Collaborative information use by high school students in a digital learning environment: Connecting metatheory, theoretical frameworks and methodology

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Abstract
This paper reports on a qualitative study of 42 Grade 9 high school students in a public high school undertaking a collaborative research task as part of their English Language Arts curriculum. Specifically, it examines the social, cognitive and interpersonal dynamics of fourteen teams of students in a digital learning environment collaboratively using information and co-constructing a joint representation of their knowledge of their curriculum topic. The paper explicates in particular the methodology and research procedures to show the synergy between metatheory, theoretical framework, methodology, research context and approaches to data collection, and provides a brief summary of illustrative findings to date.

Keywords: constructivist learning, digital environments, collaborative learning, social justice

Theoretical Framework and Literature Review
The research reported in this paper is informed by three bodies of scholarly literature: (1) the research-based literature on inquiry-directed instruction underpinned by a constructivist learning framework; (2) the scholarly research on collaborative learning, and (3) the curriculum reform initiatives and educational directions in the USA as presented in government curriculum documents and whitepaper directions. This body of literature clearly shapes the methodology chosen for this study, and shows the interconnection between meta-theory, theory, methodology and research procedures.

First, this study is informed by a metatheory of constructivist learning, and grounded in the Information Search Process model developed by Kuhlthau (2004). This view of learning is deeply embedded in educational tradition across the USA, and has been developed by influential 20th century educational thinkers such as John Dewey (1859-1952), George Kelly (1905-1967), Jerome Brunner (1915-), Jean Piaget (1896-1980), Howard Gardner (1943-) and Lev Vygotsky (1896-1934). Constructivist learning gives emphasis to an active search for meaning and understanding by learners. Common dimensions of constructivist learning include:

- students are directly involved and engaged in the discovery of new knowledge;
- students actively construct deep knowledge and deep understanding rather than passively receiving it;
- students encounter alternative perspectives and conflicting ideas so that they are able to transform prior knowledge and experience into deep understandings;
- students transfer new knowledge and skills to new circumstances;
- students take ownership and responsibility for their ongoing learning and mastery of curriculum content and skills;
- students contribute to social well being, the growth of democracy, and the development of a knowledgeable society.

Kuhlthau claims: “Two basic themes run through the theory of construction. One is that we construct our own unique personal worlds, and the other is that construction involves the total person incorporating thinking, feeling, and acting in a dynamic process of learning.” Kuhlthau (1993, 15). These
processes give direction to the data collection instruments and the approach to data analysis.

On this constructivist foundation, Kuhlthau’s 30 year research journey to date has developed the Information Search Process (ISP), a research-tested and validated model of how students engage in an information-to-knowledge journey. Key claims based on this research are:

- The ISP presents a holistic view of information seeking from the user’s perspective in six stages: task initiation, selection, exploration, focus formulation, collection and presentation.
- Information seeking and use involves interactions of three realms of experience: the affective (feelings) the cognitive (thoughts) and the physical (actions) common to each stage.
- The ISP reveals information seeking as a process of construction.
- Affective symptoms of uncertainty, confusion & frustration prevalent in the early stages are associated with vague, unclear thoughts about a topic or problem.
- As knowledge states shift to clearer, more focused thoughts, a corresponding shift in feelings of increased confidence and certainty.
- Affective aspects, such as uncertainty and confusion influence relevance judgments as much as cognitive aspects, such as personal knowledge and information content.
- Principle of uncertainty: Increased uncertainty in exploration stage of ISP indicates zone of intervention for intermediaries & system designers (Kuhlthau, 2004).

Based on this empirical model, Kuhlthau, Maniotes and Caspuri (2007, 2012) have elaborated an instructional design framework known as Guided Inquiry, and this was the design model used in shaping the sequence of instruction and learning interventions used by the class that participated in this research.

Second, the study’s methodology is informed by a body of literature from education on “collaborative learning” and “cooperative learning”, and this provides a strong empirical foundation for the directions of this research, and for analyzing and interpreting the diverse scope of qualitative data. Rockwood (1995a &1995b), Dillenbourg (1999), Graham & Misanchuk, (2004) and Chin (2011) define the differences between cooperative and collaborative learning in terms of knowledge and power. Cooperative learning is viewed as a more directed, structured and controlled approach by the teacher, where group tasks focus on identifying, presenting and sharing factual knowledge. Typically in a cooperative learning task, the learning task is divided into a set of subtasks that are undertaken individually, sometimes based on negotiation of who will complete individual parts, and then the final product is assembled by bringing together the subparts – a “divide and conquer” type of approach. In contrast, collaborative learning views knowledge as socially negotiated and constructed through collaboration by group members via engagement with the expertise, skills and insights of the group participants, requiring higher levels of interdependence between group members. Typically, the group works together from start to finish, and engage in the mutual co-construction of knowledge. We hoped to capture, in a collaborative digital space, the process of students engaging in the co-construction, or otherwise, of their research task.

An emerging body of research on cooperative and collaborative learning identifies an interdependent set of factors that shape the efficacy of these approaches. These include team-building, knowledge and pro-social training (Prichard, Bizo & Stratford [2006]) and Solomon et al. [1988]; social justice dynamics (Cohen [1994], Cohen & Lotan [1997], Johnson & Johnson [1981]); distribution of cognitive load (Daute & Dalton [1993] and Johnson & Johnson [1991]); academic achievement (Barron [2003]; Slavin [1996], Teasley [1995], Stahl [2006], and Johnson, Johnson & Stanne [1989]); team pairing (Tudge [1992]); time for group negotiation (Nystrand, Gamoran, & Heck [1993]); resolving disagreements over delegation of work responsibilities, tasks and strategies for working together, information searching, as well as what information to include in the group presentation, and time to be made available to resolve these (Chin & Chia [2004], Lazender [2005] and Meyer [2010]). Each of these dynamics provide a set of core concepts to begin an etic approach.

Some research is now also beginning to emerge in the context of the digital environment as the learning environment. Research by Lakkala, Lallimo & Hakkaraine (2005), Lakkala, Ilomäki & Palonen, (2007), Johnson, Johnson & Roseth (2010) and Scardamalia & Bereiter, (2006) identifies the complex dynamics of collaborative knowledge building in digital spaces and the complexity of using digital spaces for negotiating, debating and creating knowledge rather than individual work. While a considerable body of research has examined the individual experiences of students undertaking a research task, little research to date has investigated how students working in teams or groups use information together through an assigned research task and produce knowledge together, and particularly in a digital learning environment. More recently, Sormunen et al (2013) identified four group work strategies as students worked together in digital spaces. These were: 1) delegation, 2) division, 3) pair collaboration, and 4) group collaboration. Overall, they found that division of work into tasks to be completed individually was the dominant strategy in searching, reading and writing.

The third stream of literature underpinning this research sets the curriculum context and specifics of learning goals to be achieved by the class being studied. Curriculum reform across the USA has seen 45 states adopt the Common Core.
State Standards initiative. This initiative seeks to develop the essential intellectual, technical, social and cultural skills and knowledge necessary for students to succeed in college, career, and life, regardless of where they live. Amidst the complexity of a myriad of specific curriculum standards, the initiative gives explicit emphasis to both short focused research tasks and longer term in-depth research tasks. These tasks require students to engage with diverse texts to gain, evaluate, comprehend, synthesize, and present increasingly complex information, ideas, and evidence through listening and speaking as well as through media. From the earliest grades, they are required to develop the ability to write logical arguments based on substantive claims, sound reasoning, and relevant textual evidence, and to produce meaningful representations of the knowledge and understanding gained. At the heart of this is the constructivist theme of students engaging in information inquiry to construct a representation of knowledge and understanding of a curriculum topic that shows the depth of intellectual engagement demanded by the Common Core State Standards initiative. Shaping this curriculum reform are also a set of principles centering on information technology developments and their integration with and impact on educational outcomes. A key stimulus is the Horizon Report, published annually by an international community of scholars, visionaries, and educational practitioners in educational technology under the banner of the New Media Consortium. The 2012 Horizon Report identified 7 key trends that are key drivers of educational technology adoption, based on an extensive review of current articles, interviews, papers and research reports. Some of the key trends identified in this report that shaped the design of this study are:

1. People expect to be able to work, learn, and study whenever and wherever they want to. This trend places emphasis on just-in-time learning, as well as easy and timely access not only to networked information, but also to tools, resources, and expert guidance.

2. The world of work is increasingly collaborative, driving changes in the way student projects are structured. Consistent with the Common Core State Standards, the Horizon Report views collaboration as a critical workplace and life skill, where group processes, communication and teamwork capabilities and dispositions are developed in a sustained and purposeful way. Digital tools that support the co-construction of knowledge rely on tools such as wikis, Google Docs, Skype, and cloud-based storage such as Dropbox. In our study, Google Docs and a wiki space were adopted.

3. The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators. Given the plethora of information available digitally, the challenge is to engage students in critically thinking about the information that they access and use, and the collaborative mentoring of students by educational teams as they learn in and out of school is an integral part of this. In our study, the classroom teacher and the school librarian were deeply immersed in the mentoring of students both in the actual school environment and the digital space.

4. Education paradigms are shifting to include online learning, hybrid learning and collaborative models. The traditional face-to-face model of learning challenges schools to embrace face-to-face/online hybrid learning models have the potential to leverage opportunities for quality learning across space and time. In our study, a hybrid model was adopted, utilizing both real time class and library experiences and ongoing learning in the digital environment (Horizon Report, 2012, 4-5).

Research questions

The overall research, still ongoing, seeks to: (1) track the process of student collaborative teamwork, particularly to understand how student teams work together to build a shared representation of knowledge; (2) examine the dynamics of the co-construction of knowledge by teams of students; (3) track students’ engagement with information sources and how the teams transform and co-construct text into their joint representation of knowledge; and (4) track both individual learning and group learning, and to understand the relationship between individual knowledge developed in the process and the team representation of the joint product created in the process.

Sample and Research Environment

The research involved 2 English classes of Grade 9 students in a New Jersey public co-educational high school engaged in a collaborative inquiry-based task in a hybrid-learning environment in Fall 2013. The instructional program took place in both the school library and a wiki space. Participants were 42 students organized into 13 groups. The school was selected because of the high level of classroom teacher - school librarian instructional collaboration; the instructional team having experience with students learning and working in a collaborative digital environments (wikis and Google docs); and the instructional team’s expertise with implementation of an inquiry-based instructional framework based on the Information Search Process developed by Kuhlthau (2004). In essence, the learning environment selected for this study represents the coalescing of the key themes established in the literature review: a constructivist learning metatheory and theoretical framework, the Information Search Process as an instructional design framework, and the positioning of the study to reflect core directions in integrating information technology and collaborative learning as indicated in the Horizon Report directions.

In the school, Grade 9 English is based on the NJ State Curriculum standards and Common Core Standards, and focuses on the five elements of the language arts: reading,
writing, speaking, listening, and critical viewing. This particular group of students was in an accelerated course offering a wide range of challenging literature in the genres of short story, novel, drama, nonfiction, and poetry. The course stressed critical thinking and speaking skills, analytical and argument skills, and inquiry-centered research strategies. In the research task, students were assigned a novel, and given the following objective and prompt: **Objective:** Students will discover and develop ideas through research, prove a thesis and report on findings. **Prompt:** You must prove that your assigned novel is of respectable literary merit. To do so, you must also identify reasons for this merit and present to your classmates. This objective was built on Common Core requirements to develop the ability to write logical arguments based on substantive claims, sound reasoning, and relevant textual evidence, and to produce meaningful representations of the knowledge and understanding gained.

The assignment to the groups was random, rather than being based on student-selected groups, topic-selected groups or other means of assigning participants to groups. This was done by the English teacher, who took the view that in the workplace, people at times do not get to choose who they work with, and she saw that this was a valuable life skill for the students. Students undertook their collaborative inquiry research task in the school library where a series of lessons took place to support students with selecting and utilizing resources, and in a class wiki environment that enabled the students to discuss their research topics, establish working relationships, plan and manage the tasks, collect information sources, and work together through the process of co-constructing their products, which included a class presentation, visual display, and annotated bibliography. The wiki site also enabled the school librarian and classroom teacher to converse with students, provide feedback on progress and reflections, and help as needed for teams and individuals. The wiki environment was developed by the school librarian for the teaching enabled the researchers to capture and track their research and writing processes, their use of information sources, their interpersonal dynamics and decision-making processes, and how they went about collaboratively creating their products (Todd & Dadlani, 2013).

**Data Collection**

Consistent with a constructivist learning perspective, and cognizant of the research findings documented above in relation to collaborative learning, we wanted to develop research methods that enable us to examine the subjective development of jointly constructed understandings of students’ curriculum topic. This subjective approach assumes that the meanings and knowledge developed are both individual and an outcome of their interactions with others, and shaped by the contexts and dynamics which enable or hinder that interaction and coordination with others. These meanings are varied and multiple, leading us as researchers to look for the complexity of views rather than narrowing meanings into a few categories or ideas.

We wanted to capture that subjectivity as it occurred naturally within the learning environment. We wanted to capture the voices of the participants. And recognizing at a broader methodological level that all measurement is perhaps infallible, we saw the importance of multiple measures and observations, each of which may possess different types of limitations and errors. We saw value in the need to use triangulation across several potentially limited sources of data to get a better understanding of what was happening in the subjective reality of the classroom.

Based on the above assumptions, qualitative data were collected through the class wiki environment, and through structures set up by the instructional team, rather than by structures imposed on the learning environment by the researchers. The wiki enabled researchers to capture naturally-occurring qualitative data from the commencement of the instructional task to its conclusion. In addition, the wiki space captured interactions and feedback from the instructional team. As part of the learning requirements, students were required to make daily journal entries during the two weeks that the classes were scheduled in the library for a range of instructional interventions led by the school librarian. Students were informed that “Topics may include, but are are limited to, the research process and/or the material you find”. To this end, students were required as homework to input a journal response after the conclusion of each class into a networked Google document (1 for each day of the classes in the library) for a total of approximately 336 journal entries. Students were then required to read each other’s journal responses and comment on at least one other student’s journal response in the same networked Google document for each week of the process (referred to as the commentary stream). As a result, 290 reflection responses were collected, and overall, a total of 945 conversation entries were recorded. The majority of reflections were about one paragraph (5-6 sentences) long. On average, the responses to other reflections were around 2-3 sentences long, and posts that were responded to tended to receive 2-3 responses.

Students also completed a pre- and post- survey to provide insights into the cognitive, affective and interpersonal aspects of their group research and writing process. These were planned tasks integrated into the sequence of instruction and research journey of the students, and have been consistent used by the school librarian in collaborative instructional units to gather input to shape the design and implementation of the instructional unit. These was based on the SLIM “Reflection Tasks” (Student Learning Through Inquiry Measure developed by CISSL) to track both individual learning and group learning, with emphasis on the knowledge construction process, and the cognitive, affective and behavioral dimensions. The pre-survey was administered on the first day of the library classes and asked
students to first identify, via open ended answers what their research topic was, what interested them about that topic, what they already knew about the topic and what terms they might use to search for information on the topic. Students were then asked to indicate on a 5 point scale how much they felt they knew about the given topic (1 = nothing at all; 5 = a great deal). The remaining questions on the pre-survey asked students to write open-ended responses indicating what they like and dislike about research, what they find easy and hard about research and finally how they feel about working in groups. The post-survey asked students to provide open-ended responses about what they now know about research, what they found easy or difficult about their research, how they feel about working in a digital environment and how they feel about group work by the end of the project. Additionally, two Likert Style (5 point scale) questions were asked pertaining to students’ perceptions of the helpfulness of the reflection journal entries (1 = no help; 5 = most helpful) as well as how much they felt they learned about their topics (1 = nothing; 5 = a great deal). The journal responses, commentary stream and the more formal pre and post measures makeup the dataset used in this study (Todd & Dadlani, 2013).

Commentary on Methods and illustrative findings

Through the multiple measures, a vast amount of data was collected. As open-ended data, this has been very time consuming to analyze to construct a window into the minds of these students. While our intent as researchers is to make sense of (or interpret) the meanings the students have constructed about their collaborative learning task, relying on this continual stream, and at the same time, fragmented stream of data, has posed complexities, one of which is driven by research deadlines.

To streamline this complexity, we employed both etic and emic approaches in our data analysis. While there are various interpretations of these terms, for the purposes of this research, the emic approach takes a grounded approach, developing emergent codes extracted from the text, and establishing categories of codes to identify core concepts and their relationships, driven by the data. An etic approach to data analysis typically starts with a predetermined set of concepts, and these become the lens through which the data is analyzed and interpreted. While this does not limit the emergence of new and fresh concepts and relationships, it does give emphasis to what the researchers consider to be important. This importance is often established by the synthesis of the literature review.

An example of how emic and etic worked together in this research centered on students’ perceptions of undertaking group tasks. These findings are reported fully in Todd & Dadlani, (2013). In the analysis of the pre-and post surveys focusing on the students’ perceptions of being involved in a group process of co-constructing their argument about the literary merit of their chosen novel, employing an emic approach, we identified four key concepts that surround their participation and engagement in this work. These were: (1) social justice, (2) knowledge, (3) interpersonal, and (4) project management. The majority of responses however revolved around the social justice and knowledge dimensions. From the perspective of the students, social justice was seen in terms of equity of contribution, with intellectual input and workload to complete the group task shared equally and fairly across the group. The data showed that students valued the affordances of group work in terms of “the work is split up evenly” and “work spread out among the group”, and when the workload was shared amongst the group members, they believed that “no one would be overloaded”. However, their perceptions at the outset of the research task were quite negative, consistently expressing concerns about equal effort, fair distribution of labor, and all team members contributing their fair share of work (as opposed to social loafing), as well as team members all receiving the same assessment credit when effort was not evenly distributed. As students said: “usually the entire group does not work together”, “members tend to slack off”, and this “leads to certain people in the group doing more work than others”. Some students saw that it was easier to work alone: “it is easier to work by yourself so that you don’t have to make sure the people that you are working with are doing their jobs”, thus avoiding problems caused by “individuals in the group that are either too lazy or take complete control of the project” and thus adding “more variables that can lessen the grade” or create issues around work credit: “to grade several students on one project is unfair”.

In the analysis of the post-survey responses, and again utilizing again an emic approach, three key concepts emerged. These were: (1) knowledge creation and learning outcomes, (2) division of workload and learning equity, and (3) collegiality and cooperation. There is a difference in the way that these were categorized and labeled, based on this emic approach. The division of workload concept that emerged refers to workload balances and resultant learning outcomes. Students consistently perceived that undertaking group-based research tasks was less individual work: “I liked working in a group because I could bounce ideas off of my group members and did not have to do all of the work myself” and “there is less pressure on one person because the work can be divided”. Frequently stated were concerns about the uneven contribution of work by team members, and the flow-on of that to assessment: “I dislike the group project because we all get the same grade despite the amount of work that is put in by each group member and the presentation of each group member”.

Based on this emic process, we have become even more aware of just how much students bring with them a sense that social justice principles will be enacted in their learning environment, whether that be a classroom or a school library
or a digital learning environment. Accordingly, using “social justice” as an example here. The emic emergence of ideas around social justice, have led us to use an etic approach to uncover more insights surrounding the social justice concept, and to engage with the conversation streams, personal reflections, and feedback commentary provided in the wiki space to do this.

Accordingly, a review of the social justice literature (Dadlani & Todd, 2014) from both a philosophical perspective for example Rawls (1971), a library and information science perspective (Mehra, Albright, & Rioux, 2006), and a pragmatic social perspective, we have been able to construct a typology of social justice concepts, as shown in the table below:

<table>
<thead>
<tr>
<th>Sample Category/Subjustice Concepts</th>
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<tr>
<td><strong>Freedom of Assembly</strong></td>
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<tr>
<td>1. Control of Work Space and Contributions</td>
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<tr>
<td>a. Role responsibility</td>
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<tr>
<td>2. Collective vs. Individual Decisions</td>
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<tr>
<td>a. Unequal interactions</td>
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<tr>
<td>b. Social loafing</td>
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<tr>
<td>c. Role responsibility</td>
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<tr>
<td><strong>Distributive Justice</strong></td>
</tr>
<tr>
<td>1. Equity of labor</td>
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<tr>
<td>a. Social loafing</td>
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<tr>
<td>b. Role responsibility</td>
</tr>
<tr>
<td>2. Role Mediation</td>
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<tr>
<td>3. Collective Engagement</td>
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<tr>
<td>a. Peer Uptake</td>
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<td>4. Division of Labor</td>
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<td>a. Balanced participation</td>
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<td>5. Cooperative v. Collaborative Behavior</td>
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<td>a. Role responsibility</td>
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<td>6. Leadership</td>
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Applying this etic approach, the data sets have been then analyzed to identify the presence and strength of these categories and subcategories. For example, the Freedom of Assembly category refers to those statements which speak to the individual right to come together and collectively express promote, pursue and defend common interests – such as in the ability to have and design a space (physical or otherwise) where collective “work” and congregation can occur to bolster collaboratively pursuing some informational end. Two subcategories emerged from this category: Control of Contributions and Collective vs. Individual Decisions. Some examples of relevant statements are: “I also think that my group and I will plan out a system of how we can get all of our sources when we group together tomorrow” and “My group and I have discussed our project in much greater depth than we did yesterday. Although we have limited time in the library, my group and I decided to work on the project a lot more outside of school. We will either meet up or text or just use google docs.” This detailed analysis from an etic perspective is currently underway.

We believe that such a combined etic and emic approach, drawing on multiple sources of data, strengthens the confirmability of the relationship between interpretation and representational accuracy. Our goal is not to identify causal processes in the learning environment, but rather to document social constructs of students and educators through interpretations and interactions with each other. It begs the question: How can students and their lives as learners be portrayed “authentically”? In combining etic and emic approaches, we are able to pay attention to a careful and detailed portrayal of the collaborative learning experience. It gives us a multiple lens to examine the rich detail and sort though the complex layers of understanding, and to generate the “thick description”, a term coined by the anthropologist Clifford Geertz in the 1970s (Geertz, 1973). Additionally, as has been stated by Mehra et al (2006), our analysis engages social justice as a metatheory for the library and information science discipline, something which has seldom been overtly expressed or systematically tested in light of extant philosophical theories of social justice.

A criticism of utilizing both etic and emic approaches together extends back to epistemological debates about objectivity and the nature of knowledge and how it is generated, as well as debates about understanding perceptions and practices, or explaining them.

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REFERENCES
Curriculum Vitae

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