand of research that focused on writing from a cognitive processes perspective (Becker, 2004). Based on the computer metaphor, these information processing models depicted the mind working similar to the input/output algorithmic functions of computers. The most prominent cognitive model of writing during these years was developed by Flower and Hayes (1981) accounting for the recursive nature of writing through a hierarchical rather than linear description (Cooper & Holzman, 1983).

Their initial information processing model portrayed writing as a problem-solving activity, made up of four internal--in-the-head--conditions (planning, translating, reviewing, and monitoring) (See Figure 1). The model made a first-of-its-kind contribution to writing research, but in time was critiqued for two primary limitations: (a) the model did not account for context, and (b) the model represented expert writers rather than novice writers. A lesser criticism was the focus on planning through goal setting without an emphasis on *scripts*, which were detailed steps to produce what has been planned (Cooper & Holzman, 1983).

Figure 1

The Cognitive Process Model of the Composing Process (Flower and Hayes, 1981)

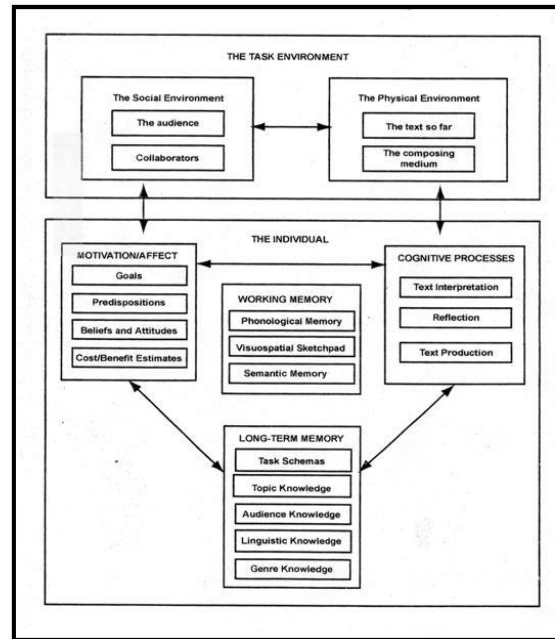


In response to these criticisms, Hayes revised the original model in 1996 to account for external conditions (i.e., context) that influenced writing tasks (See Figure 2). This revised model privileged three cognitive writing processes, a) text interpretation, b) reflection, and c) text production. The revised model also added and clarified the cognitive writing processes of long-term and working memory, motivation, and affect. A limitation of this revised model was an absence of the different strategies employed at the task level. According to Deane, Odendahl, Quinlan, Fowlers, Welsh, and Bivens-Tatum (2008), given the complexity of writing, each task calls upon a different set of cognitive strategies. For instance, text interpretation calls on reading comprehension skills while text production includes transcription skills such as spelling (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994).

Figure 2

A Recursive Model, Hayes (1996)

Hayes (1996) Recursive Model



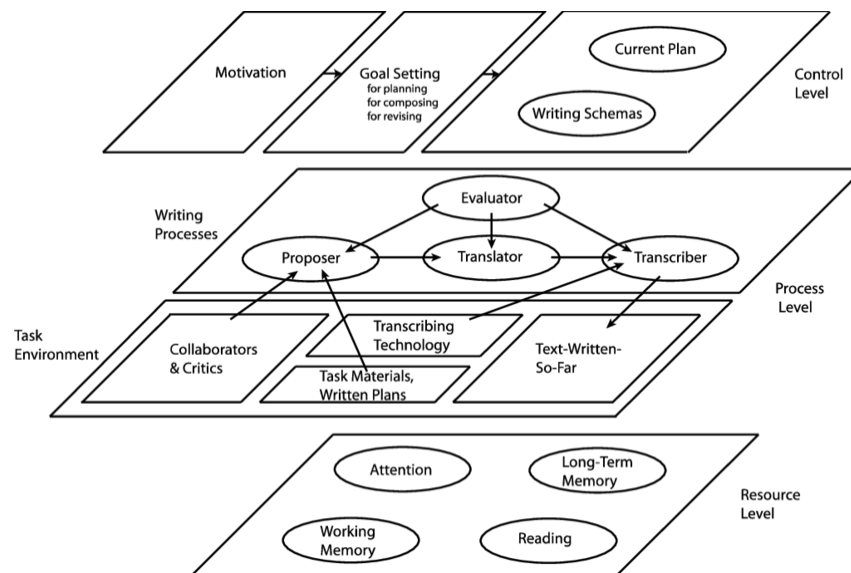
More recently, Hayes (2012) developed an expanded model to address early concerns and to more accurately represent new developments in the field regarding cognitive writing processes (See Figure 3). This more elaborate model was considerably different than previous models. For example, the monitor, intended to represent individual differences in writers, was removed because he thought it misleadingly appeared to be the center of all writer actions. Additionally, this more recent model was divided into three levels: (a) control level, (b) process level, and (c) the resource level. A limitation of this 2012 model, acknowledged by Hayes himself, is the limited scope motivation plays in writing. He agrees the model provides sufficient detail regarding motivation and goals setting, but motivation related to other aspects of writing--such as transcription or evaluation--are not represented (Hayes, 2012).

The central concern about the Hayes 2012 model, as it relates to the proposed study is that it is informed by evidence from studies that examined offline writing processes.

Furthermore, the 2012 model, like the models that preceded it have been developed based on evidence of adult writers and long-form writing.

Figure 3

Hayes's 2012 model for the cognitive processes of writing



Based on data from the cognitive writing processes and products of child writers, Bereiter and Scardamalia (1987) developed two models of varying degree of sophistication: (a) the *knowledge telling model*, a leaner and simpler model which was based on evidence from younger or “novice” writers, and (b) a *knowledge transforming model*, a richer and more complex model which was based on evidence from “expert” writers. The knowledge telling model (see Figure 4) represented a focus on local issues such as spelling and the automatic retrieval of information. The knowledge transforming model (see Figure 5) represented a focus on more global issues such as thesis development and the strategic retrieval of information (Deane, et. al, 2008; Hayes, 2012).

Figure 4

Bereiter and Scardamalia Knowledge telling model (1987)

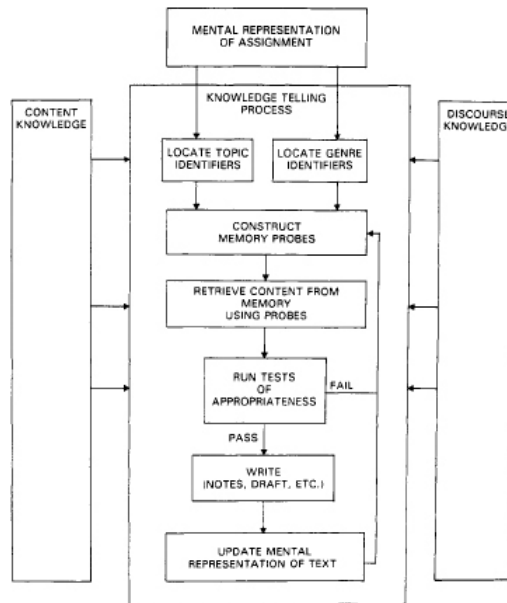
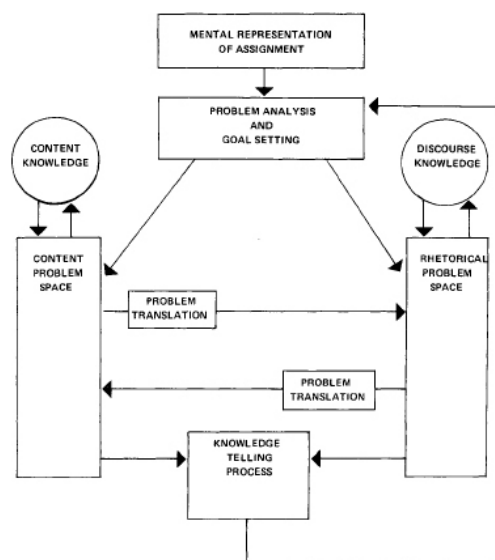


Figure 5

Bereiter and Scardamalia Knowledge transforming model (1987)



The limitation of both the knowledge telling and knowledge transforming models is the broad-stroke overview they represent of the writing process (Hayes, 2011). In spite of this limitation, Hayes (2011) recognized potential in the knowledge telling model through additional layers of detail he called sub-strategies. Other limitations raised by Gagnon (2014) related to problem solving: he thought novice writing did not require problem solving, and that young writers can overestimate their abilities, thereby misrepresenting the writing task (Gagnon, 2006).

Because Hayes's models were developed from evidence of adult writing, he sought to extend the models with evidence from children's writing (Hayes, 2011). The result was a model with sub-strategies for expository writing based on structures identified by Fuller (1995). By analyzing expository essays written by 1st- through 9th-grade students, a subset of the same data set used by Fuller (1995), Hayes identified three sub-strategies to Bereiter and Scardamalia's (1987) knowledge telling strategy. These sub-strategies were, listed in increasing complexity of writing abilities: (a) flexible focus, where the writer does not maintain focus on a general topic (See Figure 6); (b) fixed topic, where every sentence connects to one topic, found commonly in grades 1 through 5, (See Figure 7); and (c) topic elaboration where a general topic maintains the focus with subtopics introduced, found most often in grades 6 - 9 (See Figure 8) (Hayes & Berninger, 2014).

Figure 6

The Flexible Focus Model (Hayes, 2011)

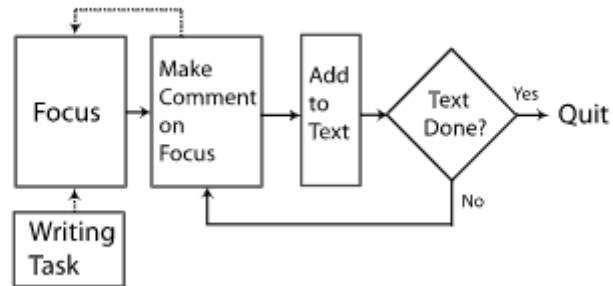


Figure 7

The Fixed Topic Model (Hayes, 2011)

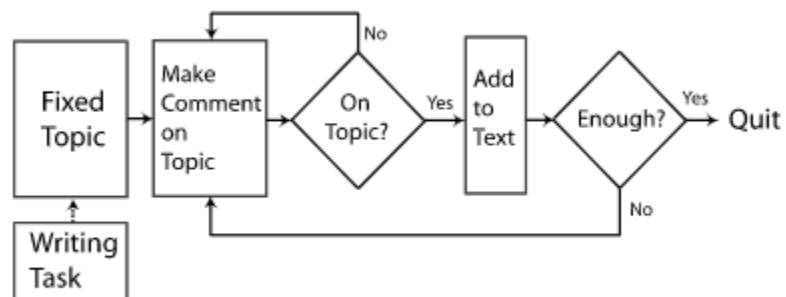
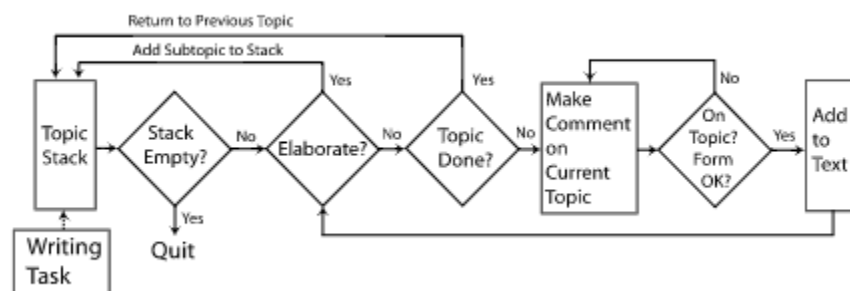


Figure 8

The Topic Elaboration Model (Hayes, 2011)



Hayes then designed computer programs using the Python language (Hayes, 2012) to check whether his models for his three sub-strategies “could actually produce the text structures that they [were] designed to produce...” (p.381). Results showed an accurate match between the sub-strategy model and text with 96% of the essays. Hayes concluded that these three sub-strategies better guided the details of instruction for strategy use when based on student cognitive skills than when based on the overarching strategy of knowledge-telling proposed by Bereiter and Scardamalia (1987).

Social Cognitive Theory

Extending the mostly cognitive-oriented models and theories of writing presented in the preceding sections, Linda Flower (1994) proposed a theory of writing that explicitly acknowledged the social elements that work in concert with the cognitive elements of writing. She and others had expressed concerns that the cognitive information processing models (e.g., Flower and Hayes, 1981) were incomplete (Flower, 1989). At the time, a clear epistemological and methodological division between social theories and cognitive theories of writing were visible. Discussing what she called the social and cognitive continuum, Flower explained,

...[T]here is no way to isolate a social process from the minds that carry it out. Although we can treat public statements, social conventions, or interpersonal events as independent objects, if we look closer, they are the collaborative creation of individual minds over time. They only exist as meaning in the interpretations individual readers and writers give to them (p. 31 of 338 Google Play digital text, 1994).

Based on this logic, she argued to integrate the cognitive and social when trying to understand the process of writing because one constructs the other. The social context builds

cognition, and in turn, cognition mediates the building of social context (Flower, 1989). Flower also called attention to the limitations of a social cognitive theory of writing, which was constructed from the methods of observation and analysis of social or cognitive activity. She argued that which is observed or noticed by the observer and the unique interpretation by that observer provides the data and tells the story which theorize a phenomenon. Flower calls the tools of observation and interpretation “blunt tools of discovery” (p.106 of 338 Google Play digital text, 1994). Because of their bluntness, the social cognitive theory of writing is considered both prominent and more comprehensive for modern day research than two other prominent theories, the cognitive process theory of writing mentioned in the previous section and the sociocultural theory of writing (Leggette et al., 2015).

Sociocultural Theory

Similar to social cognitive theory, sociocultural theory expanded the lens for understanding acts of writing. Unlike social cognitive theory, sociocultural theory did not account for what happens in the brain while writing. Rather, sociocultural theory viewed the cognitive dimensions of writing development as embedded in social and cultural interaction (Vygotsky, 1980).

As a result, writing as seen through a sociocultural lens situated any act of composing within and among an individual’s world, and as a tool for learning (Prior, 2006). Furthermore, sociocultural theory viewed writing as an artifact mediated by cultural tools and as a practice embodied by culture and context (Graham & Olinghouse, 2009; Prior, 2006). Indeed, Prior (2006) elaborates on the rich and complex nature of sociocultural theories of writing,

Sociocultural theories of writing have found, however, that they cannot live easily within the borders of a folk notion of writing, so studies increasingly explore more

semiotically rich units ..., in which an interest in writing leads to writing and reading, talk and listening, observation and action, and feeling and thinking in the world (Prior, 2006, Kindle location 1332 of 10594).

Based on sociocultural theory, writing is a collaborative social activity that is embedded with motivation, affect, and cultural influences on cognitive processes (Hodges, 2017).

Sociocultural research examines how writing is learned and used in a range of settings and how writing permeates sociocultural practices (Perry, 2012). It also focuses on learning to write from more knowledgeable others who scaffold instruction within a learner's Zone of Proximal Development (ZPD) (Wood, Bruner, & Ross, 1978). A learner's ZPD can be viewed as the zone between independence and inability to accomplish a learning goal. Within this zone of learning, the support of a more knowledgeable other helps the learner gain independence of the learning goal.

Critics of sociocultural theory point to the ambiguity of identifying and measuring an individual's Zone of Proximal Development (Allal & Ducrey, 2000) and the context specific nature of sociocultural theory, which limits study-specific results from being synthesized with other results across multiple contexts (Perry, 2012). While sociocultural theory views cognition as a collaborative process, the application of this theory to writing research has yielded little toward understanding the cognitive processes used by writers that extends beyond what cognitive theories of writing have developed (Leggette, et al., 2015).

Cognitive vs. Socio Cognitive vs. Sociocultural Theory

Leggette and colleagues (2015) applied theory evaluation criteria (Dudley-Brown, 1997) to the three theories addressed in the previous sections (*the cognitive, social cognitive, and*

sociocultural theories of writing) to evaluate their applicability in “modern day research” (p. abstract page). The seven criteria used in their analysis were:

- accuracy, which depicts components of the writing process;
- consistency, which is based on internal consistency and evidence of reliability;
- fruitfulness, which means the theory has research potential;
- simplicity/complexity, which means the concepts identified in the theory are consistently simple or consistently complex;
- scope, which signifies dependence on the phenomenon and its context;
- acceptability, which indicates the level to which the theory has been adopted; and
- sociocultural utility, which means the theory accounts for cultural differences (Leggette et al., 2015).

The *social cognitive theory* of writing was evaluated as the most complete using the above criteria. But Leggette and colleagues’ (2015) evaluation was not made without criticism. Hayes and Berninger (2014), for instance, claimed that cognitive theory accounted for sociocultural influences because both social and cultural elements constitute long-term memory and task-environment features. “If the influence of society and culture were not represented in long-term memory and the task environment, it is not clear how they could affect the writer” (p. 9 of draft).

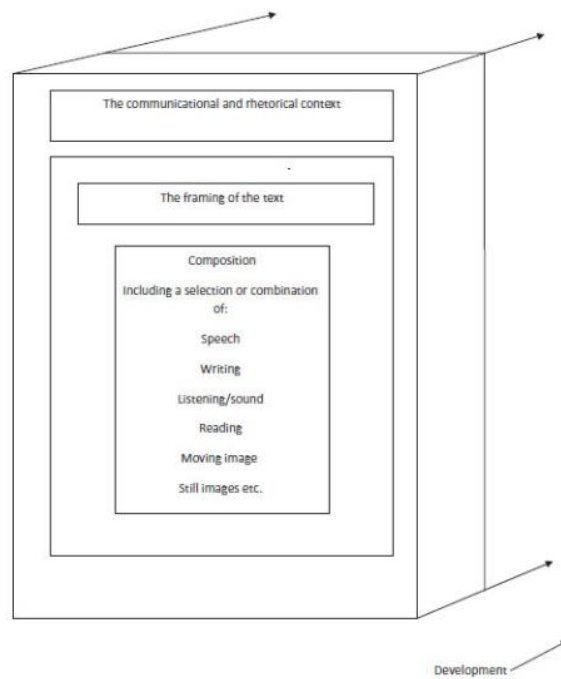
Techno Cognitive Theory

The last decade has seen the emergence of a techno cognitive theory for writing (and the production of other sign systems) (Schürer, 2006). The seeds for this theoretical work (which is at the intersection of technology, cognition, and writing) were sown by Flower’s doctoral students at Carnegie Mellon University (e.g., Ackerman, 1994; Ackerman & Oates, 1996) who

studied the workplace writing of architects and other professionals. Building on this work, Andrews and Smith (2011) made the argument some years later for a cognitive theory of writing that integrates the role of digital technologies. At the heart of their argument is the claim that current theories of writing emerged from the material conditions of off-line, long-form writing. As such, they are limited and insufficient for understanding on-line, technologically mediated short-form writing. Andrews and Smith further argued for a new theory of writing, one which described the *developing writer* rather than *writing development*. See Figure 9. Taken together, their arguments put the writer, rather than the writing process or product, at the center of a theory that has been broadened to explain writing across media (on- and off-line) and forms (from long- to short-form), thus requiring an architecture that is “multidimensional and recursive” (p. 95 of 190, Kindle loc 2018 of 4954).

Figure 9

A Model for Writing Development (Andrews & Smith, 2011)



Technologic Views

Complicating the theoretical challenge of our time has been the steeping of technology into writing practice during the early 21st century. Takayoshi's (2015, 2018) approach to this challenge was to examine trends in the literature over a 30-year period. She identifies five technologically-mediated writing tools commonly addressed: (a) word processing; (b) e-mail; (c) chat and discussion boards; (d) instant messaging; and (e) social networking software. She also identifies five multimodal composition modes: (a) visual; (b) aural; (c) video; (d) performative; and (e) three-dimensional. Despite the presence of technologically -mediated and multi-modal writing tools in the literature, she notes that there is little research which addresses the composing processes with these technological tools and compositional modes *in situ* (p. 3).

Additionally, Takayoshi's review of past scholarship indicates that writing research favors a larger focus on cultures of literacy rather than a smaller focus on individuals and their unique writing processes. As a result, she argues for the close examination of individual writers' writing processes in a network space. For her research, Takayoshi chose to start by examining the visual mode of short form writing in a social networking software application (Takayoshi, 2015). Specifically, she studied "eight Facebook writers' composing processes captured in think-aloud screencast videos" (p. 1). Her study revealed cognitive complexities attributed to what may be considered trivial short-form writing. For example, Takayoshi found in her study: a number of traditional writing processes are used when writing short-form online text, but 'new' processes are too. For instance, she identified so-called horizontal and vertical processes (p. 9). The horizontal processes describe the multiple writing spaces, audiences, contexts, and genres (email, Twitter, posting to discussion boards, word processing) one might give attention while also composing on Facebook, the primary online space of her study. Vertical writing processes are

characterized by the forward and backward recursive movement at the character level, “making changes at the character, word, and sentence level” (p. 10).

Although the composition process of writing on Facebook has been examined by Takayoshi and several others (e.g., Shepherd, 2015), the short form medium of Twitter has not. However, there exists anecdotal accounts of children writing on Twitter (e.g., Kurtz, 2009; Marich, 2016; & Waller, 2010).

The literature on children’s writing in online spaces is developed in the section below. It is a nominal review of the literature because there are only a half dozen studies to date. The literature is divided into two sections: (1) children writing in online spaces (the research literature generally), and (2) children writing with Twitter (the professional literature specifically). The first section is further divided into subsections according to the platform: (a) emailing, (b) blogging, and (c) social networking profiles.

Children Writing in Online Spaces

While there are a number of studies that look at adult writing in online spaces, (e.g., Mills & Chandra, 2011; Riley, 2015; Takayoshi, 2015), there are only a couple of studies that look at children writing in online spaces. One such study, conducted in the United Kingdom, surveyed children age 8 to 16 about their writing practices. The results indicated that children who blogged or had a social network profile were more confident writers and displayed a positive attitude toward writing and computer use compared to those who did not blog or participate in a social network (Clark & Dugdale, 2009, p. 34). While attention to children’s online writing in the UK provides evidence that young children are writing online, little consideration has been given to the writing processes employed by young children while writing online. I summarize a selection

of literature about children composing emails, blog posts, and social network site profiles, noting how these existing studies overlap but do not directly align with the proposed study.

Writing an email. Burnett and Mayers (2006), Merchant (2005b), and Wollman-Bonilla (2003) investigated the composition moves visible in the emails of children. The Burnett and Myers and Merchant studies (which drew upon the same data), for instance, found that the 5th-graders in their study used a formal writing style with initial emails between neighboring-school writing partners. The writers were conscious of surface level features including spelling, punctuation, and word choice. It wasn't until the writing partners met face-to-face that the email writing style became informal, showing less concern for mechanics. Furthermore, students were confident and enthusiastic about their writing, recognized multimodal elements as key to meaning making, and engaged in ongoing revision as the composition developed, regularly checking that their writing made sense. To enhance verbal meaning with visual effects students used emoticons at both the overall message and individual word levels. For example, within individual words a smiley-face emoticon was used to replace the "o"s in the word good, generating "g□□d" (Merchant, 2005b, p.56).

Wollman-Bonilla & Carpenter, (2003) observed her six-year-old daughter Rosa as she engaged in ongoing correspondence with relatives through both email and traditional paper-pencil mail. Although Rosa used correct punctuation and capital letters when writing paper-pencil mail, the email writing lacked conventional punctuation. When writing paper-pencil letters Rosa wrote with a formal style, indicating an awareness of audience. Conversely, her email writing included an informal conversational style, reflecting an assumption that temporal, physical, and situational context was understood. Rosa thought of her emails as "talk", she was "talking to them" but when writing letters she was "writing to them."

Writing a blog. McGrail and Davis (2011) studied the composition moves of students engaged in a 5th grade classroom blogging project. While conventions and mechanics were not emphasized during the project, students paid considerable attention to them because they wanted to present themselves well to their audience and connect with them. Thus, the impact of their written words on the blog's audience was consistently on their mind. This audience awareness did not happen immediately. Rather, it developed over time, as students transitioned away from thinking of the teacher as their primary audience. Blogging also increased student confidence and motivation as writers. For example, the students were assertive when blogging about social topics like the importance of recycling and the unacceptable conditions of dirty public restrooms (p. 429). Confidence was also demonstrated through blog comments between fellow students about topics such as the social implications of correct spelling when blogging. Over time, as student confidence grew their writing showed evidence of taking ownership of the writing process and writers' craft (p.430). For example, efforts to organize their text, elaborate ideas, and using playful language through idioms and metaphors.

Writing on a social network. Lindstrom and Niederhauser (2016) and Dowdall (2009) both studied the composition moves visible in the social network writing of children. Lindstrom and Niederhauser, for instance, studied literacy-related activity of three 5th grade female students using a closed social network site, Ning. They found that profile curation and writing style of posts influenced the writer's social and cultural experiences. For example, one student, identified as an experienced social network site user, modified her profile page more often than novice social network site users and wrote with a less formal style similar to instant messaging. As a result, this student experienced social success among her peers within the Ning online space. In contrast, another student, identified as a novice social network site user, gave little attention to

her profile page, used a formal in-school style of writing, and often posted personal or sensitive content typically only shared through direct messaging. As a result, this student “struggled to achieve social success with her peers” (p.116) within the Ning online space.

Similarly, Dowdall (2009) studied the literacy-related activity of one 12 year-old female student using the closed social network site, Bebo. Dowdall found competing tensions between the site structure and agency of writers on the site. For example, because of the co-authored nature of Bebo’s writing space, the primary author must manage the elements added by friends, followers, and commenters, but has limited control. Furthermore, when additional writing-space elements are added, the primary author can control to maintain her chosen online identity. The sociocultural aspects inherent to each writer’s unique writing experience requires knowledge overlooked or misrepresented in typical school curriculums for writing.

The current study. The current study builds upon, but differs from, the studies reviewed above. First, my study used a different online platform, namely Twitter. While children today continue to write using email, blogs, & social networks, writing on Twitter (a hybrid of the three, given it’s personal-messaging feature, microblogging format, and social media connectivity) looks poised to be used by teachers and younger students given the prominence and access to the platform.

Second, the current study examined younger participants (8 year-olds) rather than the pre-adolescent and adolescent children in five of the six studies reviewed. There is some evidence that younger children are doing more writing online than previously thought (Internet Foundation in Sweden (Davidsson, & Findahl, 2016).

Third, the current study uses a writing process model framework, Hayes (2012). The studies reviewed above have largely been agnostic when it came to use of a model, framework,

or theory. My intentional use of an *a priori* writing framework better situates the current study within existing literature addressing contemporary writing-process theories and models.

Fourth, the current study focused not only on composition moves (as the studies above did), but extends into an examination of the writing processes of children writing, allowing for a more comprehensive representation of the writer's experience. For example, from screen capture recordings and talk aloud data I can identify the specific number of composing or revising moves a child uses while also providing what the child was thinking about during that time.

And fifth, the current study used different data collection methods. Data collection for the current study involved one-on-one audio and video sessions of student talk aloud matched with video screen capture of what the student is doing on the screen. The talk aloud session was immediately followed by audio and video recorded video stimulated recall interviews.

Specific to data collection, all six studies reviewed used observations of students writing within the context of the classroom. Both this approach and the out-of-classroom one-on-one approach used for the current study has its own cost benefit. For example, the in-classroom observations preserves the original writing situation at a cost of a thinner data set of detailed on-screen composition moves. While the one-on-one observations described above allows access to a more comprehensive and thick data set used to describe the writing processes and composition moves, *in situ*. This is at the cost of the student writing away from the original classroom writing situation. This cost seems reasonable given the current study research question is focused on student writing processes and comprehension moves *in situ*. Table 1 provides an overview of how each of the six studies reviewed differ from the current study in four of the five areas: online platform, student age, writing process model framework, and data collection methods.

Table 1

Overview of differences between the current study and existing literature

Study	Online platform	Student average age	writing process model framework or writing elements to frame analysis	data collection methods
Present Study	Open SNS Twitter	2nd grade 7 & 8 yr	Hayes (2012)	Screen-capture recordings With simultaneous talk-aloud Video-stimulated retrospective interviews Product analysis
Burnett & Mayers (2006)	email	5th grade 10 & 11 yr	“the writing process”	in class observations, after project completion interviews, product analysis
Merchant (2005b)	email	5th grade 10 & 11 yr	language use experience of digital communication visual affordances critical awareness	in class observations, after project completion interviews, product analysis
Wollman-Bonilla and Carpenter (2003)	email	Kindergarten, 6 yr	style, audience awareness, mechanics	in home observations, after project completion interviews, product analysis
McGrail and Davis (2011)	blog	5th grade 10 & 11 yr	attitude, content, voice, connections and relationships, thinking, craft	in class observations, after project completion interviews, product analysis
Dowdall (2009)	Closed SNS Bebo	6th/7th grade 12 yr	Kandinsky’s terms to label different types of representation in art Impressions Improvisations compositions	interviews product analysis
Lindstrom & Niederhauser, (2016)	Closed SNS Ning	5th grade 10 & 11 yr	Not specified	interviews product analysis

Children Writing with Twitter

Practitioner accounts by Waller (2010) and Kurtz (2009) described the Twitter-based writing practices of primary students. Marich (2016) described a teacher’s use of Twitter in her

primary classroom. While the descriptions of these three practitioners are limited in scholarly scope and rigor, they suggest several themes relevant to the study of Twitter-based writing. Waller, for instance, noted that his young writers began to recognize they were writing for “an audience that extended beyond the classroom” and that “[w]riting for an audience and purpose finally began to mean something to them” (p. 15). Kurtz, for example, noted that his young writers were more effective at revising and editing their writing as they composed tweets in notebooks before publication than these same writing tasks during writing workshop. And Marich noted that the primary teacher also observed most of her students rereading their tweets, fixing grammar, punctuation, and capitalization before publishing. While hard and fast conclusions can not be drawn from these three case studies, they suggest possible reasons why further study of writing processes and composition moves with Twitter is needed.

Selecting a Writing Process Model for this Study

In this chapter I have reviewed several writing process theories and models. Because of the comprehensive nature of the writing process model by Hayes, (2012) I will use this model -- with revisions reflecting how children and adults differ (Hayes & Olinghouse, 2015)-- as a theoretical lens to examine the writing of children in an online space. Like nesting dolls, where all other dolls in a set become a part of the largest doll, I recognize elements of the other writing process theories and models previously mentioned have a part in the Hayes (2012) model. For example, the foundational writing processes identified by Rohman (1965) and better understood in practice by Emig (1971) are nested within the writing processes section of the process level in the Hayes (2012) model. The motivational aspects of an authentic audience and purpose for writing within a learning context that values all learners as writers (e.g. Calkins, 1986; Graves, 1983; Murray, 1968) as well as the multidimensional and recursive nature of the writing process

presented by Andrews and Smith (2011) are nested within the task environment section of the process level in the Hayes (2012) model. (This connection is based on adjusting the model to include motivation with the process level.) Finally, the knowledge telling and knowledge transforming strategies identified by Bereiter and Scardamalia (1987) and further detailed by Hayes (2011) are nested within the writing schemas section of the control level in the Hayes (2012) model. Moreover, given the data collected during my pilot work, as well as scholarship by other researchers, The Hayes (2012) model provides the best fit to answering my research question for five reasons.

First, the model lends itself well to understanding the observable behaviors of screen-capture video. As children wrote, it was apparent how the visible behaviors on video could be understood in light of Hayes' model. For instance, when one young girl repeatedly reread her writing before adding the next word or phrase, it signaled a clear connection to the Resource Level in Hayes' model. This level accounts for the resources used when writing but may also be used for problem solving, speaking, and decision making.

Second, the model accounts for motivation and genre knowledge, as well as the physical task environment accounting for the technological elements. Students were clearly motivated to compose tweets and displayed specific genre knowledge. For example, while composing tweets students were familiar with adding hashtags and emojis to match the intended meaning of their message. Students were also familiar with the technology, using the iPad keyboard, using the automatic word selection, and fixing up their spelling based on red underlined words.

Third, the Hayes model accounts for the internal writing processes of composing. For example, the process level of the model identifies work of the transcriber and evaluator. Transcribing includes the act of writing/typing the text (which may cause greater difficulty for

children than adults) and evaluating includes the act of checking for accuracy during the act of writing/typing (which may not be observed in a child's process). In agreement with Hayes and Olinghouse (2015) I did observe some children clearly frustrated while transcribing. For instance, one child became clearly frustrated when she could not figure out, after multiple attempts, the correct spelling of a word underlined in red. Also, counter to Hayes and Olinghouse (2015), I observed children repeatedly rereading to both edit and revise their text as they composed their tweet. This may have been initiated by the 140 character limit imposed by the platform at the time of my observations, and may not be observed now that the character limit is 280. When asking the teacher via email what she noticed in her students' writing when the character limit increased she replied,

So I am liking the 280 characters because some of my students are able to explain more in depth. In fact I had one the other day I had a student that went over the 280 character limit and I had to show her how to edit her work. The editing was something that I forgot that I taught all the time with 140 character count. So in that aspect (teaching editing and refinement in wording) the 280 character is a downfall. (Personal email communication, January 23rd, 2018)

Fourth, an important reason, though not tied directly to my pilot data, is how the model has shown alignment with the Common Core State Standards, CCSS (Hayes & Olinghouse, 2015). Teachers of writing typically follow a writing process approach characterized by planning, drafting, revising, editing, and publishing (Lacina & Silva, 2010). The Common Core State Standards, CCSS in writing also direct the use of planning, revising, editing, and rewriting. Recently, Hayes and Olinghouse (2015) compared the Hayes 2012 cognitive model of writing with the CCSS in writing. They reported the writing work listed in these standards "draw upon the cognitive processes" represented in the process level of the 2012 model (p.491).

Finally, other scholars have selected the Hayes (2012) model for similar reasons. Berdanier and Trellinger (2017), for example, developed a method to study screen-capture video of technologically mediated real-time writing processes using a modified version of the Hayes (2012) model. They made this determination during an initial open coding session while watching a segment of screen-capture video. Chapter three includes an explanation on adapting the Hayes (2012) model for the current study.

Chapter Summary

“No one theory currently encompasses all that is writing” (Hodges, 2017, p. 145).

To recap the text thus far, the literature on process-oriented theories and models of writing traces a tradition of scholarship where researchers sat side-by-side with novice and expert writers, making sense of the how and why of what writers do. Since the 1990s, this tradition has given way to social and cultural perspectives, leaving much still to be learned about a writer’s use of writing processes *in situ*.

Additionally, three patterns cut across the review of literature in the previous pages. First, writing scholarship has evolved from a narrow focus on behavior presented by Rohman’s (1965) three-phase writing process (prewriting, writing, and rewriting) to broader and more robust models that focus on the social and in-the-head processes of writing (e.g., Flower and Hayes, 1981; Bereiter and Scardamalia, 1987; Flower, 1994). Second, the scholarship has also evolved from the study of offline to online writing behaviors and processes. Taken together, the evolutions summarized in the previous two sentences represent an effort to develop a more complete and rounded understanding of what writers do when composing, outside or inside the head, and regardless of medium. And third, newly emergent scholarship on writing is evolving

from the study of longer forms of writing (e.g., stories, essays, blogs) toward shorter forms of writing (e.g., summaries, instant messaging, texting).

Building on this previous scholarship, I aim to extend our understanding of what writers do by examining children's writing from a writing process perspective in online spaces when the focus is on a short form of writing. By building primarily on the work of Takayoshi (2015), the study outlined in the next chapter extends the scholarship on writing by examining the writing processes and composition moves of young writers composing online using an unstudied short form genre (i.e., Twitter).

Finally, because existing models and theories of writing processes do not explicitly account for the "how" (composition moves) and "why" (writing processes) of what young writers do as they write for specific online spaces such as social networking sites, I will use what I have identified as the most comprehensive model (Hayes, 2012) with modifications, as a theoretical lens to examine the writing processes and composition moves of children in an online space.

Chapter 3: Method

In the following pages I outline the methods used for collecting and analyzing data on children's writing processes and composition moves (e.g. development of ideas, revision, editing, awareness of audience). First, I describe the scholarly tradition that informs my research design. Then, I provide community, school, classroom, and participant information. Finally, I conclude with a detailed explanation of the data collection and analysis.

Research Design

Case study research has a well-articulated tradition and has been used extensively for research about writing (e.g., Edwards-Groves, 2011; Ranker, 2007). Because the goal of this study was to better understand the writing processes and composition moves of individual children as they wrote in online spaces, the case study design provided a good 'fit' between research question and method. Furthermore, case study design lends itself well to examine the "how" or "why" of a complex "contemporary" phenomenon, like writing online (Yin, 2014, p. 2). Case study research also permits in-depth description of a phenomenon like online writing. Using data collection tools that capture in-the-moment and in-depth writing processes and composition moves, a case study design is the most congruent with the aim of this study.

Correspondingly, scholars who study writing processes in online spaces argue that the most appropriate data collection methods are those collected in the moment of composition via case study methods. Takayoshi (2016), for instance, explains,

Particularly with research located closer to the act of composing, research that combines methods (for example, screen capture or eye tracking with think-aloud or retrospective verbal protocols) can move toward a fuller (yet always impartial) understanding of what writers are doing and their decision-making processes p. 6.

To gather a data set rich enough for the type of understanding that Takayoshi describes, the current study design focused on case-based data which was “grounded in the moment of composing”, such as screen capture that included synchronous audio recorded talk-aloud protocol narration and video stimulated recall interviews that used proximal video excerpts from the screen capture as context for discussion.

Setting and Participants

Community

The study was conducted in a community located in a small rural town in the Western United States. The town’s population is approximately 12,000. Children in this community are generally familiar with small town 4th of July parades, September pari-mutuel horse betting races and county fairs with strong youth 4-H representation. Hunting elk, deer, antelope and sage grouse is something many children talk about in the fall. Learning to swim on summer days in an outdoor warm spring or camping in the lush mountains thick with quaking aspen trees is also a familiar family experience in this area. Snowmobiling and sledding in the large open hillsides are common winter experiences. A major community event is the annual cowboy poetry gathering, with poets from around the country visiting. In addition to this strong western influence on the community, local ethnic group experiences from local Basque clubs and nearby Shoshone tribe reservations shape the life of children and teachers. Children in this small town generally travel a few hundred miles to the closest larger city. Beyond these influences the children of this small town are relatively sheltered from the larger world.

School

This school has three to four classrooms of each grade level, K-5th grade with approximately 550 students total. According to 2014-2015 state demographic data this school is

84.7% white/Caucasian; 9.8 Hispanic/Latino; and 1.8% American Indian. 23% of students qualify for free or reduced lunch. Families generally work in agriculture, open-pit and underground mining, and small business ownership. Levels of parent education range from graduate and professional degrees living within the mid to upper middle class to those without education beyond middle or high school living below poverty. It is not uncommon to have homeless students and very-well-to-do students in one classroom.

Classroom

At the time of this study Mrs. Howe's (pseudonym) 2nd grade classroom had 18 students. Ten male, and eight female. There were no identified English Language Learners (ELL) and no students receiving additional academic support through special education. One student was being testing for special services and one student may be tested in the near future. Two students have speech Individual Education Plan (IEPs) with pull out services provided.

This classroom was equipped with a cart of iPads which students used daily during center rotations and for tweeting. Four desktop computers with Microsoft software were available but rarely used. These devices had been replaced in popularity by the iPads. The teacher reported, "We use iPads for everything because they are much more convenient and faster running. The district has decided to not support the computers in my classroom anymore, so they are outdated and very slow to run" (Howe, personal communication, Oct. 2017). An interactive whiteboard perched prominently at the front of this classroom was used daily by teacher and students. These digital technologies were an integral part of the established classroom tool-kit, just as a pencil, notebook, or table might be. Mrs. Howe welcomed me as a researcher into her classroom to examine what happens when her students composed tweets.

Teacher

The classroom teacher, Mrs. Howe, was in her 9th year of teaching. She described her approach to teaching writing as a “writer's workshop.” This approach (Atwell, 1987; Calkins, 2003; Graves, 1980) usually involved a 30 to 45-minute block of time with the first 10 to 15 minutes designated for direct instruction about a concept related to student needs and content standards. This instruction was then followed by students writing on their own as the teacher worked the room working with individuals and small groups to provide additional instruction. The workshop usually ended with a time for students to share their writing during the last 10 minutes of the workshop. Keenly aware of her students’ limited perspectives on the world beyond their small community, Mrs. Howe adopted tweeting as a regular classroom practice to expand student awareness and knowledge of the world beyond their isolated community. This is her fourth year using Twitter in her classroom.

Students

The primary participants in this study were students in Mrs. Howe’s second-grade class. All students that wanted to participate in the data collection activity were provided that opportunity if parent consent had been granted. Cresswell & Poth (2018) recommend collecting data from a sample size that is larger than the number of cases that will eventually be analyzed, so that sufficient data is generated to be adequately analyzed during the time frame.

Selecting participants. For my sample to be selected purposefully, three criteria were drawn from the literature for the selection of 8 students, which served as in depth case studies: gender, academic level, and technology attitudes and dispositions. These criteria were differentiating features of North American elementary school classrooms where the populations of students generally include both male and female students with varying academic levels

(McGeown, Goodwin, Henderson, & Wright, 2012) and a range of experiences with technology (National Educational Technology Plan, 2016). Therefore, to obtain data on the widest possible range of writing processes and composition moves, the second graders in this study were selected with these criteria in mind.

Gender. To obtain data on the widest possible range of writing processes and composition moves, the sample the study sample plan was initially intended to include both four male and four female students. These students were determined in an attempt to align gender pairs over degrees of academic level for possible cross-case analysis categories. When identifying the four male students an error was made selecting one student who I assumed had a typical male name. It was not until after long into the study I noticed something was not right. Going back into the raw data and connecting the pseudonym with the student's actual name and the video data that I realized the student I had listed as male was female. I searched my available case choices for a male student with a similar achievement level to accommodate my error and did not find a match. The remaining male cases were categorized as lower achieving and I needed a high to high-average achieving male. For this reason the final eight cases included three male students and five female students.

Academic levels. To obtain data on the widest possible range of writing processes and composition moves, the sample included students representing various academic levels determined by the most recent results of the Measured Academic Progress (MAP). MAP is a nationally normed, state-required computer-adaptive test completed two or three times per year in reading, language usage, math, and science. Specifically, scores from the Language Usage section were used to determine various academic level performance (Northwest Evaluation Association, 2013). Table 2 provides a list of the eight students selected to participate in the

current study. The students are listed starting with the student pairs who scored highest on the language usage measure, then progressively presenting the next highest-scoring pair, and so on until the lowest-scoring pair is presented.

Table 2

Study participants

Student	Male/Female	Language Usage %tile range
Hope	Female	92-94-96
Hal	Male	54-61-68
Inez	Female	56-63-70
Irene	Female	51-59-66
Kip	Male	48-56-63
Kayla	Female	48-56-63
Luke	Male	27-33-40
Lori	Female	14-19-24

Technology. Finally, to obtain data on the widest possible range of writing processes and composition moves the sample plan was to include students who indicate positive and negative dispositions with technology. Part one of the Young Children's Computer Inventory (Miyashita & Knezek,1992) was used to determine positive and negative dispositions. This five-part instrument was designed to measure attitudes and dispositions about technology use for 1st to 6th grade school children. Part one focused on computer enjoyment and computer importance, which was most relevant to the current study. Part one also fit within the time frame available to meet with students, including eleven 4-point Likert scale questions about computer enjoyment and

importance. Survey results were similar across all students, indicating a positive disposition with technology. For this reason, technology was not used as a factor for sample selection.

Consent Procedures

Because I was working with children, I realized they may feel some coercion to participate. However, there were two built in safeguards that addressed any possible coercion. First, data collection would come from the well established classroom practices and curriculum for tweeting which the teacher and students had been doing all school year. Second, writing of tweets was not graded by the teacher rather the information was used to communicate to a larger audience, including parents and teachers, what the children were learning and why they were learning it, as established for their class purpose for tweeting.

In addition to parental consent to participate, the children were asked for their assent (verbal script is provided in appendix). Because all children in the 2nd grade class were welcome to participate in the data collection session, the teacher did not have a knowledge of which case would be included in the study, minimizing coercion or undue influence. Students were (a) asked by their classroom teacher to bring home a letter of consent to their parents, or (b) parents would be invited to the classroom for a teacher-directed session explaining the consent form. The letter outlined the purpose of the study, the research activities in which their child would be involved, and the risks and benefits of participation.

Children were also asked to give their assent to participate at: (a) the same time their parents signed the consent and, (b) the time the first interview occurred. Because the participants were children ages 7 and 8, they were given an assent form that was a modified version of the consent form their parents received. Modifications (a) adjusted the formal language to more appropriate student-friendly language and (b) removed information of importance to parents but

not of relevance to the students. The assent script (See Appendix A) was read aloud to students before they completed any research related task. The classroom teacher read it aloud to students and I was available to answer any questions the classroom teacher could not answer. Once students listened to the language of the form read to them they were asked to sign the form, giving their assent to participate in the study. Before meeting with me for a talk-aloud-session students were verbally reminded that participation in the study was entirely voluntary and they could choose to stop participating for any reason, at any time with absolutely no consequence to them.

I considered the teacher might also feel some coercion to participate. I did not know the children in the 2nd grade class but I was associated with the volunteering 2nd grade teacher. The teacher and I have been teacher/mentor colleagues since 2014. When the teacher decided to use Twitter in her classroom, she asked me for guidance. It had been almost four years since this original work. For the past few years before the study, discussion between the teacher and I had been infrequent, centered on questions the teacher had about what she could do to improve her teaching. I also considered the teacher might feel obligated to let me conduct research in her classroom because of the help provided in past years. To minimize the possibility of the teacher feeling obligated or coerced, I made clear that I had other teachers that were willing to provide access to their classrooms for my research and that it was of no consequence if she would rather not have her students participate. Knowing there was an alternative classroom for my research removed undo feelings of obligation by the teacher.

Role of the Researcher

I did not know the children in the 2nd grade class but was and still am professionally associated with Mrs. Howe. We have been teacher/mentor colleagues since 2014. Because I have

been “involved in a sustained and intensive experience” with Mrs. Howe, which can be common in a qualitative case study, our continuing relationship through this study may have had some bearing on the data collection and analysis (Creswell, 2009 p.177). Most notably, I, the researcher, spent considerable time both meeting with the students and observing in the classroom. This “backyard” presence (Glesne & Peshkin, 1992 cited in Creswell, 2009) calls for extra precautions to maintain research integrity and assurance confidence in the case study’s results (Creswell, 2009). To ensure reliability, I took thick descriptive notes of what was happening and being discussed during each talk-aloud session and any necessary classroom observations as needed. To attend to validity, I employed “member checking” (Creswell, 2009) by asking the students and classroom teacher to review summary statements for accuracy.

Data Collection

In order to create a comprehensive and thick data set used to describe the writing processes and composition moves, in situ, five types of data were collected for the study: screen capture recordings, talk-aloud transcripts, video stimulated recall interview transcripts, student-written artifacts, and field notes. Table 3 provides a short description and purpose for each of the data collection tools.

Table 3

Data Collection Tools: Description and Purpose

Tool	Description	Purpose
screen capture recordings	A video recording of the computer screen showing actions made by the computer user (i.e., moving cursor, typing, changing keyboards, changing screens).	These recordings provided a record of student <i>composition moves</i> while writing a tweet. From these data I can identify the temporal, quantity, and variety of the writer’s composing moves <i>in situ</i> .

Table 3 (cont'd)

Tool	Description	Purpose
talk aloud transcripts	A written account of all words spoken by both the writer and researcher during a writing session.	These transcripts provided a record of student <i>writing processes</i> while writing a tweet. These writing processes were determined by what the student said while talking about what they were doing while writing a tweet. These data were necessary to better understand a writer's writing processes <i>in situ</i> .
video stimulated recall interview transcripts	A written account of all words spoken by both the writer and researcher while the writer watched the screen capture recording of themselves while writing a tweet and the researcher asked the writer questions to better understand the writer's intentions.	These transcripts provided a second record of student <i>writing processes</i> while writing a tweet based on watching their writing and talking about what they did and why they did a particular action. These data were necessary to better understand a writer's writing processes <i>in situ</i> .
student-written artifacts	A screen capture image of the writer's published tweet created during our writing session together	This published writing provided data about composition moves, specifically related to conventions and elements of text structure. These data were necessary to better understand a writer's writing text structure and convention knowledge, subsets of a writer's writing processes and composition moves.
field notes	notes taken during and after research observations	These notes provided a space for thinking and making sense of the writing processes and composition moves observed in the data. These data were necessary to better understand a writer's writing processes and composition moves <i>in situ</i> .

A detailed explanation of how each type of data was collected follows.

Screen Capture Data

All screen capture technologies were set up before inviting students one at a time to the data collection session in a nearby classroom.

The steps for setting up the technologies were:

1. Enable the do not disturb mode and lock the orientation on the personal iPad and iPhone.
2. Disable the automatic notifications on the laptop.
3. Connect all devices to the same wireless network.
4. Activate the Reflector Director app loaded on both my iPad and my laptop to connect devices.
5. Select the airplay device on the iPad (Holly's MacBook Pro) and turn on mirroring. The iPad screen is now mirrored on the laptop screen.
6. Open the class Twitter account on the iPad.
7. Start the Camtasia 2 screencapture in the background of the laptop to video and audio record student tweeting.
8. Plug in the external microphone.
9. Turn the iPhone memo recorder on for a backup audio recording.
10. Begin recording using the Camtasia screen capture after the student has gone through the think aloud practice protocol.

To mirror the iPad screen onto my laptop screen, I use Reflector Director as the mirroring tool. Using a local network connection between my MacBook Pro laptop and my iPad, Reflector Director allowed mirroring in real time the iPad screen onto my laptop screen. For screen capturing (Takayoshi, 2016) I then used the screen capturing tool, Camtasia, to video record both the mirrored iPad screen and a thumbnail video image of the student as he/she was composing a tweet. Camtasia is a screen recording and video editing software developed by TechSmith (<https://www.techsmith.com/>), which is recommended for technology enhanced research (Cox, 2007) and used in similar talk-aloud research (e.g., Coiro, 2006).

Talk-Aloud Data

The literature on using talk-alouds to understand the writing process is well established (e.g., Brandt, 1992; Hayes & Flower, 1980; 1981; Van Weijen, 2009; Young, 2005). Using talk

aloud protocols with young children is less common (Coiro & Dobler, 2007; Seipel, Carlson, & Clinton, 2017; Pressley & Afflerbach, 1995; Young, 2005). While Ericsson & Simon (1984) established relatively strict protocols for talk alouds, more recent uses locate talk aloud protocols along a continuum of control (Boren & Ramey, 2000). Ericsson and Simon's (1984) approach is located at the end of this continuum where strict control is used by the researcher. Careful application of scripts and limited comments by the researcher allow for less task interference. At the other end of the continuum is a *laissez-faire*, open interaction between participant and researcher. The passive, monologic participant expected from Ericsson and Simon (1984) lends itself to particular participants, questions, and tasks, whereas the more dialogic, interactive participant recognized approach lends itself to others (Sibly & Watts, 2015). Given the participants, questions, and task used in this study, I designed a talk aloud protocol that was located in the middle of the continuum. The protocol included dialogic elements from speech communication theory to design a complementary approach, controlling some aspects of the protocols, such as maintaining a consistent set of questions for every interview (tight control), but only asking these questions if they were not initiated by the writer and asking them only at points in the session when it felt conversationally natural (lose control) (Boren & Ramey, 2000). For instance, to address student thinking about their planning I will ask, "How do you decide what to tweet about?" . To address student thinking about audience and purpose I will ask, "Who's going to read your tweet?" The specific talk aloud procedures used are spelled out below.

The procedures used for collecting talk-aloud data during the tweeting session began with explaining the task according to a script of keywords and phrases. This explanation included information about the screen capture setup and other technologies in the room. What items were

called and how they would be used for the research were mentioned to address student initial curiosities. After this initial “ice breaker” to get comfortable with one another, I began the session. During each talk-aloud session the student was guided to sit down at a designated table with an iPad tablet open to the class Twitter feed that had been set up with the needed screen mirroring application. We began the recorded session after the practice phase (e.g., Pressley & Afflerbach, 1995). Once audio and video recordings were turned on we progressed through both the talk aloud script for composing a tweet and video stimulated recall conversation. While the script was visibly available to me, I used it as a guide rather than verbatim-script to create a natural and comfortable conversation-feeling with the students. I used keywords and phrases from this script rather than a word-for-word rendition (Boren & Ramey, 2000). See scripts below.

Explaining the Task

The first part of the protocol addresses student initial curiosities about the what, how, and why of our work together, intended to establish a safe and comfortable rapport and working environment for the student.

“I am learning about what children are thinking when they write in Twitter. To learn about this I need to know what you are thinking as you write. To know what you are thinking you will have to think aloud as you write.”

“Also, as a scientist, I have to keep really good notes about what you do and say. Instead of trying to write everything down I’m going to use an app that lets me video and audio record what you do and say. “

“I will try not to talk when we record. But, I will remind you to talk using a picture on a note card. Can you quickly draw a picture that would help you remember to talk about what you are thinking and doing?”

“After you are done with your tweet we will watch the recording and talk some more about what you were thinking while you were writing your tweet.”

Show student the laptop and iPad and how they record and mirror the screen.

Modeling a Talk Aloud

This part of the protocol is a demonstration of what it might sound like for someone to share their thinking out loud while engaged in a task.

“Let me show you what a talk aloud, or think aloud looks and sounds like. I will write a tweet and talk/think aloud.”

As I start to compose a tweet I will say variations of the listed phrases:

“I’m not sure what I want to say.”

“Maybe something about what I am doing.” [Type I am so excited to be learning with @ [REDACTED] 2ndgrade ! #learn #think]

“Wait, that’s not right. I’m thinking that doesn’t look right. I’m thinking I mixed up account names.” Type @ [REDACTED] 2ndGrade

“Now I have to delete where I messed up.”

“I want to say more about this work. My idea is coming to me from looking around the room” [Type I think I will learn all about how second graders]

“I want the right word here [Type think and learn and write and tweet. #schooliscool]

“I think that sounds good. I am thinking there might be a better word.”

“I am thinking I should reread to see if it makes sense.”

“I notice it’s too long. What can I change to make it fit?”

“I am thinking I will delete these hashtags because I don’t need them. I’m thinking I don’t need them because the message makes sense without them.”

[Type delete #learn #think]

Student Practice

This part of the protocol provided the student an opportunity to practice talking aloud with support. This support was gradually released as the student gained confidence and capacity for the task.

“Now, let’s try together! Help me fix this tweet up some more but let’s think or talk out loud about what we are doing and why we are doing it.”

Gradually release responsibility giving the student full control of the practice session.

“Now you try by yourself: Finish this tweet as you talk about your thinking.”

Student Composing a Tweet

This part of the protocol reminds the student of his/her job as a thinker, talker and writer and the researcher's job as a listener, reminder, and note-taker.

“Remember, I want to know your thinking as you tweet so be sure to talk about your thinking.”

“Also, it will be my job to not talk! This note card will be on the table to remind you to talk about your thinking. Sometimes I will point to the card to remind you to think out loud, but I will not talk.”

“Are you ready?”

Begin recording.

Video Stimulated Recall Interview Data

Video stimulated recall interviews were used as a follow up to talk-alouds to strengthen the validity of analysis done with the talk aloud data (Creswell, 2007; Koro-Ljungberg, Douglas, Therriault, Malcolm, & McNeill, 2013; Kuusela & Pallab 2000). Once the student published his/her tweet I paused and suggested we stand and stretch and walk to the drinking fountain or restroom if needed. Once back in the classroom I explained the next step of our work, the video stimulated recall interview. The laptop ran Camtasia once again, this time to capture the student talking about his/her video. The external microphone was also used. With the talk aloud video queued to watch from the beginning, and Camtasia ready to go, I began by using phrases from the script below.

“Now, let's watch the recording and talk about your thinking!”

“I will playback the video and pause once in a while and ask you what you were thinking when you did something that I want to know more about.”

“It will be my job to only say things like, ‘Tell me more about this, what were you thinking here?’ It will be your job to say as much as you can to help me understand. Shall we do this?”

I will then began recording and started the video playback. At various moments in the video I paused and said, “Tell me more about this, what were you thinking here?” For example, I paused the video when the writer had paused from composing for at least 10 seconds, or “pausal activities” (Schumacher, Klare, Cronin, & Moses, 1984, p. 186). Additionally, I prompted the child to signal when he/she would like to talk about a selection of the video allowing the child agency and ownership in the interview process. I ended the video stimulated recall interview session by saying: “Thank you for all of your help. It was so much fun learning with you!”

Follow-up Prompts

Based on conversations with early elementary students in previous years, I had generated prompts I was likely to pose for better understanding what the children were thinking and doing as they composed tweets. These prompts were similar to those used as follow-up prompts during the talk aloud protocol and the video stimulated recall interviews. These prompts are organized into three categories:

(a) general statements or questions for example,

- “What are you going to tell me when we watch this part?”
- “Tell me about that.”
- “How do you know?”
- “What are you noticing?”

(b) related to transcription from card to tweet, awareness of clear message, audience, and purpose for example,

- “Did you notice how you were looking at your card? Can you tell me what you were thinking about that? As you looked at your card and then typed?”
- “How do you decide what to tweet about?”
- “Who’s going to read your tweet?”

(c) related to specific and unique elements of the social networking site or digital affordances, for example,

- “Talk to me about the red underline, what you know about it?”
- “Notice how it’s in blue? What’s going on there?”
- “I want to know a little bit more about your hashtags.”
- “Where does your tweet go? What’s going on with this?”
- “Okay, what else can you tell me about twitter?”

Student-Written Artifact Data

I expected to collect two written artifacts: (a) a student-generated handwritten draft of text they planned to use as their tweet text, and (b) a screenshot of the coinciding completed tweet published during the talk aloud session. Screenshots were collected using MacBook pro screenshot capabilities (Shift + CTL + 4). Images were automatically downloaded to the MacBook desktop and then relocated to a secure location in the research files. At the time of the data collection, (the last weeks of the school year) the teacher had not been asking her students to write their tweet text draft on a notecard before tweeting. This had become a practice she abandoned in the fall of the school year. To maintain business as usual with students and their current tweeting practices, I did not collect handwritten drafts of tweet text.

Field Notes Data

As I collected and analyzed the data I kept field notes. Following recommendations from Saldaña (2016), these notes were generated in the moment of the tweet session (i.e., task environment elements beyond the keyboard such as environmental print the student may have glanced at) as well as after the session while reflecting on screen capture recordings coupled with transcripts of the talk-aloud protocols and transcripts of the video stimulated recall interviews. As explained in the previous section, the reason this type of data was import for this study had to do with making better sense of the transcript and video data. To illustrate, Figure 10 provides an example of the field notes collected while reading transcripts and watching screen capture video.

Figure 10

Field Notes Example

Seconds start	Seconds end	Description of Activity	code	Talk Aloud text	Notes
0	12	setting up	Pause		
12	13	opens Twitter space	APP		
13	14	taps screen for cursor	CR		
15	16		KS		
16	17	The	KA		
18	19	deleted automatic space	BS		
20	22	i s	TML	this	the word "this" popped up as a black word cloud above the "the" but 531 was not looking at the screen to notice. He was focused on looking at his keyboard for letters.
23	24		SB		
23	24		TM	oh	looks up at screen to see what he's typed. He looks at the laptop, not at the iPad
24	26	deleting to correct spelling	E		
25	26	hit return button	Typing error		looking at laptop screen rather than iPad screen or keyboard, tapping the backspace button, he accidentally typed the return button and sent the cursor moving down the empty typing space.
27	29	delet to move back to word space	BS		Getting back to spot where he will type, deleting "the" that he had left there. He now has a blank typing space to start again.
28	30		ST	"It's confusing me." laughing a little	His statement is based on looking at laptop screen rather than iPad screen. This is causing some confusion.
30	35		RT	"You'll have to keep your eye down here, hu (pointing to iPad screen) Pretend like this isn't here (pointing to laptop screen)	
32	34	T	TSL		

The field note excerpt above, for example, helped me identify a composition move pattern. I also created a document for sorting these notes to identify patterns based on my selected theoretical framework writing processes and composition moves categories. , see Appendix B for example.

Data Analysis

The analysis of data focused on the writing processes and composition moves from the generation of an initial idea through the transcription onto an iPad and onto the Internet as a published tweet. Rather than use a grounded theory approach (because a previous theory or framework is not available for the interpretive work of analysis), this study used a semi-grounded theory approach for data analysis (Corbin & Strauss, 2008; Glaser & Strauss, 1967). As such, the interpretive work of data analysis was initially informed by a theoretical frame, but remained open to new patterns that could extend or refine the existing theoretical framework. Specifically, a modified version of the Hayes (2012) writing processes model (etic codes) and other noticings that did not seem to fit the framework (emic codes) were used to develop a typology of different writing processes and composition moves. This approach is appropriate given my research question is both open-ended (allowing for emic codes) and related to a well established body of research, providing etic codes.

Adapting the Hayes (2012) Model

Seven criteria were used to adapt the Hayes (2012) model to study the online writing processes and composition moves of children. The first three criteria were drawn from Berdanier and Trellinger's (2017) work on developing a method for collecting data of adult's online writing processes. The criteria indicate that a model needs to capture the writing processes' (a) unique task requirements, (b) technological aspects, and (c) behaviors that are observable. The next four criteria were drawn from Hayes and Olinghouse's (2015) work¹ on adapting the Hayes (2012) model for children's writing processes. The criteria indicate that a model needs to capture

¹ Hayes and Olinghouse (2015) suggest careful consideration of four areas of the Hayes (2012) model when adapting for children: (a) transcription, or acts of handwriting/typing, spelling, punctuation and capital letter usage require greater effort from children (b) writing schemas, or strategies used by children to construct text are typically knowledge-telling rather than the more complex knowledge transforming (Bereiter and Scardamalia, 1987) (c) planning, and (d) revising, young children are less likely to employ advanced planning strategies or to revise their text.

the writing processes' (d) transcribing, (e) text structures, (f) advanced planning, and (g) revising.

These seven criteria were then used as a guide to adapt each level of the Hayes (2012) model: the *control*, *process*, and *resource* levels. Because each level includes multiple elements associated with writing, adaptations are presented by level.

The Control Level. Hayes originally represented this level by teasing out four elements associated with shaping and directing the writing activity:

- Motivation: key to the writing process
- Goal Setting: based on what the writer want to achieve
- The Current Plan: includes sub-goals to do the written work, and in memory otherwise it becomes a written plan found in the process level
- Writing Schemas: strategies to produce text, and genre knowledge

By using the criteria listed above, the control levels in Hayes' original model was adapted to those specified in the top section of Table 4 (below). For example, Hayes' original element of the current plan was deleted because of the observable behavior criteria (c). Also, a detailed description of the writing schemas elements was necessary to more accurately code these elements. This description is provided in the section following Table 4.

The Process Level. Hayes originally represented this level by first separating the internal writing processes and external factors that influence them. He delineated four basic internal writing processes:

- Proposer: generates ideas influenced by the external environment, personal experiences, collaborators, goals, etc.

- Translator: forms the non-verbal ideas into verbal representation (for adults, this is often the source for deterring writing fluency)
- Transcriber: forms the verbal ideas into written text, applying spelling, handwriting/typing, capital letters, punctuation (for children, this is often the source for deterring writing fluency)
- Evaluator: checks for accuracy at any stage of writing - rethinking ideas, selecting new words, fixing up what has been written down

The external factors were partitioned into environment and complex activities. The two environmental activities were:

- Physical task environment: technology tools, assignment materials, text written so far
- Social task environment: input at the time of writing - collaborators, verbal comments, distractions in the room that may limit working memory

The two complex activities, each with their own writing schema, employed all or some of the basic processes:

- Planning: in-advance planning and “on-line” planning or planning in-the-moments of composing (the evaluator may not engage entirely)
- Revising: a complex activity with the evaluator front and center

By using the criteria listed above, the process levels in Hayes’ original model were adapted to those specified in the middle section of Table 4. For instance, Hayes’ original elements of the proposer and translator were deleted because of the observable behavior criteria (c).

The Resource Level. Finally, Hayes originally represented this level by fleshing out four ways that writing can be used for problem solving, speaking, and decision making:

- Reading: editing and revision use repeated reading of text, purpose for reading based on task goal
- Attention: aka executive function or executive control, self-regulation, staying focused among distractions
- Long-Term Memory: knowledge of facts, events, schemas, information about a topic
- Working Memory: used to accomplish the current task, short term memory system with two sections a) verbal, and b) visual or spatial

By using the criteria listed above, the resource levels in Hayes' original model was adapted to those specified in the bottom section of Table 4. For example, Hayes' original elements of long-term and working memory were deleted because of the observable behavior criteria (c).

Table 4

Codebook for Children's online writing processes using the Hayes 2012 Cognitive Writing Processes model. This codebook is a modified version of the codebook by Berdanier and Trellinger (2017).

Level	Definition of Level	Sublevel	Code	Definitions
Writing Processes				
Control Level	Monitoring of process overall	Motivation	Motivation	Does the child enjoy this writing?
		Goal setting	Goal(s)	What does the writer want to achieve?
		Planning	In-advanced planning	What planning does the writer do before tweeting?
			In-the-moment planning	What planning does the writer do while tweeting?
		Writing schemas	Genre knowledge fundamental elements	280 character short-form writing, and teacher-assigned student signature
			Genre knowledge secondary elements	photo(s) and a hashtag. Emojis can also be considered secondary elements but are not necessary
			Genre knowledge contextual elements	followers, which can also be considered the audience, likes, cybersafety, and networking.
			Text structure	text structure classifications include both the teacher-assigned text structure and the three child-created expository text structures identified by Hayes (2011).

Table 4 (cont'd)

Level	Definition of Level	Sublevel	Code	Definitions
Composition Moves				
Process Level	Divided into internal and external processes involved in the process of writing text	Composing Processes (Transcription component skills)	Typing emoji	Adds emoji to message
			Typing single letter	Types one letter followed by keyboard search < 2 sec.
			Typing multiple letters	Types many letters without stopping, > 2 sec between letters
			Typing spacebar	Types the spacebar to move forward space
			Typing backspace	Types the delete button to move back a space
			Typing punctuation	Types a form of punctuation or special character
			Typing hashtag	Types a hashtag
			Planning	Planning what to write while writing
		Revision Processes (Evaluating)	Addition of new text	Identification of area needing detail
			Editing	Local editing: word choice, grammar, spelling
			Rewriting	Rewrite a sentence from scratch

Table 4 (cont'd)

			Revising	Alter sentence to add value without rewriting the sentence
			Reorganizing	Moving text around, including copy and paste
			Deleting	Deleting text from document without replacing
		Task Environment (external environment)	Camera	Taking or accessing photo(s)
			Tweet app	Opening space to work on iPad and submitting a tweet
			Keyboard search	Pausing to look for letter/item on the keyboard(s)
			Keyboard open or close	Changing, disappearing and reappearing keyboard
			Keyboard autocomplete	Selecting word suggestion at top of the keyboard
			Cursor reposition	Touching screen to position cursor, including magnifying glass
			Scrolling	Swiping the screen to view content below or above the working area
			Task materials	Looking at the iPad screen (student is not searching the keyboard or reading text.) looking at external sources around the room (e.g., wall posters, classroom objects associated with a learning task)
			Already accessed photo	Looking at the image captured before meeting with me

Table 4 (cont'd)

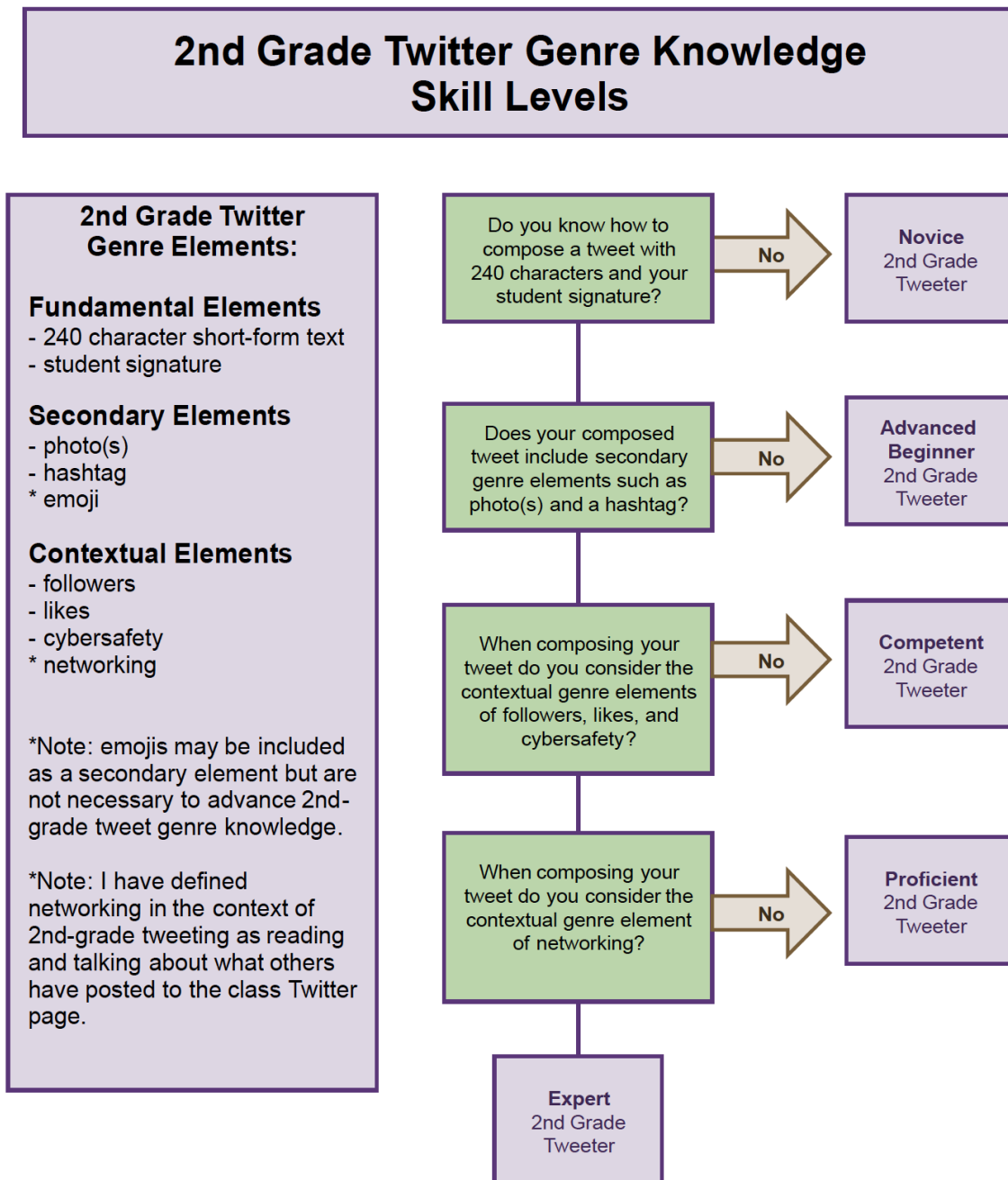
			Writing prompt	Looking at the writing prompt reminder page
Resource Level	Internal memories and general purpose processes that processes at the other level can call on	Resource Level	Reading	Reading followed by a continuation of writing or deciding to submit a tweet
			Attention diverted	Attending to something other than the tweeting task
			Pausing	Cannot observe or identify from the interview the reason for pause

Writing Schemas classification of genre knowledge. Writing schema includes knowledge of both genre elements and text structure. To determine tweet *Genre Knowledge* I used the definition of a tweet found on help.twitter.com, “A message posted to Twitter containing text, photos, a GIF, and/or video.” I also used other genre elements mentioned and or used by students during their tweeting and our discussions. Based on this information, tweet *genre knowledge* for this study includes three categories of increasing knowledge. First, knowledge of fundamental elements: 280 character short-form writing, and teacher-assigned student signature. Next, knowledge of secondary elements: photo(s) and a hashtag. Emojis can also be considered secondary elements but are not necessary to advance the student’s *genre knowledge*. The third category includes contextual elements of Twitter: *followers*, which can also be considered the audience, *likes*, *cybersafety*, and *networking*. These contextual elements are accounted for through conversation with the student and observable behaviors. Knowledge of each contextual element is accounted for when the student communicates the following: *followers* or audience as a known or unknown other that can read their tweet; *Likes* as a form of communication among users; *cyber safety* in the way of following safety lessons taught by their teacher (e.g., measures to maintain anonymity); and *networking* as reading and talking about what others have posted to the class Twitter page.

Modeled after Nathaniel Eliason’s flowchart in his blog post accessed Feb 17, 2019 The Step-by-Step Guide to Go from Novice to Expert in Any Skill, based on the work of Dreyfus and Dreyfus (1980) I constructed a flowchart for 2nd-grade tweeters genre knowledge skill levels. See figure 11.

Figure 11

Flowchart for 2nd-grade tweeters genre knowledge skill levels



*note: error in flowchart (240 characters will be changed to 280 characters)

Writing Schemas classification of Text Structure. To determine student text structure classifications I used both the teacher-assigned text structure and the three child-created expository text structures identified by Hayes (2011).

Teacher-assigned structure: The taught text structure includes a statement about what the student is learning and a second statement about why this learning is important and/or, how this learning will be helpful. Another way to classify text structure is by the three *child-created expository text structures* identified by Hayes. These three structures are listed by increased level of sophistication. First, *flexible focus*, is a stream of consciousness writing with no coordinating theme and the only writer-evaluation to text is to check for a sufficient amount of writing. Next, is the *fixed topic* structure. Every sentence is about the topic and the quality of output, (e.g., spelling, capital letters, word choice) is evaluated by the writer. Finally, in the *topic-elaboration* structure the writer “maintains focus on a general topic but may introduce subtopics related to the main topic” (Hayes & Berninger, p. 13, 2014).

Writing Processes and Composition Moves Analyses

Analyses were conducted to identify the *writing processes* (thoughts made known through talk-alouds and video-stimulated recall), *composition moves* (actions recorded by the screen-capture video and further understood by talk-alouds), and *emergent features* (thoughts and actions from all data sources) of eight second-grade tweeters. Both individual case descriptions and cross-case comparisons were conducted.

Writing processes analysis was informed by the adapted *Control Level* elements in Hayes’ (2012) Cognitive Writing Processes model. Thought units from the talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Composition moves analysis was informed by the adapted *Process and Resource Level* elements in Hayes' (2012) Cognitive Writing Processes model. And, *emergent features* were also accounted for based on what came to light during the data analysis, which were unexpected and noteworthy, extending beyond the *a priori* analyses of *writing processes* and *composition moves*.

For the *composition moves* talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level. The *letter/word/phrase level* analysis was informed by an approach developed by scholars who use miscue analysis to understand reading moves by young readers (e.g., Goodman, 1973; Perl, 1979). As a result, the letter, word and phrase analysis captured every aspect of the case real-time composition moves, which included all the letters, words and phrases composed, deleted, and revised, whether by typing or the iPad making tools available (like the autocomplete and speech-to-text tools). The *complete tweet level* was further divided into two sections: *complete tweet overall* and *complete tweet in thirds*.

The *complete tweet overall* analysis represents second-by-second, real-time composition moves over the course of composing a tweet. These data were displayed as a timeline informed by the work of Berdanier and Trellinger (2017). *Complete tweet overall* data were also categorized by levels of use or percentage of occurrences overall to investigate which of the four categories (*composing, revision processes, task environment, and resource level*) were most frequently coded. To generate a quick way to categorize this information I counted the total number of occurrences across all 27 coded areas of the four categories. From that total, I counted total occurrences for each of the four categories and divided that by the total overall composition moves occurrences to provide a percentage of use. For sorting purposes, categories with 0 to 25% of the total occurrences were ranked low. Categories with 26% to 74% of the total

occurrences were ranked moderate. Categories with 75% to 100% of the total occurrences were ranked high. Finally, the *complete tweet analysis in thirds* composition moves were divided into three time periods (beginning, middle, and final). Dividing the timeline into three equal time periods provided a clustered temporal view of the four composition moves categories. A summary of the occurrence of use in thirds by time was represented as both a table and histogram.

Emergent features analysis was informed by what came to light during the data analysis, which were unexpected and noteworthy, extending beyond the *a priori* analyses of *writing processes* and *composition moves*. One example of an emergent feature is the student's engagement with the autocomplete feature. The autocomplete feature displayed three 'suggested words' s/he could use based on the initial letters keyed in and the previous syntax. The following is an example student explanation of this feature, "It's like, it's the same thing, but, it's different, like different spelling, so, if you're trying to spell a word you could see it up there, if it's up there, you could press on it, and it puts the word up there."

Ethical Considerations

The research methods used for this case study are designed to protect the rights and welfare of research participants. The following sections explain the awareness and management plan for participant potential risks and benefits, privacy, and bias.

Potential Risks and Benefits

There were two possible minor risks associated with participation in this study. The first is fatigue from the 45-minute interviews. The second is missing class time while participating in the study. Safeguards were employed to protect against these risks. To prevent participation fatigue, data collection sessions were limited to a maximum 45-minute talk-aloud session with a

short break to stretch, walk around, have a snack, and use the restroom after the first 20 or 25 minutes. To prevent loss of class time, student participants were not held inside the classroom for data collection purposes during any regularly scheduled recess or lunch break. I worked closely with the cooperating teacher to plan data collection sessions around essential classroom instruction to avoid students missing having make-up work due to their absence from class.

There were several potential benefits for students participating in this study. For example, students may have learned something about online writing and about the scientific process of research. Also, their participation will make a significant contribution to society's emerging understanding of online writing of young children. Long term benefits may be that this research will contribute to the development of new literacies writing curriculum for young children.

Privacy

The study took place in the participants' school. All students enrolled in the 2nd grade classroom were present during the consent process. The cooperating teacher was asked to collect the permission slips as they were returned to school. These forms were sealed in an envelope and sent home with the letter. The teacher was given a folder in which to collect the permission forms. She kept the forms in a locked filing cabinet in the school office until I transported them to a secure location on campus.

Additional privacy measures included using pseudonyms and participant numbers rather than names in association with coded data. Only the principal and secondary investigator had access to the list of participant names, pseudonyms, and corresponding numbers. This information was kept in a locked filing cabinet in the principal researcher's office. Digital files were password protected. These data were initially password protected and stored on a secure

laptop. Final storage of data will be in a locked filing cabinet in the principal investigator's office. These data will be stored for ten years after publication and then destroyed.

Finally, the content of each tweet was published within a secure password-protected class Twitter account. Only those Twitter followers the teacher has allowed to follow her class account can see tweets composed during the data-collection talk-aloud session. Only teacher-assigned numbers for each student are used in the tweets sent from this account. Use of pseudonyms will be used in publications and presentations when tweet content is reported.

The classroom teacher initiated anonymity of tweets at the beginning of the school year. Each student was given a random three-digit number in place of using his/her name in tweets. Parents have been given the three-digit number associated with their child only. If for some reason a parent or child were able to identify another child's three-digit code, I instituted a second authentication factor to ensure anonymity and confidentiality. To do so, I asked the child to include in his/her tweet a new numeric code I assigned. Also, I kept notes on the content of each student's tweet, indicating if the content includes information unique to that student. Examples of those content notes could be: the book they are reading or a topic they are writing about for a class assignment. These tweets could be removed from the pool of case studies if necessary. Based on a recent scan of the existing class Twitter feed, most tweets are about general information that could be associated with any student (e.g., "We are learning to go back and reread because it helps us understand what we are reading."). Given this generality, none of the above actions became necessary.

Bias

In conducting this study, I brought a number of assumptions about writing, technology and children that influenced how the research was carried out. These assumptions have grown

out of my work as a (a) teacher of writing for 4th grade students, (b) regional coordinator for teacher professional development in the teaching of writing, and (c) scholar who reviews and synthesizes research on writing. Specifically, I was influenced by the following:

- Writing is a meaning making process (Nystrand, 2006). An author writes to present an intended message for a reader. This message must make sense and convey meaning for the reader to comprehend.
- New technologies redefine what it means to be a writer (Leu, 2016). Generally, writing has traditionally been defined as words on paper. Using the technologies of today, writing may include multiple modes to convey meaning within one text. For example, in addition to words, a writer may include moving images, audio, and hyperlinks to help convey meaning.
- Writing is a context specific social act (Shaughnessy, 1977). Every instance of writing is embedded in a particular setting and imbued with distinct technologies. For instance, unique to the micro-blogging within the setting of Twitter, this writing may involve re-tweeting someone's writing or composing a coherent message within a 280-character constraint.
- Just as online reading requires new skills, strategies and dispositions (Coiro & Dobler, 2007), the same can be said of online writing. For example, a reader's ability to navigate a three-dimensional space of Internet links while comprehending a message requires skills not necessary for comprehending a paper text. Similarly, when writing within an online space, generating text appropriate for a social media audience and purpose (e.g. hashtags, usernames, embedded URLs) requires knowledge unique to this online writing experience.

- The relationship between technological development and literacy development are “reciprocal co-evolutionary,” (Andrews & Haythornthwaite, 2007). Readers and writers adopt new ways of communicating according to available technologies. For example, the advent of cell phones introduced “texting” as a common technological tool for written communication.
- Children do not develop as writers in predictable and linear progression toward sophistication. Rather, complex and beginning skills develop in tandem (Andrews & Smith, 2011). For example, learning how to construct a complete sentence (beginning skill) while also learning about the importance of communicating an intended message for a specific audience (more advanced skill) can develop in tandem.

By articulating these assumptions, I aimed to be mindful of their potential influence on my data collection and analysis. Without this awareness, confirmation bias (Wason, 1968), was more likely to shape my interpretations so they align with my existing assumptions. To be sure, representing a reality without an imprint of the researcher’s bias is a challenge (Creswell & Poth, 2017). Thus, I consulted the *Qualitative Legitimation Model* as a self-checking precaution (Onwuegbuzie & Leech, 2007).

Chapter 4: Results

To answer the question, “What are the writing processes and composition moves made by second graders when composing tweets for online publication?” a semi-grounded theory analysis was conducted to identify the *writing processes* (thoughts made known through talk-alouds and video-stimulated recall), *composition moves* (actions recorded by the screen-capture video and further understood by talk-alouds), and *emergent features* (thoughts and actions from all data sources) of eight second-grade tweeters. This chapter presents the results of my analysis in three sections: (a) individual-case descriptions, (b) cross-case comparisons, and (c) overall summary. The results in the first section are presented by case, starting with the student pairs who scored highest on the language usage measure, then progressively presenting the next highest-scoring pair, and so on until the lowest-scoring pair is presented. The results in the second section are presented as cross-case comparisons which identify the differences and similarities between the eight cases. The final section presents an overall summary of the data analysis in response to the research question.

Individual-Case Descriptions

In this first section, I present each of the eight cases in five parts. First, I present a *general description* of the student based on observational impressions recorded while working with him or her. Second, I present results of the student’s *writing processes* analysis which is informed by the *Control Level* elements in Hayes’ (2012) Cognitive Writing Processes model. Third, I present results of the student’s *composition moves analysis* which is informed by the *Process and Resource Level* elements in Hayes’ (2012) Cognitive Writing Processes model. Fourth, I present the *emergent features* that came to light during the data analysis, which were unexpected and noteworthy, extending beyond the *a priori* analyses of *writing processes* and

composition moves. Finally, I present a *case summary*, synthesizing the individual-case analysis so a typology can be designed for use in the cross-case comparisons of section two.

Hal: High Scoring Male

General Description

Hal appeared indifferent about meeting with me, neither excited or reluctant. He was, however, curious about the technology set up for data collection and periodically asked “What’s this?”, whether before writing a tweet, after publishing one or during a scroll through the class Twitter feed. When I asked questions, although attentive, Hal sometimes yawned and periodically looked out the window into the hallway outside our meeting room. The analysis of his writing processes and composition moves, however, suggest a more inspired engagement with tweeting.

Writing Processes

Based on the writing process model of Hayes (2012), Hal’s talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Hal’s *motivation* to tweet appeared positive. He seemed motivated by the joy of tweeting and the efficient completion of it by using technological tools. For example, while tweeting, he often smiled after saying the words of a message toward the iPad microphone, then waiting for his words to appear on the screen. His delight may have been more about using the speech-to-text tool than about actually tweeting. But when I asked if he used the speech-to-text tool in class, he bashfully admitted, “No,” then said he used it at home with his grandmother’s phone. When asked if he

liked to tweet he said, “ yes,” because it’s “fun” and it “helps you become a better typer.”

Ironically, the data showed that Hal chose to use the speech-to-text tool more often than his typing skills.

Writing Processes: Goal Setting

Hal expressed two *goals* for tweeting: developing technical skills and creating meaningful messages. When asked about his first goal, he talked about how becoming a better typer would help, “...when you go into high school if you have work that you have to do on your computer you can like type it fast. So you get it done and you don't have to do it like after school.” When commenting about his second goal, he said that tweets should make sense and that the purpose of tweeting is to communicate with others. This intent was most visibly expressed in his awareness of the teacher-established tweeting guidelines. He could recite them from memory, knowing he should tweet about something he is learning (e.g., “This is my giraffe”) and how it will help him (e.g., “it will help me become a better builder”).

Writing Processes: Planning

Hal’s *planning* included both *in-advance* and *in-the-moment* planning. In both cases, he followed the teacher’s tweet format from memory and added ideas as he created his message. Evidence of Hal’s *in-advance* planning occurred when he selected an object and took a photo of it to go with his tweet, using the object and photo as tools for advanced planning. When asked how he came up with ideas for tweeting he said, “We mostly just think, then we take a picture of what we want to do, and then we start tweeting about it.” Evidence of Hal’s *in-the-moment* planning appeared when he added a second sentence to a tweet and struggled to generate an idea. My suggestion to look at his photo helped as he quickly started generating text (using the speech-to-text feature) that giraffes live in rainforests, something he learned from reading a book.

Writing Processes: Writing Schemas

Hal's thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. For starters, Hal displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. When he wanted to include an emoji in a tweet, but could not find one to match the meaning of the text, he decided that emoji-use would not enhance his message. Conversely, when the hashtag and photo Hal included in his tweet matched the meaning of the text, with little explanation necessary, he assumed that the audience would understand their meaning. And furthermore, the photo he included extended the text's meaning by showing that the giraffe was built with Legos, which was something not stated in the text. Interestingly, Hal did not include an explanation of the other items in the photo and how they may or may not be related to the Lego building.

Writing schemas: contextual elements. Hal displayed knowledge of four contextual elements as he tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, without saying the word "*followers*," Hal showed an awareness of his audience (as both known and unknown others) by using the word "everyone" when asked who reads his tweets. When asked about "*likes*," Hal said he could "like" his tweet but "you are not allowed to 'cause their iPad senses it." When it came to *cybersafety* protocols, Hal acted in ways consistent with the protocols established by his teacher. And when it came to the contextual element of "*networking*," Hal talked about how networking figured into his reading and learning from other tweets. For example, after publishing his tweet, Hal quickly started scrolling through the class twitter feed to see what others had posted. He paused at one post showing the cover of a book

about otters and asked, “Who tweeted about sea otters?” He then read the associated text aloud and questioned who might have posted the tweet based on how it was written.

Writing schemas: text structure. Hal’s completed tweet was characteristic of a *fixed topic text structure*. His topic was the giraffe. Although his second sentence is about giraffes it does not extend his initial statement about building a giraffe. Following the teacher-established guidelines to tweet about what he is learning and why or how this learning would be helpful, Hal did not explicitly say that he was learning about a STEM-related concept. Instead, he described what was in his photo, again assuming his reader would understand how building an object with Legos will help him learn about STEM-related concepts.

Composition Moves

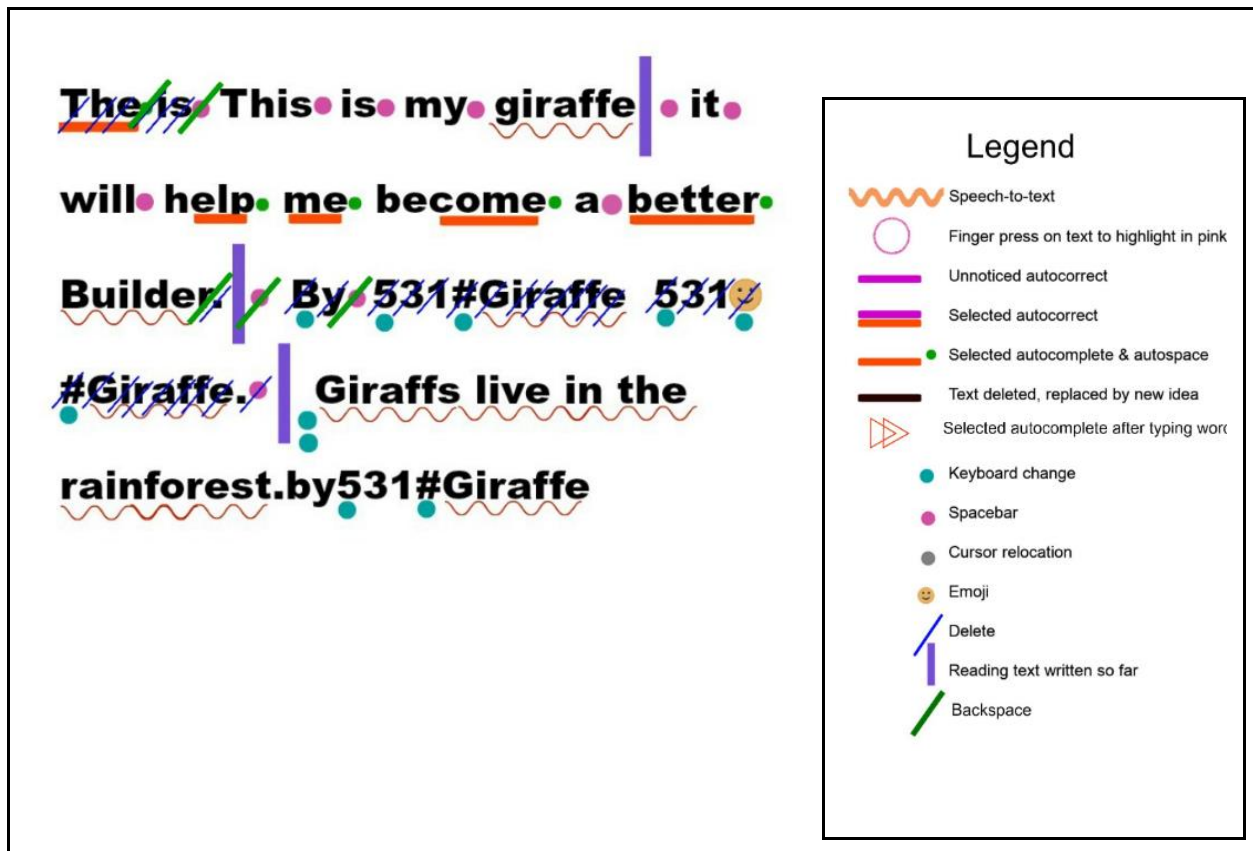
Based on the composition move model of Hayes (2012), Hal’s talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis.

Based on the screen-capture and talk-aloud data, the analysis of Hal’s letters, words and phrases was informed by an approach developed by scholars who use miscue analysis to understand reading moves by young readers (e.g., Goodman, 1973) and the composing style sheets created by Sondra Perl (1979). As a result, the letter, word and phrase analysis (see Figure 12) captured every aspect of Hal’s flow-of-composing which included all the letters, words and phrases he composed, deleted, and revised, whether by his typing or the iPad making tools available (like the autocomplete and speech-to-text tools). To illustrate, Figure 12 represents his revising with blue delete marks. And the points where Hal reread are shown as vertical purple marks. A detailed account of Hal’s letter, word, and phrase composition moves follow.

Figure 12

Hal's letter/word/phrase flow-of-composing



Hal started his tweet by immediately selecting the word “the” from the autocomplete choices. He then deleted the automatic space and typed the letters “is.” The text read, “theis.” His intention was to type the word “this.” Hal noticed the text was underlined in red and deleted “theis” entirely to restart his tweet. His second attempt started with a quick typing of “This is my” followed by a pause. Then in a whispered voice, he asked me how to spell “giraffe.” I started to say I would help him. But he interrupted, suggesting the iPad’s microphone could be used. I asked whether he had used it before. He nodded *no*. I asked if he wanted to try it. He nodded yes. Like an experienced expert with the technology, Hal pressed the microphone button, said “giraffe,” then pressed the word “done” under the voice screen. His quick and confident

actions suggested that using the microphone was not new for him. Later he admitted he was not allowed to use it in class, but that he had used the mic on his grandmother's device at home.

After "giraffe" appeared on the screen, Hal reread his text and began typing again.

Hal typed "it will h" then selected the word "help" in the autocomplete bar followed by selecting the word "me" from the refreshed autocomplete bar. He then typed, while saying aloud, "be" and then selected "become" from the autocomplete bar, saying aloud, "become." It was not clear if he intended to use the word "become" because it was always his plan or because he noticed it in the autocomplete bar. Hal then typed "a" and selected "better" from the autocomplete bar. He paused a moment, rubbed his eye and without hesitating used the microphone to create the word "builder." He stacked his right arm across his left, rested his chin on top of his cupped hand, then waited for the word to appear. Once the word popped up (with a capital B) he said it aloud, "builder," then added a period. Once finished, Hal reread the entire text he'd written, "This is my giraffe. It will help me become a better builder." While rereading, he added a space after his punctuation mark and then muttered, "no" while deleting the space putting the cursor back next to the period. He then spoke under his breath, while pressing the up-arrow key for capital letters, "By" as if a question, looking to me for permission to commence typing the standard closing to his tweet.

At this point, two minutes and 15 seconds had passed since Hal started drafting his tweet. I responded, "If you are ready for that." He quickly typed "By" followed by a space then he backspaced adding his assigned Twitter number, 531. Again, without adding a space he typed the hashtag (i.e., #) character and spoke the word "giraffe" into the microphone. Once the word appeared in his tweet text box he sat back in his chair and announced he was done. The process to this point took Hal two minutes and 44 seconds.

The procedures for tweeting in this classroom prompted students to check with their teacher before publishing their tweet. As Hal sat back in his chair, swinging his feet, I asked, “Now what?” He looked at me as if I asked a trick question, shrugged his shoulders and said, as if unsure, “We’re done?” I said, “okay” asking if there was anything he wanted to add to his tweet. He said, “no.” I followed up by asking, “How do you know when it’s ready to go?” He said, “You do, by 531 and then you can do a hashtag or something.” Then he said, “Oh,” reaching toward the iPad, “I can do an emoji.”

Hal started deleting his hashtag text. He deleted more than intended so he retyped his number, “531.” Without adding a space after “531” he opened the emoji keyboard and started scrolling to find a giraffe. He pressed the icon for animal emojis and scrolled left to view the available animal emojis. He did not see a giraffe so he closed the emoji keyboard, opened the alphabet keyboard and then the character keyboard. He typed the hashtag character and used the microphone for the word “giraffe.” Because it looked like he considered his work done, I asked if he added his picture. Being reminded, he quickly accessed the photos and selected his previously captured image. I asked if he had forgotten his picture before. He said “no,” suggesting his forgetting of the picture, in this case, could have been created by the interview context.

Returning to what I knew to be the classroom procedures for tweeting, I wanted to learn more about Hal’s writing processes and composition moves, so I asked, “Are there any words you need help with in your tweet?” Looking over his text he replied, “no.” I followed up, “Do you have any questions or do you want me to check anything before you send it off?” He scratched his back and thought a moment, “I want you to check if I spelled... ‘become,’ no wait, I know I spelled it right.” I asked how he knew. “Because I can sound it out, [he said while

pointing to the word he named the letters] ‘b e e c o m e.’” It wasn’t clear why he named the letter “e” twice. Relatedly, it wasn’t clear why he thought to name the letters connected to sounding the word out. I asked if he wanted me to check any other parts of his work and he replied by asking if he needed to put a period anywhere. It looked like he was thinking through the expectations of checking his work established by his teacher. Confirming his punctuation I said, “I know you are supposed to have more than one sentence. Do you have more than one sentence?” Hal shook his head and said he would make another sentence. He started deleting the end of his tweet, “.By531#Giraffe”. I asked why. He explained, “I have to delete them because if we do that [the standard closing that includes the assigned Twitter number and a self-selected hashtag] it’s the end of the tweet.” He then thought for a moment about what to type next. I suggested he reread his text so far. After reading he thought for a moment and said, “I can’t figure out anything else.”

At this point, I prompted Hal by asking, “Is there anything about being a builder that you could add? And then quickly added, “What are some of the strategies you use to help yourself think of ideas?” After admitting with frustration that he did not know I continued, “I know that a lot of kiddos say they look at the picture and that helps them get ideas. Do you want to look at your picture?” Hal looked at his picture and quickly opened the keyboard to type his idea. He pressed on the microphone and said, “Giraffes live in the rainforest.” I asked Hal if he wanted to tell his readers how he knows what he has written is true. He said, “We don’t usually do that.” I asked why and he replied with a shrug, “I don’t know.” I told him he could add it if he wanted to and he said that he didn’t want to. To finish up his tweet he added his end punctuation and then, without adding a space, typed “by531#” and then used the microphone to add the word “giraffe.” At this point, he had been working on his tweet for 8 minutes and 12 seconds.

As I looked over the real-time text generation letter/word/phrase-level analysis of Hal's tweet I noticed frequent changes in keyboards. He easily switched back and forth from the letter to numeric keyboards. I also noticed he moved to the special character keyboard to access the hashtag rather than returning to the letter keyboard where the hashtag is more easily accessed. Furthermore, Hal closed his keyboard to exit the emoji keyboard, then reopened the keyboard to access letters. Taken together, these moves suggest Hal made use of inefficient keyboard routines.

The prominent patterns observed in the letter/word/phrase level analysis of Hal's composition moves include both efficient and inefficient technology use. Working to maximize efficiency, more than half of Hal's tweet is 'produced' by the text generation tools that accompany Twitter (aspects of the task environment). For instance, Hal used autocomplete for four of the five consecutive words in his first sentence. He then used speech-to-text to generate words he was not sure how to spell and his entire second sentence. Inefficient technology use is found in less prominent patterns with text deletion and keyboard switching. For instance, Hal deleted entire sections of text rather than repositioning his cursor to preserve his valediction text which he typed and retyped three times. Hal also "took the long way" with keyboard changes to access needed functions.

Composition Moves: Complete Tweet Analysis

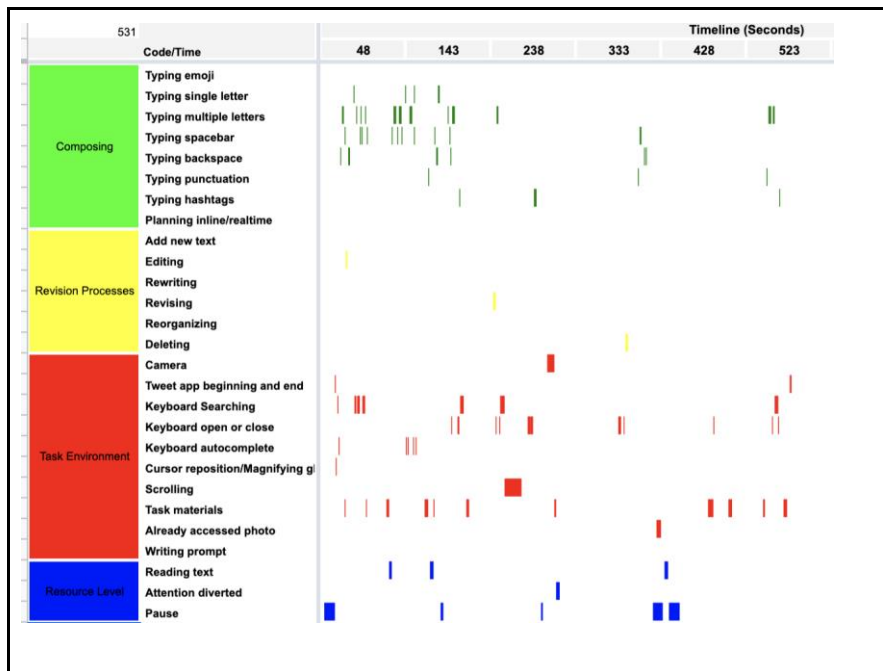
Based on the screen-capture data, the analysis of Hal's complete tweet was informed by a model of composition moves developed by Hayes (2012) and adapted by Berdanier and Trellinger (2017). The model provides a systematic way to code the salient features of real-time composition moves. Based on a careful review of the literature and pilot work, the codebook

developed for this analysis made use of four composition move elements: *composing*, *revision processes*, *task environment*, and *resource level*.

As can be seen in Figure 13, the complete tweet analysis used a timeline to represent Hal's second-by-second, real-time composition moves over the course of composing his tweet. Moving from left to right for each code, a colored bar represents the duration of a composition move element, while the white space along the timeline (i.e., which is not occupied by a colored bar) indicates the duration of a talk-aloud moment. The green bars indicate the observed duration of a *composing* move, which included eight subcategories of composing: typing emoji, typing single letter, typing multiple letters, typing spacebar, typing backspace, typing punctuation, typing hashtags, and in-the-moment planning. The yellow bars indicate the observed duration of *revision processes* moves, which included six subcategories: addition of new text, editing, rewriting, revising, reorganizing, and deleting. The red bars indicate the observed duration of *task environment* moves, which included ten subcategories: camera, tweet app beginning and end, keyboard searching, keyboard open or close, keyboard autocomplete, cursor position/magnifying glass, scrolling, task materials, already accessed photo, and writing prompt. Finally, the blue bars indicate the observed duration of *resource level* moves, which included three subcategories: reading text, attention diverted, and pause. Taken together, this view of the data permits a visual analysis of Hal's composition moves over time.

Figure 13

Hal's Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure13 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* like complete words “will” or chunks of a word “be” in the word “become” (n=12) and *typing spacebar* after typing a word (n=11). These frequencies indicate there were twelve instances when Hal typed multiple letters without stopping and eleven instances when Hal tapped the spacebar. The appearance of both happened quickly as if they were automatic composition moves for Hal. In addition, his *typing backspace* occurred five times (to reposition the cursor) and his *typing single letter* occurred four times (three times to activate the autocomplete suggestions, one time to type a single letter word, “a”). Further, Hal’s composing included three occurrences of *typing punctuation* and three of *typing hashtags*, but after revisions, his final tweet included only two punctuation marks and one hashtag. Finally, *planning*

in-the-moment was observed when Hal spontaneously added a sentence about giraffes living in the rainforest to the end of his tweet. Although Hal considered it, *typing emoji* was not evidenced in his composition moves.

The *revision processes* section of Figure 13 (colored yellow) shows only one instance each of the *editing*, *revising*, and *deleting* composition moves in the tweet. The *editing* move occurred when correcting the spelling of the first word added to his tweet. *Revising* occurred when Hal noticed he could add an emoji to the tweet. And *deleting* occurred when the hashtag text used to search for a giraffe emoji yielded nothing, Hal decided to leave an emoji out of his tweet, and thus deleted the search word “giraffe” and retyped it as a hashtag text in the tweet itself. The other three *revision processes* codes (*add new text*, *rewriting*, *reorganizing*) were not evidenced in his composition moves.

For the *task environment* section of Figure 13 (colored red), the most frequently occurring composition moves were keeping the *keyboard open or close* to access the microphone and keyboards (n=10), and using *task materials* that were ‘outside,’ but interoperable with, the Twitter app, such as the speech-to-text microphone, which Hal first used to spell the unknown words “giraffe” and “Builder,” and later to add several words to the second sentence in his tweet (n=14). In addition, he engaged in *keyboard searching* to find needed letters seven times and used the *keyboard autocomplete* tool five times. Hal accessed the *tweet app beginning and end* twice, first when he started tweeting and again when he submitted his tweet. Finally, Hal accessed the *camera* to add his previously taken photo to the tweet, engaged in *scrolling* for an emoji, looked at his *already accessed photo* and had a hand in *repositioning his cursor* one time each. *Writing prompt* was the only *task environment* code not evidenced in his composition moves.

Finally, the *resource level* section of Figure 13 (colored blue), shows there were three occurrences of *rereading text*, twice during the first few minutes of his composing and again before submitting to publish. He had his *attention diverted* only once, it was around the midpoint of his composing time. He noticed another student walking through the hallway and stopped to watch him. Hal quickly returned to his composing work. Five *pauses* were recorded, once before the tweeting started, twice toward the end of tweeting and twice around the midpoint of his composing, all of which appeared to be moments of thinking.

Complete tweet analysis: In thirds. Hal's composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 5 and Figure 14. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

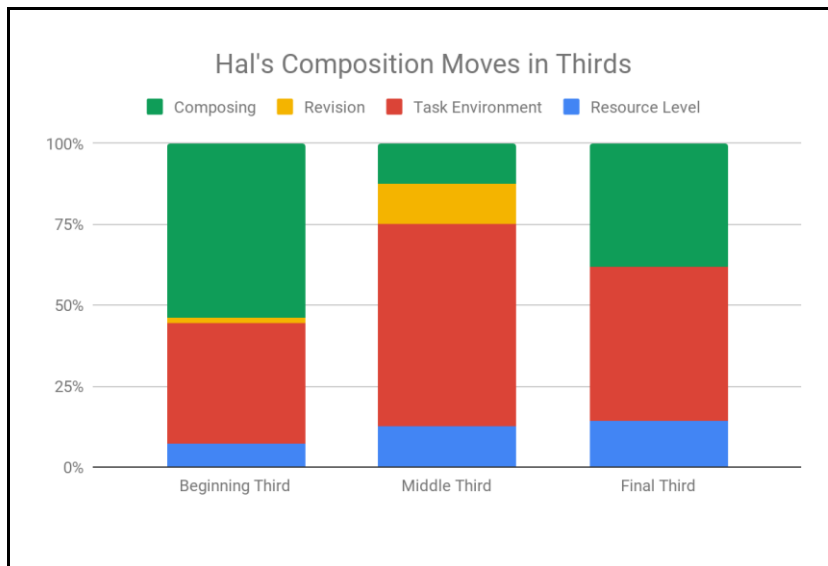
Table 5

Summary of Hal's Composition Moves frequency-of-use in thirds

	Beginning Third %	Middle Third %	Final Third %	Total %
Composing	32	2	9	43
Revision	1	2	0	3
Task Environment	22	11	11	44
Resource level	5	2	3	10
Total %	60	17	23	100

Figure 14

Hal's composition moves in thirds



The composition moves in the beginning third of Hal's tweet focused on getting something written down. He concentrated most of his composing within the beginning third of his timeline, quickly typing his message as if following a well-practiced protocol for composing a tweet about what he has learned and how it will help him. During the beginning third *task environment* elements were less frequently accessed. Also, during this time Hal did a lot of *keyboard searching* and used the *keyboard autocomplete*. *Revision* elements and *resource level* elements were of low use, *editing* once, *reading* twice and *pausing* once during the beginning third.

Hal's moves during the middle third continued the work of getting something written down using the *task materials* for speech-to-text and *keyboard autocomplete* features. Hal also frequently used the *keyboard open and closed* during this time, aligning with when Hal decided to add an *emoji*, retyping his ending text which included letters, numbers, and the hashtag, each accessed from its own keyboard. It makes sense that the largest amount of *revision* occurred

during the middle third of Hal's composition moves. By this time he had developed some writing to be manipulated and during his final third the text was generated using speech-to-text. For this reason, he may not have considered the text as something to revise. After *pausing* once, Hal had his *attention diverted* during this time.

The final third of Hal's composition moves included *multi-letter* and *single letter* typing and *punctuation* as Hal finished his message. This time also included looking at his *already accessed photo* when thinking of what to add to his tweet, then generating a final sentence using the *task materials* speech-to-text feature. Hal ended his composition moves *reading* once before publishing his tweet and *pausing* twice.

Emergent Features

Based on all the data gathered from Hal, three additional elements were identified in Hal's use of tweet-composing technology. These elements were categorized as emergent findings. During our conversations, Hal seemed confident in explaining different aspects of the technology used to compose his tweet. Even when it was apparent that he did not know specifics of a particular feature he confidently created an explanation. Two examples are *reading URLs* and *magnifying glass activation*. A third feature was Hal's use of language when talking about the *technology as knowing-other*.

Reading URLs

After publishing his tweet, Hal scrolled through the class Twitter feed stopping to read what his classmates posted. While scrolling he noticed a tweet from a teacher that his class follows. Reading the tweet aloud, he sounded out all the letters in the embedded URL as if decoding an unknown and challenging word. I asked, pointing to the URL, "What do you think all that is, that's in blue there and ends right there?" After a long pause, he replied with

confidence, “Important words.” Hal’s response is a reminder about misconceptions and what students need to learn related to genre knowledge. He believed the URL represented important words.

Magnifying Glass Activation

While watching the video of Hal’s tweeting I paused and asked Hal about the black box showing the word “this” above his typed word “theis.” He replied, “Oh! There's that black button and I could have umm just like pushed that but I didn't notice it was there.” After Hal explained the red underline indicates a misspelled word I asked him what he does to help himself with these words. He said he keeps on tweeting his ideas then goes back to fix the words. Then he demonstrated his emergent understanding of the technology, “I can keep on tweeting and then I could do this, [he presses down on the misspelled word, and nothing happens] oh, probably [what he’s trying to demonstrate is not working] because I have to do a period.” He added a period then pressed down on the word again, and the magnifying glass bubble appeared. The magnifying glass bubble allowed Hal to see his word up close and position his cursor within the letters to make corrections. His misconception that a punctuation mark like a period was needed to activate the magnifying glass bubble illustrated that his understanding of the feature was not fully developed.

Technology as a Knowing-Other

During our conversation about “liking” tweets, Hal explained why people do not “like” their own tweets explaining, “Because they umm aren't allowed to cuz their iPad senses it.” This is an example of Hal’s language addressing the technology as a “knowing other.” He also used this language when talking about the red underline used to indicate a spelling miscue, “Because it doesn't know I don't know how to spell tow.” Hal’s statements that associated the keyboard

technology as a “knowing other” (or a writing partner) was only obvious after multiple viewings of the screen capture and talk aloud data. I suspect Hal’s language may indicate something about his approach to create a concrete explanation to an abstract concept or anthropomorphising technology (Bernstein & Crowley, 2008; Heider & Simmel, 1944).

Summary of Hal -- Overall

The data interpreted for Hal resulted in a profile that indicates he is a resourceful and efficient, just-get-it-done type tweeter with some inefficient routines. For Hal’s *writing processes* he seemed *motivated* by the enjoyment of the task and the efficiency of the technology. His *tweeting goals* included developing technical skills and writing a coherent message. Hal *planned* his tweet content before writing and required some support for in-the-moment plans while writing. He used *genre knowledge* to compose short-form writing including a photo and hashtag within a *fixed topic text structure* and showed a growing understanding of *followers, likes, cybersafety*, and *networking*. Hal’s *composition moves* were dominated by *composing* (transcription component skills) and *task environment* components associated with the keyboard and task materials. Hal navigated the iPad keyboard quickly and confidently, *typing multiple letters* in a word quickly. He *edited* misspelled words but did not edit the capital letter miscues. He *revised* his text to enhance meaning with an *emoji* and used the *autocomplete* tool often. Hal’s inefficient routines include excessive keyboard switching and deleting entire text chunks that were later retyped rather than *repositioning his cursor* to change his text. Finally, Hal has an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Hope: High Scoring Female

General Description

Hope's body language gave the appearance of comfort, confidence, and a down-to-business seriousness while working with me. For instance, when getting started, she positioned herself on the chair next to me, lounging back a bit, her left elbow resting on the back of her chair. Eventually, Hope dropped her elbow off the seatback to rest her left hand in her lap. When asked about her thinking, she smiled as she provided clear and detailed explanations. Her high comfort-level at the beginning of our time together matched the level of seriousness she employed as she composed her tweet. She leaned into the tabletop, focused solely on the iPad. As instructed, Hope talked aloud as she worked on her tweet but did not ask questions or initiate conversation. It was not until after publishing her tweet that she again relaxed. Swinging her feet and quickly tapping her left and right index fingers on her chair arms, she attentively responded to all of my interview questions. The analysis of Hope's writing processes and composition moves confirmed her confident and serious engagement with tweeting.

Writing Processes

Based on the writing process work of Hayes (2012), Hope's video-stimulated recall and talk-aloud data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), like Hal, Hope's *motivation* to tweet appeared positive. She quickly engaged in her work and enjoyed talking to me about Twitter and her own tweeting. Early on, Hope made statements about being motivated by feedback from her readers. When asked about what she wanted her readers to think when they

read her tweet, she said, “I hope they think like it's really good and they might not know about the comments and stuff but they might still like it so they can learn about different things.”

During our conversation, Hope frequently mentioned other people “liking” tweets. Thus, her motivation to tweet seemed linked to the act of sharing and responding with others.

Writing Processes: Goal Setting

Hope expressed three *goals* for tweeting: creating meaningful messages, capturing the reader’s interest, and teaching her readers. When asked about her first goal, Hope spoke from memory about following the teacher-established tweet expectation: to tweet about something she is learning and how it will help her. When asked about her second goal she showed an awareness of her readers and the importance of engaging them with interesting tweet topics saying, “If we keep on repeating we wouldn't keep getting more likes and if we get new things it will be interesting” When asked about the third goal she said she hoped her readers would “learn about different things” from her tweets.

Writing Processes: Planning

Hope’s *planning* included both in-advance and in-the-moment planning. Evidence of her *in-advance planning* occurred when talking with a partner about tweet ideas and generating tweet topic possibilities over time, in anticipation for what she might writing on different days. When asked about the topic she tweeted while working with me she said, “Umm, I haven't done [tweeted about] this before and I've been wanting to [tweet about the Twitter checklist] but I just keep on forgetting, and, I don't want to really tweet about anything else.” To begin tweeting she said, “I’ll start with my picture so I don’t forget what I am writing about.” Once the picture posted in the tweet box she paused a short moment before beginning to tweet using the photo of the tweet checklist as a reminder of what she planned to tweet about. Evidence of Hope’s *in-the-*

moment planning appeared when she generated specific ideas, words, and emojis to create her message. For instance, in her sentence that read, “This helped me in 2nd grade by showing me the” she paused to consider the next word, deciding on “steps”. She also added an emoji to the end of this first sentence, making sure her emoji selection matched the meaning of her message.

Writing Processes: Writing Schemas

Hope’s thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. Hope displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. The photo Hope included was an image of the class Twitter sheet, which provided a checklist for students to check their tweet before publishing. Hope’s hashtag matched her photo: “#twittersheet”. She explained *hashtags* as a “title” that “goes at the end [of a tweet]” and is a few words “stuck together” with “no spaces in it, and it’s about what that message was.” Hope’s emoji selection was a smile with jazz hands. When I asked her to tell me about emoji selection she said, “We use emojis to show like some feelings so we could show them how we feel.” She also said she does not use an emoji every time she tweets because, “some don’t match and you don’t really feel like emojis on that tweet, even though there’s a matching one you don’t feel like it.” This statement indicates Hope’s awareness of emojis as an elective communication tool that when used, should match the meaning of the text.

Writing schemas: contextual elements. Hope displayed knowledge of four contextual elements as she tweeted: *followers*, *likes*, *cybersafety*, and *networking*. As mentioned in a previous section, Hope’s awareness of *followers* related to her topic selection and planning. She also talked about the need to choose words based on the possible reading needs of her followers.

When asked why she typed “2nd” rather than the word “second” she replied, “Well, it would be quicker and I could do it, well, so, some kids that don't really know how to spell the word second umm, they use a 2 so I did that in case the kids look without their parents on here, so they can read it.” Hope also talked about adults as followers. For instance, when talking about the tweet chart as her writing topic she said, “they [followers] might learn from it and use it as well, especially teachers, they could also use it.” She added, “The whole entire world” could read her tweet. When I asked how she knows other people read her tweets she told me about *likes*, “I know that they read it, and sometimes I am really 100% sure because people have liked it [her tweet] and put comments in it.” Specific to *cybersafety*, Hope explained the possible effects of placing a personal name in a tweet, “So, I can't put names in there unless it's about a thing and so if I put my name someone could, like get ... do something and find me and do some really bad things to us if we put names in there.” When asked about *networking*, Hope talked about connecting with other students around an activity she called “tweet of the day,” where other classes post problems and they tweet back with possible solutions. She talked about other teachers and students commenting back to her class. She also mentioned an example of students from a different class posting comments to tweets from her class, “One said we like your book and then [added the picture of] this little green guy, a monster [with] books [that] kept falling down his mouth. It kept on replaying and replaying.” Without using the term, Hope was describing a GIF.

Writing schemas: text structure. Hope's completed tweet was characteristic of a *fixed topic text structure*. Her topic was the Twitter sheet. Following the teacher-established guidelines to tweet about what she is learning and why or how this learning will be helpful Hope explained that the Twitter sheet is helpful by showing her the steps to tweet. She ended her tweet stating

what was in her photo, “This is called the Twitter sheet.” The content of Hope’s tweet did not explicitly communicate that she learned to tweet or that she learned to use the Twitter sheet. Similar to Hal, she names the object in her photo, assuming the reader knows this is what she is learning. Unlike Hal, Hope’s tweet photo does not include additional items, thus requiring the reader to infer what Hope was learning.

Composition Moves

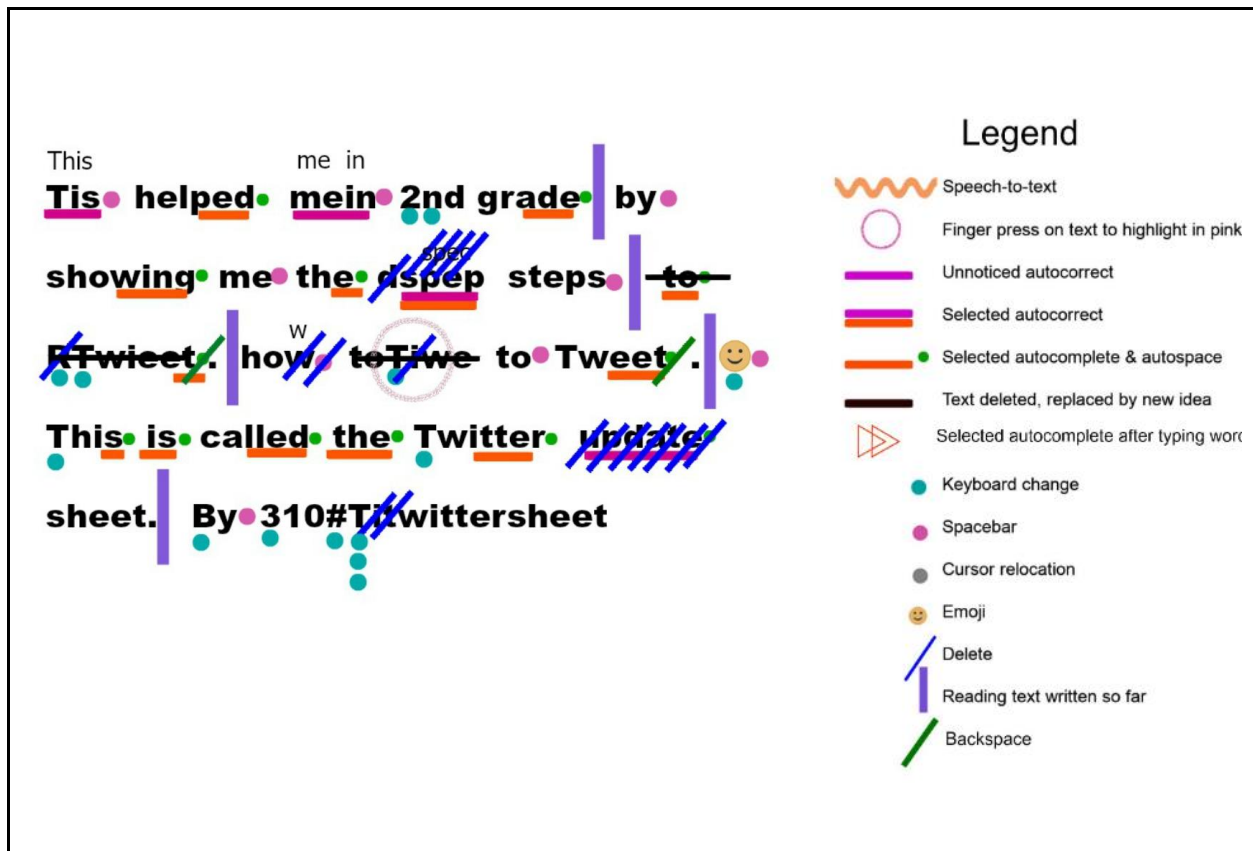
Based on the composition move model of Hayes (2012), Hope’s talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Hope’s letters, words, and phrases captured every aspect of Hope’s real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). To illustrate, Figure 15 represents Hope’s revising with blue delete marks and black horizontal lines through text. And, the points in where she and a space are shown as dark pink circles. A detailed account of Hope’s letter, word, and phrase composition moves follow.

Figure 15

Hope's letter, word, phrase flow-of-composing



Hope started her tweeting by adding her previously taken photo saying, “I’m going to start with a picture so I don’t forget what I’m writing about.” Once the photo appeared she immediately said the word “this” and with eyes fixed on her keyboard, she typed, “T i s” followed by the spacebar. Once she pressed the spacebar the autocorrect suggestion of “this” automatically appeared in her text. Typing her next word, Hope added “h e l,” then paused, looking at the autocomplete bar and selected “helped.” Next, she typed, without looking away from the keyboard, “mein” then the spacebar. Again, once she pressed the spacebar the text autocorrected to “me in”. She switched to the number keyboard, typed “2” then returned to the alphabet keyboard adding “nd”. While typing the word “grade” Hope typed “gr” then used the

autocomplete tool. Next, Hope looked up at the computer screen to see her text for the first time. At this point, she had typed six words of her sentence.

During our interview, I asked Hope to explain what she did with the autocomplete. She replied, “Umm, so, I pressed on it, because it would be quicker to spell than just like trying to find the words. It has it spelled up there [pointing to the top of the keyboard] so I can just click on it and then it shows up.” When I asked her what made the words appear she said, “I started spelling it and ‘grade’ starts with ‘gr’ so it came up.” When I asked how she learned about the autocomplete tool she replied, “Well, I just figured it out on my own, I didn’t really learn it in class.” Similar to Hal, she has discovered if she types the first few letters of her intended word the autocomplete will provide the complete word.

After speaking with me, Hope read the text she had written so far and then quickly added “by showing me the” using the autocomplete for “showing” and “the.” Hope paused for a short moment, then typed “steps”. When typing “steps” she typed then quickly deleted the letter “d” then typed “s” quietly saying the word “steps”. The next letter typed was a “p”, maybe because she had just said aloud the word steps and “p” was a dominant sound in her thinking. She carried on typing steps without noticing the “p” was in place of a “t”. The letters “spep” appeared on the screen, highlighted in blue. The autocomplete choice showed “spec” and Hope quickly selected it. Next, Hope looked at the screen and deleted “spec.”. She then quickly typed “steps,” sounding out the word as she typed. When I asked what had just happened, she replied, “I was thinking how to spell steps but I put a ‘p’ instead of a ‘t.’” When I asked how she noticed that she put a “p” instead of a “t” she said, “I thought about it to see if it was right and it wasn’t right so I went back and fixed it.” After this exchange she went back to work, first rereading the text so far and adding the rest of her sentence.

Hope used the autocomplete tool to add the word “to” then pressed the up-arrow key to show the capital letter keyboard and typed “R”, quickly deleting this letter, changing it to “T”. This may have been a common typing error given the location of the “r” and “t” on the keyboard and how quickly she made the adjustment. After typing the “T” she added “w i”, again as if using a well-known routine for typing “Twitter.” Hope paused a moment to look at the iPad screen, noticing an error, then deleting the “i”, quickly replacing it with “ee” then finishing the word using autocomplete. Hope noticed the autocomplete also automatically added a space after the word “Tweet” and pressed backspace before adding a period. At this point, two minutes and 55 seconds had passed since Hope started drafting her tweet.

After completing this sentence Hope reread, deciding she wanted to revise her sentence by adding the word “how.” Rather than moving her cursor to the location of the word she deleted the text up to the location where she wanted to add her new word. After typing “how” she typed “to” and without adding a space typed “Twi” (again adding the “i” automatically after the “w”). Hope deleted the “i” and typed the letter “e.” Before adding the next letter she pressed her index finger to the iPad screen where the text read “toTwe”. She was trying to position her cursor to add a space between her words. Instead of her cursor positioning, the text “toTwe” highlighted in pink and three suggestions in black boxes appeared above the pink highlight. These boxes read “tot we”, “tote”, and “toTe”. Ignoring these words she simply deleted the pink highlighted text, pressing the delete multiple times as if to delete each letter individually. Once she noticed the “w” in the word “how” was deleted she stopped deleting, quickly added the “w” followed by a space and then typed “to” followed by a space. Once Hope typed the capital “T” followed by “w” the autocomplete words appeared including the word “Tweet.” Hope selected this word, deleted the automatic space and typed a period.

Hope reread her sentence and decided to add an emoji. She did not place a space between the period and her selected emoji. She paused for a moment. She pressed the spacebar and started typing her next sentence. Hope typed “This is called the” using autocomplete for all four words. When typing the next two words, “Twitter sheet,” Hope used autocomplete for the word Twitter. The autocomplete added the selected word, “Twitter” followed by the unoffered, unselected word, “update.” Hope’s sentence now read, “This is called the Twitter update.” Hope quickly noticed and deleted the word “update.” She then typed “shee,” paused to look for her intended word across the autocomplete choices, then typed the letter “t” and a period. Hope reread her tweet, pausing to decide her next move. Without adding a space after her punctuation she typed “By” followed by pressing the spacebar, then typed “310” moving quickly from the letter keyboard to the numeric keyboard to the character keyboard and typed “#,” quickly returning to the numeric then letter keyboard, finally typing the letters to her hashtag, “Twittersheet.” This tweet, along with my questions and her answers, took Hope six minutes and 52 seconds to complete.

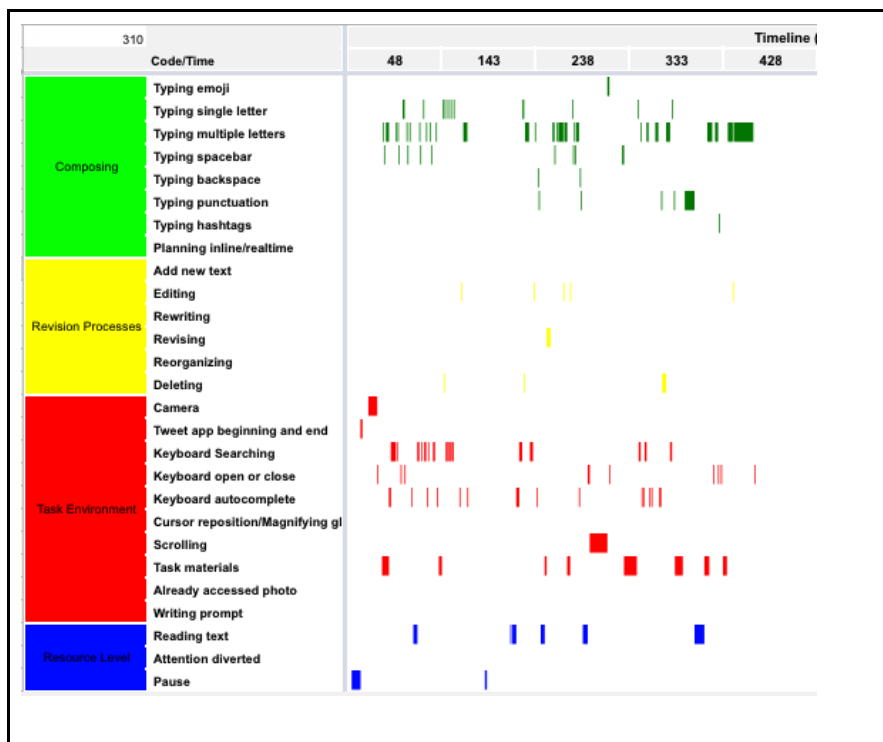
The prominent patterns observed in the letter/word/phrase analysis of Hope’s composition moves indicate that similar to Hal, more than half of Hope’s tweet is ‘produced’ by the text generation tools that accompany Twitter. For instance, Hope used autocomplete for five of six consecutive words in her last sentence. Inefficient technology use is found in less prominent patterns with text deletion and keyboard switching. For instance, Hope deleted sections of text rather than repositioning her cursor. Hope also “took the long way” with keyboard changes to access needed functions. Hope mistyped single letters with immediate corrections and unsuccessfully tried to reposition her cursor, quickly defaulting to text deletion as a solution.

Composition Moves: Complete Tweet Analysis

As described in this same section for Hal, four composition move elements: *composing*, *revision processes*, *task environment*, and *resource level* were used for this analysis. As can be seen in Figure 16, the complete tweet analysis used a timeline to represent Hope’s second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Hope’s composition moves over time.

Figure 16

Hope’s Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 16 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* like complete words “steps” and “me” or chunks of a word like “hel” in the word “helped”(n=27) and *typing single letters* (n=12). Single letters were often typed when correcting

an error. For example, typing errors with letters positioned side by side, typing “d” when she meant to type “s” and again, typing “r” when she meant to type “t.” Unlike Hal, Hope often typed more than a single letter before selecting an autocomplete suggestion. Further, Hope’s composing included nine occurrences of *typing spacebar* and five of *typing punctuation*, but after revisions, her final tweet included only two punctuation marks. In addition, *typing backspace* occurred twice, in response to the automatically created space after using the autocomplete feature. Finally, there was one instance each of the *typing emoji*, *typing hashtag*, and *planning in-the-moment*. The planning in the moment was observed when Hope added the word “how” to her first sentence after rereading the text and deciding to make a change to her text.

The *revision processes* section of Figure 16 (colored yellow) shows five *editing* occurrences, three for correcting the spelling of words after typing the wrong letter as described in the previous section and twice when typing the beginning letters of the word “Twitter” rather than the intended word, “tweet” (deleting the “i” and adding “ee.”) *Deleting* occurred three times, removing an unwanted autocorrect word, the text chunk “toTwe” created from a forgotten space, and the word “update” that automatically appeared with the selected autocomplete suggestion of the word “Twitter.” *Revising* occurred when Hope added the word “how” to an already complete sentence. The other three *revision processes* codes (*add new text*, *rewriting*, *reorganizing*) were not evidenced in Hope’s composition moves.

For the *task environment* section of Figure 16 (colored red), the most frequently occurring composition moves were *keyboard searching* to find needed letters (n=15) *keyboard autocomplete* usually after multiple letters in a word had already been typed (n=14) keeping the *keyboard open or close* to navigate between the alphabet, numeric, and special character

keyboards (n=9), and using *task materials* that were ‘outside,’ the Twitter app, such as looking at external objects, in this case Hope glanced at the class Twitter sheet (n=8). Hope accessed the *tweet app beginning and end* twice, first when she started tweeting and again when she submitted his tweet. Accessing the *camera* to add her previously taken photo, and *scrolling* for an emoji were employed one time each while composing. *Scrolling* for a meaningful emoji required more time in one moment than other composition move elements recorded. *Writing prompt, already accessed photo*, and *cursor reposition* were the only *task environment* code not evidenced in his composition moves. Only after watching the screen capture video repeatedly did I recognize Hope’s possible *cursor reposition* attempt, trying to add a space between “toTwe.” It is unclear if this moment was an attempt at a cursor reposition or using a word suggestion tool, therefore, I coded this move as *task materials*.

Finally, the *resource level* section of Figure 16 (colored blue), shows there were six occurrences of *rereading text*, once around the beginning of her writing time, after making her first edit, four times spaced out around the middle of her writing time after pausing to think or after making corrections, and again before submitting to publish. Two *pauses* were recorded, once before the tweeting started, and again around the midpoint of her composing. As I stated with Hal, these pauses may have been moments of thinking but I did not collect evidence to support this claim. *Attention diverted* was not part of Hope’s composition moves.

Complete tweet analysis: In thirds. Hope’s composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 6 and Figure 17. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing, revision, task environment*, and *resource level*.

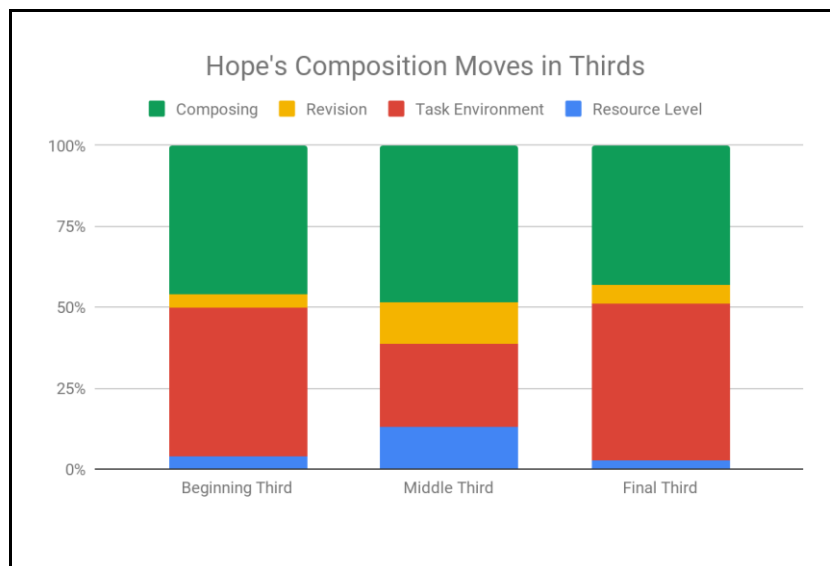
Table 6

Summary of Hope's Composition Moves frequency of use in thirds

	Beginning Third	Middle Third	End Third	Total %
Composing	19	15	11	45
Revision	2	4	2	8
Task Environment	19	8	13	40
Resource level	2	4	1	7
Total %	42	31	27	100

Figure 17

Hope's composition moves in thirds



The composition moves in the beginning third of Hope's tweet focused on *composing* as *single-letter* and spacebar typing mixed with *multi-letter typing*. Hope also did some *revision* work, *deleting* a letter typing mistake, "d" for "s" and *editing* the word "spec" for her intended word, "steps". The *task environment* work included accessing the *camera* to add her photo, *keyboard*

searching, autocomplete, and task materials (glancing at the Twitter checklist paper on the table). Hope's *resource level* work included the *pause* waiting for the Twitter app to load and *rereading* her text after making *revisions*.

The composition moves in the middle third of Hope's tweet focused on her composing as *multi-letter typing* with a few *single-letter* and *spacebar* moves. This part of the timeline also included *backspacing* to remove the automatic space provided after an *autocomplete* suggestion, *punctuation*, and adding an *emoji*. Hope's *revision* moves included three *edits*, 1 *revision*, and 1 *delete*. Here *edits* were to correct automatically noticed spelling miscues, (started typing Twitter when she meant to type Tweet), the *revision* was adding the word "how" to her first sentence and the *delete* was to remove the "r" when she meant to type a "t". Most of Hope's *task environment* time included *scrolling* for an *emoji* and *task materials* (looking at the Twitter checklist paper). She also *searched the keyboard, opened or closed the keyboard*, and used the *autocomplete*. Hope's *resource level* moves included *reading* her text four times and *pausing* once during a transition from answering my question and getting back into her writing.

The composition moves in the final third of Hope's tweet included the majority of her *composing* time with *multi-letter typing*, only two *single-letter typing* moves, a long moment adding *punctuation* and a short moment adding the *hashtag*. Hope's *revision* work included one *edit* and one *delete*, for similar reasons as previous edits and deletes. The *task environment* work included some *keyboard searching, keyboard open or close* and *autocomplete* moves but the majority of this time was *task materials*, looking at her Twitter checklist paper, looking at the computer screen, and looking at the iPad screen. This time may have been Hope's moments of thinking to decide if she had more to say or if her tweet was complete. Hope's *resource level* work included a final *reading* of her tweet before publishing.

Emergent Features

Based on all the data gathered from Hope, three additional elements associated with the tweet-composing technology features and the tweeting context were notable in the analysis of Hope's data. These elements were categorized as emergent findings. During our conversations, Hope talked comfortably and confidently about her use of tweet-composing technology in three notable areas. The first was her explanation of the *blue highlighted words*. The second was her explanation of the *black box words*. And a third feature was Hope's concern with copying, or what I have identified as *copyright*.

Blue Highlighted Words

When asked about the blue highlighted words in her tweet, Hope explained, "If a word is wrong or a word isn't spelled that way it highlights it to let us know that it isn't a real word; so, it shows up if we made a mistake or we put something there by accident." After the blue highlight disappeared, I asked Hope why, "I must have clicked on it, so it shows that I know that it's there and it tells it that I'm going to go back and fix it." Thus clicking on the blue highlighted word signaled an intention to return and correct the text, thereby making sense of something she did not fully understand at first.

Black Box Words

While watching the video of Hope's tweeting I paused and asked her about the black box showing the words "tot we", "tote", and "toTe". She explained, "Umm, it's showing words that actually have that spelling pattern, like the words that spell like that. But, I just pressed the backspace and fixed it." Hope's original intention was to reposition her cursor to add a space between her words. Her attempt created an unexpected result with the text highlighted in pink and the black box words appearing above her text. She did not tell me about trying to move her

cursor other than saying, “I forgot to put a space and the (too) got stuck on the tw.” My questioning moved to ask about the black box words rather than asking about her attempt to reposition the cursor. Similar to Hal, Hope admitted that she did not notice the black boxes when she tweets.

Copyright

When asked what parts of tweeting are frustrating, Hope brought up issues of copying. She said, “I write something down and some people actually copy me and then write some other things down, instead of exactly the same words.” I followed up saying, “They change it just a little?” and she replied, “Ya, so people sometimes actually they are not supposed to be looking at other people's work but some people actually do and it wastes their time and they are supposed to be doing their work and if you just pick off the answers and they get it wrong then you get it wrong and if you would have worked it out yourself you would have maybe had it right or a different answer than them.” I asked if this sometimes happens to her with Twitter. She said, “Ya, sometimes, like I'll say, [to another student] maybe I'll tweet about this and somebody tweets about that.” I followed up asking if she could still tweet about that same idea and she said yes. I asked why it bothered her that others tweeted about her ideas. She admitted, “They don't really think about it and they don't use their brain and it shuts their brain down and it's really hard for me to work that way.” This exchange made me think about social norms, original ideas, and ownership. Using a classmate's ideas or copying work is not new but relating this common social experience to the abstract, Internet-related concept of open access, fair-use, and copyright may be an effective instructional approach.

Summary of Hope -- Overall

The data interpreted for Hope resulted in a profile that indicates she is a conscientious and confident reader-pleaser type tweeter. For Hope's *writing processes* she seemed *motivated* by feedback from her readers and sharing her learning with others. Her tweeting *goals* included capture the interest and teaching her readers, and following the teacher-established expectation to tweet about the what and how/why of her learning. Hope *planned* her tweet content before writing and made in-the-moment plans while writing. She used *genre knowledge* to compose short-form writing including a photo, hashtag, and emoji, within a fixed topic text structure and showed a growing understanding of *followers*, *likes*, *cybersafety*, and *networking*. Hope's *composition moves* were dominated by *composing* (transcription component skills) and *task environment* components associated with the keyboard and task materials. Hope's typing was efficient and easy but included multiple typing miscues based on side-by-side keyboard location. For this reason, Hope had multiple *edits* and *deletes* to correct these miscues. Hope also *revised* her tweet by adding the word "how". *Task environment* components included frequent *keyboard searching* and *autocomplete*. She also spent time *scrolling* for an emoji and looking at the twitter checklist paper. Similar to Hal, Hope's inefficient routines include excessive keyboard switching and deleting entire text chunks that were later retyped rather than repositioning the cursor to change her text. Finally, Hope has an *emerging understanding* of the composing technology affordances and a growing concern for copyright.

Inez: Mid Scoring Female

General Description

Inez appeared very comfortable and was very confident while meeting with me. Her confidence is evidenced by how she quickly started her tweet work, accessing the iPad camera

and standing up with the iPad to take photos of the objects she planned to write about (which was a book about penguins and her sheet for taking notes while reading). Inez noticed her first picture was blurry and tried again. Once she felt satisfied with a photo(s) she settled into a chair and quickly added the two photos to her tweet space. She then paused, taking time to think about the words she would write.

Writing Processes

Based on the writing process model of Hayes (2012), Inez's talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Inez's *motivation* to tweet appeared positive. When asked if she liked to tweet she shook her head with a big smile, exclaiming, "Yes!" elaborating, "I like that people can see what I'm doing and see what I'm learning about." She followed up, restating, "Ummm, it's fun because you can have the whole world see what you are working on and then you can see what the people think about the stuff you are tweeting."

Writing Processes: Goal Setting

Inez expressed two *goals* for tweeting: to create meaningful messages and to share her thinking. When asked about her first goal, she said that tweets should make sense and that the purpose of tweeting is to communicate with others. This intent was most visibly expressed in her awareness of the teacher-established tweeting guidelines. She could recite them from memory, knowing she should tweet about something she is learning. When communicating about the

second goal she replied, “[I want to] show people what I am thinking and what's going on [in our classroom].”

Writing Processes: Planning

Inez’s *planning* included both *in-advance* and *in-the-moment planning*. Evidence of Inez’s *in-advance planning* included collecting tweet topic possibilities over time, in anticipation for what she might writing on different days. For the tweet she composed while working with me, she said, “I was already reading it so I was like hmm, this will be fast, I’ll do this [tweet about the book she was reading and the sheet she used to take notes about her reading] because I already know what I’m going to do.” Inez continued, saying sometimes she has so many ideas she defaults to random selection, “Sometimes I do Eeny, Meeny, Miny, Mo.” Evidence of Inez’s *in-the-moment planning* appeared when she generated specific ideas, words, and emojis as she created her message. For example, I asked Inez if she knew what she was going to write or if she was going to figure it out as she went along. She replied, “I don’t know.” Then, she looked at the two photos for her tweet and started typing, “I am reading a book.” After completing this sentence she looked at her photos again and then voiced as she started typing, “It is about Penguins.”

Writing Processes: Writing Schemas

Inez’s thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. For starters, Inez showed an understanding of primary and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. Her tweet represented a complete message using short-form writing, with meaningful multimodal elements, (two photos and a relevant hashtag). The photos Inez

included were an image of her book's cover and an image of the note-taking sheet. Her hashtag was "#read". When asked why hashtags are included in tweets she explained, "Because they [hashtags] like pull words together and it helps people, like if they just read that hashtag then they already know what this thing is about pretty much." Like Hope, Inez has an awareness of emojis as an elective communication tool that when used, should match the meaning of the text. For this tweet she did not add an emoji, saying she "just didn't feel like adding one."

Writing schemas: contextual elements. Inez displayed knowledge of four contextual elements as she tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, when asked about *followers* Inez talked about classmates reading tweets, then added, "Pretty much the whole world like all the states and stuff because it goes online. She then talked about correct spelling for her readers, "It's important going back and fixing your words because if they aren't spelled right then people that read your tweets can't read them because they would be like that word isn't spelled right, I can't understand it." When I asked how she knows other people read her tweets she told me about likes, "[With likes] you can see what the people think about the stuff you are tweeting." She continued, "So, then people that go to Twitter they can see my tweet and then they can comment if they like it or not." Inez followed *cybersafety* protocols established by her teacher, and, without using the term "*networking*" talked about connecting with others, learning from and helping one another, "Because it's fun and a whole bunch of people get to see it and see what you are learning and it makes you feel good that people know what you are learning. So, then if anybody sees it, [your tweet] and they think they might know how to help you if you are struggling and then they might know it's you." (She then talks about how her sister helps her with her reading because she thinks about other stuff when she's reading)

Writing schemas: text structure. Inez's completed tweet was characteristic of a *fixed topic text structure*. Her topic was the book she was reading and the sheet for notes. Following the teacher-established guidelines to tweet about what she was learning and why or how this learning will be helpful, Inez explained that she writes down her books to keep track of what she is reading. The photo matches and extends the meaning because it showed the reader what the paper looks like and the type of book being read. Similar to the photo in Hope's tweet, Inez's photos did not include additional items and it was more likely the reader could infer what Inez was learning.

Composition Moves

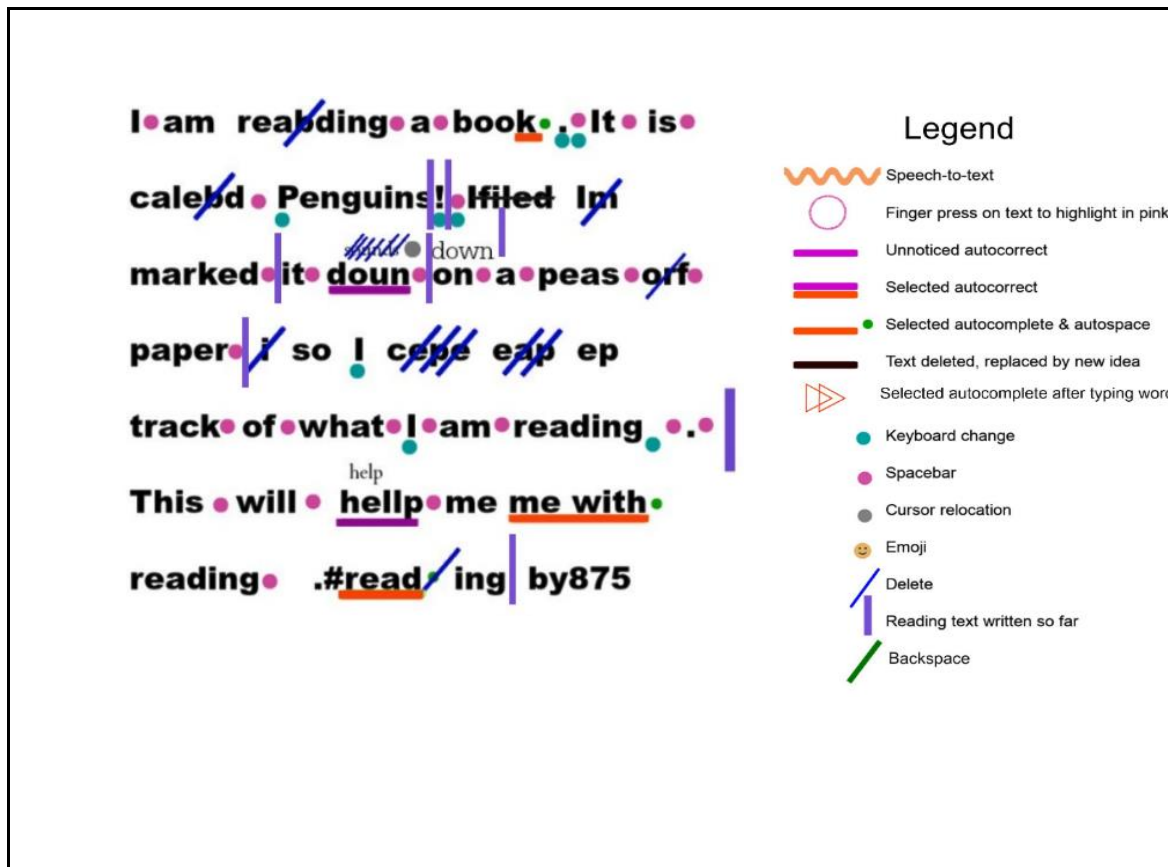
Based on the composition move model of Hayes (2012), Inez's talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Inez's letters, words and phrases captured her real-time composition moves, which included all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). Inez's use of the task environment autocomplete feature can be seen by the orange underline of text followed by a bright green circle and the teal circles show when Inez changes keyboards. The points where she rereads are shown as vertical purple marks. A detailed account of Inez's letter, word, and phrase composition moves follow.

Figure 18

Inez's letter, word, phrase flow-of-composing



Inez started her tweet session using the first two minutes and thirty seconds to take a photo of her book, and a second photo of her note-taking sheet. The first photo of her book was blurry so she took another photo then added the photos to her tweet. Inez started her first sentence typing “I am reab”, then noticed the error, deleted the “b” and typed a “d” then added “ing.” Next, she typed “a boo” then noticed and selected the word “book” in the autocomplete bar, then quickly switched from the alphabet keyboard to the number keyboard to access the period. Inez then returned to the alphabet keyboard to add a space. After adding this space the keyboard automatically applied the shift key, automatically capitalizing the next letter typed. Inez typed this first sentence in 32 seconds. After completing this sentence she paused and

repeated aloud from memory the words that she just typed, “I am reading a book.” She glanced at her reading note-taking sheet and then voiced what she would type next, “It is called.”

While composing this second sentence Inez quickly typed “It is caleb” again mistaking the letters “b” and “d,” and quickly deleted this error as if a routine composition move. Next, Inez opened her book, held the pages open to the title page and looked at the words she wanted to spell. For each letter or pair of letters in the word “Penguins”, she followed the same routine, glancing at the book, then searching the iPad keyboard for the next letter or letters and typing it with her left index finger. Inez typed “P, en, g, ui, n, s” (each comma indicates a repeat of her glancing from book to keyboard). She closed her book, voiced the word “penguins,” switched to the number keyboard, typed an exclamation mark, returned to the alphabet keyboard and pressed the spacebar. Again, Inez navigated this keyboard switching sequence as if a routine composition move.

Inez typed the letter “i” that automatically appeared as a capital “I” then, without adding a space between her words, started typing “filed” intending for the word “filled.” Glancing at the computer screen she noticed “filed” highlighted in blue. She looked at her book and reading note-taking sheet, repeated the word “filled” then looked back at what she had typed. Inez deleted the letters “ifiled.” At this time I questioned, “Why did you do that?” Before responding she typed a capital “I,” by pressing the shift key and the letter “i” without noticing the shift key was automatically engaged. Inez pushed her hair behind her ears and responded, “Because, um, I changed my mind about what I was going to do.” I probed, “What were you going to do?” She replied, “I was going to say, I filled the paper up with it.” She laughed a little and continued, “Now I’m going to put, ‘I marked it down on a piece of paper to keep track.’” She pulled her hair behind her ears again and typed the letter “m” without adding a space after the “I.” The text

highlighted blue. She deleted the “m” and added a space. She typed “marked” and then paused to think. Inez quietly restated the phrase she planned to type, “I marked it on a piece of paper,” and then returned to the keyboard. She typed the spacebar and then the letter “i.” The letter “i” highlighted blue and she paused to look at the screen as if to check that she added a space.

Once Inez realized the text was as it should be, she typed the letter “t” then a space. She then typed her next word, “down.” She typed “down” followed by the spacebar without looking at the iPad screen. Thus, Inez did not notice that when she pressed the spacebar the autocomplete suggestion of “sounds” took the place of her word “down.” Next, she typed the words/letters “on a peas or,” quickly deleted the “r” and replaced it with an “f” and continued to type “paper.” At this point, she stopped to look at her text. Inez repeated the word “paper” and typed the spacebar followed by the letter “i,” then made an “oops” sound, deleted the “i” and typed the word “so.” She looked at the iPad screen and typed a spacebar followed by a capital “I” and then typed “cepe” for the word “keep.” Her tweet text read, “I am reading a book. It is caled Penguins! I marked it sounds on a pease of paper so I cepe.”

Inez glanced at the screen and noticed blue highlighting for the letter string “cepe.” She paused, appearing to think, and then deleted the “ep” and “e” in “cepe” and tried a different spelling pattern, “ceap.” This was also highlighted in blue so she replaced “ap” with “ep,” ending with “ceep.” Looking at the screen and not seeing a blue highlight she continued on, adding a space. Once Inez added the space a red underline appeared under “ceep.” She did not look up at her screen, rather she started typing the word “track.” As soon as she typed the letter “t” the red underline disappeared from under “ceep.” She continued typing to finish her thought, “track of what I am reading.” Inez switched to the numeric keyboard to access the end punctuation mark

but this time pressed the spacebar and then the period. Pressing the spacebar again brought her back to the alphabet keyboard.

Inez began reading aloud the text written so far, “I am reading a book. It is called Penguins! I marked it” She expected to read the word “down” but saw the word “sounds.” She read again and paused again. I asked her what she was thinking. She laughed and said, “sounds,” as if wondering how “sounds” became a part of her message. She positioned the cursor next to the letter “s” at the end of “sounds” by pressing her index finger on the iPad screen and deleted the word. Next, Inez reread the text up to the point where she would type and added “doun,” then continued reading the last part of her text, “on a piece of paper so I keep track of what I am reading.” Before typing her next thought she said it aloud, “this will help me be a better reader.” She typed “this will hellp” and then the spacebar. Once she pressed the spacebar the letters “hellp” automatically switched to “help.” Inez then typed the word “me” followed by selecting the autocomplete suggestion of “me with.” She paused a moment and then typed the word “reading.” At this time Inez sat back in her chair, cracked her knuckles, and smiled with satisfaction. I questioned, “You were going to write ‘this will help me be a better reader’ and you changed your mind and said ‘help me with reading.’ Can you tell me why you decided to change...?” Inez laughed a little and replied, “Well, [looking at her writing] I don’t even know, I didn’t notice I did it.”

It’s not clear whether Inez did not notice the mismatch between her typed and voiced words or if she was avoiding the high-cognitive demand task of justifying the mismatch. She returned to her work, adding a space after the word “reading,” then switched to the numeric keyboard, typed a period, switched to the alphabet keyboard and without adding a space typed the hashtag symbol. A list of previously used hashtags appeared. Inez scrolled through this list

and selected the word “read.” The cursor automatically moved a space after the word “read.” Inez deleted this space and the list of hashtags appeared again. She ignored the list and typed “ing” then added a space and typed “by875.” At this point, Inez stopped to reread her entire message. When rereading her text she read the words she planned to write even though it did not match the text written. She read, “I marked it down on a piece of paper so I could keep track...” The text did not include the word “could.” I asked her to read that part again. Again she read as if the word “could” was in the text. I told her what I noticed about her reading. She looked again at the text. I asked if what she had written matched what she was saying. She said “no” and decided to add the word “could” to her text. Inez pressed her index finger on the letters “ceep.” The text highlighted pink and she deleted the word. She then typed, “coled” space “ceep.”

Next, I asked Inez if there were any words in her tweet that she wanted to ask about. She said, “keep.” Pointing to her text I replied, “What do you think about that word, (keep)?” She responded, “It looks kinda weird to me.” Knowing she worked on this word earlier, trying different vowel patterns, I said, “I want you to try a different beginning letter. What’s another letter you could try to start the word?” She replied “k” and I invited her to try this letter saying, “And can you do it without deleting the whole word?” but she had already deleted most of the letters, finished deleting the remaining letters then typed “keep.” Inez decided what she had written was ready to publish and tweeted her message. This tweet session ran fourteen minutes and seventeen seconds.

The patterns observed in the letter, word and phrase analysis of Inez’s composition moves ranged from typing multiple and single letters, pressing the spacebar, searching the keyboard, to looking at her task materials. She looked at the keyboard to type multiple words before looking at the text written so far. This created a problem with the text when the

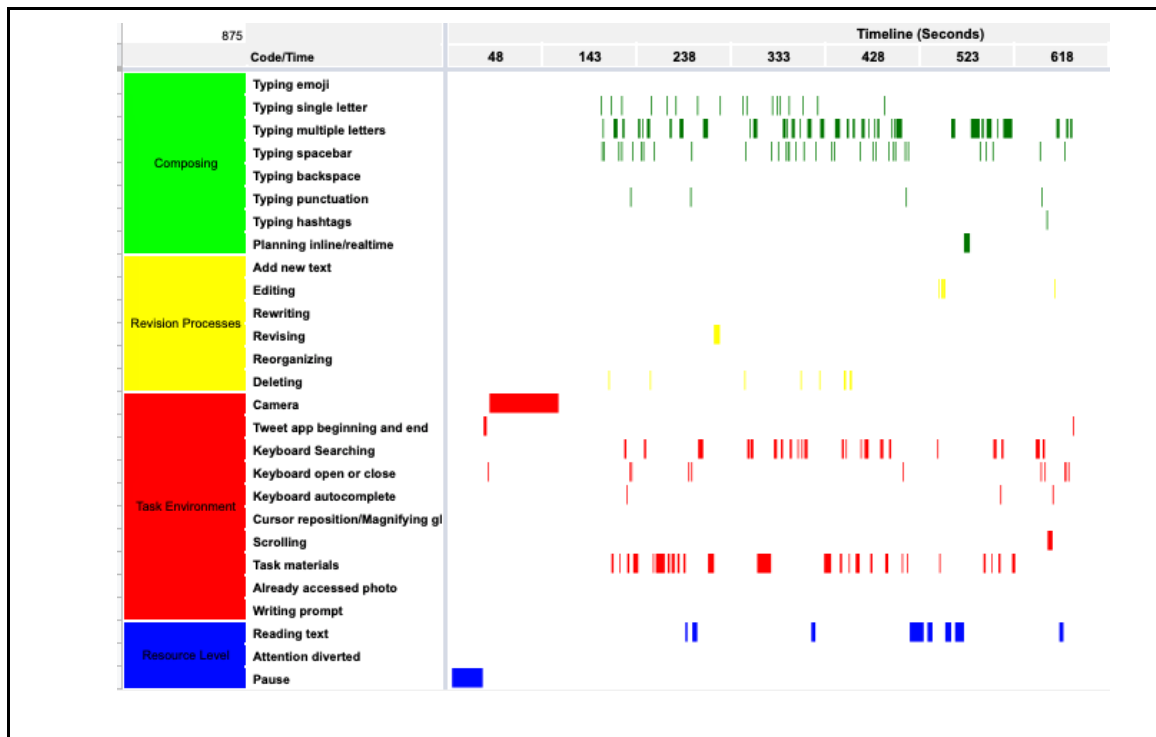
autocomplete technology changed a word without her noticing. Inez's deleting, editing, and revising occurred as she worked through sentences, usually after completing a sentence and rereading her text so far. Her composition moves also included typical Second-grade "b" and "d" errors which she corrected immediately as if typing the letter "d" followed by delete was her routine to get to the letter "b". Inez used strategies to help herself with spelling, sounding out as she typed, and trying various vowel patterns. Her use of the autocomplete technology was minimal, only three times, with the last time using the word suggestions thus changing her intended message.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing, revision processes, task environment, and resource level*. As can be seen in Figure 19, the complete tweet analysis used a timeline to represent Inez's second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Inez's composition moves over time.

Figure 19

Inez's Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure19 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* like chunks of words, “boo” and “ar” in “marked” (n=36) *typing spacebar* after a word or to switch keyboards (n=33) and *typing single* letters, often letters at the beginning and medial points of words and to correct single letter errors (n=17). Further, Inez’s composing included four occurrences of *typing punctuation* (three periods and one exclamation mark) and one *typing hashtags* in which the hashtag text was selected from a scrollable list of hashtag suggestions. Finally, *planning in-the-moment* was observed after Inez read the first part of her tweet and then planned her final sentence. She proposed the following aloud, “This will help me be a better reader.” She subsequently typed the following “This will help me with reading.” The change

from her spoken to written version may have been influenced by the autocomplete word suggestion of the text “me with” suggesting Inez’s *planning in the moment* outcome was influenced by the *task environment*. The other two *composing* codes (*typing emoji* and *typing backspace*) were not evidenced in Inez’s composition moves.

The *revision processes* section of Figure 19 (colored yellow) shows seven *deleting* occurrences, two for correcting the letter “b” to “d”; two for correcting typing mistakes, “r” for “f” and “i” for “s”; two for deleting letters from long “e” spelling patterns, “cepe” to “ceap” and “ceap” to “ceep” and once to delete letters after forgetting a space. *Editing* occurred four times, three codes are associated with Inez’s spelling correction of “sounds” to “doun” and the final *editing* code is changing the spelling of the autoselected hashtag “read” to “reading.” *Revising* occurred once when Inez typed “I filed” and then “changed her mind” about what she was going to say and typed, “I marked.” Because I had noticed multiple spelling miscues in Inez’s text I wanted to see if she made this *revision* to avoid spelling an unknown word. Inez did not attribute her *revision* to spelling, rather she changed her text to better match what she thought sounded right. When asked about this *revision* Inez replied, “I chose a sentence but then, I changed my mind on it. So, I erased it and started a new sentence.” I probed further, “What made you change your mind?” She answered, “It didn’t make sense to me in my mind. It wasn’t what I wanted to put in the sentence and I thought I wanted to change it.” Finally, I asked, “How did you know that one sounded better than the other?” Inez explained, “The first one wasn’t the one I was leaning toward. And, I felt like the second one sounded better to me.” The other three *revision processes* codes (*add new text*, *rewriting*, *reorganizing*) were not evidenced in Inez’s composition moves.

For the *task environment* section of Figure 19 (colored red), the most frequently occurring composition moves were *task materials* to glance at the iPad screen or look at both the book and the sheet for note-taking (n=25), *keyboard searching* to find needed letters (n=22) and *keyboard open or close* to navigate between the alphabet, numeric, and special character keyboards (n=9). In addition, Inez used the *keyboard autocomplete* three times, once to add the last letter to the word “book”, once to select a follow-up word after “me” to generate the phrase part, “me with,” and once to select a hashtag word. A less frequently accessed *task environment* code was *cursor reposition* used once to access a misspelled word in the text. Similar to Hope, only after watching the screen capture video repeatedly did I recognize Inez’s possible *cursor reposition* attempt, trying to correct the misspelled word, “ceep.” It is unclear if this moment was an attempt at a *cursor reposition* or using a word suggestion tool, therefore, this move was coded as *task materials*. Inez accessed the *tweet app beginning and end* twice, first when she started tweeting and again when she submitted his tweet. Accessing the *camera* to add her previously taken photo, and *scrolling* for a hashtag were employed one time each while composing. *Writing prompt*, and *already accessed photo* were the only *task environment* code not evidenced in his composition moves.

Finally, the *resource level* section of Figure 19 (colored blue), shows there were eight occurrences of *rereading text*, once around the beginning of her writing time, multiple times spaced out around the middle of her writing time after pausing to think or after making corrections, and again before submitting to publish. One *pause* was recorded to account for the time before the tweeting started. *Attention diverted* was not part of Inez’s composition moves.

Complete tweet analysis: In thirds. Inez’s composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 7 and Figure 20. Dividing the

timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

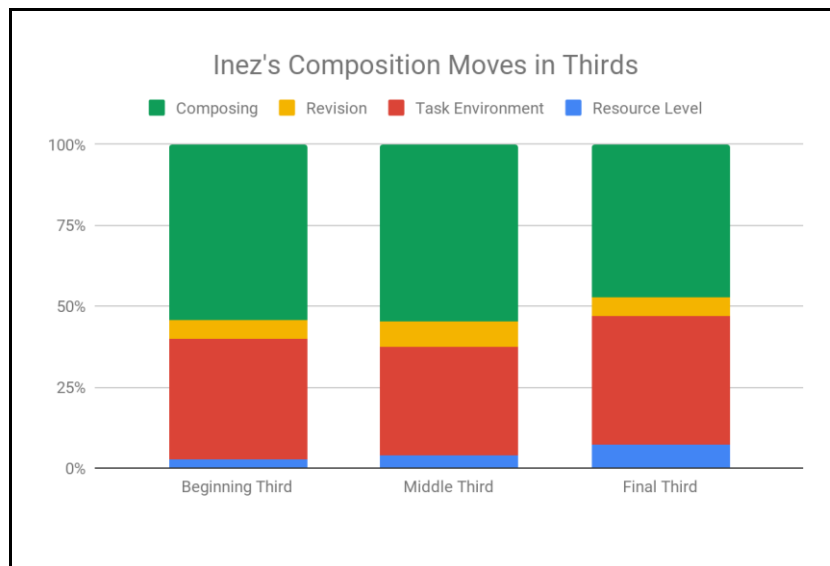
Table 7

Summary of Inez's Composition Moves frequency of use in thirds

	Beginning Third	Middle Third	End Third	Total %
Composing	11	23	18	52
Revision	1	3	2	6
Task Environment	7	14	15	36
Resource level	1	2	3	6
Total %	20	42	38	100

Figure 20

Inez's composition moves in thirds



The composition moves in the beginning third of Inez's tweet focused on *pausing* to get set up with the technology tools followed by using the *camera* to take photos of the objects Inez planned to tweet about. The beginning third *revision* included two instances of *deleting* the letter

“b,” and replacing it with the letter “d” and *typing multiple and single letters* for most of her first sentence.

The composition moves in the middle third of Inez’s tweet had the largest concentration of total composition moves. During this time both *typing multiple letters* and *typing spacebar* were numerous. Inez’s middle third revision work included *deleting* with one *revision*. The task environment moves were almost entirely *keyboard searching* and *task materials*. Finally, during this time Inez *read* her text written so far three times.

The composition moves in the final third of Inez’s tweet increased in variety. In addition to the high frequency of *typing multiple letters* and *typing spacebar* this time also included the use of *typing punctuation*, *typing hashtags*, and *in the moment planning*. All of the *editing* moves occurred during this end third. And, the task environment composition moves included a continuation of *keyboard searching*, and *task materials* with the inclusion of *scrolling*, *keyboard autocomplete* and *keyboard open or close*. Finally, the end third included five different *readings* of the text written so far.

Emergent Features

Based on all the data gathered from Inez, two additional elements associated with the tweet-composing technology features and the tweeting context were notable in the analysis of Inez’s data. These elements were categorized as emergent findings. During our conversations, Inez shared her frustration with spelling, admitting, “If I want to spell a word right and I can't figure out how it looks and it looks wrong it makes me mad and gives me a headache because I keep trying and it's super hard.” As a result, she talked about her drive to use tweet-composing technology in two notable areas. The first was her explanation of various *word tools* (*red*

underline, *blue highlight*, and *autocomplete*.) And the second feature was Inez's use of language when talking about the *technology as knowing-other* (or a partner) in the composing process.

Word tools: Red Underline, Blue Highlight, and Autocomplete

The data indicated Inez had a very familiar understanding of the *red underline*, *blue highlight*, and *autocomplete* features. When asked about these features she talked about how each was associated with misspelled words but could not explain how the features differed. During the video-stimulated recall interview, I pointed out the *red underline* appeared under a word and then disappeared after she pressed the spacebar. Asking Inez to explain what was happening she replied, "[The red underline disappeared] because I went on from it without noticing it." In contrast, when asking Inez about the *blue highlighted* word she explained, "It means I spelt it wrong. If you are spelling it wrong and you keep on going with it and it's wrong then it will highlight it because it's wrong so then it reminds you to go back and fix it." Inez did not try to make sense of why one feature disappeared (red underline) and the other feature remained (blue highlight). Finally, asking Inez to explain the *autocomplete* suggestion bar she replied, "It helps you like if you don't know the word then there might be a word they think you might be trying to spell." I probed further, " And, when you say "they might think you are trying to spell" who is they?" She explained, "Like the people who invented Twitter, they are giving ideas of what the word might be." To Inez, this explanation made sense, associating the composing platform (Twitter) with the composing tools (iPad keyboard).

Technology as a Knowing-Other

In addition to associating Twitter with the iPad keyboard, Inez's statements that associated the keyboard technology as a "knowing other" (or a writing partner) was only obvious after multiple viewings of the screen capture and talk aloud data. Similar to Hal, Inez's language

indicated something about her approach for creating a concrete explanation to an abstract concept. For instance, asking Inez to explain how the word “sounds” appeared in place of her typed text “doun” she replied, “Umm, because it didn't make sense to it? So um it just threw a word in there when I moved on because that's the word that was highlighted, and right, and so it thought I might have wanted that word, so then when I clicked to go on to the next word then it just popped that word right there.” Similarly, when asked about the autocorrect of “hellp” she replied, “That was wrong because I put another “l” so then it just went in there and helped me out and it just took the other “l” out.”

Summary of Inez -- Overall

The data interpreted for Inez resulted in a profile that indicates she is a confident tweeter even though she struggles with spelling. For Inez's *writing processes* she seemed *motivated* by sharing her work with others. Her tweeting *goals* included sharing her thinking and what she is doing in class and following the teacher-established expectation to tweet about the what and how/why of her learning. Inez *planned* her tweet content before writing and made in-the-moment plans while writing. She used *genre knowledge* to compose short-form writing including two photos and a hashtag within a fixed topic text structure and showed a growing understanding of *followers, likes, cybersafety, and networking*. Inez's *composition moves* were predominately *composing* (transcription component skills) and *task environment* components associated with the keyboard and task materials. Inez's typing was efficient and easy but included multiple typing miscues based on side-by-side keyboard location and “b” and “d” reversals. For this reason, Inez had multiple *edits* and *deletes* to correct these miscues. Inez also *revised* her tweet by changing a sentence from her initially planned text. *Task environment* components included frequent *keyboard searching* and looking at the book and papers for spelling and writing ideas.

She also spent time *scrolling* for a hashtag and used the *autocomplete* sparingly. Similar to Hal and Hope, Inez's inefficient routines include excessive keyboard switching and deleting entire text chunks but also used the efficient *cursor repositioning* to change other text. Finally, similar to Hal, Inez has an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Irene: Mid Scoring Female

General Description

Irene appeared assured when meeting with me. For instance, she immediately spoke several sentences into the external microphone about her preselected tweet topic. She then added her previously taken photo to the tweet space and quickly started typing. When editing her writing she boldly deleted words, added punctuation and checked her work several times. The analysis of her writing processes and composition moves confirmed her confidence as she enthusiastically answered my questions and composed her text, pausing only once to ask how to spell a word.

Writing Processes

Based on the writing process model of Hayes (2012), Irene's talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Irene's *motivation* to tweet appeared positive. She quickly engaged in her work and enjoyed talking to me about Twitter and her own tweeting. Irene made statements about being motivated by feedback from her readers. During our conversation, Irene mentioned other people can "comment" and "like"

tweets where a comment might be, “cool, I like your idea” and the heart icon means “I like it.” She also said tweeting is “fun” sharing with others her “imagination” and what she is learning. Thus, like Hope, her motivation to tweet seemed to be linked to the act of sharing with others.

Writing Processes: Goal Setting

Irene expressed three *goals* for tweeting: creating meaningful messages, capturing the reader’s interest, and sharing her learning. When commenting about her first goal, she said that tweets should make sense and that the purpose of tweeting is to communicate with others. This intent was most visibly expressed in her awareness of the teacher-established tweeting guidelines. Before publishing her tweet she read through the teacher-provided checklist of expectations to check her work and make necessary changes. When asked about the second goal she talked about selecting interesting content to avoid a reader thinking, “this is boring.” Irene’s third goal, to share with others was evidenced in her statement, “[When you tweet you] share ideas with everyone in the whole world, they see your imagination and it helps them know what you are learning.”

Writing Processes: Planning

Irene’s *planning* included both *in-advance* and *in-the-moment* planning. In both cases, she followed the teacher’s tweet format from memory and added ideas as she created her message. Evidence of Irene’s *in-advance* planning occurred when she selected an object and took a photo of it to go with her tweet, using the object and photo as tools for advanced planning. Irene also talked through her idea before tweeting. Evidence of Irene’s *in-the-moment planning* appeared when she started tweeting and the sentences she talked through before tweeting did not completely match the tweeted text. Irene’s *in-the-moment planning* appeared to be influenced by

the autocomplete suggestions. Thirty-one of the thirty-three words in her first draft were associated with the autocomplete or autocorrect features.

Writing Processes: Writing Schemas

Irene's thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. For starters, Irene displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. Although her published tweet did not include an emoji, Irene talked about being strategic with emoji selection saying, "You [don't want] the same emojis over and over." Conversely, when the hashtag and photo Irene included in her tweet matched the meaning of the text, with little explanation necessary, she assumed that the audience would understand their meaning. And furthermore, the photo she included extended the text's meaning by showing that the word of the day was displayed as a collection of words posted on classroom wall-cupboard doors, which was something not stated in the text. Interestingly, similar to Hal, Irene did not include an explanation of the other items in the photo and how they may or may not have been related to the word of the day.

Writing schemas: contextual elements. Irene displayed knowledge of four contextual elements as she tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, when explaining *followers* and listing those who might read her tweets she said, "scientists, our moms, everyone in our family, umm, more people in our states, and other cities, everyone in the whole school, everyone in the whole world." When asked about "*likes*," Irene explained how the "heart" icon is a symbol used to communicate appreciation. In child-friendly terms, she explained, "If you have the heart, it means you like it." When it came to *cybersafety* protocols,

Irene acted in ways consistent with the protocols established by her teacher, also elaborating on her digital footprint saying she should “keep her footprint small.” Without using the term “*networking*” Irene talked about connecting and learning from others, “[Twitter] helps you say what you are saying to other people...it's fun because you get to really like learn more stuff and you umm have a way to look at other people's ideas.”

Writing schemas: text structure. Irene’s completed tweet was characteristic of a *fixed topic text structure*. Her topic was either a reading strategy her teacher taught called “chunking” and/or the word of the day. Both were mentioned without elaboration. For instance, her first sentence (“The word of the day helps me with my words that I need some chunking.”) did not elaborate on how the word of the day helps her with chunking. Although her second sentence (“Words that are hard words I can look up and see what needs to be chunked.”), along with her photo, alluded to how the chunking strategy helped with hard words. In addition, including the word of the day as part of her topic suggested these words have been used to practice the chunking strategy.

Composition Moves:

Based on the composition move model of Hayes (2012), Irene’s talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Irene’s letters, words, and phrases captured every aspect of Irene’s real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). To illustrate, Figure 21 represents Irene’s revising with blue

delete marks and the gray circles represent student-activated cursor relocation. A detailed account of Irene's letter, word, and phrase composition moves follow.

Figure 21

Irene's first draft letter, word, phrase flow-of-composing

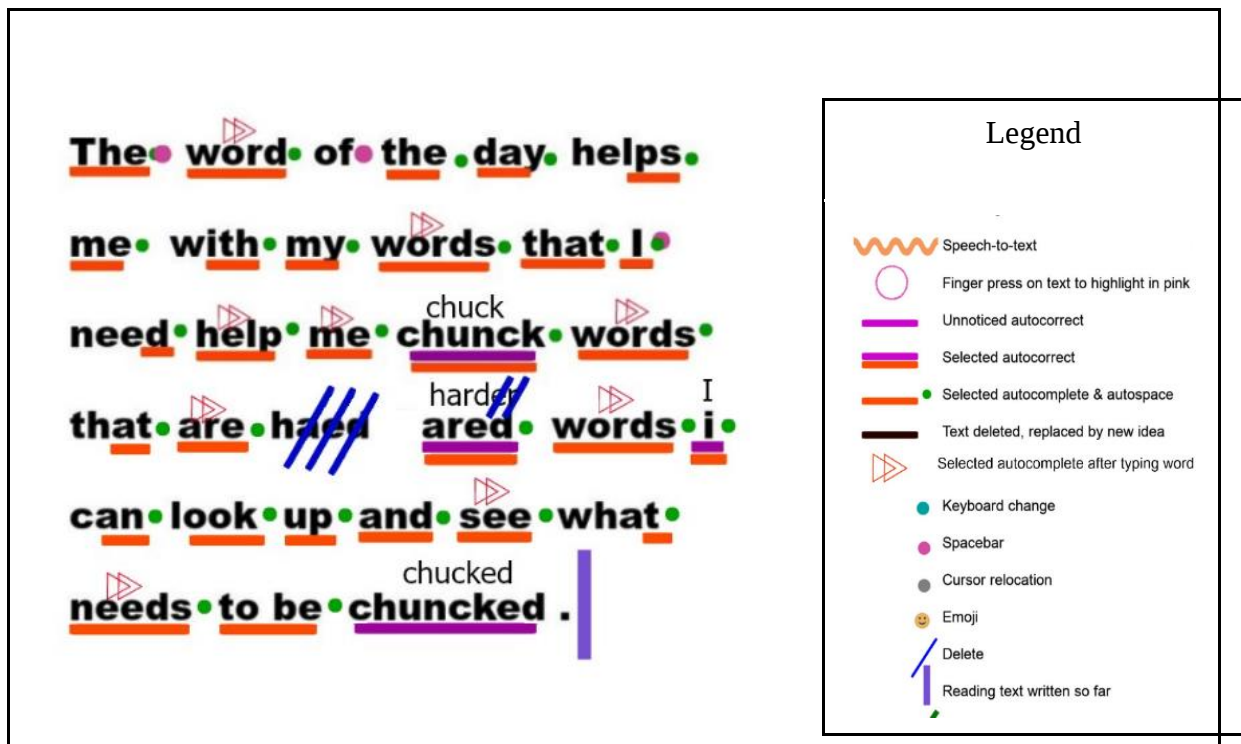
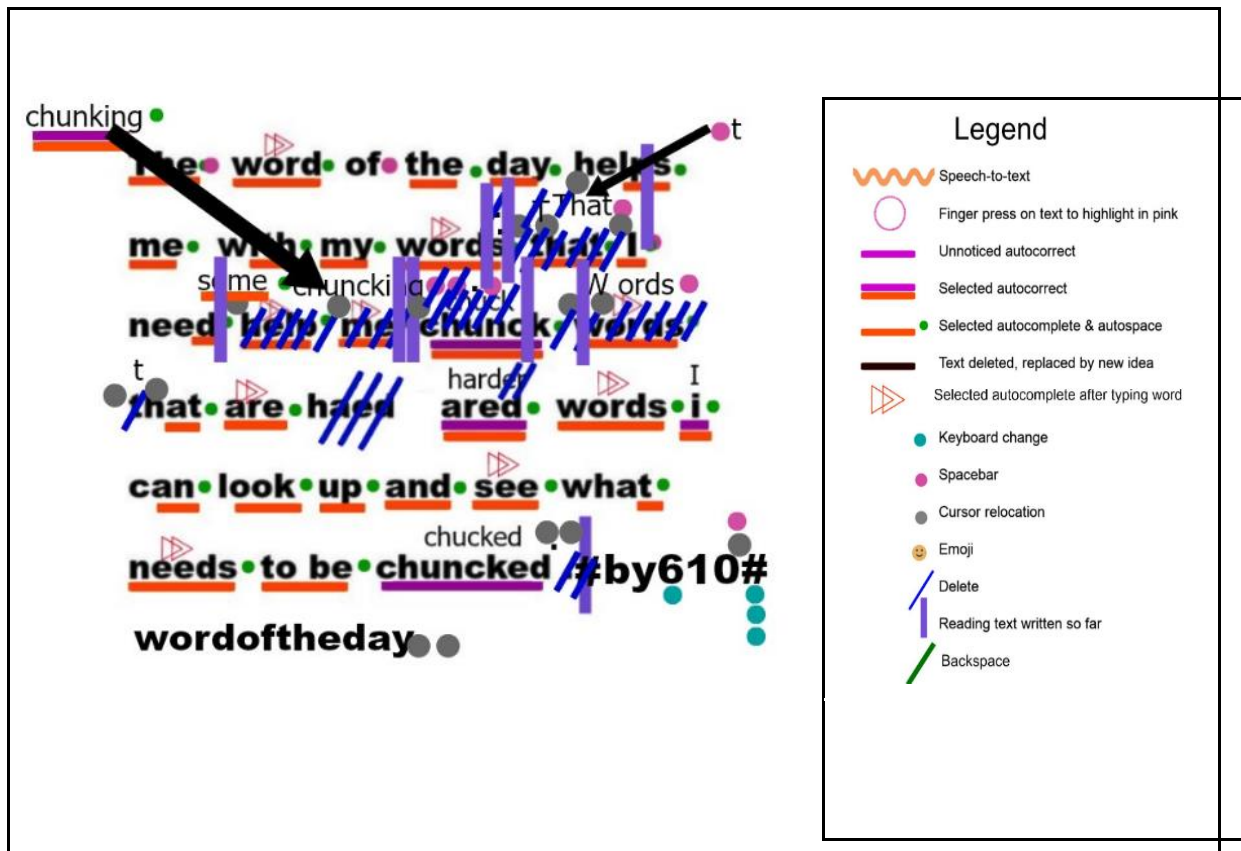


Figure 22

Irene's final draft letter, word, phrase flow-of-composing



Irene started her tweet time talking directly into the external microphone a string of words she intended to write:

This is word of the day it helps me with hard words It'll help me be a better reader. It's fun I like to use word of the day it will help me chunk hard words and have umm I can chunk the biggest word like fourth, fifth, third, or sixth grade words umm I can also be a better reader cuz um if there's words that need to be chunking I can just look at word of the day and that it will help me chunk with the words I need help chunking.

Note, her published tweet read, "The word of the day helps me with my words that I need some chunking. Words that are hard words I can look up and see what needs to be chunked."

Next, Irene added her photo to the tweet space and began to type, selecting the word “The” from the autocomplete choices. She then added a space without noticing the autocomplete choice also adds a space after the word. Next Irene typed “word” followed by tapping the autocomplete choice “word” which included the space. She then typed “o” searched for the next letter and typed “f” followed by a space. The next six words were each added using the autocomplete suggestions creating a text that now read, “The word of the day helps me with my.” Again, Irene typed out the word “words” followed by tapping the autocomplete choice “word” which included the space. She continued typing “t” then selecting the autocomplete for “that” followed by the autocomplete for “I.” Irene added the unnecessary space then typed “nee” and selected “need” from the autocomplete. The next two words Irene typed out completely followed by tapping the matching words in the autocomplete bar. Next, she searched the keyboard, typing out the letters “chunck” intending the word “chunk.” The letters highlighted blue causing Irene to pause and look at the autocorrect selections. She selected “chuck” followed by typing out the entire word “words” then tapped this same word in the autocomplete bar. Next, she typed “th” and selected “that” from the autocomplete bar. Irene typed “are” followed by tapping this same word in the autocomplete bar. Thus far, Irene’s tweet read, “The word of the day helps me with my words that I need help me chuck words that are.”

Next, Irene typed the letters “haed” for the word “hard.” This typing error may have happened because the “e” and “r” side-by-side location on the keyboard or Irene thinks the word “hard” should include the letter “e.” The letters were highlighted blue causing Irene to pause. She looked at the autocorrect word bar, did not make a selection, and deleted the letters until she was left with “h.” She asked me how to spell the word “hard.” I told her the next letter is an “a” and then as I asked, “Can you think of what is going to be next?” she typed “re” and then “d.”

The text highlighted blue and Irene looked across the autocorrect choices: “hared,” hrmed, and harder. She selected “harder” followed by deleting the suffix to produce “hard.” I asked Irene about her strategy. She replied, “I just took the ‘er’ off, I chunked!”

Returning to the iPad, Irene typed “words” followed by tapping the autocomplete for the same word. Next, she typed “i” which highlighted blue prompting her to select the autocorrect suggestion “I.” The next four words were each generated using autocomplete suggestions, “can look up and.” Next, she typed “see” followed by tapping the autocomplete for the same word. Following a similar routine, she typed “wha” selecting “what” from the suggested words then typed “needs” followed by tapping the autocomplete for the same word. Irene selected “to be” from the suggestion bar then typed “ch, u, n, c, k, ed” which highlighted blue. Ignoring this highlight she added end punctuation which caused the highlighted text to autocorrect to “chucked.” It was at this point that Irene first read her text written so far, “The word of the day helps me with my words,” she paused, repositioned her cursor before the “t” in “that,” deleted the space and typed an end punctuation mark. Directly after, she engaged the magnifying glass moving her cursor between the “t” and “h” in “that” and deleted the “t.” Next, she pressed the capslock and typed “T” automatically adding a space between the end punctuation and the capital letter. She proceeded to change her text, repositioning the cursor before the “I” positioned after the word she just added a capital “T” then deleted the space, the word “That,” and the space after the end punctuation. Then, she retyped this same text, “. That.”

Irene returned to the beginning of her tweet and reread, “The word of the day helps me with my words. That I need help” She stopped reading and quickly said “some” followed by repositioning the cursor before the “h” in “help” and then continued reading, “I need some help ...,” paused a moment and then said, “chunking.” Next, she deleted “help” and typed

“chuncking” followed by the spacebar. A red line appeared under this newly typed text. Once again, she positioned her cursor after the “e” in the word “me” and deleted this word along with the space. She replaced the space and paused. I asked about her thinking and she replied, “I’m going to remake stuff.” She positioned the cursor after “k” in “chuck,” deleted this text, then announced, “I think now this makes sense” She read the tweet from the beginning, this time when reading the second sentence she verbally inserted the word “help” which was no longer a part of the text. The beginning of the second sentence read, “That I need some chuncking words ... ,” and she read, “That I need some help chunking words... .” She continued reading, “I can look up when I, and I see,” the text read, “I can look up and see.” Irene paused, placed her index finger under her chin and said, “hmmm.” She again returned to the beginning of her tweet and reread. She read to the next location to edit, positioned the cursor before the “w” in “words,” typed and quickly deleted “.” along with the space between the words. With the cursor located after the text “chunking” the autocorrect suggestions displayed the three choices: “chuncking,” chunking, and chunking. Irene selected “chunking” then backspaced to remove the automatic space and typed her end punctuation mark. Next, she used the magnifying glass to position the cursor after “w.” She deleted this letter, pressed caps lock and typed “W.”

Rather than rereading the text, Irene just worked on, reading the next sentence, “Words that are hard words I can look up and see what needs to be chunked.” Repositioning the cursor from the position after the “W” in “Words” to the position before the “t” in “that” she deleted the space and letters “ords” then retyped these words, “ords” without adding a space, leaving the text to read “Wordsthat” underlined in red. Next Irene repositioned her cursor to the end of her tweet text. Paused, noticed the red underline, and repositioned her cursor to the position after the “t” in “Wordsthat.” She deleted the “t” added a space and then typed “t.” Next, she activated the

magnifying glass and moved her cursor the position before the “t” in “that.” Finally, without rereading, she positioned her cursor after the ending punctuation mark of her tweet and announced with a big smile, “Okay! Now that makes sense.” The text read, “The word of the day helps me with my words. That I need some chunking. Words that are hard words I can look up and see what needs to be chunked.” At this point, Irene had been working 10 minutes and 51 seconds.

Without adding a space after her end punctuation mark Irene typed “#” then said, “no” and deleted both the hashtag mark and the end punctuation mark. She retyped the period and then typed “by” switched from the alphabet keyboard to the numeric keyboard and typed “610” then switching to the special character keyboard and typed “#.” The text read “chunked.by610#.” She used the magnifying glass to move her cursor to the position between the “0” and “#” and added a space. When she added the space the keyboard automatically switched from the special character keyboard to the alphabetic keyboard. She switched to the numeric keyboard, repositioned her cursor to the position after the “#” and switched again to the alphabetic keyboard. Irene typed, “wordoftheday” without noticing the list of suggested hashtags which included “WordOfTheDay.” Total time, 12 minutes and two seconds.

I asked Irene, “How do you know when it’s ready?” She picked up her tweet checklist and said, “We ask ourselves,” and then started reading to me each checkpoint, glancing at the iPad screen as if to check her work according to each point, “Write two sentences. What are you learning about? Why are you learning about it? How will you use this information? Read your sentence out loud and check for the following: ‘my sentences have subjects, who and what.’” With a less-than-one-second glance at her tweet, she said, “umhum” and returned to reading the next point on the checklist. “My sentences have perio... [I helped her with the next word]

predicates, action and what.” Again, she acknowledged completing this item and continued reading. “My sentences make sense.” Without looking at her tweet she nodded her head and said, “Yes.” She continued, “My sentences have capitalization.” Again, with a confirming nod of her head and a very quick glance, she confirmed, “Umhum.” She continued reading, “My sentences have punctuation.” This time Irene leaned over the table to look closely at her iPad screen. She moved her lips, silently reading her writing. Without talking she stopped reading, repositioned the cursor from the end of her tweet to the position after the period ending her first sentence. She deleted the period, moved the cursor back to the end of her tweet and moved the cursor again to the end of the recently revised text that now read “wordsThat.” Irene used the magnifying glass to position the cursor in the position after “T.” She deleted the capital “T” and typed a lowercase “t.” Next, she used the magnifying glass to position the cursor between “s” and “t” and added a space. The text now read, “words that.” Finally, she read on from where she added the space, reading, “Words that I need, that I need some chunking. Words that are hard words I can look up and see what needs to be chunked. By six ten hashtag word of the day.” Irene smiled, turned to me and said, “Perfect.” Tweet publish time: 14 minutes and 27 seconds.

The prominent patterns observed in the letter, word, and phrase analysis of Irene’s composition moves indicate that similar to Hal and Hope, more than half of Irene’s tweet is ‘produced’ by the text generation tools that accompany Twitter. For instance, Irene used *autocomplete* or autocorrect for thirty-one of the thirty-three words in her first draft. Inefficient technology use is found in less prominent patterns with text deletion and selecting *autocomplete* after typing the complete word. For instance, Irene *deleted* sections of text then immediately retyped this same text. Irene also completely typed out nine words followed by tapping these

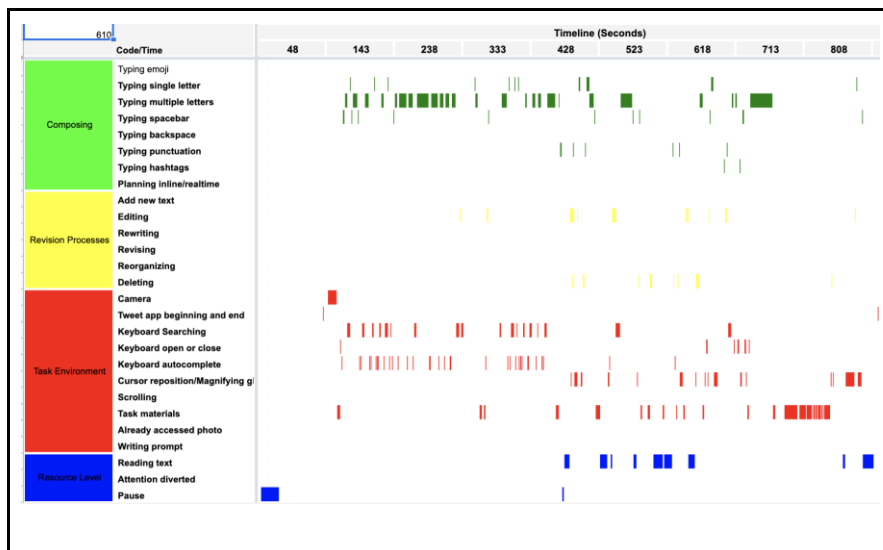
same words in the *autocomplete* bar. Irene successfully *repositioned her cursor* sixteen times and *reread* sections of her tweet nine times.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing*, *revision processes*, *task environment*, and *resource level*. As can be seen in Figure 23, the complete tweet analysis used a timeline to represent Irene’s second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Irene’s composition moves over time.

Figure 23

Irene’s Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 23 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* like chunks of words, “wor” in “word” and “re” when typing “hared” (n=25) *typing spacebar* after a word (n=11) and *typing single letters*, often letters at the beginning and medial points of words and to correct single letter miscues (n=11). Further, Irene’s composing included

six occurrences of *typing punctuation*. The first punctuation mark was typed after the last word of her complete tweet. The additional punctuation marks were included after Irene checked her work and made multiple edits. Additionally, two *typing hashtags* were observed, but after edits, her final tweet included only two punctuation marks and one hashtag. Finally, due to a lack of evidence, *planning in-the-moment* was not recorded but the possible influence of the *autocomplete* suggestions should be noted, suggesting Irene's *planning in-the-moment* outcome was influenced by the *task environment*. The other two *composing* codes (*typing emoji* and *typing backspace*) were not evidenced in Irene's composition moves.

The *revision processes* section of Figure 23 (colored yellow) shows a high frequency of *editing* to add punctuation, capital letters and fix spelling (n=11). Similarly, eight *deleting* occurrences were observed, often in conjunction with the editing occurrences. For example, Irene's first edit and delete occurred when she added an end punctuation mark creating her first sentence, "The word of the day helps me with my words." To accomplish this edit she deleted the "t" in the word "that" located after "words". She deleted the space between "t" and ".", changed the "t" to a capital "T" which automatically created a space between the end punctuation and newly added capital letter. After further edits and deletes to the second sentence, Irene returned to the previously discussed "T", changed it back to "t" and removed the "." in an attempt to address syntax miscues. The other four *revision processes* codes (*revising*, *add new text*, *rewriting*, *reorganizing*) were not evidenced in her composition moves.

For the *task environment* section of Figure 23 (colored red), the most frequently occurring composition moves were *keyboard autocomplete* to generate the majority of text (n=30), *task materials* to glance at the iPad screen and when reading the twitter sheet to check her work (n=25), *keyboard searching* to locate letters (n = 18) and *cursor reposition/magnifying*

glass to access and text to be edited (n=16). Irene employed the *keyboard open or close* seven times, once after adding her photo and six times toward the end of tweeting when adding her hashtag and signature. She accessed the *tweet app beginning and end* twice, first when she started tweeting and again when she submitted his tweet. Accessing the *camera* to add her previously taken photo was employed one time while composing. *Writing prompt, already accessed photo*, and *scrolling* were the only *task environment* code not evidenced in his composition moves.

Finally, the *resource level* section of Figure 23 (colored blue), shows there were nine occurrences of *rereading* the text. The first reading occurred after Irene typed her entire first draft. The additional rereadings were spaced out around the middle of her writing time after pausing to think or after making corrections, and again before submitting to publish. Two *pauses* were recorded to account for the time before the tweeting started and once midway through our time together. *Attention diverted* was not part of Irene's composition moves.

Complete tweet analysis: In thirds. Irene's composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 8 and Figure 24. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing, revision, task environment*, and *resource level*.

Table 8

Summary of Irene's Composition Moves frequency of use in thirds

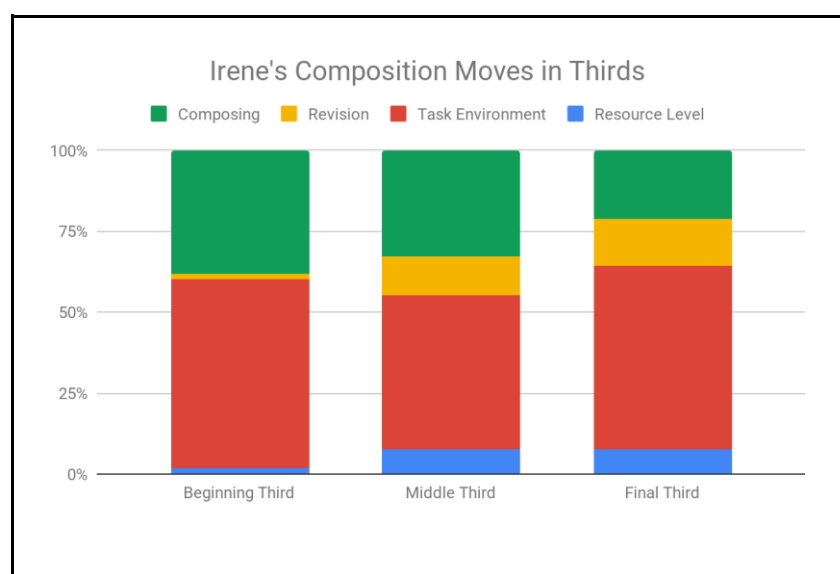
	Beginning Third	Middle Third	Final Third	Total %
Composing	10	12	8	30
Revision	1	4	5	10
	16	17	21	54

Table 8 (cont'd)

Task Environment				
Resource level	1	3	2	6
Total %	28	36	36	100

Figure 24

Irene's composition moves in thirds



The composition moves in the beginning third of Irene's tweet included the majority of her *composing* as *multi-letter typing* with some *single-letter* and *spacebar typing*. Irene's *revision* work included one *edit* when she worked to spell the word "hard." The *task environment* work included accessing the *camera* to add her photo, a high frequency of *autocomplete* use, and some *keyboard searching*. Irene's *resource level* work included the *pause* waiting for the Twitter app to load.

The composition moves in the middle third of Irene's tweet included the same concentration of total composition moves as her final third. During this time both *typing multiple*

letters, single letters, and typing spacebar were numerous with some *typing punctuation*. Irene's middle third *revision* work included both *editing* and *deleting* in equal amounts. The *task environment* moves were *keyboard autocomplete, keyboard searching* with some *cursor repositioning/magnifying glass* and *task materials*. Finally, during this time Irene *paused* once and *read* her text written so far four times.

The composition moves in the final third of Irene's tweet were similar to her middle third composition moves. When *composing*, in addition to *typing multiple letters, single letters, and typing spacebar* this time also included the use of *typing punctuation* and *typing hashtags*. For *revision*, all of the *editing* and *deleting* moves were similar to the middle third editing and deleting with an increase in *editing* by two. The *task environment* composition moves included a high increase in *task materials* and use of the *cursor reposition/magnifying glass*, a single *autocomplete* and her most frequent use of *keyboard open or close*. Finally, for *resource level*, the final third included five different *readings* of the text written so far.

Emergent Features

Based on all the data gathered from Irene, an additional element was identified in Irene's use of tweet-composing technology. This element was categorized as emergent findings associated with her statements about various word tools (*red underline, blue highlight, magnifying glass*) and what were observed in her use of the *autocomplete* word suggestions, which were short, single, unelaborated responses.

Word tools: Red Underline, Blue Highlight, Magnifying Glass and Autocomplete

The data indicated Irene has a basic understanding of the *red underline, blue highlight, and magnifying glass* features. When asked to tell me about the red underline, Irene replied, "The [red] underline means when [a word] is wrong, you can go back and fix it." Similarly,

when asked about a blue highlighted word she explained, “[The blue highlight is] when you need to finish something, it means you need to finish the word.” Interestingly, Irene did not say much more to connect the blue highlighted words with the autocomplete suggestions given her high frequency of use with this feature. Asking Irene to explain the *magnifying glass* she replied, “So, the bubble is kind of like a magnifying glass so it can help you see what you need to, it can help you when umm it's kind of like a magnifying glass so you can see what you need to do.” Finally, a close analysis of the screen capture video indicated that Irene used the autocomplete feature for most of the words in her tweet. This included words she had already typed out completely. For instance, Irene typed “words” followed by tapping the same word displayed in the autocomplete suggestion bar. Making this selection produced a space following the selected word. It was not clear why Irene made these selections. Unfortunately, I did not notice she was doing this at the time of the video stimulated recall interview thus did not ask her to tell me what she was thinking.

Summary of Irene -- Overall

The data interpreted for Irene resulted in a profile that indicates she is a confident tweeter. For Irene’s *writing processes* she seemed motivated by the enjoyment of the task and sharing her work with others. Her tweeting goals included sharing her learning and creating interesting content following the teacher-established expectation to tweet about the what and how/why of her learning. Irene planned her tweet content before writing and made in-the-moment plans while writing. She used genre knowledge to compose short-form writing including both a photo and hashtag within a fixed topic text structure. She also showed a growing understanding of followers, likes, cybersafety, and networking. Irene’s *composition moves* were predominately task environment components associated with the keyboard and task materials

followed by composing (transcription component skills). Specifically, for transcription, Hope often typed multiple and single letters and used the spacebar. For revision Irene had multiple edits and deletes. Task environment components included a high frequency of autocomplete, keyboard searching and repositioning the cursor. She also spent time looking at the twitter checklist paper. Irene was not distracted, paused only twice and read from her text nine times. Finally, Irene has an *emerging understanding* of the red underline, blue highlight, and magnifying glass features with an interesting approach when using the autocomplete feature.

Kip: Average-Low Scoring Male

General Description

Kip appeared nervous when he first started, taking a big breath as he approached the iPad to start tweeting. When I asked questions he would pause a second, take another deep breath, then answer in one-word responses. For instance, toward the beginning of our time together I asked Kip to tell me his thinking after deleting part of a word underlined red. He stopped, looked at me, then said, “capitalization?” I asked that he tell me more and he corrected himself saying, “It’s spelled wrong.” This nervousness seemed to fade over time. He started talking more, using hand gestures as he explained. In the end, analysis of his writing processes and composition moves suggested a more relaxed and confident engagement with tweeting.

Writing Processes

Based on the writing process model of Hayes (2012), Kip’s talk-aloud and video-stimulated recall data were analyzed in terms of *motivation, goal setting, planning, and writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Kip's *motivation* to tweet appeared positive. He seemed motivated by the enjoyment of the task and sharing with others. When asked if he likes to tweet Kip said, "[Tweeting is] fun because you get to write about something, and people around the world can see [the tweets], so it feels like you are an author."

Writing Processes: Goal Setting

Kip expressed two *goals* for tweeting: sharing or teaching his readers and creating meaningful messages. When asked about his first goal, Kip talked about sharing what he is doing in school so others that have Twitter might read his tweet "and then maybe they could do [what he is doing]." When commenting about his second goal, he said that tweets should make sense and that the purpose of tweeting is to communicate with others. This intent was most visibly expressed in his awareness of the teacher-established tweeting guidelines.

Writing Processes: Planning

Kip's *planning* included both *in-advance* and *in-the-moment* planning. In both cases, he followed the teacher's tweet format from memory and added ideas as he created his message. Evidence of Kip's *in-advance* planning occurred when he selected an object and took a photo of it to go with his tweet, using the object and photo as tools for advanced planning. Evidence of Kip's *in-the-moment planning* appeared when he generated specific ideas and words as he created his message. For example, when writing his second sentence Kip started listing reasons for liking math with someone. He could not think of a third reason, thus adjusting his plan. Similar to Irene, although on a much smaller scale, Kip's *in-the-moment planning* may have been

influenced by the autocomplete suggestions. This is evidenced by a word choice edit, selecting the word “someone” from the autocomplete bar after verbalizing the word “somebody.”

Writing Processes: Writing Schemas

Kip’s thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. Kip displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. He successfully composed a complete message using short-form writing, including meaningful multimodal elements, (a photo and a meaningful hashtag). Although his published tweet did not include an emoji, Kip talked about careful emoji selection. The hashtag and photo Kip included in his tweet matched the meaning of the text, with the assumption the reader shared in his classroom experience. For instance, the photo is an image of the math rotations for the day. This includes papers magnetically held to a classroom whiteboard, each paper associated with instructions written on the whiteboard.

Writing schemas: contextual elements. Kip displayed knowledge of four contextual elements as he tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, without saying the word “*followers*,” Kip showed an awareness of his audience saying those that read his tweets include “kids in the classroom, me, everyone.” He then clarified, followers only include those with a Twitter account. This led to his comments about “*likes*” saying, “So, [people with a] Twitter account, you could like theirs, like sometimes, and you could see around the whole world, twitters.” When it came to *cybersafety* protocols, Kip acted in ways consistent with the protocols established by his teacher. He also explained, “If you put your name at the end of it or like your phone number or whatever... you will.... they will maybe go to your house.” evidencing

his concrete understanding of this abstract concept. When it came to the contextual element of “*networking*,” Kip talked about sharing and receiving ideas. For example, Kip explained that he and his classmates could learn from reading other tweets “if they are doing [tweeting] about learning things,” and others could learn from his tweets, [pointing to his tweet] “about math rotations.”

Writing schemas: text structure. Kip’s completed tweet was characteristic of a *fixed topic text structure*. His topic was an aspect of a class activity called math rotations. Math with someone is one of the math rotations. Kip’s second sentence did provide a reason why he likes math with someone, “because we get to work and play with someone” but did not elaborate. Also, while following the teacher-established guidelines to tweet about what he is learning and why or how this learning is helpful, Kip did not explicitly say that he was learning a math concept. Instead, he told his readers why he liked a particular math activity, assuming his readers share a common knowledge of the math rotations and math with someone experience.

Composition Moves

Based on the composition move model of Hayes (2012), Kip’s talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

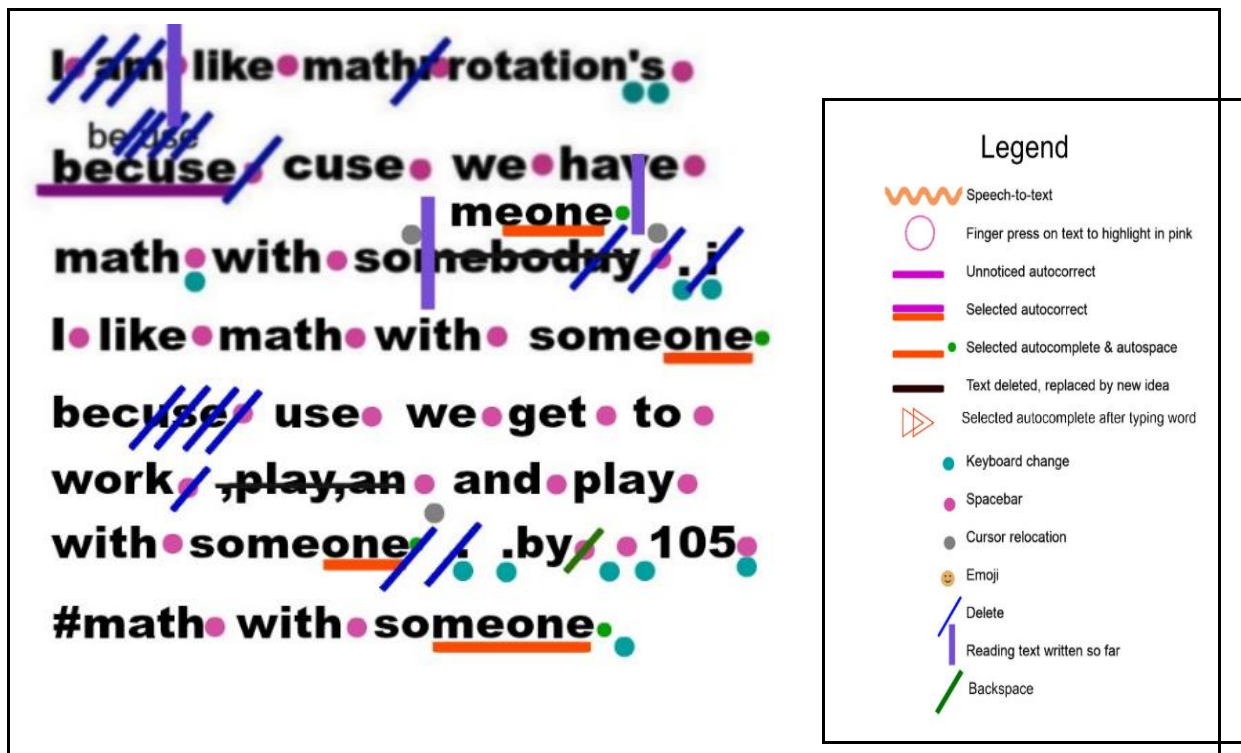
Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Kip’s letters, words and phrases captured his real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). To illustrate, Figure 25 represents Kip’s revising with blue delete marks. And the

points where he reread are shown as vertical purple marks. A detailed account of Kip's letter, word, and phrase composition moves follow.

Figure 25

Kip's letter, word, and phrase flow-of-composing



As I adjusted the screen capture to enlarge the recorded iPad screen, Kip sat patiently. Once I was done he took a deep breath, leaned in toward the iPad and started typing, "I am" then paused and deleted the word "am" along with the space separating the word I and am. He quickly re-added the space and then I interrupted asking that he tell me what he was thinking. He replied by saying what he wanted to type, "I like math rotations." As he started to type the letters in the word "like" I asked him to tell me what he was going to type before he changed his mind. He replied, "I am doing math with someone." When asked what made him change his mind he said that it didn't sound right. After reminding Kip to talk as he created his tweet he quickly started

saying aloud the words he was typing or intended to type. For example, when typing the word “math” after entering the letter “a” he said “rotations,” the next word he planned to type. Kip typed the letter “r” without adding a space, looked at the screen a moment, deleted the “r,” added a space and typed the “r” while stretching the beginning sounds /rooooo/ and typing “o” followed by saying “tations” and typing “tation.” Next, Kip made the “s” sound while changing to the number keyboard. He added the apostrophe. The keyboard automatically returned to the lowercase letters but he did not notice this change. Kip tapped the button to change the keyboard moving to the numeric keyboard, then quickly tapped the button again, returning to the alphabet keyboard. He then added the letter “s.” After completing the word he said aloud, “rotations” then repeated the word followed by the next word he intended to type, “rotations because.”

When typing “because” he left the letter “a” out. When adding a space before the next word the iPad autocorrected “becuse” to “be use.” Later, looking at the screen, Kip noticed this change and deleted until his cursor met the “e” in “be.” I asked Kip to tell me what happened. He explained, “I did this.” tapping on the space bar. I asked, “What did that do?” He replied while deleting the space he had just added, “It split it up.” His explanation revealed either a limited understanding of autocorrect or limited language to explain autocorrect.

Kip added the letters “cuse” followed by a space. This time the screen showed his attempt underlined in red. After looking at the screen he continued with his message saying the words aloud as he typed, “because we have math with somebody.” When typing “somebody” he selected the letter “u,” delete, then typed “y” as if correcting such typing errors has become automatic. To add his ending punctuation Kip changed to the numeric keyboard, typed the period and then paused to think. Returning to his typing he changed keyboards back to the alphabet board and added the letter “i” saying “I.” Noticing the lowercase “i” without the space between

words he deleted the letter. Without adding a space he pressed and held his finger on the letter “i” revealing a selection of this letter with six diacritic choices. Kip looked at the screen, mumbled to himself and then let up on the keyboard, saying “I know” and deleting the “i” again. Kip continued to problem solve deciding that he needed to use the capital letter keyboard to type “I” without a space after the previous word.

Kip continued his message, typing “like” then saying, “I like math with somebody, math with some...one...” then added a space and started typing, “I like math with someone” using the autocomplete for the first time, after typing “some” to create “someone.” Glancing at the iPad screen he repeated, “I like math with someone” from memory rather than a rereading of his text. He then said the next word, “because” then typed, “becuse.” Noticing the word was underlined in red he deleted letters “use.” I asked what he was thinking. He said as if a question, “capitalization?” I followed up saying, “Oh, for the word? Say more. Why do you think that?” Kip continued, “Because it’s wrong.” I continued, “And you think it’s the capital letter that’s wrong with it?” Kip shook his head, *no* and explained, “It’s spelled wrong.” He continued, “So, if it has a line under it, it means it’s spelled wrong but if you spell it right sometimes it does that, so, it doesn’t even... sometimes it does it but, sometimes it don’t, sometimes.” Kip’s explanation suggests a limited understanding of the keyboard tools and his attempt to invent meaning with something that does not make sense. When I asked him what he would do to help himself with the misspelled word he said while retyping “use” that he would “move along” and work on the word later.

Even though we paused from his writing to talk about the underlined word, Kip did not return to his writing by rereading first. As if mentally holding on to his ideas he jumped right back into his work saying the next words, “we get to work with someone.” While typing Kip

deleted the space after the word “work” added a comma, followed by “play,an.” He then said aloud, “we get to work, play, and” then he deleted his work until the cursor was next to the “k” in “work.” He typed a space and said with delight, “work and play” as if solving a problem. Kip then said, “with somebody” and typed “with some” and used autocomplete to create the word “someone.” Next, he quickly positioned his cursor to the second line of text where he had typed “somebody” and deleted letters until he was left with “so.I.” Kip held his finger to the iPad screen to reveal the magnifying glass. He moved his finger on the screen, whispering “I can’t get it” while trying multiple times to place his cursor between the letter “o” and the end punctuation mark. This is interesting because before accessing the magnifying glass the cursor was already in that position. This makes me wonder if he did not realize he could start typing from that position right after deleting or if he simply did not notice the cursor was already there.

Finally successful with his cursor position Kip stopped, rubbed the right side of his forehead with his right hand and started to reread the first part of his text up to the point of his cursor. He added the letter “m” then paused to look at his keyboard and then selected the autocomplete suggestion, “someone.” Once he made this selection the word was automatically followed by a space. This moved Kip's end punctuation a space away from the word. He did not correct this space error. Instead, he positioned his cursor to the end of his text and then read aloud his entire tweet. After reading he switched to the numeric keyboard and typed a period a space away from his final word and then looked up at me. Kip glanced at his screen, deleted the period and space then typed his end punctuation next to the last letter of his last word. This shows me that Kip notices when he has spaces or punctuation marks inaccurately placed. Why did he not notice the spacing error after his first sentence? Also, when typing the expected tweet ending he did not add a space after the punctuation mark. Immediately after the end punctuation,

Kip typed “by 105 #” and then, looking up at me said, “math rotations.” I asked how he decided that as his hashtag. Kip explained, “because it’s talking about half of the math rotations.” After typing the first letter of his hashtag he paused and said, “I think math with someone because it’s mainly talking about math with someone.” Kip continued typing his hashtag “#math with so” and then selected the autocomplete suggestions “someone.” To type the hashtag character (#) Kip did not change keyboards, rather he used the alphabet keyboard. Kip opened the photos, selected the image he took before starting his tweet and after getting the “okay” from the adult (me) he published his tweet. From start to finish, including a few moments of conversation, it took Kip 11 minutes and 40 seconds to compose his tweet.

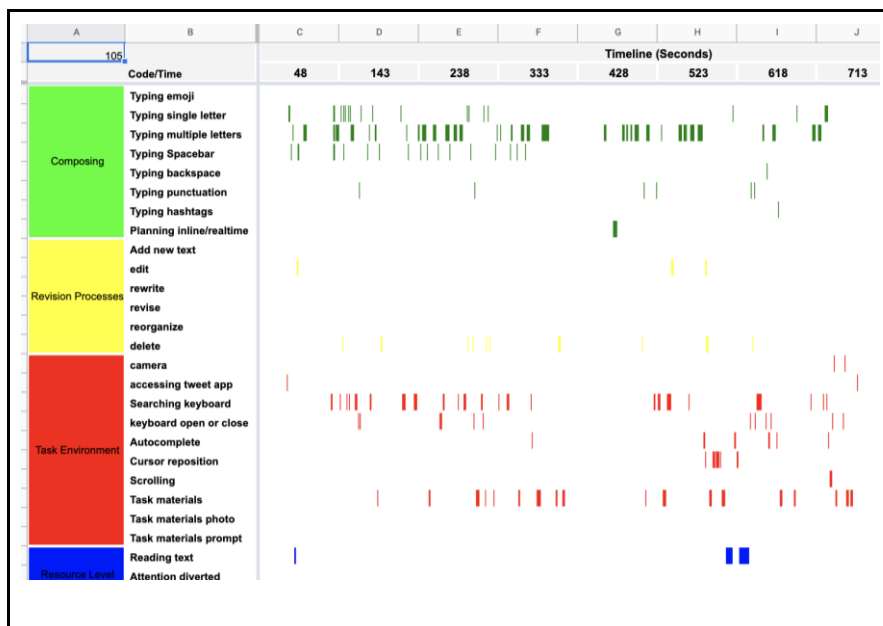
The prominent patterns observed in the letter, word, and phrase analysis of Kip’s composition moves indicate that he maintained focus the entire time, made a strategic word choice change to show consistency using “someone” rather than including “somebody.” Kip easily typed all of his words using the autocomplete tool only when completing the word “someone.” Kip included a variety of punctuation marks, using but confusing the apostrophe and including commas in a list. Kip consistently misspelled one word, “because” forgetting to add the “a.” Rather than questioning his spelling based on the red underline he reasoned the red underline was inconsistent showing correctly spelled words (homophones) with a red underline. Kip was conscientious with his spaces between words with one error after his first sentence. This error may have been influenced by just completed edits. Like most of Kip’s classmates, he did not add a space before typing his tweet ending, “by the assigned number.” Further, Kip added spaces between words in his hashtag.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing*, *revision processes*, *task environment*, and *resource level*. As can be seen in Figure 26, the complete tweet analysis used a timeline to represent Kip's second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Kip's composition moves over time.

Figure 26

Kip's Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 26 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* like chunks of words, “tion” in “rotations” (n=36) *typing spacebar* after a word (n=17) and *typing single letters*, often letters at the beginning and medial points of words and to correct single letter miscue (n=17). Further, Kip's composing included six occurrences of *typing punctuation* (three periods, two commas, and one apostrophe) and one *typing hashtags* in which

the hashtag text included spaces between the words. Finally, *typing backspace* and *planning in-the-moment* were each observed once. His *planning in-the-moment* occurred when writing his second sentence. Kip started listing reasons for liking math with someone. He could not think of a third reason, thus adjusting his plan. The *composing* code *typing emoji* was not evidenced in Kip's composition moves.

The *revision processes* section of Figure 26 indicates (colored yellow) the most frequently occurring revision processes move observed was *deleting* to correct mistyped letters such as “u” for “y” and “i” for “l” and spelling miscue corrections (n=10). *Editing* occurred three times, each when making word choice decisions. For instance, using “someone” rather than “somebody.” Similar to Irene, although on a much smaller scale, Kip's word choice edit may have been influenced by the autocomplete suggestions. This is evidenced when he selected the word “someone” from the autocomplete bar after verbalizing the word “somebody.” The other four *revision processes* codes (*revise*, *add new text*, *rewriting*, *reorganizing*) were not evidenced in Kip's composition moves.

For the *task environment* section of Figure 26 (colored red), the most frequently occurring composition moves were *keyboard searching* to find needed letters (n=23) using *task materials* when looking at the iPad screen (n=18) and keeping the *keyboard open or close* to navigate between the alphabet, numeric, and special character keyboards (n=11). Kip accessed the *keyboard autocomplete* usually after multiple letters in a word had already been typed (n=6) and the *cursor reposition/magnifying glass* to relocate his cursor five times. Kip accessed the *tweet app beginning and end* twice, first when he started tweeting and again when he submitted his tweet. He also accessed the *camera* twice, once to add his previously taken photo and once tapping the camera access button on accident. Similarly, *scrolling* was accessed once by mistake,

attempting to scroll the tweet text up to view his photo, realizing he had not yet added the photo to his tweet. *Already accessed photo* and *writing prompt* were the only *task environment* code not evidenced in his composition moves.

Finally, the *resource level* section of Figure 26 (colored blue), shows there were seven *pause* occurrences, once before the tweeting started, and multiple times throughout the composition moves. Similar to Hal, these pauses appeared to be moments of thinking. *Reading* text three times, once around the beginning of his writing time, after making his first edit, once after making corrections before adding his tweet closing signature, and again before submitting to publish. *Attention diverted* was not part of Kip's composition moves.

Complete tweet analysis: In thirds. Kip's composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 9 and Figure 27. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

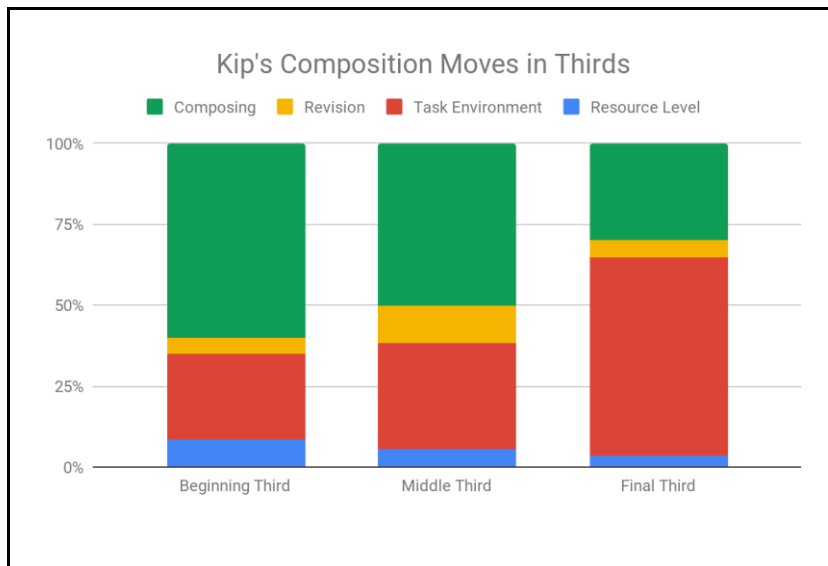
Table 9

Summary of Kip's Composition Moves frequency of use in thirds

	Beginning Third	Middle Third	Final Third	Total %
Composing	21	15	10	46
Revision	2	3	2	7
Task Environment	10	10	21	41
Resource level	3	2	1	6
Total %	36	30	34	100

Figure 27

Kip's composition moves in thirds



The composition moves in the beginning third of Kip's tweet included the majority of his *composing* as *multi and single letter typing* and *spacebar typing*. Kip also did some *revision* work, *deleting* a letter typing mistake, "r" without first typing a space and "i" for "I." He also made a word choice *edit* changing "am" to "like." The *task environment* work included *keyboard searching*, *keyboard open or close* and *task materials* (looking at the iPad screen). Kip's *resource level* work included the *pausing* waiting for the Twitter app to load and three other *pauses* with one time *reading* his text after making revisions.

The composition moves in the middle third of Kip's tweet included the majority of his composing as *multi-letter typing* with a few *single-letter* and *spacebar* moves. This part of the timeline also included *punctuation*, (commas in a sequence) and *in-the-moment planning* (thinking of what to write after "because," trying out a few ideas). Kip's *revision* moves included six *deletes*. These *deletes* were to remove typing and spelling miscues. Most of Kips's *task environment* time is similar to his beginning third with *keyboard searching* and *task materials*,

the difference being a reduction in *keyboard searching* and an increase in *task materials* (looking at iPad screen, thinking). Kip also used the *autocomplete* once for the word “someone.” Kip’s *resource level* moves included three *pauses*. He *paused* after completing his first sentence and after the beginning phrase of his second sentence. The third *pause* was during a transition from answering my question and getting back into his writing.

The composition moves in the final third of Kip’s tweet included the majority of his *composing* time with *multi-letter typing*, only three *single-letter typing* moves, two short moments of adding *punctuation* and a short moment adding the *hashtag*. Kip’s *revision* work included two *edits* and two *deletes*, for similar reasons as previous edits and deletes. The *task environment* work included an increase in the variety of moves. *Keyboard searching* and *task materials* remained similar to the beginning and middle thirds. The final third included accessing the *camera*, *scrolling*, and using the *cursor reposition* for the first time. There was also increased use of *keyboard open or close* and *autocomplete*. Kip’s *resource level* work included two *readings* of his tweet while making final changes before tweeting.

Emergent Features

Based on all the data gathered from Kip, an additional element was identified in Kip’s use of tweet-composing technology. This element was categorized as emergent findings associated with his statements about various word tools (*red underline*, and *autocomplete*). Similar to Irene, during the video-stimulated recall interview, Kip provided short responses without much elaboration.

Word tools: Red Underline and Autocomplete

The data indicated Kip has a basic understanding of the *red underline* and *autocomplete* features with some misconceptions. Kip talked about the *red underline* and misspelled words,

but noted how sometimes it appears when the spelling is correct. He explained, “because, one time I spelled when ‘win’ [and another time I wrote] ‘we won,’ and [those words were] underlined.” It makes sense that Kip would be confused, not expecting reasons beyond the obvious misspelling to activate the red underline. Similarly, during the video-stimulated recall interview, I asked Kip about an *autocomplete* action he did not notice while typing. The close video showed "becuse" highlighted in blue change to "be use" (a choice provided by the autocomplete) when Kip pressed the spacebar. After watching this video segment Kip responded, “It's the same thing, but, it's different, like different spelling.” He then explained how the feature works, “If you're trying to spell a word you could see it up there [pointing at the top of the keyboard] if it's up there, you could press on it, and it puts the word up there. I did it [for the word] ‘somewhere,’ but I only use it sometimes.” When I asked him if this feature was helpful he answered, “It's helpful because if you forgot how to do it and then if you see the word, you look at it, and if it spells right you press on it, so it helps you spell it.” Kip also recognized the *autocomplete* feature as a convenient tool for generating “big words” because “it’s a faster way.”

Summary of Kip -- Overall

The data interpreted for Kip resulted in a profile that indicates Kip is a confident tweeter even though, at first, he seemed nervous. For Kip’s *writing processes* he seemed motivated by sharing his learning with others and feeling like an author. His tweeting goals included sharing what he was doing in class and following the teacher-established expectation to tweet about the what and how/why of his learning. Kip planned his tweet content before writing and made in-the-moment plans while writing. He used genre knowledge to compose short-form writing including a photo and a hashtag within a fixed topic text structure and showed a growing understanding of followers, likes, cybersafety, and networking. Kip’s *composition moves* were

predominately composing (transcription component skills) and task environment components associated with the keyboard and task materials. Kip's typing was efficient and easy, with some typing errors based on side-by-side keyboard location and accidental typing moves. For this reason, Kip had multiple edits and deletes to correct these errors and adjust for word choice changes. Task environment components included frequent keyboard searching and looking at the iPad screen doing what looked like thinking of what to write next. He used the autocomplete as a faster way to write big words and the cursor repositioning as an efficient tool when navigating the text. Finally, Kip has an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Kayla: Average-Low Scoring Female

General Description

Kayla appeared less confident than her classmates when meeting with me. This is evidenced by her immediate request for help both for an initial idea and spelling the fourth word of her tweet. She also experienced several keyboard-related errors during our meeting. The analysis of her writing processes and composition moves, however, provided evidence of a more resilient problem-solving engagement with tweeting as time went by.

Writing Processes

Based on the writing process model of Hayes (2012), Kayla's talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Kayla's *motivation* to tweet appeared positive. When asked if she likes to tweet she shook her head with

a big smile, then explained that she liked to tweet, “because you getta tweet and send it and people like it and stuff.” Similar to Hope and other students, Kayla appears motivated by sharing with others and receiving feedback in the form of “likes” from her readers.

Writing Processes: Goal Setting

Kayla expressed two *goals* for tweeting: sharing with her readers and creating meaningful messages. When asked about her first goal, Kayla talked about sharing what she is doing so other people on Twitter can see her tweets. When asked about her second goal she explained why she made changes to her text, “I changed my mind instead of changing the sentence, I went back and made it the same way it was before, because, I’m like, it didn’t make sense. If I added another word, it wouldn’t make sense.” She also stated more than once while tweeting, “I’m going to read it to make sure it makes sense.”

Writing Processes: Planning

Kayla’s *planning* included both *in-advance* and *in-the-moment* planning. In both cases, she followed the teacher’s tweet format from memory and added ideas as she created her message. Evidence of Kayla’s *in-advance* planning occurred when she selected an object and took a photo of it to go with her tweet, using the object and photo as tools for advanced planning. Evidence of Kayla’s *in-the-moment planning* appeared when she generated specific ideas and words as she created her message. For example, before typing, Kayla paused, unsure of what to write about. After loading her previously taken photo she quickly started her first sentence, “This is are math rotations.” Kayla’s *in-the-moment planning* also appeared while “thinking about what to add,” but when she could not think of another word she explained, “I was thinking I should add another word but I didn’t know a word so that’s why I went back.”

Writing Processes: Writing Schemas

Kayla's thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. Kayla displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, and hashtag. She successfully composed a complete message using short-form writing, including meaningful multimodal elements, (photos and a meaningful hashtag). The hashtag and photo Kayla included in her tweet matched the meaning of the text, with the assumption the reader shared in her classroom experience. For instance, Kayla selected the same photo content as Kip, an image of the math rotations for the day. As stated previously, this included papers magnetically held to a classroom whiteboard, each paper associated with instructions written on the whiteboard.

Writing schemas: contextual elements. Kayla displayed knowledge of four contextual elements as she tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, in a statement explaining the importance of a coherent message she evidenced her awareness of *followers* and *likes* explaining, "The people who follow and want to retweet [your tweet] and like it and stuff, If it don't make sense, they're not going to like it." In contrast, when asked who reads and likes her tweets she admitted, "I'm not sure. Well, when it was Leprechaun's day, a leprechaun liked ours, It's Liam the Leprechaun." When it came to *cybersafety* protocols, Kayla acted in ways consistent with the protocols established by her teacher. When it came to the contextual element of "*networking*," Kayla talked in generalities, saying "they" and why she needs to fix her mistakes so "they get what the tweet says."

Writing schemas: text structure. Kayla's completed tweet was characteristic of a *fixed topic text structure*. Similar to Kip, her topic was math rotations. When asked how she knew her tweet was ready to publish she said, "[I know] because I told how I use it and why, how it could help." Looking again at her published tweet the first sentence read, "This is are math rotations." Similar to other students, she did not explicitly say what she is learning, she tells the reader about the content of her photo. Kayla's second sentence reads, "This will help me with math." Again, similar to other students, this statement did not explain the details of her math learning.

Composition Moves

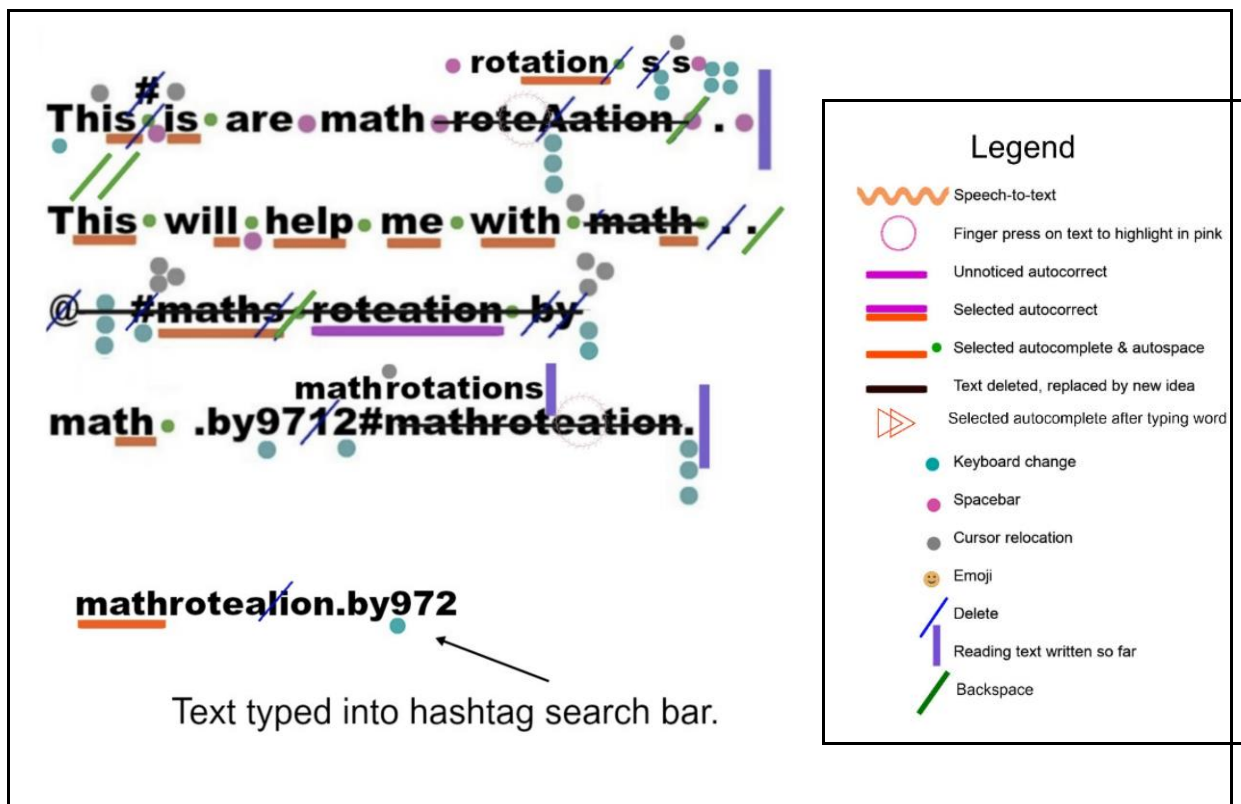
Based on the composition move model of Hayes (2012), Kayla's talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Kayla's letters, words and phrases captured her real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). Kayla's use of the task environment autocomplete feature can be seen by the orange underline of text followed by a bright green circle. The line of text toward the bottom of the figure illustrates Kayla's composing without realizing she was typing in the hashtag search bar. A detailed account of Kayla's letter, word, and phrase composition moves follow.

Figure 28

Kayla's letter, word, phrase flow-of-composing



Kayla started her tweet by immediately asking for help, saying she did not know what to tweet. After I suggested looking at her photo, she starting typing. She keyed in, “Th” then selected "this" from the autocomplete word bar. Next, she typed, “is” a space, and "are" without pausing between letters. Next, she said aloud her next words, “math rotations” then asked, “how do you spell math rotations?” I responded by asking what she could do to help herself and she replied, “Sound it out,” as she started typing, “m” “a” “th” followed by the spacebar. Next, she searched the keyboard, typing each letter between searches, “r” “o” “t” “e.” After typing “e” the caps lock automatically engaged on the keyboard without Kayla noticing. The caps lock disengaged once the "A" was typed. Kayla paused a moment, looked at the letter, then backspaced to deleted "A." Next, the numeric keyboard opened and switched to the special

characters keyboard, then switched to the alphabet keyboard. This all happened in seconds as if switching through the keyboards has become a common composition move. Next, Kayla searched the keyboard and typed, “t” “io” “n” followed by the space bar. She looked up from the keyboard, adjusted in her seat and smiled. Looking back at the iPad screen she removed the space, typed a period and pressed the spacebar. At this point, Kayla had been working two minutes and forty-seven seconds.

After reading her first sentence she looked up, scratched her neck, and continued to her next sentence. She typed “T” and selected "this" from the autocomplete choices. She searched the keyboard and selected “w” then “i” and selected "will" from the autocomplete choices. After the autocomplete selection, the cursor automatically spaced for the next word. When Kayla typed the spacebar the cursor blinked but stayed in its already spaced position. The next three words, “help, me, with” were selected from the autocomplete bar then Kayla searched the keyboard and typed, “m” “a” followed by "math" from the autocomplete bar. Without noticing the automatic space Kayla typed her end punctuation. She looked at the iPad screen, deleted the punctuation mark and space then retyped the punctuation next the last word in her second sentence. At this time, three minutes and fifty-seven seconds had passed.

Kayla paused a moment and I asked about her thinking. She replied, “I’m thinking about what to write next.” Looking at the iPad screen (thinking) she deleted her end punctuation from her second sentence, put her left fist to her mouth and continued to think. Unable to come up with more words to add on, she retyped her end punctuation. Kayla pressed buttons causing multiple keyboard switches including the “edit photo” screen. She laughed, not sure what was happening. She returned to the tweet space, smiled, took a deep breath and returned to her writing. She opened the alphabet keyboard and typed “#,” looked at the screen and selected

"maths" from the scrollable hashtag choices and deleted the "s." Kayla scrolled through the hashtag choices looking for "#mathrotations." Unsuccessful, and without noticing her cursor in the hashtag search bar after the word "math" she started typing, "r." Kayla continued typing and searching the keyboard between single and multi-letter typing. She typed, "o" "t" "ea" "l" deleted "l" and continued typing and searching, "t" "io" "n." Still typing in the hashtag search bar she continued, "." "b" "y" switched to the numeric keyboard and typed, "9," searched the keyboard, "7" "2" and showed me the screen. She mumbled something like, "I don't know what's going on." Somehow she returned to the tweet text space. The text she typed in the hashtag search bar showed up in her tweet text space without "by 972." The text read, "This is are math roteation. This will help me with math.#mathroteation" Next, she typed "b" "y" and then said, "Oohh, I was supposed to but the 'by' over here," pointing to the space in the text before the hashtag symbol. She deleted the word "by" and repositioned the cursor between "#" and "m." At this point, the entire tweet highlighted in blue. Confused, Kayla commented, "Oopsie, what is it doing?" then the keyboard closed and opened again, the cursor positioned back between "#" and "m." As she tried to move her cursor she positioned it the end of "This" in her first sentence and the cursor changed to "#." At this point, both Kayla and I were confused but she was resilient and problem solved her way through the confusion.

The tweet text read, "This# is are math roteation. This will help me with #.#mathroteation." Somehow the last word of her second sentence, "math" became highlighted and replaced with "#." Kayla muttered, "I might just have to..." as she moved the cursor to the end of the entire tweet and started deleting. Now the text read, "This# is are math roteation. This will help me with." Next, she noticed the "#" next to "This," moved the cursor and deleted both the space between the words and the "#" leaving "Thisis." She added a space between the words

and moved the cursor to the end of the tweet text and retyped “m” “a” and then selected “math” from the autocomplete choices. After talking to me for a moment she returned to her work, searching the keyboard for end punctuation followed by “b” “y.” She switched to the numeric keyboard and typed “971,” deleted the “1” and typed “2.” She returned to the alphabet keyboard and typed “#.” Moving a bit in her chair she carried on, typing “math” “rot” paused to sound out the word then typed “eat” “i” “on.” I asked Kayla, “Anything else?” She replied, “I spelled rotations wrong. I don’t know how to spell it.” I asked her, “How do you know that it’s wrong?” She explained, “Because when I was writing up here [points to the first sentence] it made a red line so it’s wrong.” Kayla prepared to correct the spelling but first, the keyboard minimized then reappeared. The text “roteation” highlighted pink then highlighted blue with “cut and copy” edit choices above the word. Kayla deleted the word.

At this point, I started talking her through what to do. I instructed, “Okay, now you want a space,” creating a space after the word “math” in her first sentence. Next, I showed Kayla a notecard with the word “rotations” written in marker. She looked at the card and typed “r” “o” “t,” noticed the word “rotation” in the autocomplete bar and tapped it. She typed “s” then noticed it was a space away from the word “rotation.” Rather than type the delete button, she tapped the “return” button by mistake. This moved her text to the second line. Again the keyboard minimized and reopened. This is when I noticed every time Kayla did this keyboard switch it moved her cursor to the end of her tweet text. She repositioned the cursor after the “s,” and deleted both the letter and the space after the word “rotation.” She typed the “s” and asked for help returning the second line text back to the first line. I asked if she had any ideas to solve the problem. She made a movement that looked like she was trying to drag the text where she wanted it. Realizing this approach would not work she looked to me for help. I instructed Kayla

to place the cursor next to “.” on the second line and press backspace to bring the text to the first line.

With a huge smile of relief, Kayla looked at me and swayed in her seat. She reread her tweet to make sure it was ready to publish. She read, “This is are math rotations. This will help me with math by nine seven two hashtag math rotations.” She then told me, “I still need to fix this ‘rotations’.” She tapped on the word and “mathroteation” highlighted in pink. She pressed delete. Forgetting that the word “math” was part of her hashtag, she started typing, “r” “o” “t” “at” “io” “n” “s” saying “rotations,” and “I think I’m done, but I’m going to read to see if it makes sense.” She read, “This is our math rotations. This will help me with math by nine seven two hashtag.... Utoh! [pointing to the text] the math just disappeared!” She moved the cursor between the “#” and the letter “r” and quickly typed “math.” Finally, with another big smile, she published her tweet. This tweet session ended at 14 minutes and forty-two seconds.

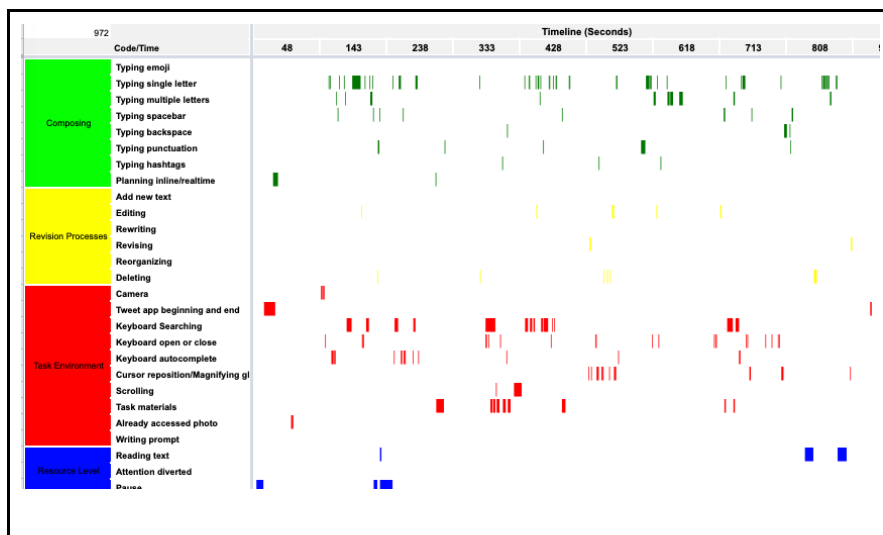
The prominent patterns observed in the letter, word, and phrase analysis of Kayla’s composition moves indicate that similar to Hal, Hope, and Irene, more than half of Kayla’s tweet is ‘produced’ by the text generation tools that accompany Twitter. For instance, Kayla used autocomplete or autocorrect for twelve of the nineteen words typed. Inefficient technology use is found in less prominent patterns with text deletion. For instance, Kayla deleted sections of text then immediately retyped this same text. Most prominent was the inefficient frequent keyboard switching and accidental button pushing (all associated with the keyboard task environment). Kayla successfully repositioned her cursor eleven times and reread sections of her tweet three times.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing*, *revision processes*, *task environment*, and *resource level*. As can be seen in Figure 29, the complete tweet analysis used a timeline to represent Kayla’s second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Kayla’s composition moves over time.

Figure 29

Kayla’s Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 29 indicates (colored green), the most frequently occurring composition moves observed were *typing single letters* as Kayla typed most words a letter at a time (n=41). When typing words found a second or third time in her tweet such as “math” and “rotation” she often used *typing multiple letters* for example “ath” in math and “io” and “tion” in rotation (n=10). The next most frequent composition move was *typing spacebar* after a word (n=8). Further, Kayla’s composing included five *typing punctuation* occurrences and three each of *typing backspace* to remove a space after a

word and to correct text placement that was accidentally moved to the second line of her text box and *typing hashtags*. *Typing hashtags* occurred twice in the confusion of keyboard switching and button pushing and a final time to create her tweet closing. Finally, *planning in-the-moment* was observed twice. First after adding her photo and again when thinking of additional words to add to her second sentence. The *composing* code *typing emoji* was not evidenced in Kayla's composition moves.

The *revision processes* section of Figure 29 (colored yellow) shows six *deleting* occurrences, to remove unwanted letters such as "s" in "maths" and accidentally typed characters such as the # and @ symbols. *Editing* occurred five times, correcting spelling errors in the word "rotations" and cleaning up accidental typing. *Revising* occurred twice. First when Kayla took a photo of her pre-selected object, inspected the photo for quality, and decided to retake the picture for improved quality. Kayla revised again when she changed her hashtag text from "#rotations" to "#mathrotations." The other three *revision processes* codes (*add new text*, *rewriting*, *reorganizing*) were not evidenced in Kayla's composition moves.

For the *task environment* section of Figure 29 (colored red), the most frequently occurring composition moves were keeping the *keyboard open or close* many times appearing unintentional (n=22), and *keyboard searching* to find needed letters (n=14). The use of both *keyboard autocomplete* and *cursor reposition* to access different parts of text occurred eleven times. *Task materials* occurred nine times, twice to look at a note card to spell the word "rotations" and seven times to look at the iPad screen, appearing to think. Kayla used *scrolling* twice. First for a hashtag and again to scroll her screen from looking at her picture back up to look at her text box. Kayla accessed the *tweet app beginning and end* twice first when she started tweeting, and again when she submitted his tweet. Accessing the *camera* also occurred twice, once to take a

picture of her previously taken photo and to add her photo to her tweet. Kayla looked at her *already accessed photo* once to think of what to write and *writing prompt* as the only *task environment* code not evidenced in Kayla's composition moves.

Finally, the *resource level* section of Figure 29 (colored blue), shows there were three occurrences each of *reading text* and *pausing*. The first reading occurred after completing her first sentence. The remaining readings occurred once while making edits and again before submitting her tweet. The *pausing* occurrences recorded to account for the time before the tweeting started and twice midway through our time together. *Attention diverted* was not part of Kayla's composition moves.

Complete tweet analysis: In thirds. Kayla's composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 10 and Figure 30. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

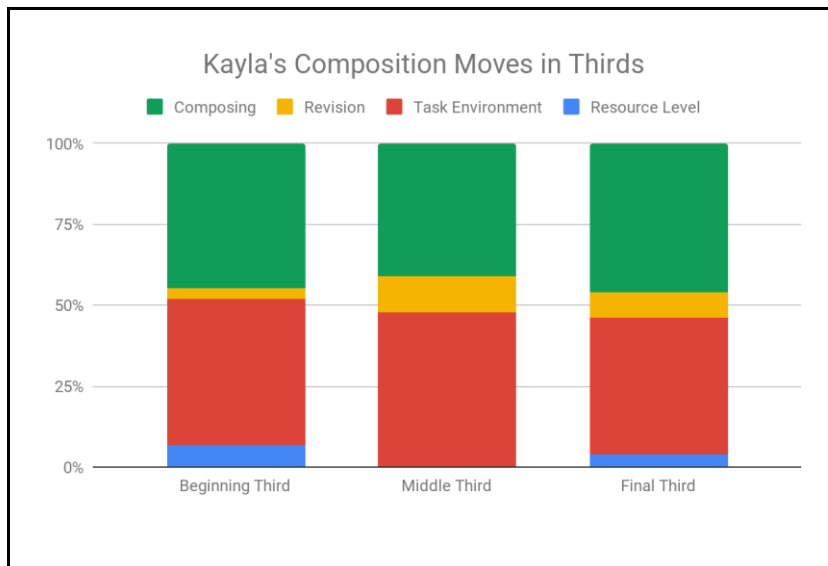
Table 10

Summary of Kayla's Composition Moves frequency of use in thirds

	Beginning Third	Middle Third	Final Third	Total %
Composing	13	18	12	43
Revision	1	5	2	8
Task Environment	13	21	11	45
Resource level	2	0	1	4
Total %	29	44	27	100%

Figure 30

Kayla's composition moves in thirds



The composition moves in the beginning third of Kayla's tweet focused on adding her photo, thinking of what to write, and typing her first two sentences. During the beginning third, both composing and task environment elements were given equal attention. During this time Kayla did a lot of *single letter typing*, *keyboard searching* and used the *keyboard autocomplete*. Revision elements and resource level elements were of low use, *deleting* and *editing* each once, *reading* once and *pausing* three times.

The composition moves in the middle third of Kayla's tweet included adding her hashtag text and assigned tweet number. This time is also when frequent errors occurred with random and often unintentional button pushing and keyboard changes. Once again, composing and task environment elements had a similar frequency of use. Kayla employed her highest frequency of *typing single letter*, *keyboard searching*, *cursor reposition*, and *task materials* during this time. She also used *keyboard open and closed* often during this time. It makes sense that the largest amount of revision occurred during the middle third of Kayla's composition moves as she

worked to fix the errors created from her unintentional button pushing. She stayed focused without pausing or stopping to read her text during this middle third of her composing.

The composition moves in the final third of Kayla's tweet included *single letter typing* and some *multi-letter typing*. Kayla finished with some editing, deleting, to continue fixing errors and revising, making a change to her hashtag text. Her task environment moves were mostly *keyboard open or close* with some *cursor reposition* and *task materials*. Kayla ended her composition moves *reading* twice once while making final corrections and again before publishing her tweet.

Emergent Features

There were no emergent features (i.e., unexpected or noteworthy patterns that extended beyond the *a priori* analysis of *writing processes* and *composition moves*) associated with this case.

Summary of Kayla -- Overall

The data interpreted for Kayla resulted in a profile that indicates she is a resilient problem solver type tweeter with some difficulty navigating the keyboard. For Kayla's *writing processes* she seemed motivated by the enjoyment of the task and sharing with others. Her tweeting goals included sharing with others and writing a coherent message. Kayla planned her tweet content before writing and required some support for in-the-moment plans while writing. She used *genre knowledge* to compose short-form writing including a photo and hashtag within a fixed topic text structure and showed a growing understanding of followers, likes, cybersafety, and networking. Kayla's *composition moves* were dominated by composing (transcription component skills) and task environment components associated with the keyboard and task materials. Kayla navigated the iPad keyboard at first with slow and methodical movements, which eventually turned into

random keyboard switching and unintentional button pushing. She edited misspelled words and worked diligently to address all errors. She considered revising her text to enhance meaning with additional words and used the cursor reposition and autocomplete tool often.

Luke: Low Scoring Male

General Description

At first, Luke appeared nervous when meeting with me. He frequently rubbed his forehead, sometimes pulling at his eyebrow when pausing to answer my questions. While rubbing his head he would admit, “I’m trying to think. It’s hard sometimes.” Over time his comfort-level seemed to increase as his quiet voice grew louder, easily answering questions and often flashing a big toothless smile. For instance, Luke asked if he spelled “word” correctly, I responded, “How would you know?” He replied, “It would be underlined.” I directed him to look at the word without an underline and asked, “Okay, so, what do you think?” He said that it was okay and returned to typing. The analysis of his writing processes and composition moves suggest Luke is a tentative yet capable tweeter.

Writing Processes

Based on the writing process model of Hayes (2012), Luke’s talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Luke’s *motivation* to tweet appeared positive but conflicted. He seemed motivated by sharing with others and improving writing skills but often felt conflicted when he had an opportunity to tweet because it

took time away from completing his reading goal. When asked about this conflict Luke explained,

Well, when I don't meet my reading goal and um it's kind of a hard choice because, reading and tweeting, is kind of hard so sometimes, some days when Mrs. Hammer gives us a choice, we tweet or we read to self. Sometimes I choose tweeting and sometimes I choose read-to-self.

Writing Processes: Goal Setting

Luke expressed three *goals* for tweeting: sharing with his friends, becoming a better writer, and constructing meaningful messages. When asked about the first goal, Luke explained how he liked to see what his friends are tweeting about and, “When [I am] done my friends can see what I am tweeting.” When asked about his second goal, Luke talked mostly about spelling saying, “[Tweeting] helps me learn how to spell words.” And, people tweet to “Be a better writer.” Finally, when asked about his third goal, Luke talked about the importance of his tweet making sense.

Writing Processes: Planning

Luke’s *planning* included both *in-advance* and *in-the-moment* planning. In both cases, he followed the teacher’s tweet format from memory and added ideas as he created his message. Evidence of Luke’s *in-advance* planning first appeared when he uttered, “So, first I think. Then, when I’m trying to take a picture I think what I’m going to take a picture of, and then I look at the picture, and then I think of my sentence.” Evidence of Luke’s *in-the-moment* planning occurred when he considered writing his tweet about using iPads and then changed his mind to write about his original idea, the word “clever.” Luke also planned specific word choices while

writing as he thought about how to finish his sentence, “Clever means you are” Luke thought for a moment and ended his sentence with the word “smart.”

Writing Processes: Writing Schemas

Luke’s thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. For starters, Luke displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. He successfully composed a complete message using short-form writing, including meaningful multimodal elements, (a photo and a meaningful hashtag). Although his published tweet did include two emojis, Luke could not explain why he selected both which were an open book and the American flag. For the first emoji, he explained, “It’s like if you are reading a book and you find ‘clever’.” Similarly, Luke’s second emoji was randomly selected.

Writing schemas: contextual elements. Luke displayed knowledge of four contextual elements as he tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, without saying the word “*followers*,” Luke showed an awareness of his audience saying, “I hope that everyone reads [my tweet].” Then he continued, trying to clarify, “Everyone in the world... well, some people read our tweets and some people don’t.” When asked about “*likes*”, Luke said, “Umm, people read our tweets to see if they like it or not.” When it came to *cybersafety* protocols, Luke acted in ways consistent with the protocols established by his teacher. He also explained, “You don’t want your footprint big. You want it small. And you do not want to put your address because people would um call you and then and then, that would not be good.” evidencing his concrete understanding of this abstract concept. When it came to the contextual

element of “*networking*,” Luke talked about sharing and receiving ideas. For example, Luke explained that he and his classmates could get new ideas from tweets, “You can see what they are tweeting about, and then, you get an idea from them.” He continued, describing how a friend’s tweet gave him an idea for his own tweet, “Like, how I showed you my [tweet about my] Dusty, I got that dusty from one of my friend’s ideas then I had the idea what to do.” (A “Dusty” is their school mascot.)

Writing schemas: text structure. Luke’s completed tweet is characteristic of a fixed topic text structure. His topic is the word “clever.” He writes the word means “smart” but does not provide elaboration. He then writes “It helps me learn,” without clarifying. For example, while following the teacher-established guidelines to tweet about what he is learning and why or how this learning is helpful, Luke did not write about how this learning, assuming his readers share a common knowledge of the class vocabulary instruction. Conversely, I think the reader can assume Luke is learning about new words.

Composition Moves

Based on the composition move model of Hayes (2012), Luke’s talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

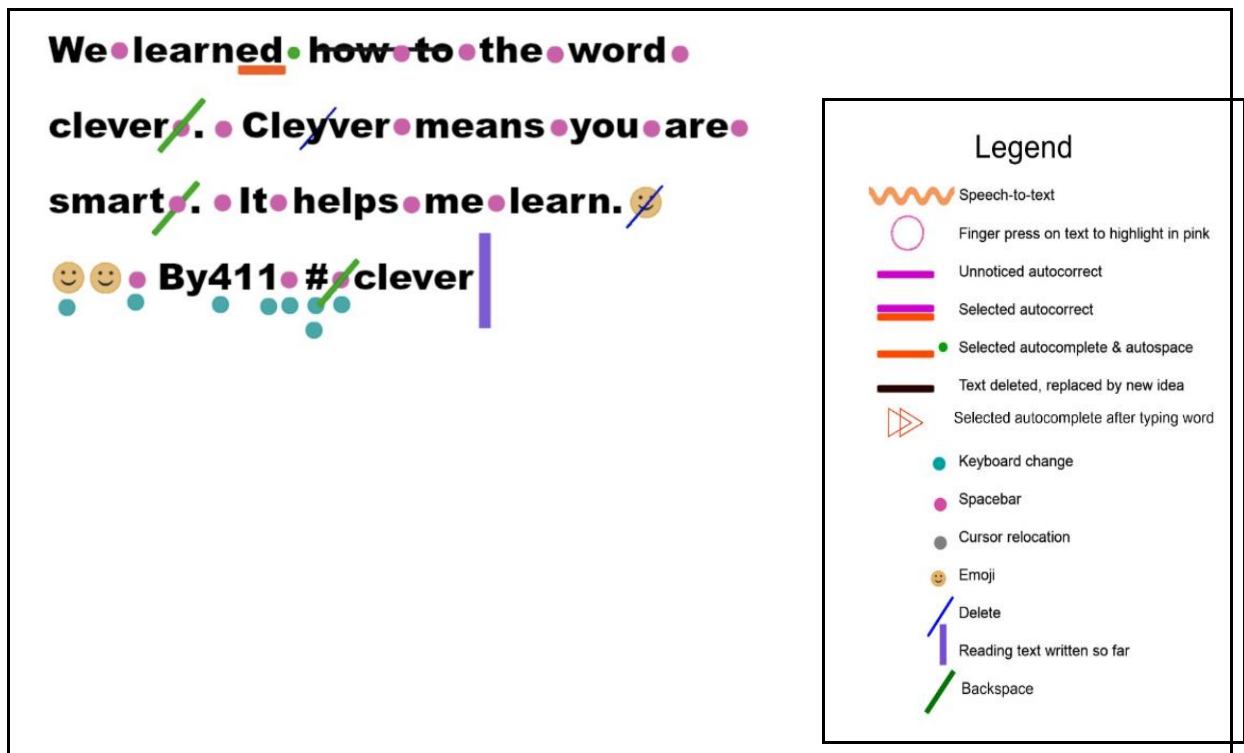
Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Luke’s letters, words and phrases captured his real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). To illustrate, Figure 31 represents Luke’s spacebar use with bright pink circles. And

a point where he revised is shown as a horizontal black mark strikethrough. A detailed account of Luke’s letter, word, and phrase composition moves follow.

Figure 31

Luke’s letter, word, phrase flow-of-composing



Luke started his tweet by adding his preselected photo of the word “clever” to his tweet space. Noticing his apprehension or nervousness, I tried to ease Luke into the work by reminding him of one of the tweet prompts provided by his teacher. I said, “What was the most important thing you learned in second grade and why was it the most important or how is it going to help you?” It was the final weeks of the school year thus the additional tweet prompt about the most important thing they learned in second grade. I think Luke’s initial idea was influenced by my reminding him of the prompt, causing him to start tweeting about iPads rather than the word “clever.” As Luke started typing he glanced at the laptop screen showing the iPad screen he was

working on. He smiled and said that it was fun to look at the larger screen then as if immediately forgetting about the larger screen he focused on the iPad keyboard and started typing, “We learn” followed by selecting “learned” from the autocomplete choices. He continued typing, “how to” then paused and deleted “how to.” I asked about his thinking and Luke explained that he was going to type something about learning how to use iPads but his picture did not match that idea and he was not sure how he could take a picture of an iPad. I offered to help him either take a photo or find a photo of an iPad but he quickly decided to stick with writing about his original photo, a picture of the word “clever.” Luke started typing again, adding on to his text, “We learned the word” then asked if he spelled “word” correctly. I responded, “How would you know?” Luke said, “It would be underlined.” I directed him to look at the word without an underline and asked, “Okay, so, what do you think?” He said that it was okay and returned to typing. Luke typed out “clever” followed by the spacebar then deleted the space and added an end punctuation mark. From the time Luke started typing his tweet to the completion of this first sentence, including short moments of our talking was one minute and fifty-seven seconds.

Continuing with his second sentence, Luke added a space after his end punctuation automatically activating the caps lock for his next word. He typed, “Cley” then quickly deleted the “y” and continued typing, “ver.” Next, he typed, “m” “ea” “n” “s” and glanced at the iPad screen as if thinking. Then he continued, “y” “ou” space “are” space “sma” “rt” and a space. Again, like the first sentence, Luke deleted the space, added his end punctuation mark and typed the spacebar. Composing this third sentence, Luke typed, “I” “t” space, “h” “e” “I” “p” “s” space, “me” followed by a long pause. I asked, “What are you thinking?” He answered, “I’m trying to think of what I can type after ‘me’.” He tried a few ideas speaking them out loud, “It will help me learn, wait, it will help me ... [nervous laugh followed by inaudible word].” Finally,

Luke typed “learn.” this time immediately adding his end punctuation. He looked at me with a smile saying, “I’m all done.” Our total time together, including the beginning time to add his photo, was six minutes and twenty-one seconds.

I asked Luke, “How do you know when you are done?” he replied, “I added a period.” I followed up, “Okay, and when you tweet, [and you get your ideas down] how do you know it’s time to put that period to say you are done?” Luke thought for a moment and answered, “When you can’t think of any more sentences.” I then asked if he had any more ideas to add. He shook his head *no*, so I reminded him to add his end signature, “by 411.” This is when Luke said, “I want to put an emoji!” He opened the emoji keyboard and scrolled through the images looking for an emoji character he liked from watching the Emoji Movie. Unable to find this particular emoji he selected an open book to represent being smart. He also added the American flag. I asked about this selection and he explained, “It’s the state ... flag.” recognizing he was unsure if using the word “state” was correct. I then asked why he decided to add this flag to his tweet. He said, “Ummm... [shrugging shoulders] I just wanted to add it.” I asked that he tell me more but he appeared flustered so I responded to reassure him, “It’s okay!” and then he typed his end signature, first pressing the spacebar then typing, “By411” I said, “Then what?” He replied, “hashtag.” I said, “Okay, make sure you add a space.” He created a space after the number one and typed, “#clever.” I’m not sure Luke would have added a space if I had not given the reminder. I may have been providing these reminders in response to his apparent nervousness. Luke’s finger hovered over the “tweet” button and I quickly said, “Don’t push tweet yet!” How do we know it’s ready to push tweet?” Luck replied, “We read it to see if it makes sense.” He read his tweet, “We learned the word clever. Clever means you are smart. It helps me learn.

Hashtag clever.” He gave me a thumbs up and we agreed he should publish his tweet. The total time at this moment was twelve minutes and twenty-six seconds.

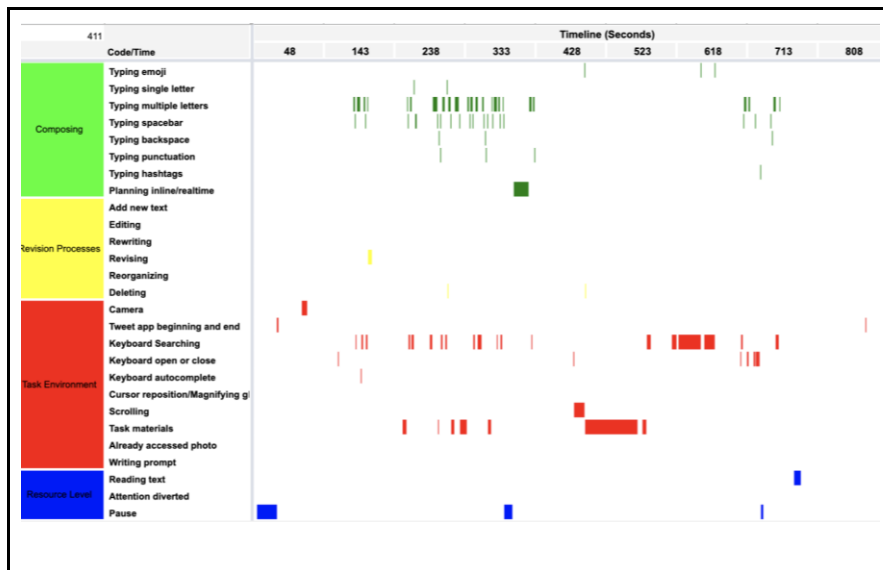
There were few prominent patterns observed in the letter, word, and phrase level analysis of Luke’s *composition moves*, based on his simple and mostly efficient composing. Within the three short sentences, Luke wrote his composing consisted mostly of typing multiple letters, using the spacebar between words, random emoji selection, and moments of planning. When typing multiple letters he usually quickly typed the first three or four letters of the word, slowing down to add any remaining letters for longer words. Pressing the spacebar was an automatic composition move often requiring a backspace to add punctuation at the end of his sentence. Luke’s revision included starting to write one idea, deleting the text, and writing a different idea. He also deleted two typing errors, the letter “y” in “clever” and a cat-face emoji that he seemed to tap on by accident. Luke’s task environment work was prominently keyboard searching to locate initial letters in words and to search emojis, and task materials to look at his iPad screen. Luke’s resource level moves were few, only reading once when prompted before submitting his tweet and pausing three times. Finally, Luke had only two text errors associated with spacing.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing*, *revision processes*, *task environment*, and *resource level*. As can be seen in Figure 32, the complete tweet analysis used a timeline to represent Luke’s second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Luke’s composition moves over time.

Figure 32

Luke's Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 32 indicates (colored green), the most frequently occurring composition moves observed were *typing multiple letters* used for almost all of the words typed and usually the beginning chunks (n=24). The second most frequent composing move was typing spacebar (n = 18). Luke added a space after every word as if a routine composition move. This space bar routine caused a need for *typing backspace* for each of his three sentences, removing the space to then use *typing punctuation* (n=3). Luke only typed single letters twice. First when typing the word “word,” searching for the letter “d” and again typing “clever” searching for the letter “v” and mistakenly typing “y.” These single letter typing moments may be associated with the visual similarities between letters, (“b” and “d” and “v” and “y”). *Typing hashtag* and *in the moment planning* were each employed once.

The *revision processes* section of Figure 32 (colored yellow) shows very few revision moves. *Deleting* occurred twice, each time first to delete the unwanted letter “y” in the word

“clever” and again to delete a cat-face emoji. Luke employed *revising* once when starting to type about iPad learning and then changing his idea to type about the word “clever.” The other four *revision processes* codes (*add new text, editing, rewriting, reorganizing*) were not evidenced in Luke’s composition moves.

For the *task environment* section of Figure 32 (colored red), the most frequently occurring composition moves were *keyboard searching* to locate letters and emojis (n=19), *keyboard open or close* (n=7), and *task materials* when looking at the iPad screen (n=7). Luke accessed the *tweet app beginning and end* twice, first when he started tweeting and again when he submitted his tweet. Accessing the *camera* to add his previously taken photo, *scrolling* for a hashtag, and *keyboard autocomplete* were employed one time each while composing. *Cursor reposition, already accessed photo, and writing prompt* were the only *task environment* code not evidenced in his composition moves.

Finally, the *resource level* section of Figure 32 (colored blue), shows there were three moments of *pausing* and one of *reading*. The *pausing* occurrences recorded to account for the time before the tweeting started and twice midway through our time together. The reading occurred after being prompted to check his text before submitting his tweet. *Attention diverted* was not part of Luke’s composition moves.

Complete tweet analysis: In thirds. Luke’s composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 11 and Figure 33. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing, revision, task environment, and resource level*.

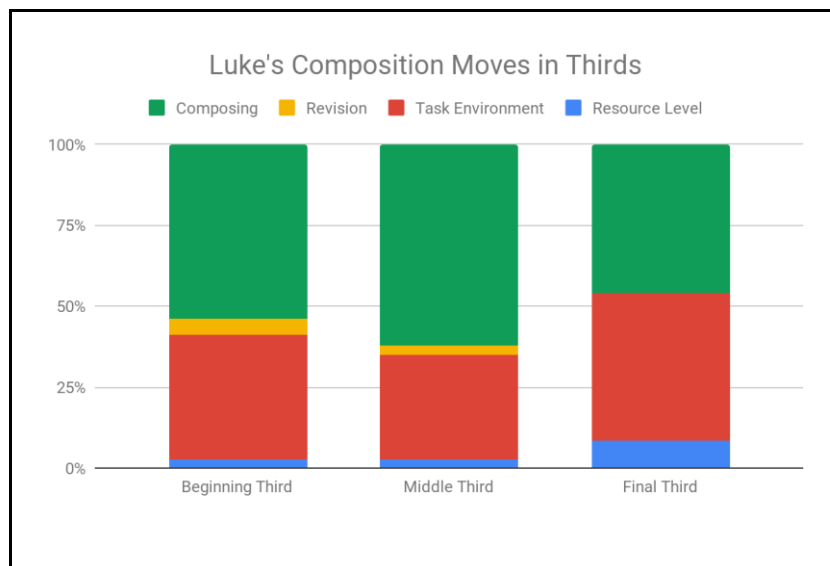
Table 11

Summary of Luke's Composition Moves frequency-of-use in thirds

	Beginning Third %	Middle Third %	Final Third %	Total %
Composing	21	23	11	55
Revision	2	1	0	3
Task Environment	15	12	11	38
Resource level	1	1	2	4
Total %	39	37	24	100

Figure 33

Luke's composition moves in thirds



The composition moves in the beginning third of Luke's tweet focused on adding his photo, thinking of what to write, and typing his first sentences and part of his second sentence. During the beginning third, composing was most frequent followed by task environment elements. During this time Luke did a lot of *multi-letter typing*, *typing spacebar*, and *keyboard*

searching. *Single-letter typing* and *typing punctuation* also occurred. Revision elements and resource level elements were of low use, *deleting*, *reading*, and *pausing* each one time.

The composition moves in the middle third of Luke's tweet were similar to the beginning third with similar amounts of *multi-letter typing*, *typing spacebar*, and *keyboard searching*. The middle third also included *typing punctuation*, searching for emojis looking at the keyboard screen (*task materials*) and *pausing* once.

The composition moves in the final third of Luke's tweet included some *multi-letter typing*, *typing emoji*, *typing spacebar*, and *typing hashtag*. Luke did not employ revision processes during this time and task environment moves were mostly *keyboard search* and *keyboard open or close* Luke ended his composition moves *pausing* once and *reading* once before publishing her tweet.

Emergent Features

There were no emergent features (i.e., unexpected or noteworthy patterns that extended beyond the *a priori* analysis of *writing processes* and *composition moves*) associated with this case.

Summary of Luke -- Overall

The data interpreted for Luke resulted in a profile that indicates he is a tentative yet capable tweeter. Nervous and unsure of his abilities yet competent in his knowledge of Twitter and the ability to compose a complete tweet. For Luke's *writing processes* he seemed motivated by sharing with others and improving his spelling, conversely, Sometimes he does not like to tweet because it conflicts with time reading. His tweeting goals included sharing with others, becoming a better writer, and writing a coherent message. Luke planned his tweet content before writing and made in-the-moment plans while writing. He used *genre knowledge* to compose

short-form writing including a photo, hashtag, and two emojis. The photo, hashtag, and one emoji clearly matched the text. Luke used a fixed topic text structure and showed a growing understanding of followers, likes, cybersafety, and networking. Luke's *composition moves* were dominated by composing (transcription component skills) and task environment components associated with the keyboard and task materials. Luke navigated the iPad keyboard easily, typing most text with multi-letter typing, using the spacebar, keyboard searching and looking at the iPad screen. He deleted typing errors and considered revising his text once. Finally, Luke paused three periodically during our time together and had to be reminded to read his tweet before publishing.

Lori: Low Scoring Female

General Description

Lori appeared confident while working with me, but this confidence was occasionally juxtaposed with moments of dependence. For instance, Lori showed confidence when beginning to tweet, activating the Twitter application, typing her first sentence and inventing a strategy to eliminate the red underline. But, during a moment of problem-solving, she displayed a sense of dependence, looking up to me for help on multiple occasions, saying "I don't know what to do next." Lori's confidence returned once she was given guidance for next steps. The analysis of her writing processes and composition moves are peppered with elements of confidence and moments of dependence.

Writing Processes

Based on the writing process model of Hayes (2012), Lori's talk-aloud and video-stimulated recall data were analyzed in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*.

Writing Processes: Motivation

Drawing on both the verbal and body language data (see Appendix C), Lori's *motivation* to tweet appeared positive. She seemed motivated by the enjoyment of the task and sharing with others. When asked if she likes to tweet, Lori said enthusiastically, "Yes!" I asked why. She replied, "Um, because it's fun and we get to tweet about what we learned in school and um what we do."

Writing Processes: Goal Setting

Lori expressed two *goals* for tweeting: creating meaningful messages and sharing what she has done in school. When asked about her first goal Lori could recall from memory the teacher-established tweet expectation explaining, "[M]y teacher says, always say what you're going to write about and say how it helps you and say what you can do with it." When asked about the second goal she talked about sharing her learning and what she is doing in school.

Writing Processes: Planning

Lori's *planning* included both *in-advance* and *in-the-moment* planning. In both cases, she followed the teacher's tweet format from memory and added ideas as she created her message. Evidence of Lori's *in-advance* and *in-the-moment planning* first appeared when she explained, "We were talking and thinking about things. [Then,] I finally figured it out and I said 'We can build things out of Legos.' She continued to explain, "And with the Lego, it helped me [picking up her Lego structure] figure out what to write about, that's why I brought all of these things for me to help knowing what do write about."

Writing Processes: Writing Schemas

Lori's thinking about tweets demonstrated considerable awareness about three aspects of writing schemas: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. For starters, Lori displayed knowledge about the fundamental and secondary elements of the Twitter genre: 280 character limit, student signature, photo, hashtag, and emoji. Lori did not add a hashtag or emoji to her text explaining, “If there is enough room they can put a hashtag but if they don't want to put a hashtag they don't have to put one.”

Writing schemas: contextual elements. Lori displayed knowledge of four contextual elements as she tweeted: *followers*, *likes*, *cybersafety*, and *networking*. For instance, without saying the word “*followers*,” Lori showed an awareness of her audience by explaining who can read her tweets, “Umm, mostly my friends in the class, my teacher, everybody in the school, my mom and my dad and my sister.” Lori did not talk about *followers* at a global level but did say, “Mostly on twitter, umm, everybody has twitter accounts so everybody can see our tweets.” When I asked what she meant by “everybody” she replied, “Maybe only families or friends, just family, and friends that you know.” When asked about “*likes*”, Lori said, “Sometimes whenever some people actually read our tweets they actually like it.” When it came to *cybersafety* protocols, Lori acted in ways consistent with the protocols established by her teacher. And when it came to the contextual element of “*networking*,” Lori talked about learning from reading other people’s tweets. how networking figured into his reading and learning from other tweets.

Writing schemas: text structure. Lori’s completed tweet was characteristic of a *fixed topic text structure*. Her topic was STEM. Following the teacher-established guidelines to tweet about what she was learning and why or how this learning would be helpful, Lori explicitly stated that “Stem helps” her learn how to build. She did not explain the contents of her photos, similar to Hal, assuming her reader would understand how building an object with Legos will help her learn about STEM-related concepts.

Composition Moves

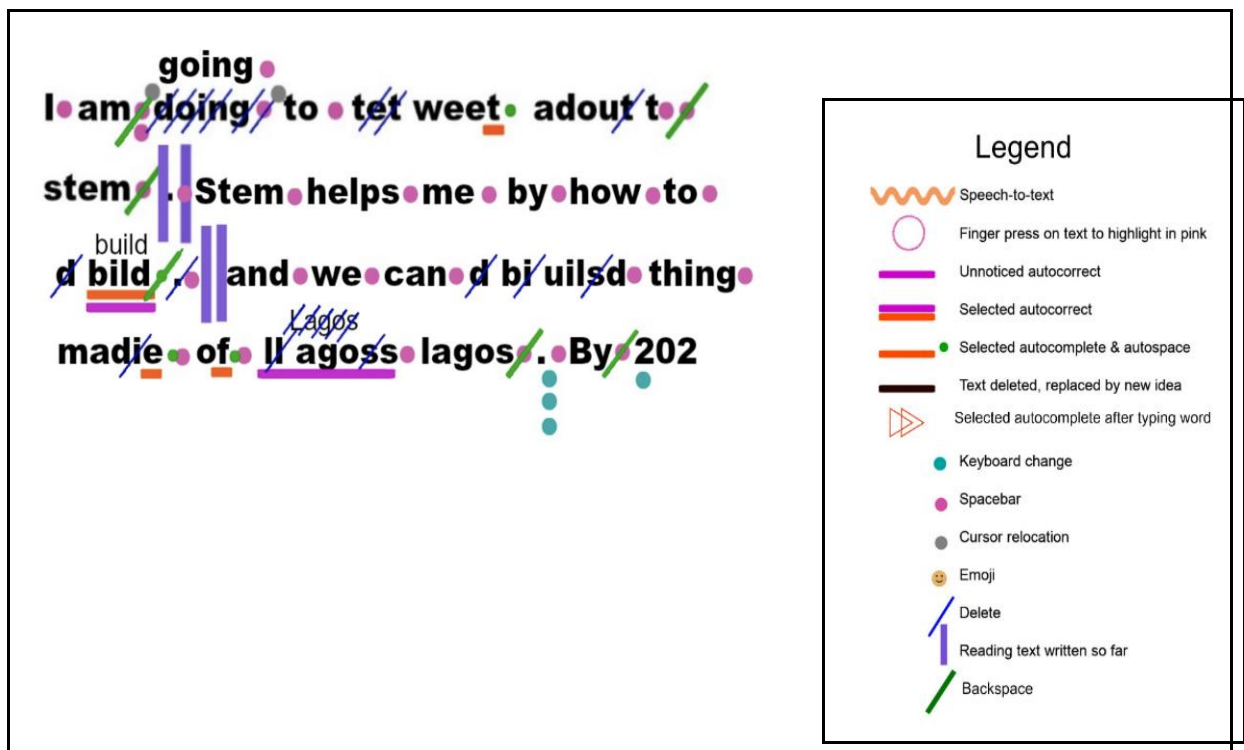
Based on the composition move model of Hayes (2012), Lori's talk-aloud and screen-capture video data were analyzed at two levels: the *letter/word/phrase* level and the *complete tweet* level.

Composition Moves: Letter, Word and Phrase Level Analysis

Based on the screen-capture and talk-aloud data, the analysis of Lori's letters, words, and phrases captured every aspect of Lori's real-time composition moves, which includes all the text composed, by either typing or using tools made available by the iPad to generate words, (i.e., autocomplete and autocorrect). To illustrate, Figure 34 represents Lori's revising with blue delete marks and the gray circles represent student-activated cursor relocation. A detailed account of Lori's letter, word, and phrase composition moves follow.

Figure 34

Lori's letter, word, and phrase flow-of-composing



Lori started her tweet by immediately typing “I” space “a” “m” then glanced at the iPad screen. Because she had not talked while composing this first part of her tweet I took advantage of this pause to ask a question, “So, how do you know what you are going to write about?” Without hesitation, Lori answered, “Ummm, I’m going to write about STEM and how it works.” I followed up asking how she came up with her tweet idea. Lori again quickly answered, “My teacher helped me and I decided to do it.” This makes me think her teacher provided tweet suggestions for Lori as part of her *in-advance-planning*. I asked if she knew what words she was going to say and Lori replied saying she was going to “Think of it while she wrote it.” Finally, I reminded Lori to talk out loud as she worked and to tell me what she was thinking. She shook her head *yes* as she leaned over the iPad to continue typing.

Lori typed “d” “o” “in” “g” as she audibly stretched out the word in unison with her typing. She paused a moment then typed “to” space, “t” “et.” The text “tet” highlighted in blue and Lori paused explaining, “Ummm [deletes “t” then “e”] ummm, how to spell twee..., oh, it’s right up there.” I asked where she noticed the word “tweet” and she pointed to the top right corner of her tweet composing space at the “tweet” button. Working from the remaining “t” in her “tet” text, she searched for the “w” until I pointed her into that top left location of her keyboard. She typed, “w” “e” then looked up at the “tweet” button for the next letter, “e” then selected “tweet” from the autocomplete suggestions. Next, Lori typed, “a” “d” “o” “u” “t.” The letters highlighted in blue and she stopped to look at me. I asked, “What are you thinking?” I thought she would make a comment about the spelling or the blue highlight. Instead, she told me her next word, “About STEM.” She mistakenly deleted and retyped the “t” in “adout,” added a space, then a second space quickly deleted the second space and typed, “stem” this time locating each letter at a quick pace than when typing previous words. Lori tapped the spacebar, deleted

the space, and typed an end punctuation mark. The text thus far read, “I am doing to tweet about stem.” Including short moments of talking between typing, three minutes had passed.

After this first sentence, Lori looked up at me without talking. I waited two seconds before saying, “Now what?” After ten seconds of thinking, she shrugged her shoulders and responded, “I don’t know.” For clarification, I asked if she did not know what to do next or what to write next. She admitted, “I don’t know what to do next.” I asked, “Do you want to reread your tweet? Do you want to write some more?” Lori began reading to herself. I reminded her to read out loud. She read, “I am doing to tweet about STEM.” Then, quickly noticed her error and as she approached the iPad keyboard reading again, “I am GOING to tweet about STEM, that makes more sense.” Lori repositioned the cursor before “d” in “doing.” She pressed the delete button eliminating the space between the word “am” and “doing” then quickly reapplied the space. Next, she positioned the cursor at the end of “doing” plus the space, deleted “doing,” and typed “g” “oi” “n” “g” followed by a space. Lori said out loud, “GOING to tweet about stem” as she positioned the cursor to the end of her sentence. Again, she looked at me and I again responded, “Now what? Do you want to say more? [pausing a moment] How do you know if you need to say more or if you’ve said enough?” Lori answered by saying, “I need to say more but I don’t know what else to do.” This comment makes me think her first statement about not knowing what to do likely means she does not know what to write next. I nudged, “Okay, how can you help yourself come up with something else to say?” Lori placed her right index finger under her lip and gazed down at her chair. Finally, with a shy smile, finger now rocking against a lower front tooth, she responded, “I don’t know.” Asking Lori how she gets ideas to write she said that she “mostly thinks” and waits until she gets an idea. I assured her that it was okay if she needed to wait and think. After twenty-three seconds of wait time, Lori looked up at me, still

unsure of what to write next. I told her, “You can ask me if you need help.” She shook her head, yes and said, “Ya, I need help.”

After I asked Lori who would be reading her tweet and what she wanted her readers to know about STEM she sat up tall on the edge of her seat excited about her answer, “How it helps me!” Lori returned to typing, “Stem” space “hel” “p” “s” space “me” space “b” “y” space. She paused a moment repeating, “by, by,” then exclaimed, “by how to build!” and quickly returned to typing, “h” “o” “w” space “to” space, “b” “ild” and selecting “build” from the autocorrect suggestion. This selection included an automatic space after the word “build.” Lori deleted this autospace and added her end punctuation mark. Our time together thus far was seven minutes and fifty seconds.

Similar to when Lori finished her first sentence, she looked up at me. Again, I prompted, “Now what?” Again, she replied, “Ummmm.... I don’t know.” I suggested she read her text so far. She read, “I am going to tweet about stem. Stem helps me by how to build.” Providing support I continued, “How did you, how did you figure out what to say here, ‘stem helps me by how to build.’?” She explained how she looked at a paper illustrating a child-friendly version of the engineering design process she brought from class. She looked at her paper again and again exclaimed, “Ummmm... I don't know what to do.” I replied,

That's okay! So, let's see. you've got 2nd graders and 3rd graders that are going to read your tweet. And, so now they know, that STEM helps you because STEM helps you by how to build. Anything else that you want your readers to know about STEM?

Our conversation continued with Lori answering, “Ummmm ... What to do with it!” Continuing my questions, I responded, “Say more about that.” As she thought I pursued, “So, what to do with... .” and she answered, “The stem.” I followed up saying, “I'm not sure I understand. Talk

to me about that.” Lori explained, “Ummm... like how to build and like, if we can take it apart we can rebuild it.”

I responded, “Right, have you done that before?”

“Ya!” Lori said with a smile.

I asked, “Well, is that something you want to tell your readers?” As she nodded her head yes I continued, “How would you say that?” Lori sat thinking for a long moment so I suggested she read her text written so far. She read, “I am going to tweet about stem. Stem helps me by how to build.” After thinking about what to say next Lori said happily, “And we can build things out of Legos or cups! In my class, we build Legos, [and] once we actually built a tower of cups!” This time for in-the-moment planning with support ended at eleven minutes and thirty seconds, for a total of three minutes and forty seconds.

With renewed energy, Lori returned to the iPad, quickly deleted her end punctuation mark, added a space and began to type in a sing-song voice: “and” space “we” space “can” space “d” delete, “b” “i” delete, “ui” “l” “s” delete, “d” space, “thing” space, “mad” “i” delete, noticed and selected “made” from the autocomplete. Next, she added a space without noticing the space automatically followed the autocomplete word. Lori typed “of” space “ll” then deleted the extra “l” followed by typing “agos.” She noticed the letters, “lagos” highlighted in blue and deleted the “s” to eliminate the highlight. Next Lori retyped the “s” and pressed the spacebar creating the autocorrect to replace “lagos” with “Lagos.” After noticing this change, Lori deleted “Lagos” and retyped the word, “lagos” followed by a space. Then, she deleted the space and added her end punctuation mark.

Following her now familiar pattern, once she completed her sentence she looked up at me as if waiting for approval or next steps. I asked, “Now what?” With a deep breath and a tug at her

red hair across the back of her ear, she said, “I think that’s enough.” Lori took a photo of the “Engineering Design Process” paper and Lego dinosaur structure that she brought with her from class, explaining to me that it would create a “double picture thingy.” I asked why it would be important to include both pictures. Lori explained, “Then they can see what I did and how you can do it.” She quickly returned to the alphabet keyboard from adding the photos and typed without adding a space after her end punctuation, “By202” saying, “But, if we have enough room we can put a hashtag but there isn’t.” In the middle of my asking, “How do you know that you don’t have enough room?” you hear my voice trail off with a long “wait” as she pressed the button to publish her tweet. Including our conversation mixed in with Lori’s writing, fifteen minutes and thirty-four seconds passed.

I wanted to know more of Lori’s thinking so I persisted, “How do you know if there’s enough room How did you know there wasn’t enough room?” Taking her small hands to create a box she answered, “Because there’s a small bit of room left.” Again, I asked, “How do you know? That’s something you can teach me because I’m not sure how that works. Can you tell me more about how you knew that you didn’t have enough room for the hashtag?” Lori candidly replied, “Because, if we do any more then it will be down there [pointing to the screen] then there will be tons more room and I’ll have to write more.” Unsatisfied, I continued:

And, that’s something you don’t want to do? Tell me more about that; I’m still trying to understand what you meant when you said if you put more right here on the next line you’d have a whole bunch more room and you’d have to write more. Is that what you said or did I not hear it right?

Listening intently, Lori agreed, “Um, that’s what I said.” Again, I persisted, “So can you tell me more about that? How much more would you have to write?” Again, Lori kindly replied,

“Ummm, I don't know.” Finally, I asked, “Why wouldn't you want to write more?” She responded, “Because um, some people like to just write a small bit and they like being done.” I questioned further, “Is that what you like, to just say it short and be done?” By now Lori was sucking on the charm of her necklace, inching toward the end of her chair, she nodded her head, *yes*.

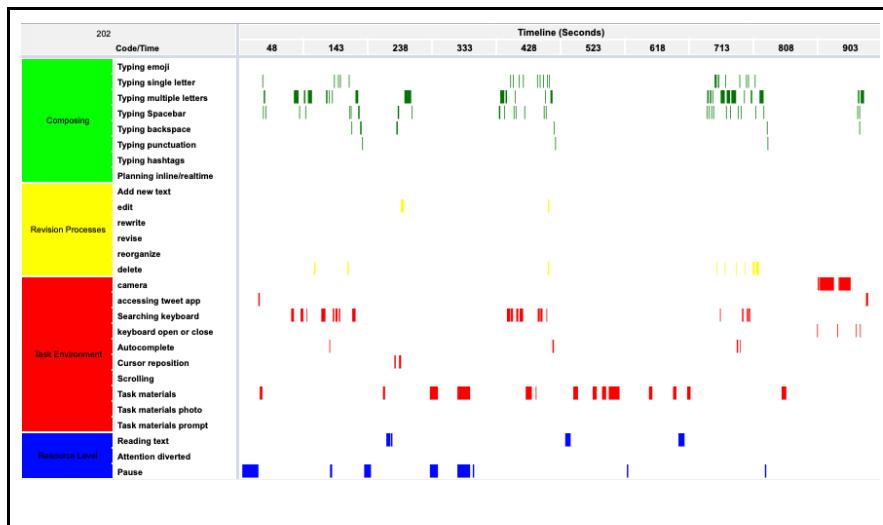
The prominent patterns observed in the letter, word and phrase analysis of Lori's composition moves were varied but concentrated with *typing multiple and single letters*, the *spacebar*, *searching the keyboard*, and looking at her *task materials*. Lori's *deleting* and *editing*, occurred as she worked through sentences. Her *composition moves* also included typical second-grade “b” and “d” miscues which she did not correct in the word “about” and did correct when typing the word “build.” Lori invented a strategy to remove blue highlights and red underlines. If a word highlighted in blue she would *delete* the final letter, retype that letter and then press the *spacebar*. If a word was underlined red she would press the *spacebar* adding two spaces after the underlined word and then *delete* the extra space. Her use of the *autocomplete* technology was minimal, only three times. Finally, Lori *paused* often after completing a sentence or phrase, as if not sure what to do next and only *read* her text when prompted.

Composition Moves: Complete Tweet Analysis

As previously stated, four composition move elements were used for this analysis: *composing*, *revision processes*, *task environment*, and *resource level*. As can be seen in Figure 35, the complete tweet analysis used a timeline to represent Lori's second-by-second real-time composition moves over the course of composing a tweet. Taken together, this view of the data permits a visual analysis of Lori's composition moves over time.

Figure 35

Lori's Complete Tweet Composition Moves Frequency of Use Timeline Analysis



Complete tweet analysis: Overall. As the *composing* section of Figure 35 indicates (colored green), the most frequently occurring composition moves observed were *typing spacebar* to separate words, (n=28), *typing multiple letters* like complete words “to” and “am” or chunks of a word like “oi” in the word “going” (n=25) and *typing single letters* (n=22). Single letters were often typed when correcting miscues and for longer words. For example, typing the word “about” Lori typed slowly searching for letters. Also, when addressing typing errors caused by letters positioned side by side on the keyboard, for example typing “s” when she meant to type “d.” Further, Lori’s composing included six *typing backspace* codes, in response to the automatically created space after using the autocomplete feature and to remove extra spaces, and three *typing punctuation*. The other three *composing* codes (*typing emoji*, *typing hashtags*, and *in-the-moment planning*) were not evidenced in Lori’s composition moves. Codes for *in-the-moment planning* were not added because Lori only added more to her text with my support making it unclear if this would be a composition move she would have used on her own.

The *revision processes* section of Figure 35 (colored yellow) shows *deleting* occurred nine times to remove unwanted letters such as “d” for “b” and “s” for “d.” *Deleting* also occurred when Lori deleted a word highlighted in blue only to retype that same word as a strategy to remove the highlight. Also, *editing* occurred twice, first to change “doing” to “going” and again when adjusting the spelling of “build.” The other four *revision processes* codes (*revising*, *add new text*, *rewriting*, *reorganizing*) were not evidenced in Lori’s composition moves.

For the *task environment* section of Figure 35 (colored red), the most frequently occurring composition moves were *keyboard searching* to find needed letters (n=19) and *task materials* such as looking at the iPad screen or external objects (n=14). Employing *keyboard autocomplete*, usually after multiple letters in a word had already been typed, keeping the *keyboard open or close* to navigate between the keyboard and camera when taking and loading photos, and accessing the *camera* occurred four times each. Lori accessed twice each the *cursor reposition* to edit the word “doing” and *tweet app beginning and end*, first when she started tweeting and again when she submitted her tweet. *Scrolling*, *writing prompt*, and *already accessed photo*, were the only *task environment* code not evidenced in her composition moves.

Finally, the *resource level* section of Figure 35 (colored blue), shows there were eight occurrences of *pausing*, once before the tweeting started, and multiple times throughout her composing. As I stated with the other cases, these pauses may have been moments of thinking but I did not collect evidence to support this claim. There were four occurrences of *reading text*, all from my prompting. Lori read twice around the beginning of her writing time, after her first sentence and again twice after her second sentence. Each of these moments was times when Lori admitted she did “not know what to do next.” Lori did not read her tweet before submitting to publish. *Attention diverted* was not part of Lori’s composition moves.

Complete tweet analysis: In thirds. Lori's composition moves were divided into three time periods (beginning, middle, and final) as shown in Table 12 and Figure 36. Dividing the timeline into three equal time periods provides a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

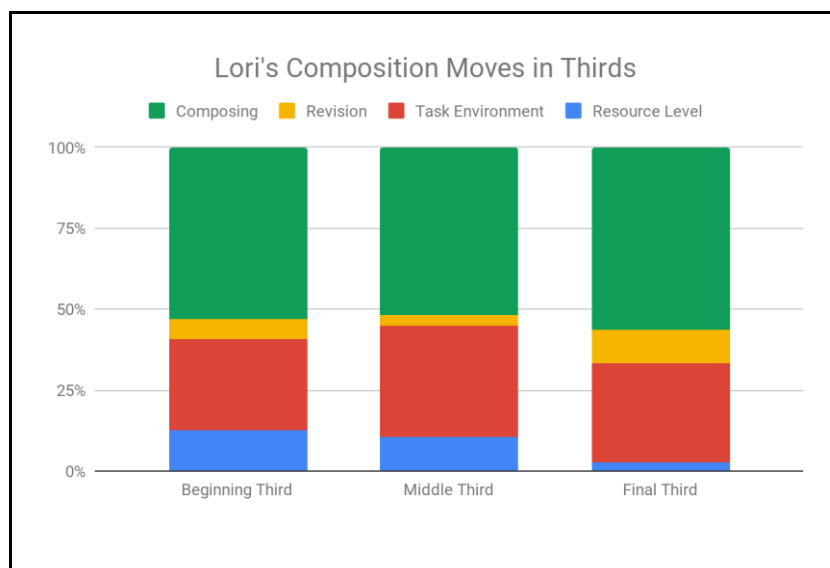
Table 12

Summary of Lori's Composition Moves frequency of use in thirds

	Beginning Third %	Middle Third %	Final Third %	Total %
Composing	18	15	22	54
Revision	2	1	4	7
Task Environment	8	10	12	31
Resource level	4	3	1	8
Total %	32	29	39	100

Figure 36

Lori's composition moves in thirds



The composition moves in the beginning third of Lori's tweet included *composing* as *multi-letter*, *single letter* and *spacebar typing*, including a punctuation mark to complete her first sentence. This part of the timeline also included *backspacing* to remove the automatic space provided after an autocomplete suggestion or other extra spaces. Lori also did some *revision* work, editing the word "doing" for her intended word, "going" and *deleting* last letters in two words highlighted in blue, "tet" and "adout." The *task environment* work included *keyboard searching*, *task materials* (glancing at the iPad screen), and cursor reposition twice to access the word "doing" in her first sentence. Lori's *resource level* work included *pausing* four times, first waiting for the Twitter app to load and again while working on and after completing her first sentence. After being prompted, Lori *read* her first sentence twice to help her think of what to write next and to hear how the sentence would sound after making a correction.

The composition moves in the middle third of Lori's tweet included composing as *single letter typing* with some *multi-letter typing* and *spacebar* moves. Similar to the beginning third, this part of the timeline also included *backspacing* to remove the automatic space provided after an autocomplete suggestion or other extra spaces, and a *punctuation* mark to end her second sentence. Lori's *revision* moves included a single delete. When typing the word "build" she started with the letter "d" then quickly deleted the letter and typed "b." Most of Lori's *task environment* time included searching the keyboard, task materials, and one autocomplete. Lori's *resource level* moves included *pausing* three times and *reading* her text once.

The composition moves in the final third of Lori's tweet were similar to the beginning third, included *composing* as *multi-letter*, and *spacebar typing*, with some *single letter typing* mixed in. Also, this time included a punctuation mark to complete her third sentence and *backspacing* to remove the automatic space provided after an autocomplete suggestion or other

extra spaces. Lori's *revision* work included one *edit* and six *deletes*, for similar reasons as previous edits and deletes. The *task environment* work included some *keyboard searching*, *keyboard open or close*, accessing the *camera* with some *task materials* and *autocomplete* moves. Lori's *resource level* work included a final *pausing* and a *reading* after her delete work but she did not read her tweet before publishing.

Emergent Features

There were no emergent features (i.e., unexpected or noteworthy patterns that extended beyond the *a priori* analysis of *writing processes* and *composition moves*) associated with this case.

Summary of Lori -- Overall

The data interpreted for Lori resulted in a profile that indicates she is a dependent yet confident tweeter, or similar to Luke, she is a tentative yet capable tweeter. Reluctant and unsure of her abilities yet competent in her knowledge of Twitter and ability to compose a complete tweet. For Lori's *writing processes* she seemed motivated by the enjoyment of the task and sharing with others. Her tweeting goals included sharing with others and writing a coherent message. Lori planned her tweet content before writing, bringing her Lego structure and "Engineering Design Process" paper to our meeting. She made in-the-moment plans before writing each of her sentences with significant teacher-support (my support). She used *genre knowledge* to compose short-form writing including two photos. Lori used a fixed topic text structure and showed a growing understanding of followers, likes, cybersafety, and networking. Lori's *composition moves* were largely composing (transcription component skills) and task environment components associated with the keyboard and task materials. Lori typed most text with multi-letter typing, using the spacebar, keyboard searching and looking at the iPad screen.

She deleted typing errors and edited spelling twice. Finally, Lori paused often during our time together and had to be reminded to read her tweet.

Cross-Case Comparisons

In this second section, I present comparisons of the eight cases in three parts. First, I present comparisons based on the *writing processes* data (i.e., thoughts made known through talk-alouds and video-stimulated recall). Second, I present comparisons based on the *composition moves* data (i.e., actions recorded by the screen-capture video and further understood by talk-alouds). Finally, I present comparisons based on the *emergent features* data (i.e., thoughts and actions from all data sources).

Cross-Case Comparison Writing Processes

Based on the writing process model of Hayes (2012), codes from talk-aloud and video-stimulated recall data were compared across cases in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*. Table 13 summarizes the individual findings for each of the eight tweeters, highlighted to indicate patterns.

Table 13

Cross-case comparison of each student's writing processes highlighted to indicate patterns

	Hal	Hope	Inez	Irene	Kip	Kayla	Luke	Lori
Motivation	- For fun - To develop technical skills	- To share work with others - For fun	- To share work with others - For fun	- To share work with others - For fun	- To share work with others - For fun	- To share work with others - For fun	- To share work with others - For fun - Sometimes not motivated to tweet	- To share work with others - For fun
Goal Setting	- To share about their learning - To ensure messages make sense - To develop technical skills	- To share about their learning - To ensure messages make sense - To teach others	- To share about their learning - To ensure messages make sense	- To share about their learning - To ensure messages make sense	- To share about their learning - To ensure messages make sense	- To share about their learning - To ensure messages make sense	- To share about their learning - To ensure messages make sense	- To share about their learning - To ensure messages make sense
Planning	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To use autocomplete suggestions - To seek teacher support	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To use autocomplete suggestions	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To use autocomplete suggestions	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To use autocomplete suggestions - To seek teacher support	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To seek teacher support	In-advance - To pre-select topic & take photo In-the-moment - To think of each sentence while writing - To seek teacher support
Writing Schemas - genre knowledge ²	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter
Writing Schemas - contextual elements ³	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter	To demonstrate elements of a 2nd-grade expert tweeter
Writing Schemas - text structure	Fixed Topic Giraffe Text of Tweet This is my giraffe. It will help me become a better Builder. Giraffes live in the rainforest. by531#Giraffe	Fixed Topic Twitter sheet Text of Tweet This helped me in 2nd grade by showing me the steps how to Tweet. This is called the Twitter sheet. By 310#Twittersheet	Fixed Topic - Reading a book - Reading log Text of Tweet I am reading a book. It is called Penguins! I marked it down on a peas of paper so I could keep track of what I am reading. This will help me with reading. #reading by875	Fixed Topic Word of the day Text of Tweet The word of the day helps me with my words that I need some chunking. Words that are hard words I can look up and see what needs to be chunked. by610 #wordoftheday	Fixed Topic Math with someone Text of Tweet I like math rotations because we have math with someone. I like math with someone because we get to work and play with someone. By 105 #math with someone	Fixed Topic Math rotations Text of Tweet This is are math rotations. This will help me with math. by972#mathrotations	Fixed Topic The word clever Text of Tweet We learned the word clever. Clever means you are smart. It helps me learn. By 411 #Clever	Fixed Topic STEM Text of Tweet I am going to tweet about stem. Stem helps me by how to build and we can build things made of legos. By 202

² See Figure 11 for the flow chart used to conduct this analysis.

³ Also see Figure 11.

As can be seen in Table 13, seven of the eight students expressed the same two types of *motivation* for tweeting: (a) to share their work with others, and (b) to have fun. In addition, Hal expressed *motivation* to develop better technical skills as a result of his tweeting.

Similarly, all eight students expressed *goals* that were focused on following the teacher-established guideline for tweeting (which was to create a message that would make sense to their audience about content from their learning). Table 13 indicates that an additional goal was voiced by Hal and Hope. Hal's additional goal was to gain technical skills from his tweeting. Hope's goal was to tweet interesting content that would teach her readers something new and give ideas to other teachers about learning experiences they might want to try in their classroom.

Likewise, Table 13 shows that all eight students' *in-advance planning* followed the same pattern: selecting an object and then taking a photo of that object for their tweet, using the object and photo as tools for advanced planning. In like manner, all eight students' *in-the-moment planning* indicated their thoughtful generation of each sentence (using specific words and ideas to use) while writing about their pre-selected tweet object. Additionally, students' *in-the-moment planning* for generating letters, words and ideas was of three types: used autocomplete suggestions to add letters, words and ideas (Hal, Hope, Irene, and Kip), sought teacher support for letter, word and idea generation (Hal, Kayla, Luke, and Lori), and worked independently on letter, word and idea generation (Hope, Inez, Irene, and Kip).

Overall, Table 13 shows that students' demonstrated considerable awareness about three aspects of *writing schemas*: *genre knowledge*, *contextual elements*, and *text structure*.

Writing schemas: genre knowledge. All eight students provided evidence of including and/or explaining the *fundamental* (i.e., 280 character limit, student signature) and *secondary* (i.e., photo and hashtag) *elements* of the Twitter genre. In addition, Hope and Luke added the

optional emojis to their tweets. Hope included an emoji matching the meaning of her text after her first sentence. Luke included two emojis as part of his tweet closure. One of the two aligned with the meaning of his text. Lori, interestingly, was aware that a hashtag was needed in her tweet, but did not add one because she “did not have enough room” (although the 280 character limit had not been reached; she had 176 characters remaining).

Writing schemas: contextual elements. Table 13 indicates that all eight students displayed knowledge of the four contextual elements as they tweeted or talked about tweeting: *followers*, *likes*, *cybersafety*, and *networking*. Specifically, all eight students mentioned something about others (*followers*) reading their tweets and *liking* their tweets. When it came to *cybersafety* protocols, all eight students acted in ways consistent with the protocols established by their teacher. Lastly, without using the term “*networking*,” all eight students talked about connecting with and learning from others.

Writing schemas: text structure. As the bottom row of Table 13 displays, all eight students’ completed tweets that constituted a fixed topic text structure. KEY: Each part of their tweet’s text structure is color coded using the teacher’s 3 established guidelines for tweeting. The guideline begins with the direction to: Write 2 sentences. Then it prompts students with 3 questions: What are you learning about? (highlighted in yellow) Why are you learning about it? (highlighted in turquoise) How will you use this information? (highlighted in green) The pink highlight accounts for elaboration. Each respective topic aligned with the item in the pre-selected photo (highlighted in yellow). Each student followed the teacher-established guidelines to tweet about: (a) *what* information they were learning (highlighted in yellow), (b) *why* they were learning about it (highlighted in turquoise), and/or (c) *how* they would use it (highlighted in green). Inez, Irene, and Lori wrote text that may be considered a statement about the “how” part

of the prompt (highlighted in green). Hal, Kip, and Luke added additional information about their topic (highlighted in pink).

Cross-Case Comparison Composition Moves

Based on the writing process model of Hayes (2012), a cross-case comparison was conducted at two levels: the *letter/word/phrase* level and the *complete tweet* level. Four composition moves elements were used for analysis at each of the two levels: *composing*, *revision processes*, *task environment*, and *resource level*. To both manage the large amount of data and to see if a similar number of coded composition moves generated a similar flow-of-composing, comparison pairs with identical or a similar number of codes for a particular composition move were conducted.

Cross-Case Comparison of Composition Moves: Letter, Word and Phrase Level Analysis

A cross-case comparison was made of the letter, word, and phrase moves enacted by the eight students. The comparison analyzes flow-of-composing figures that have been paired. Each pair represents one of the four *composition moves*: *composing*, *revision processes*, *task environment*, and *resource level*. Pair selection was based on similar quantities of codes for each of the four composition moves elements. Luke and Irene were compared based on their same quantity of codes from the *composing* category, (n=55). Inez and Kayla were compared based on their similar quantity of codes from the *revision processes* category, (n=12) and (n=13) respectively. Luke and Hal were compared based on their similar quantity of codes from the *task environment* category, (n=38) and (n=42) respectively. And, Inez and Irene were compared based on their similar quantity of codes from the *resource level* category, (n=9) and (n=11) respectively.

Composing. While the number of *composing* codes for Luke and Irene were identical (n=55) their flow-of-composing figures for the complete tweet letter, word, and phrase analysis displayed very different story lines for their *composition moves*. As seen in Table 14 and Figure 37, Luke typed every letter of every word in his tweet, except one (when he used the autocomplete feature to let the iPad add the “ed” to the end of “learned”). He also added spaces between every word, backspacing on three occasions. Additionally, he typed three complete emojis (leaving two in his published tweet), three punctuation marks, and one hashtag. In short, Luke was a *do-it-yourselfer* when it came to *composing* a tweet. In other words, Luke did not take advantage of the various keyboard tools such as the autocomplete.

In contrast, Irene typed very few complete words, opting instead to key in a letter or two and then let the autocomplete feature take over the rest of the ‘typing.’ As a result, she used the spacebar less frequently than Luke because the autocomplete feature automatically placed a space after the word selected by her. As Irene’s flow-of-composing figure indicates, she did not use the backspace at all, she typed six punctuation marks (with only two ending up in her published tweet), and she typed two hashtags (with only one in her published tweet). Hence, Irene was an *autopilot-user* when it came to *composing* a tweet. In other words, Irene used the keyboard tools.

Thus, the identical number of *composing* codes for Luke and Irene could suggest similarity in the pattern for their composition moves, but their flow-of-composing figures indicate otherwise. Luke was a *do-it-yourselfer* while composing, Irene was an *autopilot-user*.

Table 14

Composing code totals for Luke and Irene

Composing:	Luke	Irene
Typing emoji	3	0
Typing single letter	2	11
Typing multiple letters	24	25
Typing spacebar	18	11
Typing backspace	3	0
Typing punctuation	3	6
Typing hashtags	1	2
Planning inline/realtime	1	0
Total	55	55

Figure 37

Side-by-side comparison of Luke and Irene's letter, word, phrase flow-of-composing figures

Luke's Composing Codes (n=55)	Irene's Composing Codes (n=55)
Mrs. Hammer @Hammers2ndGrade · May 22 We learned the word clever. Clever means you are smart. It helps me learn. 📖 🇺🇸 By411 #clever We learned how to the word clever. Clever means you are smart. It helps me learn. 📖 😊😊 By411 #clever	Mrs. Hammer @Hammers2ndGrade · May 22 The word of the day helps me with my words that I need some chunking. Words that are hard words I can look up and see what needs to be chunked.by610 #wordoftheday chunking The word of the day helps me with my words that I need some chunking. Words that are hard words I can look up and see what needs to be chunked.by610 #wordoftheday

Revision Processes. While the number of *revision processes* codes for Inez and Kayla were similar (n=12 and 13 respectively), their flow-of-composing figures for the complete tweet letter, word, and phrase analysis displayed very different story lines for their *composition moves*. As seen in Table 15 and Figure 38, Inez was deleting letters and spaces at nearly every turn: two for correcting the letter “b” to “d”; two for correcting typing mistakes, “r” for “f” and “i” for “s”; two for deleting letters from long “e” spelling patterns, “cepe” to “ceap” and “ceap” to “ceep”; and one for forgetting a space after deleting letters. Her repeated *editing* of words appeared four times, three of which were associated with correcting and re-correcting the spelling of “sounds” to “doun” and one for the spelling of the autoselected hashtag “read” to “reading.” Furthermore, she whispered “changed my mind” while *revising* “I filed” to “I marked.” In short, Inez was a *flip-flopper* when it came to *revision processes* in her tweet. In other words, Inez would type letters before realizing changes were needed. She flipped and flopped between typing and deleting, fixing spelling errors based on what looked right or suggestions provided by autocomplete.

In contrast, Kayla’s deleting was more measured than Inez’s, though nearly the same in number. In a business-like manner, she removed unwanted letters such as “s” in “maths” and meticulously excised mis-typed characters such as the # and @ symbols. Her editing occurred one more time than Inez’s, but with studied spelling error corrections on challenging 2nd grade words like “rotations” and the cleaning up of incidental keystrokes. In addition, Kayla’s *revising* occurred twice, once when she took a photo of her pre-selected object, inspected the photo for quality, and decided to retake the picture for improved quality; and again when she changed her hashtag text from “#rotations” to “#mathrotations.” Thus, Kayla was a *chaos-cleaner* when it came to *revision processes* in her tweet. In other words, Kayla would type her message without

noticing accidental cursor movement or accidentally typing random characters, then deleting to clean up the message.

Thus, the similar number of *revision processes* codes for Inez and Kayla could suggest similarity in the pattern for their composition moves, but their flow-of-composing figures indicate otherwise. Inez was a *flip-flopper* while composing, Kayla was a *chaos-cleaner*.

Table 15

Revision Processes code totals for Inez and Kayla

Revision Processes:	Inez	Kayla
Add new text	0	0
Editing	4	5
Rewriting	0	0
Revising	1	2
Reorganizing	0	0
Deleting	7	6
Total	12	13

Figure 38

Side-by-side comparison of Ineze and Kayla's letter, word, phrase flow-of-composing figures

Inez's Revision Processes Codes (n=12)	Kayla's Revision Processes Codes (n=13)
Mrs. Hammer @Hammers2ndGrade · May 23 I am reading a book. It is called Penguins! I marked it down on a peas of paper so I coled keep track of what I am reading . This will help me with reading .#reading by875	Mrs. Hammer @Hammers2ndGrade · May 21 This is are math rotations. This will help me with math.by972#mathrotations.

Task Environment. While the number of *task environment* codes for Luke and Hal were similar (n=38 and 42 respectively), their flow-of-composing figures for the complete tweet letter, word, and phrase analysis displayed very different story lines about their composition moves. As seen in Table 16 and Figure 39, Luke spent considerable time searching the keyboard to locate letters and emojis (n=19), opening, closing or toggling among keyboards (n=7), and looking at the iPad screen (n=7). He tapped the iPad screen on two occasions, once when he started tweeting and then again when he submitted his tweet. And unlike other students in this study, he dawdled with the camera while adding his previously taken photo, got lost while scrolling for a hashtag, and marveled at the *keyboard autocomplete* feature in a star-struck composing moment.

Thus, Luke was a *keyboard-clunker/lost-in-the-labyrinth* when it came to *task environment* influences on his tweet. In other words, Luke was not fluent and confident with the task environment, specifically the keyboard, often taking extended amounts of time to complete typing tasks.

Conversely, Hal's opening, closing and toggling among keyboards was more feveredly focused on the shiny and new. He toyed happily with the microphone and keyboards (n=10) and used other apps, tools and materials that were 'outside,' but interoperable with, the Twitter app, such as the speech-to-text microphone. In fact, his fixation with the speech-to-text feature was his lodestar. He first used it to spell the unknown words "giraffe" and "Builder," and later to add all of the words to the second sentence in his tweet (n=14). In addition, he engaged in quick keyboard searching to find needed letters seven times and used the keyboard autocomplete tool nearly as often. To a lesser degree, Hal tapped around the iPad screen, once when he started tweeting and again when he submitted his tweet. Finally, he popped open the camera to add his photo to the tweet, amped-up his scrolling swipes in search of an emoji, rummaged for the photo he'd already taken, and whisked his cursor from one location to another. Thus, Hal was a *kid-in-a-candy-store/inspector gadget* when it came to *task environment* influences on his tweet. In other words, Hal confidently navigated the task environment, trying new typing supports offered by the keyboard technology.

Thus, the similar number of *task environment* codes for Luke and Hal could suggest similarity in the pattern for their composition moves, but their flow-of-composing figures indicate otherwise. Luke was a *keyboard-clunker/lost-in-the-labyrinth* while composing, Hal was a *kid-in-a-candy-store/inspector-gadget*.

Table 16

Task Environment code totals for Luke and Hal

Task Environment:	Luke	Hal
Camera	1	1
Tweet app beginning and end	2	2
Keyboard Searching	19	7
Keyboard open or close	7	10
Keyboard autocomplete	1	5
Cursor reposition	0	1
Scrolling	1	1
Task materials	7	14
Already accessed photo	0	1
Writing prompt	0	0
Total	38	42

Figure 39

Side-by-side comparison of Luke and Hal's letter, word, phrase flow-of-composing figure

Luke's Task Environment Codes (n=38)	Hal's Task Environment Codes (n=42)
Mrs. Hammer @Hammers2ndGrade · May 22 We learned the word clever. Clever means you are smart. It helps me learn. 📖 🇺🇸 By411 #clever	Mrs. Hammer @Hammers2ndGrade · May 23 This is my giraffe it will help me become a better Builder. Giraffes live in the rainforest.by531#Giraffe
We • learned • how • to • the • word • clever • . • Cleyver • means • you • are • smart • . • It • helps • me • learn. 🧐 😊😊 By411 • # • clever	The is This • is • my • giraffe • it • will • help • me • become • a • better • Builder • By • 531#Giraffe 531 🧐 #Giraffe • Giraffs live in the rainforest.by531#Giraffe

Resource Level. Finally, while the number of *resource level* codes for Inez and Irene were similar (n=9 and 11 respectively), their flow-of-composing figures for the complete tweet letter, word, and phrase analysis displayed a different story lines for their composition moves. As seen in Table 17, and Figure 40, Inez was reading right away, first at the beginning of her writing time, multiple times spaced out around the middle of her writing time after a thinking or editing moment and again before submitting to publish. Inez paused only once before tweeting. In short, Inez was a *right-away reader* when it came to *resource level* engagement while composing her tweet. In other words, Inez employed rereading DURING writing.

In contrast, Irene delayed reading, waiting to type her entire first draft before her first read. Similar to Inez, the additional rereadings were spaced out around the middle of her writing time after a thinking or editing moment and again before submitting to publish. Irene paused twice, once before tweeting and again midway through tweeting. In short, Irene was a *slow-to-go reader* when it came to *resource level* engagement while composing her tweet. In other words, Irene employed rereading AFTER writing her complete message.

In sum, the similar number of *resource level* codes for Inez and Irene could suggest similarity in the pattern for their composition moves, but their flow-of-composing figures indicate otherwise. Inez was a *right-away-reader* while composing, Irene was a *slow-to-go reader*.

Table 17

Resource Level code totals for Inez and Irene

Resource Level:	Inez	Irene
Reading text	8	9
Attention diverted	0	0
Pause, unknown reason	1	2
Total	9	11

Figure 40

Side-by-side comparison of Inez and Irene's letter, word, phrase flow-of-composing figures

Inez's Resource Level (n=9)	Irene's Resource Level Codes (n=11)
Mrs. Hammer @Hammers2ndGrade · May 23 I am reading a book. It is called Penguins! I marked it down on a peas of paper so I coled keep track of what I am reading . This will help me with reading .#reading by875	Mrs. Hammer @Hammers2ndGrade · May 22 The word of the day helps me with my words that I need some chunking.Words that are hard words I can look up and see what needs to be chucked.by610 #wordoftheday

In sum, the flow-of-composing figures from selected cases provides insight into the diversity of writing moves among young writers. Although each student's published tweet looks similar in many ways, the letter, word, and phrase flow-of-composing figures tells a different

story. In other words, a similar quantity of composition moves codes for one of the four elements does not equal a similar composition moves experience. The cross-case comparison work in the next section identifies the similarities across cases with the four composition moves. It will be important to keep in mind how these surface-level similarities may have multiple meanings when it comes to how each tweeter experienced a particular composition move.

Cross-Case Comparison of Composition Moves: Complete Tweet Analysis: Overall

The cross-case comparison of composition moves initially examined the overall patterns for the four codes: *composing*, *revision processes*, *task environment*, and *resource level*. Table 18 displays the eight students at the top of each column, with the four main composition moves in the far left column. The sub-codes for each composition move are entered inside each cell and highlighted to indicate prominence. The highlights indicate the most frequently occurring sub-codes for *composing* (green), *revision processes* (yellow) and *task environment* (light red). The shades of blue highlights indicate patterns in the *resource level* section.

Table 18

Cross-case comparison of each student's composition moves highlighted to indicate patterns

	Hal	Hope	Inez	Irene	Kip	Kayla	Luke	Lori
Composing	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .	Typing emoji . Typing single letter . Typing multiple letter . Typing spacebar . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning . Typing backspace . Typing punctuation . Typing hashtag . In the moment planning .
Revision Processes	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .	Add new text . Editing . Rewriting . Revising . Reorganizing . Deleting .
Task Environment	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .	Camera . Tweet app . Keyboard searching . Keyboard open close . Keyboard autocomplete . Cursor Reposition . Scrolling . Task materials . Already accessed photo . Writing prompt .

Table 18 (cont'd)

Resource Level	Focused	Focused	Focused	Focused	Focused	Focused	Focused	Focused
	Rereading at end of thought/sentence	Rereading at end of thought/sentence Rereading (noticed unwanted autocorrect)	Rereading at end of thought/sentence Rereading (noticed unwanted autocorrect)	Rereading at end of thought/sentence	Rereading at end of thought/sentence Rereading (noticed word to change)	Rereading at end of thought/sentence	Rereading at end (with prompting)	Rereading (w/ prompting)
	Attention diverted once							Pausing/ thinking/ stuck

For the composition move of *composing*, two patterns were evident. One was the pattern of *multi-letter*, *spacebar* and *backspace* moves made by Hal and Luke. These sub-codes suggest that their typing was proficient enough to key in multiple letters and spaces, punctuated occasionally with a tap on the backspace to delete an unnecessary space. The other pattern was composed of *single-letter*, *multi-letter* and *spacebar* moves made by Hope, Inez, Irene, Kip, Kayla and Lori. Their typing was a mix of single and multiple letters peppered with periodic pressing of the spacebar. The other four sub-codes for *composing* appeared infrequently.

Three patterns were evident in the composition move of *revision processes*. One was formed by the *editing*, *deleting* and *revising* moves made by Hal, Hope and Inez. This combination of sub-codes suggested that their revision was proficient enough to address misspelled words, delete occasional typing mistakes and make changes to tweet content to enhance meaning. The second pattern was made up of *editing* and *deleting* moves made by Irene, Kip, Kayla and Lori. Their revision was proficient enough to address misspelled words and delete occasional typing mistakes. And the third pattern was composed of *deleting* and *revising* moves made by Luke. His revision was proficient enough to delete occasional typing mistakes and make changes to tweet content to enhance meaning.

For the composition move of *task environment*, three patterns are evident. One was the pattern of *keyboard searching*, *keyboard open or close*, *keyboard autocomplete*, and *task materials* moves made by Hal, Hope, Inez, Kip, Luke and Lori. This combination of sub-codes suggested that their task environment moves were a combination of scanning the keyboard for letters, toggling among keyboards, selecting autocomplete suggestions, and spending time looking at the iPad screen or other assignment materials. The second pattern was made up of *keyboard searching*, *keyboard open or close*, *keyboard autocomplete*, and *cursor reposition* moves by Kayla. This combination of subcodes suggest her task environment was scanning the keyboard for letters, toggling among keyboards, selecting autocomplete suggestions, and moving the cursor from one location to another. And the third pattern was composed of *keyboard searching*, *keyboard autocomplete*, *cursor reposition* and *task materials* moves by Irene. This combination of sub-codes suggested that their task environment moves were a combination of scanning the keyboard for letters, selecting autocomplete suggestions, moving the cursor from one location to another, and spending time looking at the iPad screen or other assignment materials.

Three patterns were evident in the composition move of *resource level*. One was the pattern of *focused*, *rereading at end of thought/sentence* and *rereading (noticed unwanted autocorrect)* moves made by Hope, Inez and Kip. Their combination of sub-codes suggested that resource level use was focused with an eye toward noticing miscues, rereading often. The second pattern was made up of *focused* and *reader at end of thought/sentence* moves made by Hal, Irene and Kayla. Their resource level moves were focused with reading often. And the third pattern was composed of *focused* and *rereading (with prompting)* moves by Luke and Lori. Their resource level moves were focused without a concern for rereading unless reminded.

Cross-Case Comparison of Composition Moves: Complete Tweet Analysis: In Thirds

The cross-case comparison of composition moves was also divided into three time periods (beginning, middle, and final). Dividing the timeline into three equal time periods provided a clustered temporal view of the four composition moves: *composing*, *revision*, *task environment*, and *resource level*.

Table 19

Most Frequent code occurrence divided into three time periods, highlighted to indicate patterns

Key: Composing, Revision Processes, Task Environment Resource Level

	Hal	Hope	Inez	Irene	Kip	Kayla	Luke	Lori
Beginning third	Composing	Composing	Composing		Composing	Composing	Composing	Composing
		Task Environment		Task Environment		Task Environment		
Middle third		Composing	Composing		Composing		Composing	Composing
	Task Environment			Task Environment		Task Environment		
Final third			Composing			Composing	Composing	Composing
	Task Environment	Task Environment		Task Environment	Task Environment		Task Environment	

Table 20
Summary of All Cases Composition Moves frequency of use in thirds

	Beginning Third %	Middle Third %	Final Third %	Total %
Composing	17	16	13	46
Revision	1	3	2	6
Task Environment	13	14	15	42
Resource level	2	2	2	6
Total %	33	35	32	100

The overall pattern across Tables 20 and 21 are the prominence of *composing* and *task environment* moves in the compositions of the students across all three time periods. Simply put, this meant that the eight students were largely focused on typing and technology tools, assignment materials, and text written so far in the task environment while composing their tweets. The beginning third of the tweets was largely shaped by *composing* moves (7 of the 8 students in Table 19; 17% vs 13% in column 1 in Table 20). The middle third was shaped by a mix of *composing* and *task environment* moves, with a larger number of students using *composing* moves (5 of the 8 students in Table 19; 16% vs 14% in column 2 of Table 20). And the final third was shaped by a re-mix of *task environment* and *composing* moves, with a slight increase in the number of students using *task environment* moves (5 of the 8 students in Table 19; 15% vs 13% in column 3 of Table 20). In sum, the prominence of *composing* moves by students decreased slightly from beginning to middle to final (i.e., from 7 to 5 to 4), while the *task environment* moves increased slightly from beginning to middle to final (i.e., from 3 to 3 to 5). Such patterns suggest that student moves represented a shift from getting words on the screen to manipulating the words once on the screen. The composition moves for *revision processes* and *resource level* were used much less frequently by the students across all three time periods.

Cross-Case Comparison of Emergent Features

Based on all the data analyzed from the “Emergent Features” case studies (i.e., screen capture recordings, talk-aloud transcripts, video stimulated recall interview transcripts, student written artifacts, and field notes), eight elements associated with the tweet-composing technology and context were summarized and re-analyzed using Table 21. The eight elements were: (a) *autocomplete*, (b) *red underline*, (c) *blue highlight*, (d) *technology as “knowing other”*, (e) *magnifying glass activation*, (f) *black-box words*, (g) *copyright*, and (h) *reading URLs*.

To scaffold the analysis of emergent features, I designed a *conceptual spectrum* that indicated the degree of student understanding of features used or mentioned. The spectrum is informed by the concept of learning progressions in education (i.e., Mosher, 2011). The degrees of understanding were determined from student explanations and/or observable use of features. The spectrum included six conceptual bands ranging from an *accurate* understanding on one end to a complete lack of feature awareness (*incognizant*) on the other. These conceptual bands were used to analyze each of the eight emerging feature elements across the eight cases in Table 21.

The conceptual spectrum band was defined and color coded for visual analysis. The first spectrum level, *accurate conception*, highlighted green in Table 21, indicates a student correctly understands and uses the associated element consistently. The second spectrum level, *patchy conception*, highlighted yellow, indicates a student mostly understands, but utilizes the associated element inconsistently or excessively. The third spectrum level, *partial conception*, highlighted purple, indicates a student has limited or incomplete understanding of the associated element. The fourth spectrum level, *false conception*, highlighted red, indicates a student misunderstands the associated element. The fifth spectrum level, *strategy-creating conception*, highlighted blue, indicates a student has varying degrees of understanding and invents/creates a

strategy/response to work with the associated element. Finally, the sixth spectrum level, *incognizant conception*, highlighted white, indicates a student is not aware that the associated element exists. The comparison of each student, for each element, along the conceptual spectrum, follows.

Table 21

Cross-case comparison of each student's emergent features highlighted to indicate patterns

	Hal	Hope	Inez	Irene	Kip	Kayla	Luke	Lori
Autocomplete		• Quicker to spell words than typing	• Words you might be trying to spell					
			• Sometimes forgets to use this feature	• Used with most words	• Sometimes forgets to use this feature			
			• Words suggested by "The people who made Twitter."					
	Single letter activation strategy	Multi-letter activation strategy		Possible strategy to add space between words	Strategy to type longer words faster			
Red Underline	• Indicates spelling mistake			• Indicates spelling mistake	• Indicates spelling mistake			
			• Disappears if unnoticed		• Sometimes it underlines correct spelling			• Indicates a word is too close to another word
								• Spacebar strategy: double spaces, deletes a space

Table 21 (cont'd)

Blue highlight		Tells you something is spelled wrong or it's not a real word						
				Indicates "unfinished words"				• Changes the word from what she wants to write
		• Clicking on blue highlight tells computer she knows it's there and she will go back and fix it	A reminder to go back to that word		So you know where you are with your typing			
								• Spacebar strategy: double spaces, deletes a space
Technology as "knowing other"								
		•Anthropomorphism of technology	•Anthropomorphism of technology					
Magnifying glass activation		• To view small areas		• To view small areas				
		• punctuation activation						

Table 21 (cont'd)

Black box words		•Provides words with similar spelling pattern						
				• students are not allowed to use those words				
	• Inattentional blindness (feature not noticed)	• Inattentional blindness (feature not noticed)						
Copyright								
		• students should not copy tweet ideas						
Reading URLs								
	• important word • Word to sound out							

Autocomplete

The *autocomplete* feature was available on the iPad keyboard used by each student. When a student typed on the keyboard the *autocomplete* feature displayed three ‘suggested words’ s/he could use based on the initial letters keyed in and the previous syntax. If the student noticed these suggested words and thought one fit his/her writing intention, s/he could simply tap a word on the wordbar displayed across the top of the keyboard and the complete word would appear in the text box followed by an automatic space so the next word could be entered.

The cross-case comparison of *autocomplete* findings is displayed in the first row of Table 21. The row is subdivided into six sub-rows that represent the bands of the conceptual spectrum, starting with the top sub-row, with each successive band below it (i.e., from *accurate conception* across the top sub-row, moving to the next band in the next sub-row, with *incognizant conception* across the bottom sub-row).

The *autocomplete* feature was identified as emergent for five of the eight students: Hal, Hope, Inez, Irene and Kip. Two students, Hal and Inez, were found to have an *accurate conception* of the *autocomplete* capability for displaying words the writer is trying to spell and to add words to a tweet quicker than typing a full word letter by letter. Three students were found to have a *patchy conception*, with Inez and Kip admitting they sometimes forgot about the *autocomplete* feature, while Irene used the *autocomplete* excessively, selecting an autocomplete word suggestion for all but two of the words in her tweet, including words she had already typed out completely. One student, Inez, provided a *false conception* when she explained that the *autocomplete* words were being generated by the “people who make Twitter.” Finally, four students expressed *strategy-creating conceptions* for the *autocomplete* feature. Hal consistently typed a single letter before selecting an *autocomplete* suggestion where as; Hope consistently

typed multiple letters before making a selection; Irene appeared to use the *autocomplete* feature to add spaces between her words; Kip reported using the *autocomplete* feature only when typing long words. No evidence was found to indicate students had *partial* or *incognizant conceptions* of the *autocomplete* feature.

Red Underline

The *red underline* feature was available on the iPad keyboard used by each student. When a student typed on the keyboard the *red underline* appeared under the text which did not follow typical English spelling and/or syntax, such as homophones. If the student typed a string of letters that did not match an autocomplete suggestion a *red underline* would appear once the spacebar was tapped, notifying the student of a possible spelling error. If the student tapped the spacebar a second time the *red underline* would disappear. If the student tapped on the underlined text it would become highlighted pink and a black box would appear above the pink highlighted word providing suggested replacements for the word, or the phrase “No Replacements Found.”

The cross-case comparison of *red underline* findings is displayed in the second row of Table 21, which, like the *autocomplete* row, is subdivided into six sub-rows that from top-to-bottom represent the conceptual spectrum (from *accurate conception* to *incognizant conception*). The *red underline* feature was identified as emergent for five of the eight students: Hal, Inez, Irene, Kip and Lori. Three students, Hal, Irene and Kip, were found to have an *accurate conception* of the *red underline* feature for indicating a spelling error. Three students were found to have a *partial conception*. Inez explained that the *red underline* will “just go away if you don’t notice it.” This is partially true, but the underline disappears not because it is not noticed, but because the spacebar is pressed. Kip explained that sometimes correctly spelled words are

underlined in red, therefore, “It’s not always right.” This partial understanding accounts for Kip’s limited understanding of homophones. Finally, Lori explained that the *red underline* appears when a space is not placed between words. This makes sense given that the combination of two words without a space is more likely to produce misspellings rather than compound words. One student, Lori, provided an *strategy-creating conception* when confronted with a word marked by a *red underline* after pressing the spacebar. She proceeded to press the spacebar a second time to remove the red underline, then deleted the extra space before typing her next word. No evidence was found to indicate students had *patchy*, *false* or *incognizant conceptions* of the *red underline* feature.

Blue Highlight

The *blue highlight* feature was available on the iPad keyboard used by each student. When a student typed on the keyboard the *blue highlight* appeared once an unexpected letter was added to a string of letters typically found in a word. For example, if the string of letters typed was “jok” like in “joke” or “jokes,” and the next letter typed did not follow this anticipated spelling, such as “jok” then “y,” the text would be highlighted blue signalling the writer of a possible mistake. In response to this possible mistake, the autocomplete wordbar would then display three suggestions. Continuing with the example, the suggestions might be, “joky” to account for the already typed letters, “joke” and “jokes.” The word bar would automatically highlight in white the word located in the center of the three suggestions. If the writer pressed the spacebar, the center word, in this example “joke,” would automatically replace the *blue highlighted* word, “joky.” If the writer did not select the word “joke” and deleted the “e,” replacing it with the original spelling using “y,” the *blue highlight* would not reappear over “joky.” Rather, once the spacebar was pressed the word would display a *red underline*.

The cross-case comparison of *blue highlight* findings for each student is displayed in the third row of Table 21. The *blue highlight* feature was identified as emergent for five of the eight students: Hope, Inez, Irene, Kip and Lori. One student, Hope, was found to have an *accurate conception* of the *blue highlight* feature for correcting a spelling error or “when it’s not a real word.” Two students, Irene and Lori, provided evidence of *partial conceptions*. Irene said the *blue highlight* indicated “unfinished words, which could be considered an accurate statement given that the highlight may appear before the writer has finished typing a word. But, it was coded a *partial conception* because Irene did not realize the *blue highlight* of the unfinished word was a signal to the writer to consider the autocomplete suggestions. Relatedly, Lori explained that the *blue highlight* would “Change the word from what [she] wants to write,” thus her understanding was a partial conception of why the word changed. Three students--Hope, Inez and Kip--provided data indicating *false conception*. Hope, for example, explained that clicking on the *blue highlight* signaled the computer that, “she knows [the *blue highlight*] is there and she will go back and fix it later.” Inez said the blue highlight is a reminder to go back to that word; and Kip said the blue highlight is there so you know “where you are with your typing.” Finally, Lori provided evidence of *strategy-creating conception* for the *blue highlight* feature that paralleled that which she gave for the *red underline* feature. For instance, when confronted with a *blue highlight* word after the initial spacebar press, she retyped the word originally typed, then pressed the spacebar again. At this point the *red underline* appears. She pressed the spacebar a second time to remove the *red underline*, then deleted the extra space before typing her next word. No evidence was found to indicate students had *patchy* or *incognizant conceptions* of the *blue highlight* feature.

Technology as Knowing Other

Technology as “knowing other” is a feature of the language used by students to explain what the digital technology was ‘doing’ as they composed their tweets. The cross-case comparison of *technology as “knowing other”* is displayed in the fourth row of Table 21. This feature was identified as emergent for two of the eight students. In both cases, the students used language that anthropomorphized a feature of the digital technology being used. Such a conception of technology was evidence of a *false conception* because the students misunderstood the associated element. Hal, for instance, explained why people do not “like” their own tweets, “Because they umm aren't allowed to cuz their iPad senses it.” And, when Inez asked about the autocorrect of “hellp,” she replied, “That was wrong because I put another “I” so then it just went in there and helped me out and it just took the other “I” out.” No evidence was found to indicate students had *accurate, patchy, partial, strategy-creating, or incognizant conceptions of technology as “knowing other.”*

Magnifying Glass Activation

The *magnifying glass activation* feature was available on the iPad used by each student. To activate the magnifying glass when typing, the writer had to firmly press a finger on or between letters and words on the iPad screen. The location was usually where a typing error existed or a place where a letter or word needed to be added or deleted. The firm finger press activated a magnified circular view (approximately an inch in diameter) of text on the screen. While maintaining the firm finger press, the writer slid her finger across the text. As her finger slid, the cursor followed. The magnification remained as long as the finger remained firmly pressed on the iPad screen. When the writer removed her finger from touching the screen, the cursor was inserted at the last touch point.

The cross-case comparison of the magnifying glass activation findings for each student is displayed in the fifth row of Table 21. The magnifying glass feature was identified as emergent for two of the eight students: Hal and Irene. Both students explained that the purpose of this feature was to view small areas, which was an *accurate conception* of the feature. In addition, Hal explained that end-of-sentence punctuation was necessary to activate the magnifying feature, which is a *false conception*. Furthermore, he made an attempt at one point to demonstrate how the *magnifying glass* would not appear unless a period was added to the end of his sentence. After adding the period, he tried the magnification feature, which activated the *magnifying glass*. No evidence was found to indicate students had *patchy*, *partial*, *strategy-creating*, and *incognizant conceptions* of the *magnifying glass* feature.

Black Box Words

The *black box words* feature was available on the iPad keyboard used by each student. Three variations of the *black box words* were observed. First, if the writer firmly pressed a finger to the iPad screen at the location of a word, a *black box* with three command choices appeared, “select,” “select all,” and “paste.” Second, if the writer double tapped a word, the *black box* would appear with six command choices: “cut,” “copy,” “paste,” “replace...,” “define,” and “share... .” And third, if a single word was activated, and the writer selected a word from the autocomplete suggestions, then deleting the space to position the cursor next to the last letter of the autocomplete word, a *black box* would appear with additional word choices.

The cross-case comparison of the *black box words* findings for each student is displayed in the sixth row of Table 21. The *black box words* feature was identified as emergent for three of the eight students: Hope, Irene and Hal. Hope, for instance, reasoned that the *black box words* provided “Words with similar spelling patterns,” which was evidence of an *accurate conception*.

Irene claimed that “students are not allowed to use those words” in the *black box*, which was evidence of a *false conception*. Finally, both Hope and Hal admitted that they had never noticed the *black box word* feature until it was pointed out during their video stimulated recall interview. By not noticing this feature, which Simons and Chabris (1999) call “inattentional blindness,” both students provided evidence of an *incognizant conception* of the *black box words* feature. No evidence was found to indicate students had *patchy, partial, strategy-creating, or incognizant conceptions* of the *black box words* feature.

Copyright

Copyright was a feature of the composing process expressed by a student when peers poached ideas from her tweet to use in their own. The cross-case comparison of *copyright* is displayed in the seventh row of Table 21. This feature was identified as emergent for one of the eight students. Hope brought up the issue of copying when asked which parts of tweeting were frustrating. She said, “I write something down and some people actually copy me and then write some other things down, instead of exactly the same words.” Such a conception of composing with technology was evidence of *partial conception* because of Internet issues related to open access, fair-use and copyright. No evidence was found to indicate students had *accurate, patchy, false, strategy-creating, or incognizant conceptions* of *copyright*.

Reading URL

Reading URL is a feature of the process used by students to indicate their understanding of what a feature is. The cross-case comparison of *reading URL* is displayed in the eighth row of Table 21. This feature was identified as emergent for one of the eight students: Hal. While reading a tweet aloud, Hal sounded out all the letters in the embedded URL as if decoding an unknown or challenging word, indicating his *false conception* of a URL as a word that signified

spoken or written meaning in the conventional sense. No evidence was found to indicate students had *accurate, patchy, partial, strategy-creating, or incognizant conceptions* for reading URL.

Summary of Cross-Case Comparison -- Overall

The data interpreted for the cross-case comparison of the eight cases provided categories of similarities and differences in each of three parts. First, the *writing processes* data (i.e., thoughts made known through talk-alouds and video-stimulated recall) suggests each of the eight cases were similar in terms of *motivation, goal setting, planning, and writing schemas*.

Second, the *composition moves* data (i.e., actions recorded by the screen-capture video and further understood by talk-alouds) suggests both similarities and differences across cases. At the *complete tweet level* it is easy to notice various commonalities based on quantity of codes for each of the composition moves elements: *composing, revision processes, task environment, and resource level*. But, when evaluating a composition move elements at the *letter/word/phrase level* differences, considerable differences are noticed in each student's composition move experience.

Finally, the *emergent features* data (i.e., thoughts and actions from all data sources) suggest a spectrum of conceptual knowledge (from *accurate conception* to *incognizant conception*) related to eight elements associated with the tweet-composing technology features and the tweeting context: (a) *autocomplete*, (b) *red underline*, (c) *blue highlight*, (d) *technology as "knowing other"*, (e) *magnifying glass activation*, (f) *black-box words*, (g) *copyright*, and (h) *reading URLs*.

Chapter Summary

The results of this study provided some answers to the research question, "What are the writing processes and composition moves made by second graders when composing tweets for

online publication?” The eight individual-case descriptions provided a look into the nuances of each tweeter’s writing processes, composition moves, and emergent findings. A summary of each case then a summary of the cross-case comparisons follow.

Individual-Case Summaries

Hal is a resourceful and efficient, just-get-it-done type tweeter, who was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment* with support, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Hal’s *composition moves* in *composing* involved quick *multi-letter*, *spacebar* and *backspace* typing that intermittently employed a “single letter” strategy to activate the *autocomplete* suggestions for the retyping of several text sections. He easily *edited* a word underlined in red and considered *revising* his text by adding an emoji. Hal’s *task environment* composition moves were mostly *keyboard open or closed* and *task materials* which included moments looking at the iPad screen and time spent using the speech-to-text feature. Finally, Hal’s resource level composition moves were few, maintaining a focus with limited *pausing* and *rereading* before adding on and before publishing his tweet. Finally, Hal revealed an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Hope is a conscientious and confident reader-pleaser type tweeter, who was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment*, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Hope’s *composition moves* in *composing* involved quick *multi-letter*, and *single-letter typing*, and the use of a “multi-letter” strategy to activate the *autocomplete* suggestions for the typing of several text sections. She easily noticed and *edited* typing miscues and *revised* her text by adding a word to an existing

sentence. Hope's *task environment* composition moves were mostly *keyboard searching*, *autocomplete*, and *keyboard open or close*. Finally, Hope's *resource level* composition moves included limited *pausing* and multiple *rereadings* at the completion of each sentence, after fixing a miscue, before adding on, and before publishing her tweet. Finally, Hope revealed an *emerging understanding* of the composing technology affordances and a growing concern for copyright.

Inez is a confident tweeter even though she struggles with spelling. Inez was *motivated* and *goal oriented* with an *in-advance plan* and the ability to *plan in-the-moment*, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Inez's *composition moves* in *composing* involved quick *multi-letter*, *spacebar*, and *single-letter typing*. Her *revision* work involved *deleting* single letters and *editing* misspelled words and *revising* her text to make it sound better. Inez's *task environment* composition moves were mostly *task materials* (looking at external documents and the iPad screen) and *keyboard searching*. Finally, Inez's *resource level* composition moves were few, maintaining a focus with a single beginning of tweet *pause* and *rereading* after making changes, before adding on and before publishing her tweet. Finally, similar to Hal, Inez has an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Irene is a confident tweeter. She was *motivated* and *goal oriented* with an *in-advance plan* and the ability to *plan in-the-moment*, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Irene's *composition moves* in *composing* involved *multi-letter* and *single-letter typing* with limited *spacebar* use. Her *revision* work involved *editing* and *deleting* to address misspelled words, capital letter, punctuation, and syntax miscues. Irene's *task environment* composition moves were mostly *keyboard autocomplete* (generating most of her text), *task materials* (looking at external documents and the iPad screen), and *keyboard*

searching. Finally, Irene's *resource level* composition moves were few, maintaining a focus with a beginning and mid-tweet writing *pause* and *rereading* after making changes and before publishing her tweet. Finally, Irene has an *emerging understanding* of the red underline, blue highlight, and magnifying glass features.

Kip is a confident tweeter even though, at first, he seemed nervous. He saw himself as an author, was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment* with support, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Kip's *composition moves* in *composing* included quick *multi-letter* and *single-letter typing*, and the use of a "multi-letter" strategy to activate the *autocomplete* suggestions for the typing of the word "someone." He easily noticed and *edited* for word choice and typing miscues in conjunction with multiple *deletes*. Kip's *task environment* composition moves were mostly *keyboard searching*, *task materials*, and *keyboard open or close*. Finally, Kip's *resource level* composition moves included multiple *pausing* and three *rereadings* after fixing miscues, and toward the end of his tweeting. Finally, Kip has an *emerging understanding* of the iPad keyboard affordances inventing explanations to how and why things work without fully understanding the technology.

Kayla is a resilient problem solver type tweeter with some difficulty navigating the keyboard. Kayla was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment*, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Kayla's *composition moves* in *composing* involved a high number of *single-letter typing*, with some *multi-letter typing* and *spacebar*. Her *revision* work included *editing* spelling miscues and *deleting* unwanted text and her *task environment* composition moves were mostly *keyboard open or close*, *keyboard searching*, *autocomplete* and *cursor reposition*. Finally, Kayla's *resource*

level composition moves included limited *pausing* and multiple *readings* at the end of her first sentence and before publishing her tweet.

Luke is a tentative yet capable tweeter. Nervous and unsure of his abilities yet competent in his knowledge of Twitter and the ability to compose a complete tweet. Luke was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment*, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Conversely, Sometimes Luke did not like to tweet because it conflicts with time reading. Luke's *composition moves* in *composing* included a high number of *multi-letter typing* and *spacebar* with two *single-letter typing* occurrences that may have been associated with visually similar letters. His revision work included *deleting* unwanted text and one *idea revision*. Luke's *task environment* composition moves were mostly *keyboard searching*, *keyboard open or close*, and *task materials* when looking at the iPad screen. Finally, Luke's *resource level* composition moves included limited *pausing* and one *reading* before publishing his tweet.

Lori is a dependent yet confident tweeter, reluctant and unsure of her abilities yet competent in her knowledge of Twitter and ability to compose a complete tweet. Lori was *motivated* and *goal* oriented with an *in-advance plan* and the ability to *plan in-the-moment* with significant support, displaying a 2nd-grade expert level *writing schema* knowledge of Twitter. Lori's *composition moves* in *composing* included frequent *typing spacebar*, *multi-letter*, and *single-letter typing*. She noticed and *edited* spelling errors and easily *deleted* multiple typing errors. Lori's *task environment* composition moves were mostly *keyboard searching* and *task materials*. Finally, Lori's *resource level* composition moves included multiple *pausing* and *readings* only when prompted.

Cross-Case Comparisons Summary

The data interpreted for the cross-case comparison of the eight cases provided categories of similarities and differences in each of three parts. First, the *writing processes* data (i.e., thoughts made known through talk-alouds and video-stimulated recall) suggests each of the eight cases were similar in terms of *motivation*, *goal setting*, *planning*, and *writing schemas*. Second, the *composition moves* data (i.e., actions recorded by the screen-capture video and further understood by talk-alouds) suggests both similarities and differences across cases. At the *complete tweet level* it is easy to notice various commonalities based on quantity of codes for each of the composition moves elements: *composing*, *revision processes*, *task environment*, and *resource level*. But, when evaluating a composition move element at the *letter/word/phrase level* considerable differences are noticed in each student's composition move experience. Finally, the *emergent features* data (i.e., thoughts and actions from all data sources) suggest a spectrum of conceptual knowledge (from *accurate* to *incognizant*) related to eight elements associated with the tweet-composing technology features and the tweeting context.

Chapter 5: Discussion, Limitations, and Implications

Evidence indicates that young children are writing online (e.g., Clark & Dugdale, 2009), but little consideration has been given to the actual *writing processes* and *composition moves* made by these children, especially when they compose short form writing online. Such a paucity of research is a problem for theoretical development and pedagogical design. This study addressed both these problems by posing the question: What are the writing processes and composition moves made by second graders when composing tweets for online publication?

Theoretically, this study's results extend the nascent research on children's online writing by using (and adapting) the most comprehensive model of offline writing (Hayes, 2012) as a lens to closely examine the online writing processes and composition moves of eight second-grade children ("tweeters") *in situ* as they compose short form writing for their class Twitter account. Through this lens I conducted a multi-case study, analyzing data from field notes, written artifacts, screen capture, talk aloud transcripts, and video-stimulated recall interview transcripts. The result is an account of the "why" (writing processes) and "how" (composition moves) of young writers writing online.

Pedagogically, this study's results extend the nascent research on children's online writing by describing one approach to short-form writing online and illustrating how it shapes the writing processes and composition moves of young children (cf., Maggio, L  t  , Chenu, Jisa, & Fayol, 2012; or Merchant, 2005). While other approaches could have resulted in different accounts of what young writers do as they write online, the pedagogical approach utilized in this study provides another lens for understanding how one particular approach shapes the online composing of children.

I begin this chapter by discussing how my study results suggest Twitter writing is similar to other writing according to the modified Hayes (2012) model. I then discuss how Twitter writing is unique in some ways, addressing elements not accounted for by the Hayes model. I also discuss how children's Twitter writing is shaped by the curriculum. I conclude this chapter first identifying limitations of the study and then offering implications for future instruction and research.

Children's Twitter Writing is Similar to Other Writing

The results of my analysis indicate that the eight second graders' online, short-form writing is generally similar to other forms of childrens' writing. By slightly adapting Hayes' (2012) comprehensive model of the writing process (see chapter 2)--so it also included the processes and moves that children's writing exhibits (Hayes & Olinghouse, 2015)--I examined the Twitter writing using a two-part analytic framework: *writing processes* (i.e., thoughts made known through talk-alouds and video-stimulated recall), and *composition moves* (i.e., actions recorded by the screen-capture video and further understood by talk-alouds). I discuss these similarities in the following sections, first with *writing processes*.

Writing Processes: Motivation

The writing-processes results on *motivation* indicated that, in general, the eight tweeters tweeted for "fun" and "sharing with others" with Hal motivated to tweet for fun and gain technical expertise and Luke occasionally not motivated to tweet. Having fun is similar to prior research on young children composing online (McGrail & Davis, 2011; Merchant, 2005b). And "sharing with others" is also similar to prior research on children's motivation for online composing (Burnett & Mayers, 2006; McGrail & Davis, 2011). Thus, the results of this study

confirm previous scholarship and extend it by providing evidence that *motivation* is a part of the writing process that extends into children's writing with Twitter's short form.

Writing Processes: Goal Setting

The results on *goal setting* indicated that the tweeters' goals were to "make sense" to their reader when tweeting about "content from their learning." All eight tweeters voiced these twin goals. While prior research on online composing does not report goal setting as a writing process voiced by children (e.g., Burnett and Mayers, 2006 and Merchant, 2005b), there is evidence in the literature that offline composing does so (e.g., Graham, McKeown, Kiuahara, and Harris, 2012). Thus, the results of this study confirm previous scholarship and extend it by providing evidence that *goal setting* is an integral part of the writing process when children write online with Twitter.

Writing Processes: Planning

The results indicated that two forms of *planning* were manifest in the eight children's online composing: *in-advance* and *in-the-moment*. All eight tweeters voiced *in-advance* planning by first selecting an object as the focus for their tweet, then taking a photo of it. Other forms of *in-advance* planning are represented in adolescent's online composing (Lawrence, Niiya, & Warschauer, 2015). Thus, the results of this study confirm previous scholarship and extend it by providing evidence that *in-advance* planning is a part of the writing process that extends into children's writing with Twitter's short form.

In addition, all eight students voiced *in-the-moment* planning, indicated by their thoughtful composing of each sentence and the generating of each letter and word. Prior research on children's online and offline composing provides partial evidence of *in-the-moment* planning (e.g., Burnett & Mayers, 2006; Bereiter & Scardamalia, 1987), but the general description of

planning made by McGrail and Davis (2011) of children's online composing suggests that *in-the-moment* planning is indeed an integral process of their writing. Thus, the results of this study confirm previous scholarship and extend it by providing evidence that both forms of *planning* are an integral part of the writing process when children write online with Twitter.

Writing Processes: Writing Schemas

Finally, the writing-processes results generally indicated that *writing schemas* were manifest in the eight children's online composing. Specifically, writing schemas were represented in three ways: (a) used *genre knowledge* to compose short-form writing including multimodal elements, (b) showed an awareness and growing understanding of *followers*, *likes*, *cybersafety*, and *networking*, and (c) developed a *fixed topic* text structure using their photo as a way to tell the reader more about their topic. The 'awareness' of genre knowledge in children's online writing is alluded to (e.g., Dowdall, 2009; Lindstrom & Niederhauser 2016). Of particular note, though, is recent work by Takayoshi (2018) which incorporates writing schemas into a model of adult online composers who are simultaneously engaging with multiple online spaces. Thus, the results of this study confirm previous scholarship and extend it by providing evidence that writing schemas are a part of the writing process that extends into children's writing with Twitter's short form.

Composition Moves: Composing

The composition-moves results for *composing* indicated that all eight tweeters generated multi-letters and single letters as well as using the spacebar and backspace when initially producing text on the screen. Prior research on young children's online *composing* at the character-level is limited (Dowdall, 2009; Lindstrom & Niederhauser, 2016; McGrail & Davis, 2011). Although, findings on young adults composing online describes a "recursive, truncated,

character-focused way of composing” (Takayoshi, 2018, p.564). Thus, the results of this study confirm previous scholarship and extend it by providing evidence that *composing* at the character-level may be a more significant feature in young children’s online composing than previous studies reported.

Composition Moves: Revision Processes

The results for *revision processes* indicated that the eight tweeters recursively used *editing* and *deleting* at the character level when manipulating existing text on the screen. Prior research on children’s online writing indicates some children attend to mechanical features when manipulating existing text such as the conventions of punctuation and spelling (e.g., McGrail and Davis, 2011; Merchant, 2005b). This result is similar to the attention children paid to surface-level convention problems found by MacArthur, Graham, and Harris’ (2004) with young offline writers. Correspondingly, Takayoshi (2018) found that young adults recursively used *editing* and *deleting* behaviors for both surface-level conventions and deeper-level craft decisions at the character level in her study of online writing. Thus, the results of this study confirms previous scholarship by providing evidence that recursive revision processes *are* a factor in young children’s online composing.

Moreover, the recursive *edit* and *delete* behaviors used by the eight tweeters were mostly in response to the tactical cues provided by the transcription technology to detect problems (i.e., the *red underline* and *blue highlight*). These results are in line with Bereiter and Scardamalia’s (1983) findings that tactical cues in offline writing support the increase of student revision processes (e.g., correction of misspelled word). Compared to their findings, my results showed that the eight tweeters had differing responses to the tactical cues (*red underline*, *blue highlight*). For example, tactical cues were misunderstood, misused, purposefully ignored, or unnoticed,

similar to what is represented in the model of Flower and Hayes (1986). Thus, the results of this study confirm and extend the range of possible responses young writers have to available keyboard tactical cues and the knowledge used during *revision processes*.

Composition Moves: Task Environment

The results for *task environment* indicated that the eight tweeters used various combinations of *keyboard searching*, *keyboard open or close*, *keyboard autocomplete*, *cursor reposition*, and *task materials* to produce their short-form writing. In other words, the eight tweeters' *task environment* was comprised of scanning the keyboard for letters, toggling among keyboards, selecting autocomplete suggestions, moving the cursor from one location to another, and spending time looking at the iPad screen or other assignment materials. These detailed results build on the 'awareness' of *task environment* elements implied in previous research (e.g., Merchant, 2005b; Wollman-Bonilla & Carpenter, 2003). Notably, Takayoshi (2018) found *task environment* elements integral to the online composing of adults (i.e., engaging with multiple online space notifications). Thus, the results of this study confirm and extend previous scholarship by providing nuanced evidence that the *task environment* is a factor in young children's online composing.

Composition Moves: Resource Level

Finally, the composition-moves results for *resource level* indicated that nearly all of the eight tweeters read and reread their Twitter text to (a) check that the message makes sense (b) think of what else to add, and (c) check for mechanical and local problems (e.g., spelling and punctuation.) These results are similar to previous scholarship on children's online (e.g., Burnett & Myers, 2006) and offline writing (e.g., Bereiter and Scardamalia, 1983). Thus, the results for these aspects of *resource level* are confirmed by previous research.

In addition, pausing was a *resource level* composition move made by all eight tweeters, with patterns of *pause duration* and *timeline location* unique to each tweeter. Previous research found that both types of pausing are associated with more thoughtful planning and better text quality in children writing offline (Limpo & Alves, 2017). Other studies have found that pauses in offline writing are associated with the length and qualities of words previously written by children (Maggio et. al., 2012). In sum, the results of this study confirm previous scholarship by providing evidence that pausing behaviors constitute the *resource level* composition moves in young children's online composing.

Children's Twitter Writing is Unique in Some Ways

The results of my analysis also indicate that the eight second graders' online, short-form writing is unique in several ways from childrens' offline short- and long-form writing. Based on their distinctive explanations of iPad and Twitter attributes, the tweeters voiced eight *writing processes* and *composition moves* that were not elements of the modified Hayes (2012) writing model: (a) *autocomplete*, (b) *red underline*, (c) *blue highlight*, (d) *technology as "knowing other"*, (e) *magnifying glass activation*, (f) *black-box words*, (g) *copyright*, and (h) *reading URLs*. I located the conceptual veracity of these elements, called *emergent features*, along a spectrum (ranging from *accurate* to *partial*, *patchy*, *false*, *strategy-creating*, and *incognizant conceptions*) so a non-binary band of codes could be used for visual analysis. These emergent features may account for some ways children's Twitter writing is unique to other writing. These eight *emergent features* are discussed next.

Emergent Features: Autocomplete, Red Underline, and Blue Highlight

The results for *emergent features* indicated most tweeters expressed a combination of accurate, patchy, false, and strategy-creating conceptions for the *autocomplete*, *red underline*,

and *blue highlight* features. Because these features are not accounted for in the Hayes (2012) model, and because a range of understandings about these features were voiced by some of the eight tweeters in the present study (and unexamined or unreported in previous studies), my results provide a preliminary basis for claiming that emergent features such as *autocomplete*, *red underline*, and *blue highlight* are not uniformly understood--or used--by young children composing online. Consequently, a more contemporary writing model for young short-form social media writers would account for the conceptual spectrum that these three emergent features could have on children's online composing.

Emergent Features: Magnifying glass activation, Black Box Words, Copyright and Reading URLs

In addition, there were other *emergent features* expressed by some tweeters that were a combination of accurate and false conceptions for the *magnifying glass activation* feature, *black box words*, *copyright*, and *reading URLs*. Because these features were also not accounted for in the Hayes (2012) model, and because a range of understandings about these features were put into words by tweeters in the present study (and unexamined or unreported in previous studies), my results provide a preliminary basis for claiming that *emergent features* such as *magnifying glass activation*, *black box words*, *copyright*, and *reading URLs* are not uniformly understood--or used--by young children composing online. Consequently, a more contemporary writing model for young short-form social media writers would account for the conceptual spectrum that these four *emergent features* could have on children's online composing.

Emergent Features: Technology as Knowing-Other

Finally, some tweeters expressed what I initially coded as false conceptions about features in the iPad and Twitter, conceptualizing the technology as a “*knowing other*.” In other

words, these tweeters used anthropomorphic language when talking about technological features of the iPad and Twitter. This finding is not found in previous research on young children's online writing but is well represented in other research fields (e.g., Airenti, 2015, says computers are most often anthropomorphized). Moreover, research shows that anthropomorphization of computers is not the result of "false conceptions" per se, but rather the results of talking about interactive processes (between people and computers) with language structures that make it natural to talk about interaction in human terms. In short, our language makes it convenient to talk about technology in this way (Papert, 1988). Therefore, a more contemporary writing model for young short-form social media writers would include anthropomorphic features as they emerge featuring the symbiotic interactions between writer and digital technologies.

Children's Twitter Writing is Shaped by the Curriculum

Finally, the results of my individual and cross-case analyses indicate similar patterns between the teacher's curriculum and the children's *writing processes* (motivation, goal setting, planning, and writing schemas). These similarities suggest that the design of the teacher's Twitter curriculum shaped the tweeting of all eight children as they wrote (Bazerman, et al., 2017). This curriculum, represented in the teacher-created handout in Figure 41, described the *procedures* (i.e., prewrite, draft, revise, edit, publish), *structure* (e.g., "Write 2 sentences:"), and *criteria* (e.g., "Check for the following: My sentences have subjects") students were to use when composing a tweet. Over time, the teacher modeled the elements of this curriculum, gradually releasing responsibility for tweeting in this way to the students, so they eventually used the teacher-created handout as a tool to guide their tweeting (Pearson & Gallagher, 1983). As a result of this process, the teacher's Twitter curriculum shaped the way in which all eight children tweeted.

Figure 41

Teacher-created handout for Tweeting

Number _____

PREWRITE Brainstorm and organize your ideas.	Write 2 sentences: What are you learning about? Why are you learning about it? How will you use this information? Or- Ask a question about what you are learning about? Why did you ask this question? Read your sentences out loud and check for the following: <table border="1"> <tr> <td>My sentences have subjects. (who, what)</td> </tr> <tr> <td>My sentences have predicates. (action, what)</td> </tr> <tr> <td>My sentences make sense.</td> </tr> <tr> <td>My sentences have CAPITALIZATION.</td> </tr> <tr> <td>My sentences have punctuation. (. ? !)</td> </tr> </table>	My sentences have subjects. (who, what)	My sentences have predicates. (action, what)	My sentences make sense.	My sentences have CAPITALIZATION.	My sentences have punctuation. (. ? !)
My sentences have subjects. (who, what)						
My sentences have predicates. (action, what)						
My sentences make sense.						
My sentences have CAPITALIZATION.						
My sentences have punctuation. (. ? !)						
DRAFT Use your ideas to write a rough draft.						
REVISE Make changes to improve your writing.						
EDIT Proofread and correct mistakes. Good Writers						
PUBLISH Write and share your final copy.						

Curriculum and Motivation

The evidence for this curriculum-shaping-the-tweets conclusion is visible when the writing processes (motivation, goal setting, planning, and writing schemas) were used to examine the teacher-created handout. In regards to motivation, the teacher's curriculum allowed children to choose 'if' and 'when' they would tweet. They could also choose their topic for the tweet. As previous research indicates, choice and autonomy-enhancing experiences are powerful motivators in children's writing to learn (Assor, Kaplan, & Roth, 2002). Moreover, authentic writing experiences in the classroom have also been found to motivate children's writing (e.g., Murray, 1985; Graves, 1994). And teaching students to tweet for a real purpose, to a real audience, with authentic feedback from peer readers online was one way in which the teacher's curriculum shaped the children's twitter writing.

Curriculum and Goal Setting

When asked about *goals* for tweeting, all eight tweeters reported similar *goal setting* processes: to create a message that would make sense to their audience about content from their learning. This goal setting intent has a direct link to the criteria for tweeting listed in the teacher-created handout, which was to tweet about their learning and to check that their sentences make sense. The effect of this criteria was to teach students to reread their tweet before publishing it and to ask themselves if they had achieved the goal of making sense in their tweet. Previous research has indicated that setting goals for reading to achieve a particular writing task is an integral part of the writing task environment (Hayes, 2012; Hayes, Flower, Schriver, Stratman, & Carey, 1987). The consistent reminders to check for meaning when reading and writing was another way in which the teacher's curriculum shaped the children's Twitter writing.

Curriculum and Planning

In terms of *planning*, the teacher's curriculum prompted children to use *in-advance planning* as they composed a tweet. The planning process began with guidance to: (a) think about what they might want to tweet about, (b) share their ideas with a classmate, and (c) take a picture of an object best representing their selected topic. This planning aspect of the curriculum included time for students to talk about their plans and for the teacher to provide direct instruction on how to use the technology to take a photo and add the photo to a tweet. Previous research indicates the powerful influence that planning has on the form and structure of children's writing (Graham & Harris, 2016; 2017). These planning processes and moves were yet another way in which the teacher's curriculum shaped the children's twitter writing.

Curriculum and Writing Schemas

Finally, the teacher's curriculum prompted the use of *writing schemas* by all eight tweeters, which resulted in their: (a) using *genre knowledge* to compose short-form writing including multimodal elements; (b) showing an awareness and growing understanding of *followers*, *likes*, *cybersafety*, and *networking*; and (c) developing a *fixed topic text structure* using their photo as a way to tell the reader more about their topic. The teacher's schema-shaping process occurred during daily discussions of their class twitter feed, which was projected as an enlarged shared-reading document for all the class to see. During these discussions the teacher directly taught about using *genre knowledge* to create meaningful messages with a *fixed topic text structure* limited to 280 characters (short form writing). Her two-step method was to first model her own tweeting process, and then follow it with shared writing of a class tweet. The teacher and children also talked from time to time about *followers*, *likes*, connecting with others in a *network* and *cybersafety* during these daily discussions. These daily, whole-class demonstrations and discussions were yet another way in which the teacher's curriculum shaped the children's writing.

These consistently implemented curricular elements were part of daily writing instruction with Twitter and over the course of the school year became an integral part of everyday practice for composing tweets. As a result, the evidence indicates that the design of the teacher's curriculum shaped the way student *motivation*, *goal setting*, *planning* and knowledge of *writing schemas* was enacted in their Twitter composing. This finding is similar to research that examined the influence of curriculum on children's long-form offline writing (i.e., Harris & Graham, 2016). This study extends that finding to short-form online writing.

Limitations

Although actions were followed to increase trustworthiness, the results of this multi-case study are limited to the particular circumstances from which it was conducted. To increase trustworthiness, both *composition moves* and writing processes were clearly defined based on existing models and theories of off-line, long-form writing (e.g., Bereiter and Scardamalia, 1987; Hayes, 2011; 2012; Hayes & Olinghouse, 2015) and short-form online writing (e.g., Takayoshi 2015, 2018). Ultimately, for this case study, the Hayes (2012) Cognitive Writing Processes Model was selected as a theoretical lens, with necessary modifications based on seven clearly described criteria. Also, the customary three-to-five case-study participants (Creswell & Poth, 2018) was increased to eight participants. Finally, multiple sources of evidence, thick description of each case and recursive, constant comparative analysis were used. With each subsequent analysis, any overlooked action in the screen capture was noted, amending the data to accurately reflect the composition moves of each tweeter (Yin, 2018).

Even with these measures to strengthen trustworthiness, certain concerns remain. Second-by-second writing behaviors may have been overlooked in the data analysis phase, given the volume of video data. Data saturation may not have been achieved, especially given the diversity of possible *composition moves* at the character level of *composing* and various *task environment* influences from each of the eight tweeters. And the researcher's inherent bias related to teaching writing to children and the established relationship with the classroom teacher, providing information about the eight tweeters' tweeting experiences that were not obvious to an outsider, may have limited the results.

Implications

This study heeds the largely unanswered call to use moments of composing as objects of study (Takayoshi, 2018). Consequently, it has methodological, theoretical, and pedagogical implications. Methodologically, this study captured those moments of composing by using screen-capture video on an iPad screen while simultaneously capturing video of the iPad user and corresponding audio. The result is a study that illustrates a method worth refining so that other detailed analyses of composing moments can be conducted. Additional theoretical and pedagogical implications follow.

Theoretically, the results of this study suggest that the lens used for data analysis was useful for understanding children's individual short-form writing experiences in online spaces. Further study--with a wider variety of participants, curricula, settings, and technologies --would develop the modified Hayes (2012) model even further as a tool for theorizing the *processes* and *moves* of short- and long-form writing in off- and on-line spaces. Such a project would be analogous to the work that Limp and Alves' (2017) did to extend the text production model of Chenoweth and Hayes (2001, 2003) to encompass early writers' attempts at producing text. The accrual of studies that expand and refine our models of composing would, in the long run, lead to a re-theorizing of what writing is and how it's done (Merchant, 2007).

Pedagogically, the results of this study indicate that the linear writing process espoused by many teachers --start with drafting/planning, composing, revising, editing, and finish with publishing (Hayes & Olinghouse, 2014) --is out of step with the practice of composing online. Even previous scholarship on composing offline has suggested that teaching writing in a stepwise manner does not represent the actual work of writers (e.g., Murray, 1985; Graves, 1994). The actual work of young writers tweeting in this study shows the iterative and

idiosyncratic ways their writing processes and composition moves play out online, just as they would offline, but in a wider range of ways because of what the technology affords. In particular, the data from this study imply several pedagogical possibilities for supporting the writing development of children composing short-form prose online using a technology like Twitter. Two examples are provided below in Figure 42. In each, one of the *composition moves* observed in the data serves as the basis for: formulating a tweeting criteria (stated in the left column), that if mis-composed by a child tweeting (illustrated in the middle column), the teacher can provide pedagogical support focused on (stated in the right column).

Figure 42

Pedagogical possibilities for supporting children composing short-form prose online

Composition Moves -- Editing		
If your tweeting criteria include ...	And students type something like ...	Then your instruction should focus on ...
• Signing tweets with an anonymous label • Close tweet with a hashtag summary	<i>by310#read</i> [instead of <i>By 310 #read</i>]	• Spacing • Concept of word • Concept of hashtag • Concept of URL
Composition Moves -- Task Environment		
If your tweeting criteria include ...	And students include something like ...	Then your instruction should focus on ...
• Using a photo as a planning tool	• An image with represents unrelated content	Selecting an image that • clearly communicates the topic of focus • captures reader interest • includes only related information

Future Research

Results of the present study suggest when composing a tweet to publish on their class Twitter account, young children utilized all the elements of Hayes' (2012) model for offline

writing, as well as some new elements, which were made possible by the affordances of composing online with Twitter. Further, because the Hayes' (2012) model had been designed for adult writers in an off-line context, it was necessary to modify his model for use as a theoretical lens for data analysis. The effect was to extend and refine Hayes' model so it included eight elements divided into two categories: (a) *writing processes*: motivation, goals setting, planning, and writing scheme; and (b) *composition moves*: composing, revision processes, task environment, and resource level. In addition, an additional set of features emerged that did not fit neatly into either of these categories. These were labeled *emergent features*, and provided an evidence-based opportunity to imagine possibilities beyond what Hayes' portrayed in 2012. In that spirit, I discuss future research possibilities that emerge from the adapted model and results of this study.

A number of new questions could be posed by subsequent research on writing. For example, at what age do writers composing in online spaces experience the layering distractions described by Takayoshi (2018)? What type of instructional interventions for children might best prepare them for these layering distractions? What are the theoretical implications for this type of writing context in terms of *motivation*, *goal setting*, and *planning*? For instance, do contemporary composers set *goals* or create *in-advance plans* while experiencing simultaneous layers of online spaces and frequent notification distractions?

In addition, methodological refinements could be made. For instance, further research might design a leaner way to describe the flow of composing while also illustrating the complex and many times almost simultaneous composition moves. Relatedly, an improved approach for preserving and accounting for the complex and individually unique nature of the writing experience might be developed to map out writing profile criteria for qualitative comparative

analysis QCA (Ragin & Davey, 2016). And finally, an approach to systematically identify profiles of young writers composing short-form writing for an online networked space may help identify unique learning needs of writers.

Regarding elements of the Hayes (2012) adapted model, future research could examine an element such as the *task environment* to understand what aspects of an environment assist the writer best or least, or not at all (Clark & Salomon 1986). With this particular element, the question remains, were the *task environment* features experienced by the eight tweeters a candidate for internalization? Does the technology captured in the *task environment* subcategories of the modified Hayes (2012) model somehow overtly model the writing process? If so, how? If not, why? In addition, Takayoshi, (2018) discussed *task environment* related experiences such as the immediate response to the frequent notification, interrupting the writing process, yet adult online writers developed effective responses. Considering these adult online writing experiences, what are the implications for teaching children self-regulation in anticipation of this possible constant disruption by notifications? The eight tweeters in my study seem to have developed effective responses to the “transcription interruptions” caused by the task environment.

Finally, future research may consider already existing data--such as that from this study--through differing conceptual lenses. One fruitful lens might be the issues initially raised by Fayol and colleagues (2012) about the automation of task operations, such as children achieving “real-time management of the simultaneous involvement of the various processes” (p. 143). Another might be one more finely attuned to the cognitive *strategies* related to writing (problem-solving, decision making, searching, questioning) and the work of processing information competing for limited space in short term memory (Jonassen & Reeves, 1996). A final approach, suggested by

Hayes and Berninger (2014), is to examine writing for social media (such as Twitter) as having more in common with conversational features than formal school writing by considering the data from the present study through a conversational process theoretical lens

APPENDICES

APPENDIX A: Assent Script

CHILD ASSENT TEMPLATE

Verbal assent script for below minimal risk activities (young children):

Hi, I am *Mrs. Marich* from Michigan State University. I am trying to learn something about what children think and do when they write a tweet and post it on Twitter. I would like you to help me with this research. You do not have to do it, if you do not want to. Nobody will be upset with you if you decide you would rather do something else. Does this sound like it would be something you would like to do? Thank you.

Assent Template for Ages 8 to 12:

Young Tweeters Tweeting

Person leading the study: Holly Marich

Why are we doing this research?

The reason I am doing this research is to learn something about what children think and do when they write a tweet and post it on Twitter.

Why are you being asked to participate in this research study?

I am asking you to participate in this study because I know you tweet all the time for your class Twitter page.

What will happen during the study?

During the study the first thing we will do is meet in the next room where I have my laptop and iPad set up to video and audio record. We will sit down at the table together and I will tell you about all of the neat technology I will be using for the study. Then, I will video and audio record what you are doing and saying while you write an idea for a tweet on this notecard. After you are finished writing your idea I will continue watching you while you write your tweet. As you are working I will want you to talk to me about what you are doing. After you publish your tweet we will watch the video of you working. While we watch this video I will pause the video to ask you questions about what you were doing. After we watch all of the video and you have told me all that you think is important to teach me about what you do when you tweet, we will be done and you will go back to class.

Risks and Benefits?

The good things about being in the study are that you will help me learn something new about children writing and this new information may help other teachers when they teach writing. A problem with being a part of this study is that you may get tired as we work together and you will be out of your classroom for about 45 min. But, we will take breaks if you need them and you will not miss recess or lunch with your class.

Who will be told the things we learn about you in this study? ***The information I learn from this study will be shared with other teachers and parents that let their children tweet. It will also be shared with other researchers.***

Do you know how you use a number when you tweet instead of adding your name? I will do the same thing with the study. I will not use your name at all in the study.

What if you or your parents do not want you to be in this study?

You can only participate if both you and your parents agree for you to be in the study. Nobody will be upset if you do not want to be in the study. It is your decision. If you decide to be in the study, and later change your mind that is okay too. You can stop being in the study anytime you like.

If you have any questions about the study, you can either tell your parents and have them talk to me, or talk to me yourself. Here is my phone number and address: [REDACTED],
[REDACTED], Holly Marich [REDACTED]

Documentation of Assent

Would you like to participate in the study?

Student Name _____ Date _____

If you sign your name on this page, it means that you agree to take part in this research study. You may change your mind at any time.

APPENDIX B: Talk Aloud and Interview Analysis Example

Table 22

Talk Aloud and Interview Analysis Example Control Level Writing Processes

Talk Aloud & Interview Analysis: Writing Processes: Thoughts made known through think aloud and interview

Control Level Writing Processes			
		Characteristics	Note
Motivation	Disposition	Expresses enjoyment in the task - body language	“Because if we do any more then it will be down there (pointing to screen) then there will be tons more room and I'll have to write more.” “Because um, some people like to just write a small bit and they like being done.” When asked if she likes to tweet she said Yes!. I asked why. She replied, “Um, because it's fun and we get to tweet about like what we learned in school and um what we do” “Umm usually because I like writing more and tweeting is fun to do.” “because, I like finishing my sentences and making sure there's no problems and ya.”
		Expresses enjoyment in the task - verbally	
		Expresses interest in doing a good job at the task	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 22 (cont'd)

Control Level Writing Processes			
		Characteristics	Note
Goal setting	Purpose (follow teacher-generated tweeting expectations)	Can articulate the purpose of the writing task: to communicate with others.	“Um, because it's fun and we get to tweet about like what we learned in school and um what we do” “Ya, but my teacher says, always say what you're going to write about and say how it helps you and say what you can do with it.”
		To help others learn about what they are learning.	
		To help others learn about what he/she is doing.	
Planning	Idea Generation	Generating Tweet ideas before planning the text	“I finally figured it out and then... umm, I said and we can build things out of Legos...Well, while we were talking and thinking about things. And with the lego it helped me (picking up her lego structure) figure out what to write about. ...umhumm that's why I brought all of these things for me to help knowing what do write about.”
	Planning	Making a plan before writing	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 22 (cont'd)

Control Level Writing Processes			
		Characteristics	Note
Writing Schemas	Audience	Can identify audience as known others	"Umm, mostly my friends in the class my teacher, everybody in the school"
		Can identify audience as unknown others	"The same and my mom and my dad and my sister."
		Can identify audience as global, unknown other, and known other	"Ummm, because, ummm . sometimes whenever some people actually read our tweets they actually like it."
	Genre Knowledge of General Tweet defined as a message posted to Twitter containing text, photos, a GIF, and/or video.	Hashtag (summarize tweet content)	"Ummm, mostly when someone is done they put B10 (I'm not sure what she said there) if there is enough room they can put a hashtag but if they don't want to put a hashtag they don't have to put one."
		Mentions concept of Tweet Like ☐	"sometimes whenever some people actually read our tweets they actually like it."
		multimodal including links, photos, GIFs, videos, surveys, emojis	Two Photos
		Followers	
		Networking	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 22 (cont'd)

Control Level Writing Processes			
		Characteristics	Note
		Cyber Safety	
	Text Structure	Knowledge telling, Flexible Focus Fixed Topic Strategy	

Table 23

Control Level Aspects of Genre Knowledge and Text Structure

Control Level Aspects of Genre Knowledge and Text Structure					
Elements	Code				Notes
	Matches meaning of text	Extends meaning of text	Repeats existing text	Assumes audience knows context (temporal)	
# hashtag					No explanation in the tweet to give context. Provides a picture of the Engineering design process with the assumption that readers know how this connects with her message about STEM.

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 23 (cont'd)

Control Level Aspects of Genre Knowledge and Text Structure					
photo	X	X			
emoji					

Table 24

Control Level Goal Setting

Control Level: Goal Setting, The goal is dictated by the assignment expectations. This may also dictate text structure.			
Prompt Expectations	Text from Tweet	Notes	
		*Elaborates	Clarity of message
What am I learning about	"I am going to tweet about stem."		As a reader, I can easily infer that she is learning about STEM.
why am I learning it			
or how is it going to help me	"Stem helps me by how to build and we can build thing made of lagos"	X	Extends with details - building with Legos.

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Published Tweet Analysis:

Composition Moves: What can be observed - screen capture and published tweet

Figure 43

Published Tweet Example



Table 25

Talk Aloud and Interview Analysis Example Composition Moves

Process Level: Composing and Revising		
Transcriber	composing such as	
Frustration	Statements or obvious body language indicating the task is perceived as too hard	"Umm, like, something that I don't know really what to write about"
Evaluator	editing or revising such as	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 25 (cont'd)

Inline planning	planning what to write while writing	
Task environment	the immediate social and physical surroundings such as keyboard technologies or the text written so far	
Meaning making Collaborators and Critics	the tweeted message making sense	

Table 26

Talk Aloud and Interview Analysis Example Editing for Spelling, Spacing, Capital Letters, and Punctuation

Process Level Editing for spelling, spacing, capital letters, and punctuation		
code	Text	explanation
spelling	adout	B and d reversals she did not catch this one but caught another when typing build. This noticing may be attributed to letter position in word.
spelling	lagos	This spelling was offered in the autocomplete and she selected it. It matched her initial spelling
spelling	thing	Should have been things
spacing	lagos.By202	No space between by and 202

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 26 (cont'd)

spacing	lagos.By202	No space after end punctuation
End punctuation used at the end of sentences		
Capital letters used for proper pronouns		

Other Interesting Notables:

Spontaneous use of strategies

Automation of task operations

Technology features that assist the writer

Table 27

Other Interesting Notables Keyboard Technology Confusion and Understanding

Keyboard technology confusion and understanding		
Ya, you have to plan it out, hu.	ummmhum	
Okay, so let's watch some of the video and if you see a part that you want to talk to me about you tell me to stop, okay. So we are not going to just play the video I'm going to fast forward until I see something that I want you to tell me about.		

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 27 (cont'd)

What's going on right there?	Mostly I went back because when it gets outlined it kind of like changes the word that I use and what I wrote so I go back and rewrite it and then I like double like go forward then go back one more then it won't be all messed up	She has created a strategy for dealing with the blue highlight without recognizing how the blue highlight might help her.
So, is that what happened right here?	ya	
Let's watch I'm going to back up just a little bit while you create this word um, what word are you doing here? do you remember?	about	
Okay, so let's see what's going on.		
So, do you notice, what's wrong with the word so far? Anything?	I'm missing the u and the t	the word is not all typed yet. It says ado. She does not notice the d in place of the b
Okay, let's keep watching. So, there you go. You have your u	Look! It's going to show up like that. (She points to the screen)	This is around 2 min. 20 sec of the screen capture video.
The words across here? (pointing to the autocomplete selections)	Ya, but, the one that's actually white and outlined blue like that, it's , that word is going to show up like that.	
And, is that a good thing? Is that helpful, or...	It's kind of frustrating.	She is using our interview language "frustrating"

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 27 (cont'd)

Tell me, tell me what you mean, why is it frustrating?	Because whenever like I write the other one I like push the space and it shows up with that and I have to erase the whole word.	
So, it automatically puts that word up there?	ya	
and it's not the word you wanted	ya	Does this mean there is partial knowledge, using but confusing? what's going on here?
Let's see, does it happen here in our video?		
Alright, so you deleted the t in the word about	and then it went back to normal.	
So, you deleted that, so tell me that, tell me what your strategy was there.	Um, go back and redo it.	
So, do you delete the whole word or part of the word or what?	part of the word and then you fix it and then I push spacer twice and then I go back one.	
So, do you delete the whole word or part of the word or what?	part of the word and then you fix it and then I push spacer twice and then I go back one.	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 27 (cont'd)

Ohhh, okay. Why do you press space twice?	Because then umm, the red line under it kind of means, don't get the word too close to this one, so I push the spacer twice and then I push the back button and then the red line under it is not there.	Interesting, we were talking about the blue highlight which showed up first but while watching the video, after she used her strategy to remove the blue highlight, and then fix the word (in this case, put the t back) the red underline appeared. She also has her own understanding of what the red underline means. strategy invention
tell me what you are thinking, why was that a good spot to stop and tell me what's going on?	It's underlined, and whenever it's underlined blue it kind of gets me frustrated and it makes me a little mad because, umm, I'm trying to write and if I like push the space button it will show up with a different word sometimes.	
Okay, teach me about that. How do you know or how does that work?	Mostly on twitter, umm, everybody has twitter accounts so everybody can see our tweets	
Okay, okay, who's everybody?	Like everybody in the school, everybody's family,	
Okay, what about the lady at the grocery store?	She looks at me confused.	

APPENDIX B: Talk Aloud and Interview Analysis Example (cont'd)

Table 27 (cont'd)

The lady that checks out the groceries? Can that person read my tweets? Or your tweets?	maybe only families or friends	
So, it's not like, just anybody	just family and friends that you know.	

Table 28

Other: Possibly Related to Social Norms

Possibly Related to Social Norms		
Umm, because some people already tweeted about that and some people actually copy other people but, then some people read both tweets and they usually notice they are the same and then they learn the same thing.	this chuck is about issues of duplicate tweets - kids copying what others have tweeted. This makes me wonder about the social pressures in the classroom, the tacit social norms among the children.	

APPENDIX C: Screen Capture & Think Aloud Data Example

Table 29

Screen Capture & Think Aloud Data Example

Screen Capture & Think Aloud Data Example					
Seconds start	Seconds end	Description of Activity	code	Talk Aloud text	Notes
0	12	setting up	Pause		
12	13	opens Twitter space	APP		
13	14	taps screen for cursor	CR		
15	16		KS		
16	17	The	KA		
18	19	deleted automatic space	BS		
20	22	i s	TML	this	the word "this" popped up as a black word cloud above the "the" but 531 was not looking at the screen to notice. He was focused on looking at his keyboard for letters.
23	24		SB		
23	24		TM	oh	looks up at screen to see what he's typed. He looks at the laptop, not at the iPad
24	26	deleting to correct spelling	E		

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

28	30		ST	"It's confusing me." laughing a little	His statement is based on looking at laptop screen rather than iPad screen. This is causing some confusion.
30	35		RT	"You'll have to keep your eye down here, hu (pointing to iPad screen) Pretend like this isn't here (pointing to laptop screen)	
33	34	T	TSL		
34	36		KS		
36	37	h i s	TML	saying the word he is typing "this"	
37	40		KS		
40	41		SB		
41	42	i s	TML	is	
42	43		SB		
43	46		KS		
46	47	m y	TML	my	
47	48		TM		Looks up at laptop screen
48	49		SB		
50	54		SAH	Umm, how do you spell giraffe?	
54	61		RAQ	Oh, okay, so let's think about it. I'll help you. Tell me if you umm..	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

60	62		ST	Or there's a microphone.	
62	63		RQ	Have you used that before?	
63	64		SAQ	nods head no	
64	65		RQ	Do you want to try it?	as I ask this, he is already typing the microphone icon
65	66	taps microphone icon	KM		
67	69	talks into the microphone	KM, ST	"giraffe"	
69	70	taps done under audio stream	KM, Done		
70	73	watches screen, waiting	TM		He rests his chin in the cup of his virtual fist and watches to see the result of his initial use of the microphone.
73	76	rereads his text so far	Read	This is my giraffe	
76	77		SB		
78	81	i t	TML	/i/ /t/	sounding out as he types
82	83		SB		
84	87	w i l l	TML	will saying word as he types	
87	88		SB		
89	91		ST	"help"	says word as he gets ready to type it
91	92	h	TSL		

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

92	93	auto complete the word help	KA		
94	95	auto complete the word me	KA	"me"	
96	99	b e	TML	"be"	
100	101	auto complete the word become	KA	"become"	
101	102	a	TSL	"a"	
101	102		SB		
103	104	auto complete the word better	KA	"better"	
105	108		ST	"a better"	restates what he's written before adding next word
109	110		KM		
110	112	"builder" into microphone	KM, ST	"builder"	
112	113		KM, Done		
113	117		TM		watches with chin in fist
117	118	period	TP	"period"	
119	123		Read	"This is my giraffe it will help me become a better builder."	
123	124		TM	ummm	thinking of next word
124	125		SB		

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

126	128	delets space	BS	wait, and then, capitalize (as he taps up arrow for capital letters)	
128	130		TSL	cap button	
131	134		Pause		thinking of what to type next
135	136		ST	"by?"	Says this like a question, looking up at me.
136	139		RAQ	If you are ready for that.	
139	140	B y	TML	"by"	
141	142		SB		
142	143		BS		It's like the SB is an automatic movement, then it is deleted because the writer did not mean to put it there.
143	144	number keyboard	KO		
144	147	531	TML	"five hundred thirty one"	
147	149		RQ	Then what?	
150	152	special character keyboard	KO		
152	153		TH	"hashtag"	
153	157		KS		
157	158		KM		
158	159		KM, ST	"giraffe"	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

159	160		KM, Done		
160	163	watches screen	TM		sits back in seat, knowing he is done with the task
164	165		RQ	Now what?	
165	170	thinking	SAQ	Ummm... we are done (shrugs shoulders)	
171	176		RQ	Okay so is there anything else you want to add to your tweet?	
176	177		SAQ	shakes head, "no"	
177	179		RQ	How do you know that it's ready to go?	
180	190		SAQ	Um, you do, "by 531" and then you can do a hashtag, or something. Oh, I can do one more... (starts deleting his text)	
190	193	deleting all text after "By"	R		He is revising, changing the text to add value, deleted too far on accident
193	194	number keyboard	KO		
194	196	531	TML		putting his number back, he must not have meant to delete that part.
197	198	opens to emojis	KO		
198	203	searching for a giraffe	KS	they have a giraffe	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

203	222	scrolling, looking for giraffe	Scroll	I don't see a giraffe...nope	
222	224		RQ	"so what are you thinking?"	
224	228		SAQ	"ummm, I'm done."	
229	232	back to letters	KO		
232	235	special character KB	KO	I need a hashtag	
236	239		TH	hashtag	
240	241		KM		
241	242		KM, ST	"giraffe"	
244	246	Pause to look at me	Pause		
247	249		RQ	Ummm, did you add your picture?	
250	251		SAQ	no (moving toward keyboard to add pic)	
251	259	opens space to access pic	C		getting picture he took before meeting with me.
254	256		RQ	Have you forgotten your picture before?	
257	258		SAQ	No	
259	261	watching as picture shows up	TM		

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

261	265	looks out window at sound of kids	ATT		
265	268	We start talking here.	RQ	Let's see, this is your giraffe?	We start chatting about his work at this point.
			SAQ	ummmhumm, nodding yes	
			RQ	Okay, are there any words you need help with in your tweet?	
			SAQ	Ummm, no, (looking at text)	
			RQ	Do you have any questions or do you want me to check anything before you send it off?	
			SAQ	"check" as he pushes iPad in my direction	
			RQ	what do you want me to check?	
			SAQ	If I spelled... become, no, ya I spelled it.	
			RQ	how do you know that it's okay?	
			SAQ	Because I can sound it out, then he spells it, b e c o m e	
			RQ	Alright, okay, what else would you like me to look at or check?	
			SAQ	Ummm, if I have to put a period anywhere.	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

			RQ	Do you have more than one sentence?	
			SAQ	nods no	
			RQ	So, what should you do?	
			SAQ	make another sentence. (grabbing iPad)	
331	334	taps screen, opens up image	KO		
335	336	I close image and help him get to text	tech error		
337	338	opens letters	KO		
339	342	deletes text ending with cursor next to Builder	D		
341	342		RQ	So, why are you deleting those things?	
342	352		SAQ	Because I have to delete them, then if we do that, it's at the end of the tweet.	
353	354	.	TP		adds a period that he accidentally deleted
355	357		SB	and then, no	
358	359	hit return button	Enter		his return button by accident

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

360	361	hit BS button	BS		
362	363		BS		
363	367		RQ	So, why don't you put a space after the period? You put a space, then you backed up.	
367	369		SAQ	I don't know. shrugs shoulders	
370	381	Thinking	Pause	I can't remember	
381	383		RT	Go ahead and reread	
383	387	rereads text so far	Read	This is my giraffe it wil help me become a better Builder.	
388	400	thinking	Pause	ummm, I can't figure out anything else.	
			RQ	Hmmm, is there anything about being a builder that you could add?	
			SAQ	shakes head no	
			RQ	how do you come up with more to write, you know, when you have to write more? What are some of the things you do to help yourself think of ideas?	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

			SAQ	I don't know, shrugs shoulders	
			RT	I know a lot of kiddos say they look at the picture, umm, and that helps them get ideas. Do you want to look at your picture?	
432	438	opens image	TM		
438	439	opens letters	KO		
438	439		RQ	Do you already have an idea?	
439	440		SAQ	shakes head, yes, as he looks at keyboard	
440	446	I help him	RT	Okay, make sure you are in the right place, becuae builder is down here.	the cursor was at the end of the first line rather than at the end of the writing. I'm not sure why I quickly told him to check his cursor location. Maybe I did not want to allow him to make that error and start all over.
447	449	opens microphone	KM		
449	453	talks into microphone	KM, ST	Giraffes live in the rainforest"	
453	455		KM, Done		
455	459	watches screen for text to appear	TM		
460	462		RQ	Is it what you want it to be?	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

462	463		SAQ	shakes head yes	
			RQ	Why did you decide, giraffes live in the rainforest, and how do you know that?	
			SAQ	Ummm, cuz I've read about giraffes and it tells you where they live.	
			RQ	Who's going to read this tweet?	
			SAQ	everyone.	
			RQ	So, should you tell your readers how you know this is true? Do you think they will want to know more, or...	
			SAQ	we don't usually do that , though.	this makes me laugh. He's quick to answer.
			RQ	Why not?	
			SAQ	shrugs shoulders, I don't know.	
			RQ	Well, you can do it if you want.	
			SAQ	I don't want to.	
460	494		RT	Okay and that's okay. You can be done.	
494	496	looking at screen	TM		

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

496	497		RQ	Do you have your end punctuation?	Why did I ask this? I am leading here!
498	499	types a period	TP		
500	503	b y	TML		
504	505	numbers	KO		
505	507	531	TML		
507	511		KS		
511	512	special character KB	KO		
512	513		TH	hashtag	
514	515		KM		
515	516		KM, ST	giraffe	
516	517		KM, Done		
517	521	watches text appear	TM		
521	522		RQ	Is it ready to go?	
522	523		SAQ	shakes head yes	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

			RQ	So, 531, while we wait, can you tell me, how do you plan what you are going to tweet about?	
			SAQ	We mostly just think then we take a picture of what we want to do and then we start tweeting about it.	
			RQ	I noticed you did that. When I went to pick you up at your class I asked you, "Do you know what you want to tweet about?" and you said no, but then you quickly came up with an idea. How did you come up with your idea?	
			SAQ	Cuz, I remember that we built a girraffe with Legos.	
			RQ	How do you decide that that's something that should be tweeted about	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

			RQ	How does it make you feel, knowing everyone is going to read your tweet?	
			SAQ	Shrugs shoulders, smiles, I don't know.	
			RQ	You don't know? Who reads your tweet?	
			SAQ	Mrs. Hammer, my friends,	
			RQ	I've read some of your tweets.	
			SAQ	You've liked some of them! (moving to scroll through feed to find it)	
			ST	I know where one that is super funny.	
			RQ	And, how does that make you feel when somebody likes a tweet?	
			SAQ	Good. (scrolling through feed) there's one where Solly is eating books.	
			ST	Who tweeted about sea otters? (stops to look at someone's tweet)	
				Now what are you going to do?	
				I want to read it.	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Okay. Go ahead.	
				He reads the tweet aloud.	
				Do you know who that is? (by 461)	
				umhummm, nodding head yes	
				who do you think it is?	
				I think it's L--- or T___	
				Why do you think that's who wrote it?	
				Because they've told me their number.	
				So, you just liked that. Can you tell me about that? Why do people like tweets?	
				So, like this one (shows me a tweet with a 1 next to the heart) has been liked. So someone likes their sentence. (scrolling) and like that one, so people liked the sentence, so there's that thing right there. (pointing to heart)	
				okay	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Then they click it and it shows that red thing. (talking and scrolling) hey (scrolling)	
				What are you looking at now? Another book?	
				umhumm, nodding head yes	
				what made you stop to look at that book?	
				It's cuz I've already read it before.	
				Do you get ideas for what to read about when you read other peoples' tweets?	
				No, I've already had this book.	
				unhuu. So, what made you decide to stop and look at that tweet?	
				Because I really wanted to look at the book to make sure it's the right one and it is.	
				Okay. now what are you looking for?	
				What is this (looking at a pic of flooring)	
				What does it say?	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Reading tweet aloud: This is the school ground. It is red, gray, and white. It is a cool pattern. by sixhundred fifty one, hashtag ground.	
				What do you think about that?	
				Shrugs shoulders super high, I don't know!	
				Laugh,	
				It's kind of funny!	
				Ya, did it surprise you?	
				shakes head yes (keeps scrolling through feed)	
				Now, why did you decide to click on this one?	
				Cuz, um, it's one of the ones that we did when we were Skyping.	
				He reads the tweet aloud. It's ends with "hashtag emoji"	
				but what kind of emoji?	
				happy	
				does that make sense?	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Okay, so, _____, do you like to tweet?	
				Because it's um like fun like um, helps you, become a better like typer	
				Okay, say more about that.	
				Ummmm.... so when you go into high school you if you have work that you have to do on your computer you can like type it fast. So you get it done.	
				Right.	
				and you don't have to do it like after school.	
				Does it matter to you that other people read your tweets?	
				shakes head no	
				why not?	
				I don't know (he starts looking at the class Twitter Feed again)	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				you are reading other peoples' tweets. Aren't you.	
				we are allowed to.	
				of course you are.	
				As he scrolls through the tweets he notices he can slide the screen left to right and when he does this the same screen of the class tweeter feed shows up.	
				Have you ever seen that before?	
				No (smiles)	
				he keeps sliding the screen up down, left, right, just exploring	
				What are you thinking? (he stopped at a tweet)	
				He reads the tweet aloud "my kind of teaching day! MASD informational (it actually says environmental) center field trip, field trip. hashtag mas . masssd proud (for #hasdproud)	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				does that make sense?	
				No	
				what would you do to..	
				chunk it up.	
				okay.	
				he starts chunking up the hashtag, sounding out each letter. Is that a d?	
				I think so. I'm wondering if that, look right up here, (pointing to the text that says MASD)	
				Hold on. I know how to make sure it's a d (opens up a blank space to type a tweet)	
				How are you going to make sure it's a d?	
				okay, it's a d (looking at the keyboard then closing the keyboard to go back to the tweets)	
				What did you do? How did you help yourself?	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Becuase, the b is supposed to be down there (pointing to a space on the keyboard) and the d is supposed to be up there (pointing as if he where looking at the keyboard)	
				He goes back to read the hashtag, masssd proud	
				Ya, I think that might be the name of their school or um the initials fo rthier school, MASD so, MASD proud. Does that make sense?	
				Ummm maybe.	
				So, what do you think this tweet is about?	
				This was just tweeted.	
				How do you know that?	
				Because mine is right here and if I go up to see more, I could.	
				Right here is says right and the letter m which means eight minutes ago. that was tweeted eight minutes ago.	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				Oh, mine was tweeted nine minutes ago. That means it tweeted before mine.	
				Why, what do you mean?	
				Cuz, nine minutes is before eight minutes. Eight min. is after nine (starts scrolling through feed) that was one hour	
				So, one hour ago this happened and (scrolling up) nine minutes ago, this happened (scrolling up again) and, eight minutes ago this happened. Oh, wait (the time changed) nine minutes ago that happened.	
				It's not eight. (he looks at the tweet confused)	
				Why do you think it changed?	
				Ohhhh cuz it's counting on the clock!!! (he's excited, like he solved a puzzle.)	
				So, do you think that number will change again? Look at this one, right here.	
				umhummm and starts scrolling again	

APPENDIX C: Screen Capture & Think Aloud Data Example (cont'd)

Table 29 (cont'd)

				He scrolls by a Downy ad "whoa, what's that?" Oh, it's just a commercial. Then goes back to scrolling, stopping at a tweet with five emojis a horse, car, truck, motorcycle, house, he says, "hey, those emojis aren't supposed to be there." Then he starts reading the tweet aloud, "I am learning about getting my day on schedule. World (for Earth emoji) it is great to have a scuttle to do that I need to be on time. (he looks confused) "horse, bike, garbage truck, motorcycle, by sixhundred fifty three hashtag skittle" looking confused.	
				What are you thinking?	
				Looking at tweet for a while, then, "It doesn't make sense."	
				So, when you see a tweet and it doesn't make sense what does that make you think as a writer?	
				I don't know. They were trying to do it fast.	
				ohhh. okay. (he starts scrolling again)	
				So, let's move forward, I need to ask you some more questions and we need to watch the video of you tweeting. are you ready?	

APPENDIX D: Eight Tweeters Tweeting Code Book

Table 30

Writing Processes Codebook

Writing Processes: Thoughts made known through talk aloud and interview

Control Level Codes: Writing Processes			
Action/ Indicator	Code	Statements about:	Example
Motivation	M	Statements or obvious body language expressing enjoyment/willingness to tweet “Willingness to engage in writing” Hayes 2012	“It's fun because you get to write about something, and people around the world can see them, so it feels like you are an author.” “because it's fun and we get to tweet about like what we learned in school and um what we do.” “That other people get to read what you are learning about.”
Goals	Goal MM	Reasons for tweeting, purpose, goals, why he/she tweets And statements about the tweeted message making sense	“That you don't tweet random things. Like, you don't need to have a picture but it needs to have what makes sense.” “I'm going to read it to make sure it makes sense.”
Planning In-advance	Planning IAP	Generating tweet ideas, planning tweet content before writing	“We mostly just think then we take a picture of what we want to do and then we start tweeting about it.”

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 30 (cont'd)

Planning In-the-moment	Planning IMP	Generating ideas, next words, while tweeting	"I'm wondering what I should write next."
Writing Schema Fundamental elements	TS	Teacher-created guidelines, writing prompt, 280 character limit	"because I told how I use it and why, how it could help"
Writing Schema Genre knowledge Multimodal Fundamental elements	Multimodal	The online-space use of images, emojis, GIFs, URLs	"Sometimes I put emojis and sometimes I don't." The tweet might include one or more multimodal elements: Photo of the word "clever" The reader can see that clever is a word of the day and is part of what they do in the classroom
Writing Schema Genre knowledge Hashtags Fundamental elements	Hashtag	The online-space social aspect of hashtags	"Hashtags are um, hashtags um are kind like a title but it goes at the end and it's a few words stuck together there are no spaces in it and it's about what that message was."
Writing Schema Genre knowledge Followers Contextual elements	Followers or A-audience	The online-space social aspect of following, who reads the tweet	"Mentioned his audience from all over the world. Kids in the classroom, me, everyone."
Writing Schema Genre knowledge Likes Contextual elements	Likes	The online-space social aspect of likes	"Sometimes whenever some people actually read our tweets they actually like it."

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 30 (cont'd)

Writing Schema Genre knowledge Cyber Safety Contextual elements	Cybersafety	The online-space safety/ digital citizenship	"If you put your name at the end of it or like your phone number or whatever... you will.... they will maybe go to your house." "...we want our footprint small, small."
Writing Schema Genre knowledge Networking Contextual elements	Networking	The online-space social aspect of networking	"So we can learn and some actually tweet comments to us and their own tweets and so and sometimes they get funny little videos on it on comments so it tells us, they type something below and then a funny picture." "You can see what they are tweeting about. And then, you get an idea from them"
Writing Schema Genre knowledge Text Structure	Text Structure	Text Structures: what, why, how flexible focus, fixed topic, topic elaboration, assumes reader context knowledge	Text Structures: what, why, how flexible focus, fixed topic, topic elaboration, assumes reader context knowledge

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 31

Composition Moves Code Book

Composition Moves: What can be observed - screen capture
A letter, Phrase, and Word Flow of Composing

Composition Moves - Flow of Composing	
Composing Code	Action/Definition
 Emoji	Types emoji
 Spacebar	Types spacebar
 Backspace	Types backspace to delete space
Revision Processes Code	Action/Definition
 Delete	Types backspace to delete text
 Text deleted, replaced by new idea	Revision, word changes based on original thinking made known from talk-aloud or from changes in the text
Task Environment Code	Action/Definition
 Speech-to-text	Adds words to tweet using the speech to text microphone feature on the iPad keyboard

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 31 (cont'd)

 Finger press on text to highlight in pink	Pressing a finger to the iPad screen where the text has been typed and corresponding text is highlighted pink
 Unnoticed autocorrect	Word typed by the child is changed by the autocorrect feature and the child does not notice this change.
 Selected autocorrect	Word typed by the child is spelled incorrectly, the autocorrect feature then suggests words the child may have been trying to type, the child selects one of these words.
 Selected autocomplete & autospace	Selects a word from the autocomplete suggestions.
 Selected autocomplete after typing word	Types an entire word and before typing the next word or typing a spacebar the student taps on the matching autocomplete suggestion.
 Keyboard change	Switching between any of the available keyboards: alphabetic, alphanumeric, special character, emoji keyboards.
 Cursor relocation	Moves cursor to a new location in the text. This may include activating the magnifying glass.
Resource Level Code	Action/Definition
 Reading text written so far	The student stops typing and reads what has been typed so far. This is either a part of the text or the entire text.

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 32

Process Level Codes: Composition Moves related to Transcription

Composition Moves (27 codes): What can be observed - screen capture

Process Level Codes: Composition Moves related to Transcription/Composing Component Skills			
Composing Elements	Code	Action/Definition	Example found in screen-capture
Typing emoji	Emoji	Adds emoji to message	Types book emoji
Typing a single letter	TSL	Types one letter followed by keyboard search < 2 sec.	Typed "m"
Typing multi-letter	TML	Types many letters without stopping, > 2 sec between letters	Typed "k e d" when typing the word "marked" Types "p a p e r" moving quickly between letters
Typing spacebar	TSB	Types the spacebar to move forward space	Types "h o w" then spacebar then "t o" In some cases, it's like the space bar is an automatic movement, then it is deleted because the writer did not mean to put it there.
Typing backspace	TBS	Types the delete button to move back a space	Types "tweet" from autocomplete, presses delete to remove the automatic space after "tweet" then types end punctuation.

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 32 (cont'd)

Typing punctuation	TP	Types a form of punctuation or special character	types end punctuation. types an apostrophe for “rotation’s”
Typing hashtags	TH	Types a hashtag	Types “#clever”
In-the-moment planning	P	While writing, thinks of what to write	“ummm, I can't figure out anything else.” Student says, "I like math with someone because" then thinks of what to type next.

Table 33

Process Level Codes: Composition Moves related to Revision

Process Level Codes: Composition Moves related to Revision/Evaluation Skills			
Revision Processes			
Revision Elements	Code	Action/Definition	Example found in screen-capture
Addition of new text	NT	Identifying area needing detail and adding text	n/a

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 33 (cont'd)

Editing	E	Changing word choice, grammar, spelling	deleting letters to leave only “s” to correct spelling of “down” that was autocorrected to “sounds”
Rewriting	RW	Rewriting a sentence from scratch	n/a
Revising	R	Altering a sentence to add value without rewriting	deleted “ifiled” to revise her idea (she was going to write, “I filled out the paper” and changed her mind to write, “I marked it down on a piece of paper.”
Reorganizing	RO	Moving text around, including copy and paste	n/a
Deleting	D	Deleting text from the document	Typed “d” deletes “d”, types “s”, d is next to s on the keyboard.

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 34

Process Level Codes: Composition Moves related to Task Environment

Process Level Codes: Composition Moves related to Task Environment, Interacting with the media, composing technology, assignment materials			
Task Environment			
Task Env. Element	Code	Action/Definition	Example found in screen-capture
Camera	C	Taking or accessing photo(s)	opens photos to access pic
Twitter app	App	Opening space to work on iPad and submitting a tweet	Taps twitter app on iPad to start tweeting. Taps "tweet" button in top right of screen to submit tweet
Keyboard searching	KS	Pausing to look for letter/item on the keyboard(s)	Types "s o m e" then searches keyboard for the letter "b" to type "body"
Keyboard open or closed	KO	Changing, disappearing and reappearing keyboard	changes to number keyboard
Keyboard autocomplete	KA	Selecting word suggestion at top of the keyboard	selects autocomplete word, "someone"

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 34 (cont'd)

Cursor move	CR/MG	Touching screen to position cursor, including magnifying glass (MG)	Moves cursor location to the end of first "somebody" in message
Scrolling	Scroll	Swiping the screen to view content below or above the working area	Scrolling through emoji keyboard, then says, "I don't see a giraffe...nope"
Task materials	TM	Looking at environmental print - external sources - iPad screen - assignment pages	Looking inside the book for the title Looking at picture and papers Thinking, looking at screen saying words Says "builder" into the microphone
Already accessed photo	AAP	Looking at the image captured before meeting with me	Posts photo before tweeting. Pauses from tweeting to look at photo for ideas.
Writing prompt	WP	Looking at the writing prompt reminder	Looks at the white paper the teacher provided to remind the students of their writing prompt.

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 35

Process Level Codes: Composition Moves related to Resource Level

Resource level Codes: Composition Moves			
Resource Level			
Resource Elements	Code	Action/Definition	Example found in screen-capture
Reading	Read	Reading followed by a continuation of writing or deciding to submit a tweet	Reads, "called penguins"
Attention diverted	ATT	Attending to something other than the tweeting task	looks out the window at students walking through the hallway
Pausing	Pause	Cannot observe or identify from the interview the reason for pause	Pausing, takes a breath, pulls hair away from face Pausing, thinking about the next letter

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 36

Emergent Features Codes

Emergent Features: What can be observed – screen capture, and what is made apparent from any other data			
Process Level Codes: Writing Processes/Composition Moves Emergent Features			
Emergent Features			
autocomplete	autocomplete	the autocomplete feature displayed three 'suggested words' s/he could use based on the initial letters keyed in and the previous syntax.	"It's like, it's the same thing, but, it's different, like different spelling, so, if you're trying to spell a word you could see it up there, if it's up there, you could press on it, and it puts the word up there."
Red underline	Red underline	When a student typed on the keyboard the red underline appeared under the text which did not follow typical English spelling and/or syntax, such as homophones.	"The [red] underline means when it is wrong, you can go back and fix it."
Blue highlight	Blue highlight	When a student typed on the keyboard the blue highlight appeared once an unexpected letter was added to a string of letters typically found in a word.	"It means like if you um if a word is wrong or a word isn't spelled that way it highlights it to let us know that it isn't a real word."
"Knowing other"	"knowing other"	a feature of the language used by students to explain what digital technology was 'doing' as they composed their tweets.	"Because it doesn't know, I don't know how to spell tow."

APPENDIX D: Eight Tweeters Tweeting Code Book (cont'd)

Table 36 (cont'd)

Magnifying glass	MG	To activate the magnifying glass when typing, the writer had to firmly press a finger on or between letters and words on the iPad screen.	"It's kind of like a magnifying glass so you can see what you need to do."
Black Box Words	Black box words	if the writer firmly pressed a finger to the iPad screen at the location of a word, a black box with three command choices appeared, "select," "select all," and "paste" or "cut," "copy," "paste," "replace...," "define," and "share..." or, additional word choices.	"It's showing words that actually have that spelling pattern, like the words that spell like that." "Oh! There's that black button and I could have umm just like pushed that but I didn't notice it was there."
Copyright	copyright	feature of the composing process expressed by a student when peers poached ideas from her tweet to use in their own.	"I write something down and some people actually copy me and then write some other things down, instead of exactly the same words"
URLs	URLs	a feature of the process used by students to indicate their understanding of what a feature is.	Reading a posted tweet aloud, at the URL he read: "msftsokial/gnavfa" sounding out the letters, as if decoding a hard word.

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