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Co-reflection in online learning: collaborative critical thinking as narrative

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Abstract This article presents findings from a comparative case study of the learning experiences of two graduate students in an online action research course. The key roles played by reflection and co-reflection, an emerging concept, are identified through the use of narrative analysis. Co-reflection is a collaborative critical thinking process mediated by language, broadly construed to include all meaningful signs. Two types of co-reflection are proposed: tacit and active. Regardless of type, the evidence shows that co-reflection involves cognitive and affective interactions in synergy with relationship building. To the study of group cognition, this study contributes evidence of the potential of co-reflection as a core process. The simple, flexible software tools used in the course (wiki-style collaborative software and simple email and chat programs) effectively supported inquiry learning and co-reflection by allowing learners to freely and easily create their own web pages and to adapt the tools for their different communication and learning styles.

Keywords Affective domain · Co-construction of knowledge · Collaborative learning · Co-reflection · Distance learning · Higher education · Narrative analysis · Reflection · Wiki

Introduction

Among teaching approaches that require sustained and independent critical questioning, action research has a well-established professional development role in teacher education (McKernan, 1996). Within the field of library and information science (LIS), action research projects and courses are increasingly becoming a means of providing future professionals with pragmatic research skills to meet the challenges of a rapidly evolving field. This article examines one such course,

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designed as rigorous inquiry learning based on constructivist principles (Vygotsky, 1978; Wells, 1999) and facilitated principally online by the researcher. Two graduate students, Ruth and Sarah (pseudonyms), in the LIS Program of a major university studied action research and applied their knowledge to independent research projects related to telementoring two high school students in information literacy. The study focuses on features of social constructionist learning in a virtual classroom, particularly critical thinking through reflection and collaborative reflection, or co-reflection. Notable features of the pedagogical approach include an emphasis on research as disciplined, self-aware inquiry and a holistic view of learning that incorporates affect. The online workspace was created using wiki-style collaborative software (http://tavi.sourceforge.net/WikkiTikkiTavi), with email and chat programs added to the wiki website. Using these tools, the graduate students created a substantial body of online written artifacts describing their learning.

This article will develop the conceptual background for co-reflection as a collaborative critical thinking process and examine the processes of reflection and co-reflection in the online course, through the lens of narrative analysis.

Conceptual background

Social constructionist learning

The pedagogical framework used to design the action research course delineates the *a priori* assumptions for the research analysis. This framework was adapted from Gordon Wells' dialogic inquiry process: individuals use experience, knowledge, and information to co-construct knowledge and create, use, and improve representational artifacts (Wells, 1999). Co-construction of knowledge refers to knowledge that is interactively produced through language (broadly construed to include all meaningful signs) in a synergy of individual ideas and perspectives that results in a whole that is greater than the sum of these parts. Such knowledge-building activity involves individual and group processes that lead to creative results that would not have been achieved by any single individual alone (Bereiter, 2002, p. 283).

Within CSCL, the co-construction of knowledge has been theorized from different perspectives. Clark's theory of common ground (Clark & Brennan, 1991) provides preliminary considerations for the use of language as a collaborative activity of establishing and extending common ground for efficient communication. Important theoretical contributions to the concept of co-construction of knowledge come from activity theory (Engestrom, 2001; Leont'ev, 1978), situated learning (Lave & Wenger, 1991), and distributed cognition (Hutchins, 1995). According to Nardi (2001), these complementary theories have different emphases. Activity theory has as its unit of analysis an activity that is comprised of subject (persons or groups engaged in the activity), object (objective or goal), actions (goal-directed processes), and operations (the way an activity is carried out). Situated learning has as its unit of analysis "the activity of persons-acting in a setting," i.e., the relationship between individuals and environment within an activity. In contrast to activity theory, the goal orientation of individuals is not considered. The unit of analysis in distributed cognition is a larger cognitive system composed of individuals

and artifacts, with an emphasis on cognitive structures, representations, and the interrelationships between individuals and artifacts.

Recently, Stahl (2006) has suggested that the focus should be small groups as the engine that connects individually constructed learning with knowledge constructed at the system level. Stahl proposes the concept of group-mediated learning and indicates how knowledge that is co-constructed by a small group is distinct from individually constructed knowledge and from knowledge at the level of a community of practice. He suggests that this concept provides the missing link in the chain of knowledge construction from individual to community and society, and that studying the co-construction of knowledge at the small group level best illuminates the process of social construction of knowledge. Stahl's "analytic cell of collaboration is the mediation of *group cognition as discourse*" (p. 421).

Suthers (2005) adds the complementary idea that intersubjective learning is the primary mechanism of small group cognition. He proposes a methodology that consists of "microanalysis of conversation" to study knowledge construction as "the composition of interpretations of a dynamically changing context." In elaborating on the method, he states: "An act of interpretation may take the form of predications, commentary, restatements, or expressions of attitude (for example), enacted verbally, gesturally, or through manipulations of representations... so the analysis begins by identifying uptake events in which one participant takes up another's contribution and does something further with it" (Suthers, 2005, pp. 667–668). Although attitude is mentioned, this approach appears to focus primarily on cognition and does not appear to attend to the broad range of affective influences on group learning.

Taken together, these theories and approaches contribute important dimensions to the concept of co-construction of knowledge: meaning-making, goal orientation, the importance of context, artifacts as the embodiment of socially constructed knowledge, the relationship between individuals and artifacts, small group mediated learning, and the larger system of cognitive structures and representations that encompasses individuals, groups, and artifacts. As discussed later, I propose to add the narrative as a unit of analysis that accommodates both individual and group learning and provides a means to ascertain the roles of affect and relationship building.

Reflection, reflective practice, and co-reflection

The analyses of learning presented here focus on reflection as an individual critical thinking process, co-reflection as a collaborative critical thinking process, and the synergy between the two processes. There are many dimensions and definitions of reflection and reflective practice. Among the most important contributions have been those of Dewey, Schön, Van Manen, and Boud. Within the context of experiential learning, Dewey defines reflective thought as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends... it is a conscious and voluntary effort to establish belief upon a firm basis of reasons" (Dewey, 1910/1997, p. 6).

Schön (1983) extends this to a view of reflection as the process of professionals creatively responding to the problems of practice in a manner that is both experiential and social. He distinguishes between observing thinking and action as they

are occurring—reflection-in-action—and observation after an experience in order to affect changes in future practice—reflection-on-action. Van Manen (1977) suggests three levels of reflectivity that are widely used to distinguish among types of reflectivity: (1) technical reflection focused on examining skills, strategies, and methods used to reach predetermined goals; (2) practical reflection focused on the methods to reach goals and also on examining the goals themselves; and (3) critical reflection that questions the broader moral, ethical, and social assumptions underlying the goals, often with a call for change or reform.

Dewey's well-accepted conceptualization of "how we think" does not include the role of affect, a critical oversight recognized by Boud, Keogh, and Walker (1985). They define reflection as the "intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations" (p. 19). Reflection is controlled by the learner, is purposeful, and involves affect and cognition in an interrelated and interactive way. The reflection process consists of three stages: (1) returning to experience, (2) attending to feelings, and (3) reevaluating experience. Experience is comprised of behavior, ideas, and feelings. In returning to experience during the reflection process, the reflective practitioner utilizes positive feelings and removes obstructing feelings. Reevaluating experience involves making new associations, integrating thoughts and feelings, validation of new perceptions, and appropriation into the practitioner's belief system. The potential outcomes of the reflection process are new perspectives on experience, changes in behavior, readiness for application, and commitment to action. Based on these views of reflection and an examination of the study data, I identified elements of a narrative of reflection (discussed below).

Building on Boud et al.'s (1985) definition of reflection, I propose that co-reflection is a collaborative critical thinking process involving cognitive and affective interactions between two or more individuals who explore their experiences in order to reach new intersubjective understandings and appreciations. Making explicit the affective dimension of interactions clarifies that, through emotions, those involved in co-reflection participate more deeply and personally in the collaborative critical thinking process. Co-reflection utilizes reflection and also exhibits three interactional characteristics, as derived from the study data: (1) sharing experience, information, and feelings; (2) achievement of intersubjective understanding through collaborative meaning making; and (3) synergy between co-reflection and relationship building. Through co-reflection, groups weigh reasons, arguments, and supporting evidence and examine alternative perspectives to achieve a clearer understanding by drawing on collective experience. The goal is to transform frames of reference to make them better guides for action. Affect plays a key role: "Effective participation in discourse and in transformative learning requires emotional maturity—awareness, empathy, and control... knowing and managing one's emotions, motivating oneself, recognizing emotions in others and handling relationships—as well as clear thinking" (Mezirow, 2000, pp. 10–11).

I propose that the reflective self can take at least two stances in the processes of co-reflection, depending on the level of social interaction. Regardless of level, the reflective self operates according to Vygotsky's (1978, p. 88) assumption that "human learning presupposes a specific social nature and a process by which [individuals] grow into the intellectual life around them." Immersion in intellectual life involves responding to the thoughts, feelings, and actions of others who may or may not be co-present in the learning group.

In the first stance—tacit co-reflection—the reflective self engages in inquiry without directly seeking feedback during the process. The process of co-reflecting, attaining intersubjective understanding, and co-constructing knowledge is subtle and indirect. It accrues through responses to others who are brought to mind through reading, memories of previous interactions, or vicarious experience. Tacit co-reflection is supported when records of thoughts, feelings, and actions remain visible to co-learners as potential sources for further reflection, as in the case of online learning environments where the products of the reflective self can make a valuable contribution to group cognition. The distinction made between individual reflection and tacit co-reflection is that the latter emphasizes changes in frames of reference of the participants in co-reflection (e.g., student and teacher) and the achievement of intersubjective understanding through tacit means such as nonverbal interactions with affective dimensions.

In the second stance—active co-reflection—the reflective self engages in inquiry through explicitly seeking feedback in an overtly interactional and discursive manner. This involves transparency about thoughts, feelings, and actions. Active co-reflection provides more opportunities for relationship building than tacit co-reflection. As described below with examples, the nature of co-reflection is that participants attain intersubjective understanding and build knowledge together not only through discourse and the construction of representational artifacts, but also through nonverbal interactions with affective dimensions.

Intersubjective understanding

Intersubjective understanding refers to the results of the processes of co-constructing knowledge and collaborative meaning making that is deeper, more personal, and more immediate than the public products of these processes. The idea of intersubjective understanding is complex and far-reaching, and will not be fully discussed here. The claim that groups can achieve intersubjective understanding has been accepted by theorists from different traditions who propose a variety of elements and processes necessary for attaining it (e.g., Bakhtin, 1986; Habermas, 1984, 1987; Heidegger, 1959/1971; Ricoeur, 1974). A core element appears to be lived experience within a shared world, and a core recognition is the opacity of interior life and social life, which presents obvious barriers to the attainment of intersubjective understanding and the determination of whether and how this has occurred.

Habermas (1984, 1987) addresses the problem of opacity in his theory of communicative action. He describes the process of reaching intersubjective understanding as being centrally concerned with transparency, equality among speakers, and the validity of utterances based on "truth, rightness, and sincerity." Communicative action takes place within a lifeworld comprised of culture, society, and personality. Though Habermas does not provide a straightforward definition of the lifeworld, it is implied to be common conceptions, or a worldview taken for granted. Further, "the lifeworld is... the transcendental site where speaker and hearer meet, where they can reciprocally raise claims that their utterances fit the world (objective, social, or subjective), and where they can criticize and confirm those validity claims, settle their disagreements, and arrive at agreements" (Habermas, 1987, p. 126). The implications for group learning through co-reflection are that speakers approach transparency in communication through truthfulness

about their perceptions of the objective world, adherence to norms valued by their social world, and sincerity regarding their subjective world. The process of seeking intersubjective understanding involves bringing out elements of the lifeworld, as appropriate to a specific context.

In his sociocultural theory of education, Wells positions understanding as the goal of education and defines it as the result of collaborative meaning making that occurs in action:

> Understanding differs from knowledge building in being more personal and immediate. Whereas the latter, of necessity, requires that meaning should be made explicit, understanding is typically more holistic and intuitive; and where knowledge building is often temporarily detached from primary activity, understanding is deeply implicated in action, as it occurs, since it is in terms of our understanding of the possibilities for, and constraints on, action in a setting that we decide how to act. Put more generally, it is our understanding that constitutes the interpretive framework in terms of which we make sense of new experience and which guides effective and responsible action. (Wells, 1999, p. 84–85)

While this view of understanding recognizes the collaborative nature of this achievement for the individual, intersubjective understanding at its deepest levels can be considered a mutually constructed frame of reference that is deeply implicated in mutual action and that helps group members make sense of new experience within the group context. Such understanding guides effective and responsible group action.

I associate Stahl's work on group cognition with Habermasian processes of communicative action within the lifeworld, in the sense that group cognition refers to cognition that takes place primarily within group processes of interpersonal interaction and is situated and contextual:

> It is a social product of the interaction of groups—not primarily of individuals—discussing and acting in the world in culturally mediated ways. Individuals who are socialized into the community learn to speak and understand language as part of their learning in order to participate in that community ... In this story, cognition takes place primarily in group processes of inter-personal interaction, including mother–child, best friends, husband–wife, teacher–student, boss–employee, extended family, social network, gang, tribe, neighborhood, community of practice, etc. The products of cognition—*thoughts*—exist in discourse, symbolic representations, meaningful gestures, patterns of behavior; they persist in texts and other inscriptions, in physical artifacts, in computer databases, in cultural standards and in the memories of individual minds. Individual cognition emerges as a secondary effect, although it later seems to acquire a dominant role in our introspective narratives. (Stahl, 2006, p. 18; italics added)

Stahl appears to use the term "interaction" to indicate primarily collaborative cognitive activities. This study assumes a broader meaning, including not only collaborative intellectual activity but also the affective qualities and activities involved in relationship building. The result is new intersubjective understandings and appreciations.

Study purpose

The purpose of this comparative case study is to examine the process of co-constructing knowledge and how this influences the learning and practice of action research in a one-semester course conducted predominantly online. The data used for analysis include: (1) email messages, (2) student assignments on "wiki" pages and comments on those pages, (3) journal entries, (4) chat transcripts, (5) student research reports, (6) server logs, (7) transcripts of face-to-face meetings and interviews, and (8) results of a final questionnaire about the course. The presence of only two students encouraged extensive and intensive discussions more characteristic of coaching or mentoring than classroom interaction. Via email, Ruth sent the instructor approximately 14,550 words and received 17,190 words from the instructor, while Sarah sent 36,990 words and received 35,730. Ruth's course activity in email, journals, wiki pages, and chat sessions totaled 35,940 words, while Sarah's totaled 75,420. The research approach taken was qualitative, using narrative analysis as the primary means of interpretation.

Narrative analysis

The narrative serves three functions in this study: (1) an analytical tool for understanding and tracing how learning transformations occur; (2) a reification of experience that was used by participants in reflection and co-reflection; and (3) an indicator of the affective qualities of a communicator's message or state of understanding.

According to Toolan (1988, p. 7), "a minimalist definition of narrative might be 'a perceived sequence of non-randomly connected events.'" A story is represented by a plot that conveys meaning through both its narrative content and its discourse. A plot consists of sequential and consequential events—"the events in the story must disrupt an initial state of equilibrium that sets in motion an inversion of situation, a change of fortunes—from good to bad, from bad to good, or no such reversal of polarity, just an 'after' different from the 'before'" (Franzosi, 2004, p. 57). The essential part is a complicating action that spurs change. The emphasis in narrative analysis is on intention, action, and agency rather than structural analysis or static variables (Franzosi, 2004).

Narrative analysis is a theoretically coherent means of studying learning as a complex, multidimensional process shaped by individual uniqueness and social context. Individuals and groups use stories for thinking and making meaning (Bruner, 1996). Moreover, narrative analysis can be used "to explore the semiotic, cognitive, and sociointeractional environments in which narrative acquires salience and to which stories in turn lend structures" (Herman, 2003, p. 3). The process of learning can be seen as a plot. A basic textbook definition of learning (Schunk, 2000, p. 484) is "an enduring change in behavior or in the capacity to behave in a given fashion resulting from practice or other forms of experience." A more complex view is offered by transformative learning theory (Mezirow, 2000, p. 5): "[learning is] the process by which we transform our taken-for-granted frames of reference... to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs and opinions that will prove more true or

justified to guide action." A major benefit of perceiving learning as a narrative is an emphasis on how learners use their frames of reference to make meaning. This respects individual backgrounds and learning differences and serves as a counterbalance to the predominantly behaviorist orientation of many classrooms and educational textbooks (e.g., Schunk above).

As a meaning-making tool, narratives are necessarily selective and subjective. The most important narratives reported by Ruth and Sarah were the stories of learning action research that they presented in their final papers. These do not capture all the influences on their learning nor the complete story of the learning itself, but rather identify key elements from the students' perspectives. As data, these narratives are closer to lived experience than respondents' answers to open-ended interview questions, surveys, or end-of-course evaluations. Selectivity and subjectivity are, in fact, the strengths of these narratives: they lead to greater internal validity. The value of examining narratives of the learning experience is the potential for understanding the complex means by which discovery learning occurs. As Kohler Riessman (1993, p. 4) emphasizes, "Precisely because they are essential meaning-making structures, narratives must be preserved, not fractured, by investigators, who must respect respondents' ways of constructing meaning and analyze how it is accomplished."

Narrative analysis can contribute to theory building about the nature of individual and group cognition. The method enables researchers as well as instructors to analyze small changes in narrative situation at the level of event, as well as larger changes in frames of reference at the levels of a learning episode or an entire course. The benefit is that, at each level, learning is seen as a plot—a multidimensional, dynamic phenomenon focused on changes in states of understanding or frames of reference.

As researcher, I interpreted the students' discourse to determine the plots for their narratives. My stance as a full participant–observer had advantages and disadvantages. By studying my own teaching, I could use the intimate knowledge I had about the context, participants, and processes. I was highly motivated to understand how my students learned, to innovate and adapt my teaching for the online environment, and to delve into the meaning of virtual teaching by experiencing it. The disadvantages of being a participant–observer include: (1) blindness to aspects of the setting and participants that could be more easily seen by a detached observer; (2) bias that causes the researcher to take sides in conflicts of interest among participants; (3) ethical issues of trust, possible deception, and how much can be revealed without harming others; (4) personal issues and emotional stress related to sustaining learning relationships vs. achieving research goals; and (5) power issues in the relationship between instructor/researcher and student participants.

Analytical process and data sources

Narrative analysis was used to trace critical transformations in student understanding (often labeled by the students as "aha's"). Using these as guides, I identified plots for three types of student narratives, each with a different learning outcome focus: (1) a primary learning narrative focused on the attainment of course objectives, (2) a key individual narrative focused on unique individual learning

outcomes within learning framework, and (3) a co-reflection narrative focused on the co-construction of knowledge. The choice of plot elements was derived from a semantic analysis of key texts, usually derived from the students' final papers and journal entries. I interpreted the student narratives, supported by triangulated data from other student self-reports, such as other written assignments, email messages, chat transcripts, interview data, and student responses on a final questionnaire. The accuracy of the interpretations was reviewed and challenged or confirmed by the participants. For the sake of brevity, the primary learning narratives will not be discussed here. The most significant reflection and co-reflection narratives are the focus of this article.

Based on a review of the literature and preliminary data analysis, a plot structure for the reflection narratives was developed, consisting of seven elements of reflection: (1) being confronted with a challenging question or situation, (2) dealing with feelings/emotions related to the challenge, (3) bringing experience into the thinking/reflecting process, (4) reframing perspective through a bridging of the concrete and the abstract, (5) making a leap of thinking in response to a cognitive and emotional challenge, (6) integrating the new knowledge cognitively and affectively, and (7) identifying the implications for future action. The complicating action within the reflection narrative is making a leap of thinking.

Using these elements, I analyzed how the students achieved a learning transformation. In both cases, the challenging situation that initiated a reflection narrative also initiated a learning experience that led to new understandings related to their research questions and higher self-efficacy in some important action research skills. The story grammar of the reflection narratives serves three purposes. First, it provides a typology of the steps in the reflection processes of the two adult students in this study that recognizes the importance of affect. This typology will be tested and revised in future studies involving larger class sizes, as well as other studies involving mentoring. Second, it provides a framework for identifying and elaborating upon the processes of transformational learning. Third, it provides the means to understand and appreciate learning differences through a focus on the learning that is most valued by the students themselves, within the course framework and objectives.

A co-reflection narrative was also identified to illuminate how knowledge was co-constructed in the student–instructor dyads. The co-reflection narrative is based on the reflection narrative but also exhibits three interactional characteristics, as observed in the data: (1) sharing experience, information, and feelings; (2) achievement of intersubjective understanding through collaborative meaning making; and (3) synergy between co-reflection and relationship building. There is considerable interplay between the two types of narratives. The significance of the dyadic co-reflection interactions were determined using two criteria: (1) nature and degree of individual co-learner transformations in frames of reference, and (2) nature and degree of intersubjective understandings reached through co-reflection.

Student-to-student and whole group co-reflection interactions did not occur to any significant degree. A likely reason is that Ruth began the course with a negative attitude toward online communication that changed gradually over time. The chat medium was the most important venue for whole group co-reflection, and Ruth had a particular aversion to the chat medium for reasons that will become evident later in this article. I speculate, but cannot confirm without further research with other students and other group learning configurations, that one or more of the following

factors may also have been influential: (1) student differences created initial barriers to the sharing of ideas that were difficult to overcome while using primarily online media for communication; (2) the instructor focused her efforts on individual mentoring rather than actively fostering student-to-student co-construction of knowledge; and (3) the students did not have the time, energy, or motivation to devote efforts to providing online feedback on each other's work.

After describing the lifeworld shared by the participants to provide the sociocultural background, the remainder of this article will examine the participants' processes of reflection and co-reflection and conclude with a discussion of the major findings.

A shared lifeworld for co-reflection

Because understanding is a personal way of knowing that is only fully revealed and exercised in action (e.g., Lave & Wenger, 1991; Nardi, 2001; Wells, 1999), jointly undertaken activity is essential. Effective joint activity is enabled by a shared lifeworld and contributes to its reproduction. To this lifeworld, learners bring with them unique sets of personal resources that include degree of motivation, as well as frames of reference in the form of experience, knowledge, understanding, and perceived self-efficacy (Bandura, 1997). The professional culture that the study's participants shared as experienced teachers and trained librarians provided a common set of values and vocabulary related to inquiry learning, learner agency, information literacy skills, social responsibility, and teaching in the service of lifelong learning. That this was an all-female group may have played a role in supporting the expression of feelings during the learning process.

Despite the common values and assumptions, there were marked differences in previous experience. While Sarah (a high school English teacher) and the instructor had previous experience with reflective practice and journaling, only the instructor had research experience. Uniquely, Sarah had participated in her high school's professional development program, as well as doing peer cognitive coaching. Ruth (an elementary school teacher) had not participated in a professional development program, although she had met informally with peers in developing grade-level teaching strategies. She did not do journaling as a regular practice. Only Ruth had previous experience with a completely online course that had left her with misgivings about online communication. Sarah had used online learning tools to support work in face-to-face classes. Both students were new to the wiki software. The instructor had no experience teaching or taking a completely online course but had used the wiki software to support learning in face-to-face classes.

As course designer, the instructor contributed structure, materials, activities, learning objectives, and explicit and implicit values, assumptions, and goals. The course pedagogical framework has already been presented. The instructor's goals were to: (1) provide an environment conducive for self-awareness, critical thinking, and self-empowerment; (2) provide a range of action research tools through content appropriate for novice researchers; (3) foster the co-construction of knowledge; (4) facilitate online communication to maximize its advantages and minimize its deficiencies; and (5) introduce new software that could be useful to participants in their future work. The instructor's functions included: (1) provide a framework and

activities for learning; (2) monitor the learning process; (3) assist learners in achieving their own goals within the framework; (4) assist learners in the acquisition of awareness, concepts, methods, and strategies relevant to action research; (5) assist learners in planning and conducting an action research project; and (6) provide guidance, encouragement, and support through communication characterized by acceptance, empathy, and genuineness.

We now turn to presentations of the reflection and co-reflection narratives of Ruth and Sarah through the lens of narrative analysis, followed by discussion and conclusions. All names used in these discussions are pseudonymous.

Tacit co-reflection: Ruth

Within the primary narrative of learning action research, Ruth's most significant learning narrative focused on changing her view of herself as a teacher. Her statements indicate that she was highly motivated to help "weaker" others in her life (her students and her child). Her writings also indicate that she was facing pressures or conflicts in her personal or professional life, although one cannot speculate why. In an early journal entry (2/3/04), she writes about "self-doubt and [the] need to constantly justify one's actions," and in her final paper (5/14/04) she mentions that self-sacrifice had curtailed her own professional development. Reflection and co-reflection helped her overcome negative emotions about herself and achieve self-confidence and increased self-efficacy. While active co-reflection during face-to-face meetings occurred at critical moments and was key to relationship building, the Ruth-instructor online co-reflection process was largely subtle and indirect. The foci of the co-construction of knowledge and intersubjective understanding were: (1) the nature of action research and (2) the influence of learning style differences on teaching and learning.

Active co-reflection: the complex nature of action research

In undertaking the course, Ruth attended to three new activities simultaneously—learning about action research, telementoring a high school student (Jessica) in information literacy skills and research skills for a senior project, and conducting an action research project about the telementoring. Ruth's original research questions were: "How can a student's learning style be accommodated while in a telementoring relationship? What are the potential benefits (specifically affective) as well as limitations of these strategies?" For various reasons, Ruth had the opportunity to meet Jessica regularly face-to-face so few email exchanges occurred. Concerned that Ruth would not have sufficient data to answer her research questions, the instructor emailed Ruth several times and suggested that she consider the effects on her research project. Grateful for the concern, Ruth responded that she felt she could still complete her project as planned.

Ruth scheduled a face-to-face meeting with the instructor on 4/17/04, and they discussed how she could complete her project and final report with the data she had gathered so far. After brainstorming and considering alternatives, Ruth changed her focus to examining her learning style through her experiences as both a telementor

of Jessica and a telementee in the action research course. In the final interview, Ruth described the research process:

> I think at first I thought that I'd have a handle on everything, but as I got into it, things started to get out of control. To me, I think the thing that hit me the most was the complexity... it seems to me the more you try to control it, controlling the research project and everything in it, the more out of control it gets. And then you try and convince yourself that you have control over it. The biggest thing is to realize that you have to let it go. It kind of has like a life of its own. And that you have to deal with it. And then if you do that, everything starts to fall in place. (6/12/04)

When asked at what point she realized that, she said, "I think after I had that meeting with [the instructor] face-to-face. [The instructor] kind of helped me problem solve. Up to that point I had no idea how I'm going to do it."

The last major online interaction between Ruth and the instructor occurred as Ruth was writing her final paper. At the final face-to-face class meeting (5/8/04), it appeared that Ruth had brought a draft of her final paper in a large envelope, ready to submit for comments. However, she did not turn it in. Later, the instructor emailed her inviting the draft, which Ruth then submitted. After the instructor returned the draft with comments, Ruth emailed her response: "Thanks for your helpful comments. If you hadn't built such a caring and nonjudgmental relationship with me throughout this semester, I wouldn't have thought of sending the draft, really sketchy draft to you. Thanks again for all of your support."

In this simplified narrative, we see evidence of the interaction between the reflection and co-reflection processes. Ruth shared information and feelings about her action research process, while the instructor shared information about action research and a concern for Ruth's progress. Ruth was confronted with the challenge of completing her project on time and felt overwhelmed and out of control. After actively co-reflecting with the instructor, she realized that she needed to reframe her research questions to focus on her own learning style, also becoming aware of a need to respect the creative process and cease clinging to her original agenda. The dyad achieved intersubjective understanding about a way to solve Ruth's problem. Ruth's final comment gives evidence that co-reflection about Ruth's final paper would not have occurred without affective support and relationship building.

Tacit co-reflection: a garden metaphor for the research process

Ruth frequently used gardening metaphors in her writings—Jessica was the seed that she would pour sunshine on from afar, and learning style awareness was the seed that blossomed into self-discovery in her final paper. Toward the end of the course, a garden metaphor of the research process created by the instructor grew in richness and intersubjective meaning not through direct discussion but through Ruth's innovative use of the metaphor to structure her final research report.

At a face-to-face meeting, Ruth, a visual learner, expressed a need for graphic ways to understand action research midway through the course. As a verbal learner, the instructor had not noticed how excessively wordy the wiki had grown. She streamlined the site, created site maps, and posted graphic models of action research including a description of the research process as the personal story of a gardener

tending a garden of new ideas, infused with some of her feelings about research as a personally and socially meaningful pursuit. Ruth quickly emailed her response: "I just wanted to send my kudos for the 'garden' research process model. This is one that I most identified with. I especially like that it created a mental image of the steps in the research process in a creative, yet effective way... It's interesting that in [another] class where we needed to explain our philosophy of librarianship, I actually gave each person in our class soil, a pot, and some sunflower seeds and I ended with 'Librarians plant the seeds of lifelong learning.'"

The garden metaphor, which had been individually meaningful, became intersubjectively meaningful. It appears to have helped Ruth scaffold her thinking about her research project. Her final paper, entitled "The Harvest of Self-Discovery," used a unifying metaphor of plowing, planting, and harvesting a spring crop. The background of the study was the "soil" in which she planted "seeds of self-discovery" about her learning style and how it had limited her effectiveness as a teacher. Reviewing the literature ("plowing the field") allowed her to delve deeply into previous studies and "intermingle their soil" with hers. Methodology dealt with why and how the seeds were planted and the growing cycle. Findings were the harvest that "will lead to an unearthing of various truths" and "lead to a new cycle of planting."

An argument can be made that the garden model of the research process gave Ruth "permission" to use this somewhat unorthodox and creative method of presenting her research results, and that this allowed her to think and express herself more clearly. The metaphor seemed to take on a life of its own as a conceptual artifact and product of tacit co-reflection. By the end of the course, "garden" became a one-word reference for the research process that embodied the potential of a new idea, tending, nurturing, growth cycles, maturity, the satisfaction of harvest, and a look to the future. The strength of the metaphor's affective reach is clear when one considers the impact of the term "research methods" versus the metaphor Ruth and the instructor used for these: "gardening tools." The metaphor also signaled the end of the process of overcoming mutual frustrations that were caused, in whole or in part, by learning style differences.

The garden metaphor served three functions. First, as a shared reference for the research process, it was the instrument used for tacit co-reflection. Second, changes in the metaphor contributed by each member of the dyad provided evidence of group cognition. Through mutually observed, incremental additions, each member contributed unique dimensions to a richer understanding of the nature of action research. Third, the metaphor indicated a deeper complex of thoughts and feelings, not easily expressed, which comprised the intersubjective understanding reached about the research process.

Tacit co-reflection: the influence of learning style differences on teaching and learning

Ruth's greatest transformational learning experience was related to her role as a teacher. By examining and reflecting on the data gathered for her research project, she was able to critique the premise that she had been adequately accommodating students with different learning styles. In her final paper, she addressed her process of self-change, the risks involved, and its great personal significance. As a result, she

achieved a more accurate understanding of herself as a teacher, a more open-minded and empathetic view of her former students, and a basis for more effective action in the future. In a journal entry, Ruth noted how understanding another's learning style could serve not only the cognitive goal of better understanding but also affective and relationship building goals.

> The biggest aha for me regarding my research this week is that I set out to learn about Jess's learning style so that I could help her in terms of understanding the research process and writing. However, what seems to be happening is that learning about her learning style has taught me how to build a better relationship with her. Quite interesting, but profound I think because no learning can occur until we feel another person values us for who we are and seems to understand us unconditionally. I think there is an assumption that everyone learns like us. Understanding that this is not reality is a wake-up call. (4/1/04)

This quote, juxtaposed with the following quote from her final paper, seems to indicate that Ruth's view of the relationship between herself and the instructor also improved due to the changes made to the wiki:

> By allowing students to learn through methods they are comfortable with, we acknowledge that how they learn is important. I experienced this firsthand as a telementee, as additional visual material was added to the instructional Web page. It allowed me to 'see' the research process through the addition of charts, diagrams, and a metaphor. It affected me cognitively and emotionally. I now not only had a mental picture that I could refer to, but the feeling of being acknowledged transformed into increased motivation and a desire to learn more. (5/14/04)

As she examined her experiences as a telementor and telementee, the data caused her to confront negative emotions and reevaluate basic assumptions about herself, as she notes in her final paper: "I had to admit my insecurities about communicating in chat, my misgivings about oral learning, and my irritation with learning out of sequence" (5/14/04). She makes a clear connection to her own teaching: "The need for consistency of the information presented is a reflection of my desire to keep things 'in order,' in sequence. As I reflect on my teaching, I find that I get irritated at students who skip steps to complete projects. Why can't you do #1 first, #2 second I ask them? Their answer to this question is simple: I can't do #1 and then #2 because the order of things doesn't really matter to me; your #1 is different from mine" (5/14/04).

There is strong evidence that her experience of being accommodated by an instructor with a different learning style was one of the consequential events that led to her self-reevaluation. The instructor also benefited greatly from the learning partnership with Ruth, experiencing a similar awakening to how limited her instructional strategies were, with the accompanying emotions of surprise, chagrin, empathy, and finally the satisfaction of implementing improvements. The instructor was able to reframe her own perspective by trying to understand Ruth's and made many changes to the wiki as a result.

Using her self-reports, particularly her final paper ("The Harvest of Self-Discovery"), as researcher I identified Ruth's most significant learning as the

transformation of her view of herself as a teacher. The plot consists of the elements of the reflection narrative as shown in Table 1. The turning point in this narrative is redefining what makes a good teacher, a leap of thinking that indicates an important learning transformation (highlighted in the table).

Dealing with student–instructor learning style differences resulted in transformations in Ruth's and the instructor's views of themselves and each other as teachers and learners. Without intentional dialogue about learning style differences, the dyad achieved a common experience of self-examination, change in self-view, and intention to change teaching practices that resulted from the interactions—partly verbal, but also behavioral and emotional. I identify this as evidence of tacit co-reflection.

Ruth valued the affective quality of the online interactions. In her final course comments, she noted that she appreciated that the instructor "responded quickly to comments, questions, and concerns; provided constructive feedback to clarify thoughts and ideas in research proposal and module questions; and provided supportive and risk-free on-line environment (chat, email) that I could freely ask questions without feeling intimidated" (6/12/04).

Ruth's final definition of action research is a concise and elegant description of both her personal transformation and the "action" in action research: "Action research is exactly that. It is research that 'moves.' What 'moves' in action research is the researcher's understanding of himself/herself. The understanding 'moves' from limited insight to expanded outcomes, from frustration with not being able to change others to a focus on changing what you can—yourself" (5/14/04). Ruth's

Table 1 Reflection narrative in Ruth's final paper

Elements of reflection narrative	"The Harvest of Self-Discovery": Ruth's story of self-change
Being confronted with a challenging question or situation	Confronted evidence of her bias in favor of visual learners.
Dealing with feelings/ emotions related to the challenge	Felt irritated with past students and the course instructor; felt valued as a learner in the action research course; felt vulnerable facing her weaknesses; desired self-growth and empowerment.
Bringing experience into the thinking/ reflecting process	Examined her thoughts, feelings, and behavior as a teacher, mentor, and student.
Reframing perspective through a bridging of the concrete and the abstract	Used evidence and metaphors to understand that her view of herself as a good teacher who accommodated diverse learners was inaccurate.
Making a leap of thinking in response to a cognitive and emotional challenge	Redefined good teacher to include the importance of self-awareness, reflection, and professional development.
Integrating the new knowledge cognitively and affectively	Confirmed that she had the personal power, wisdom, and confidence to continue learning, growing, and becoming a good teacher as she had redefined it.
Identifying the implications for future action	Planned to teach with multiple strategies while introducing students to new strategies to cope with a wide range of learning situations.

view of research had changed from one of "library research" to a complex, constantly evolving process undertaken by self-aware, critically questioning researchers.

Ruth was also confident about her abilities as an action researcher, becoming able to question the findings of others based on her own knowledge of the research process. When asked on the final questionnaire if and how her experiences during the semester had changed her perception of herself, she responded: "I see every experience positive or negative as a learning opportunity. I now see myself as a vehicle to help others 'see' reflection as an important part of being and becoming 'human'" (6/12/04). She added a new goal to her role as teacher—to help others discover a means to empower themselves and enrich their own lives through reflection.

It is readily conceivable that Ruth's narratives of learning would have been significantly different in a face-to-face class environment. The frustrations experienced by Ruth and the instructor over learning style differences (that led to significant learning transformations for both) were exacerbated by the online medium. Not only does the online medium increase the barriers to open and fluid communication (Clark & Brennan, 1991), text-based online communication can be disadvantageous to visual learners. Regarding a previous online class experience, Ruth noted: "I actually had a class that was totally online. The scary part is that when something is written as opposed to spoken, it can be taken in a different way. For me, I was very cautious about the way I wrote things, because it was open to interpretation. I was so uncomfortable" (12/5/03). Regarding her chat experiences during the course, Ruth noted: "I often find giving an answer on demand difficult, as I need to hear it out, revise it, think about it again and then share it. I often write a message, erase it, write it again, erase it... the discussion has already moved on, so I erase it. It really comes down to my need to process through" (4/18/04). The class met virtually in chat sessions 14 times and face-to-face four times. At the end of the course, Ruth ranked face-to-face meetings (second) as more important for her learning than email (third) and far more important than chat (ninth). In fact, the two most significant Ruth-instructor active co-reflection events (the discussions about improving the course and refocusing Ruth's research project) occurred during face-to-face sessions.

For Ruth and the instructor, Ruth's initial reluctance to use online communication and the barrier of learning style differences led to difficulties in open communication and relationship building. Tacit co-reflection through online communication evolved over time, and intersubjective understanding was achieved over the importance of appreciating learning style differences. By the end of the semester Ruth appreciated the caring relationship that had developed online.

Active co-reflection: Sarah

Sarah's learning experiences in the course were complex and multilayered, shaped by several important narratives within the primary narrative of learning action research. Her most significant learning focused on her action research project about telementoring a high school student (Corel) in information literacy skills and research skills for a senior project. Her goal was to examine how her "method of communication, means of noticing/observation, and definition of what it means to

be an effective teacher changed due to the virtual format." Specifically, she aimed to look at the questions she posed to Corel, the purposes behind the questions, and how questions in a virtual setting might differ from questions posed in a traditional, face-to-face classroom. Reflection and particularly co-reflection helped Sarah reexamine her assumptions, seek alternative interpretations, and reformulate her thinking. In the Sarah-instructor dyad, the main focus of the co-construction of knowledge and intersubjective understanding was research on Sarah's telementoring relationship with Corel.

Active co-reflection: building virtual relationships

Sarah believed that relationship building would be "crucial in a telementoring situation"—"If the student did not feel a connection to the mentor, she would not take intellectual risks, pose questions or share personal realizations and feelings that one is able to share in an intellectually safe and nurturing setting" (5/11/04). Sarah believed that the virtual environment required different strategies for relationship building due to the lack of physical and auditory nuances available in face-to-face conversations. She stated that her greatest fear was being unable to establish an emotional connection: "Primarily, I feared that I would not be able to spark an emotional connection with my mentee and that if this did not occur, she would not email and our telementoring experience would fail" (5/11/04).

In contrast to Ruth, Sarah was practiced at reflecting and peer coaching. She used the elements of the reflection narrative as she actively co-reflected with the instructor as her primary partner. She and the instructor regularly exchanged email messages throughout the process of focusing the topic, clarifying action research concepts, coding email messages exchanged with Corel, analyzing data, and writing the final paper. Sarah also identified in her writings some of the means and benefits of co-reflection. She made a clear connection and distinction between reflection and co-reflection: sharing her reflections helped her to see things from different vantage points and attain a better, less limited, less judgmental perspective.

To the collaborative examination of Sarah's telementoring relationship with Corel, Sarah contributed insights and experiences as a classroom teacher of similar students. She was able to understand and interpret Corel's writings, to adapt her face-to-face teaching skills to her online communication with Corel, and to analyze the email data with penetrating questions and insights. It is important to note that Sarah and Corel communicated solely online and met each other for the first time at Corel's final presentation of her completed senior project. As a co-learner, the instructor learned from Sarah about constructivist teaching at the high-school level and how telementors effectively communicate with high school students by being open, accepting, empathetic, humorous, and accessible.

The instructor assisted Sarah by introducing the action research concepts and methods Sarah needed for her analysis. She also provided readings and exercises aimed at guiding Sarah through the coding and analysis process. She mentored Sarah in action research, providing cognitive and affective support. She noticed that Sarah was developing a telementoring relationship with Corel apart from Sarah's role as a librarian and provided background information about the senior project. The following email exchange regarding Sarah's telementor role (3/4/04–3/5/04) provides an example of the interactional characteristics involved in active co-reflection. (Excerpts from the two emails are presented, integrated into a format

resembling a dialogue, with the instructor's responses in italic font. Sarah's icon is ✍, and the instructor's icon is ➽.)

✍ Hi [Instructor],

...When I begin to think of my questions and analyzing my data, I always go back to the fact that I'm not really acting as a teacher, yet the questions I'm posing are teacher type questions—where I compare myself as a teacher in the classroom and a teacher now online. I wonder if that is a shift in thinking I need to do or if I can still approach my research from this vantage point.

➽ *I think you can approach the research from the standpoint of a being a teacher. Try it and see if it needs refinement by the time you write your final report. I think Corel thinks of you as a teacher, and more specifically as an English teacher, as well as a librarian.*

✍ The problem also goes back to my initial feelings of being a little lost. I know I kept pestering you for clarification and that you shared everything you knew and you invited me to contact Lee [the high school librarian in charge of the senior project]. I want to emphasize that I appreciate your openness and willingness to help me at every step of the process.

➽ *I fully understand this feeling of being "lost." I knew you felt lost, because I also felt this way, but I was at a loss to know what to do to improve the situation. There were factors at work beyond our control, and beyond my understanding.*

✍ I guess I realized that the "go with the flow" mentality is something that I am uncomfortable with personally and when I thought more about why, I realized it is because I haven't really taught with that lack of framework. I have always had goals, objects and a clear path to travel on. This is really my own weakness, but I wonder how it played into my "in-action" or my hesitancy. (I recall now that Central [High School] was hit hard with the virus early in the school year and we didn't realize this until a few days or even 1 week in—this maybe slowed things down too.)

➽ *To teach with "goals, objects, and a clear path to travel on"... many teacher educators would point to you as someone to emulate! Given your admirable need for a framework and the uncertain nature of the senior project, I appreciate your patience and good will, and how well you've gone with the flow despite discomfort.*

✍ I'm not trying to complain and bring up issues we have already discussed because I certainly know the constant flux was/is challenging for you, too. But what I was thinking was that this is a big variable when I approach my research—it seems almost contrived for me to describe my role as a mentor because I felt I wasn't really acting with knowledge or expertise—I was just responding to Corel.

➽ *I think you can say that your role as a librarian mentor for the senior project was limited. I don't agree when you say you weren't acting with knowledge and expertise. It's true that you weren't using some of your librarian's expertise, like helping with search strategies and finding resources. But I do think you used your English teacher's expertise in the discussion with Corel about Shakespeare and her AP [Advanced Placement] English paper. You might expand your definition of mentor. On the TeleMentoring page on the wiki, I give this definition of mentor from The National Mentoring Partnership*:

> *A mentor is an adult who, along with parents, provides young people with support, counsel, friendship, reinforcement and a constructive example. Mentors are good listeners, people who care, people who want to help young people bring out*

strengths that are already there." Further: "They [the NMP] state that successful mentors: (1) have a sincere desire to be involved with a young person; (2) respect young people; (3) actively listen; (4) empathize; (5) see solutions and opportunities; and (5) are flexible and open.

You fit that description pretty well, don't you think?

✍ I just wanted to put this out there to you because as I'm composing my proposal, I wonder if I'm misrepresenting myself as a mentor involved with the Central senior project. I feel very distant from the Central part of the project. I do feel a bond with Corel, but I don't think it is necessarily a mentor bond where I have helped her with her project. So as I prepare to analyze data, I just wonder where these variables fit in?

➽ *I think it will depend on what your study focus is, or ends up being after you complete the data collection and analysis. Let's keep thinking about this and discussing it.*

Reflection and co-reflection narratives are evident in this exchange. Sarah was confronted with the issue of how to characterize her role as a telementor in her action research project. In her reflections, she dealt with feelings of confusion and frustration over the ambiguity of her role and the lack of clear goals and structure in the high school's senior project. She recounted the experiences that led to questioning and difficulties in analyzing the data. Even though Sarah had been given the responsibility to act as a librarian telementor to help Corel develop her information literacy skills, there were numerous delays in the completion of important activities that led to ambiguities about what Corel was doing and how Sarah should assist.

Rather than urging Sarah to continue to try to be a librarian telementor, the instructor empathized with her feeling of being at a loss about her role and admitted to Sarah for the first time that she had also felt lost and powerless. The instructor praised Sarah's efforts to continue working with Corel despite the fact that the lack of actionable goals had caused her discomfort. The instructor had observed the email communication between Sarah and Corel and been impressed with Sarah's sincerity, warmth, humor, and ability to listen to and empathize with Corel. Referring to the definition of telementor posted on the wiki, the instructor encouraged Sarah to value her considerable strengths as a teacher and mentor. In this example from mid-semester, a trusting relationship between Sarah and the instructor had developed to support, for the first time, the sharing of experience, information, and discomforting feelings about the difficulties of the telementoring project. We also see the beginnings of the achievement of intersubjective understanding about a new view of Sarah's role that was different from the role of librarian.

Sarah's research methodology involved coding and categorizing the questions she had posed to Corel in her email messages, as well as Corel's responses. In the process of coding, she realized that she needed to understand exactly what kind of relationship they were building and how it was changing. Sarah noted, "In fact, I felt there wasn't a relationship until my professor shared her insights from reading my emails with Corel. Only then, did I begin to see how a relationship had formed" (5/11/04). The coding and categorization, as well as her active solicitation of feedback from her instructor, led to major insights and an evolving framework for the analysis and interpretation.

> These categories proved too broad for the time frame within which I was working. My instructor emailed me two questions to consider—how did I invite Corel to trust me? If I did more than to establish trust in the relationship, what were the things that I did? Suddenly, the analysis and organization of my data became more clear. I charted the data and analyzed it. From this organization of the data, I saw the various roles that I played emerge. This became the framework of my research report. (5/11/04)

More importantly, the analysis process allowed her to discover much more about Corel and the relationship she had fostered:

> I anticipated I would find much information on movies and her homework for other classes. In terms of the [senior] project, I knew I would find our exchange of potential questions she could pose to a [community mentor], but I did not expect to find much more than that. However, as soon as I returned to the emails, I noticed that we had shared much more personal information about our lives than I had recollected. I also noticed that she shared her successes and self-doubts. Later, as I began rereading and analyzing the emails, I could see so much in them—the student reaching out with ideas to be validated or the student seeking someone to listen or sharing successes and challenges. Now, I see the student's maturity and humor. I see a sharing of conversation. (5/11/04)

Through her analysis of the email data, Sarah identified the supportive listener role through which she had transferred her interpersonal skills as a classroom teacher to the virtual environment. This enabled her to reach her goals "to be a caring, nurturing, compassionate teacher who valued student input and the rapport between students and teacher; who provided the opportunities for student inquiry and encouraged students to take intellectual risks" (5/11/04). She stated in her final paper, "Possibly, my goals to be a caring, nurturing telementor were met."

Using her self-reports, as researcher I identified Sarah's most significant learning as the building of a virtual relationship with her telementee. The plot consists of the elements of the reflection narrative as shown in Table 2. The turning point in this narrative is refocusing her role in the telementoring relationship, a leap of thinking that indicates a learning transformation (highlighted in the table).

Like Ruth, Sarah also valued the affective quality of the online interactions. In her final course comments, she stated, "I really like how patient you [instructor] were and encouraging, how you asked me good questions to get me to think about things, how you took so much time to respond to my journals or the emails. I always felt that you were really thinking and looking at things, and that your perspective was so helpful to me" (6/17/04). On the importance of trust, Sarah noted: "One reason I was able to email you and talk, communicate with you the way I was, is that I trusted you" (6/17/04). Like Ruth, she also noted the importance of feeling valued as a learner: "As a student, I appreciated your [instructor's] encouraging, patient, supportive role. You gave me space to flounder yet you also gave me words of support when you saw that I needed them. While you probably saw some glitches and errors in my process, you gave me space to learn at my own pace. I felt valued as a student and I think this is crucial for learning to occur" (7/7/04).

Table 2 Reflection Narrative in Sarah's Final Paper

Elements of reflection narrative	Sarah's story of learning a new role
Being confronted with a challenging question or situation	Perceived an inability as an online librarian to help her high school telementee complete her senior project.
Dealing with feelings/emotions related to the challenge	Fear of failure; frustration over the ambiguity of her role as a telementor; pleasure in exchanging ideas, experiences, and feelings with her telementee.
Bringing experience into the thinking/reflecting process	Examined the telementoring communication in the light of her experiences as a classroom teacher; came to better understand her telementee and to recognize how she had transferred teaching goals and interpersonal strategies from the classroom to the virtual setting.
Reframing perspective through a bridging of the concrete and the abstract	Examined the evidence with a researcher's eyes and identified other telementoring roles—supportive listener, teacher, co-learner.
Making a leap of thinking in response to a cognitive and emotional challenge	Recognized that relationship building, not coaching information literacy skills, was the achievement to be valued.
Integrating the new knowledge cognitively and affectively	Accepted and valued her most important role as supportive listener.
Identifying the implications for future action	Recommended improvements for more successful future telementoring and senior projects.

While Ruth seems to have transformed her view of herself dramatically through her work in the course, Sarah worked steadily at incremental changes in her understanding of telementoring, action research, and using the wiki for online communication and learning. To meet the complex needs of the telementoring project, Sarah took four roles—supportive listener, teacher, librarian, and co-learner—that she identified and examined in her final paper. From an earlier inability to see a relationship developing, Sarah became more discriminating about the relationship and more precise in her ability to analyze it, enabled by the persistence in electronic form of the telementoring conversations. Higher perceived self-efficacy regarding action research is evident in one of her final course comments: "I now see teacher research as an important part of teaching. I feel capable of doing teacher research" (7/7/04).

For Sarah and the instructor, the similarities in their teaching philosophies, experience with reflective practice and journaling, and interest in literature and writing imply some commonly held assumptions and tacit knowledge about teaching, learning, writing, and doing research. This is not to say that there were not important differences in their views. It seems that co-reflection is aided by a balance of similarities and differences, as Sarah noted in her final course comments: "What I most enjoyed during the [course] was sharing my reflections with [the instructor] through emails, journals, and the dialogue and with Ruth and [the instructor] via the chats. I realized that even though I thought I was being open minded or considering something from various vantage points, there was still more interpretation that could be made. I think the dialogue with [the instructor] proved

this to be the most true for me. It's curious, even though Ruth and I are both teachers, mothers, librarians … I think we see things so differently" (6/17/04).

In several of her writings, Sarah articulated the importance of teachers as co-learners with their students. It is very likely that the instructor's ability to take the role of a co-learner with Sarah was facilitated and supported by Sarah's belief in the value of teachers as co-learners and her regular practice of this in her own classroom. This illustrates the subtle but important ways that shared social practices support learning and the attainment of intersubjective understanding.

In contrast to Ruth, Sarah adapted well to the online medium. She noted: "I learned that I like the virtual format for my learning. I liked that I could go back to read our chats or return to email 'discussions.' I appreciated having the course 'texts' online and in PDF formats. I really liked putting my work in the wiki once I finally learned how to do it" (7/7/04). Regarding the chat sessions, Sarah stated: "They were really interesting in that I could see how Ruth and I were just seeing things so differently. The chat did help me understand what was important in the reading, how it connected to what we're doing, how we can use this information" (6/17/04). She noted that the online medium may have even encouraged more open communication: "Email with you [instructor] was so good because you just kept me energized, and encouraged me, and you gave me things to think about, and I really appreciated how quick the turnaround was. I was probably more willing to ask you things via the email or confess things than if we had been face to face" (6/17/04).

The evidence indicates that Sarah and the instructor achieved a considerable degree of transparency in their communication using the online medium, through truthfulness about their perceptions of the telementoring project, adherence to norms valued by their professional world, and sincerity regarding their subjective worlds. This supported their active co-reflection.

Discussion

Though Ruth and Sarah were exposed to the same course and instructor, because they were influenced by different backgrounds and frames of reference, each took a different learning path toward understanding and practicing action research. The differences are clearly seen in the examples that have been presented. What were the common factors in the learning processes of two such different students? Both students engaged in an inquiry process that was initiated by their own questions and curiosity, faced unexpected obstacles that were cognitively and emotionally challenging, reframed their views of the situation and their roles, and discovered a new way to solve their problems. Both also engaged in co-reflection with the instructor in which affect and relationship building played key roles. Co-reflection helped move the students toward creative solutions that they discovered for themselves.

In Ruth's case, co-reflection with the instructor was largely tacit, arguably influenced in large measure by the use of online media for communication. In the areas that Ruth deemed most important, critical thinking, new perspectives, and intersubjective understanding were not achieved directly through dialogue but rather through indirect communicative actions—the instructor's reorganization of the wiki website to accommodate Ruth's visual learning style, and Ruth's elaboration of the garden metaphor of the research process. Ruth and the instructor

each made contributions that the other could understand, share, and build upon. In her final paper, Ruth appropriated the garden metaphor in her own way. She also analyzed herself as a visual learner and teacher and closely examined her thoughts and feelings related to self-change. Through reading Ruth's final paper, the instructor gained a deeper understanding of the metaphor and of how visual learners use metaphor to scaffold learning, cognitively and affectively. The instructor also reexamined her own thoughts and feelings related to self-change as a verbal learner and teacher. In this way, the resolution of a conflict in learning styles led to intersubjective understanding about the value of understanding and accommodating learning style differences. Ruth's final paper can thus be seen as the most significant product of dyadic as well as individual cognition resulting from co-reflection.

In Sarah's case, co-reflection with the instructor was active. Sarah frequently and explicitly sought feedback throughout the course. She tended to use a spontaneous, conversational style in her writing and was self-aware and unusually clear about her feelings and motivations. She commented that the online media might even have encouraged her to be more frank and open than she would have been in a face-to-face classroom environment. Related to the learning Sarah deemed most important—building a virtual relationship with her telementee—she and the instructor actively co-reflected. Although Sarah had skillfully adapted her face-to-face teaching skills and relationship-building skills to telementoring, she was unaware of this until the instructor pointed it out. As Sarah attempted to understand and analyze how she had built a virtual relationship with Corel, the instructor introduced concepts and methods needed for analysis and provided readings and exercises for Sarah's needs. The instructor also mentored Sarah in the use of action research methods and provided emotional support. Sarah used these resources to analyze her data with deep questions and insights, sharing her teaching philosophy and experiences as a reflective practitioner in the process. After Sarah and the instructor shared their frustrations about the ambiguities of the telementoring project, co-reflection enabled Sarah to see a change in her role from librarian to supportive listener. In her final paper, she provided revealing insights about her roles and the nature of online communication. Although not purposefully so, Sarah's research project was collaborative, and her final paper was in part a co-construction of knowledge by Sarah and the instructor. Sarah's final paper can thus be seen as the most significant product of dyadic as well as individual cognition resulting from co-reflection.

For both students, the impetus for solving their problems was not only an intellectual challenge but also an emotional one. In Ruth's case, frustrations with understanding action research and the instructor's verbal learning style pushed her toward requesting accommodations for her visual learning style. The pressing problem of how to complete her research project with limited data gave her the constant feeling of being out of control. One of Ruth's most important discoveries as a result of the course was: "When you hit a brick wall, pick yourself up and find a way over it, under it, or around it" (6/12/04). In Sarah's case, coping with a telementoring situation over which she had little control left her frustrated and confused. Amidst the ambiguity, she could find few means to fulfill the librarian mentor role she had been tasked with. Coming to terms with this and seeing a new role that she had not expected to take was primarily an emotional challenge; she stated that her greatest fear was that she would not be able to connect emotionally

with her telementee. When the expected trajectories for their telementoring work did not occur, both students were faced with unexpected situations and discomforting emotions that challenged them to find creative solutions.

Emotional support from the instructor was important for the learning of both students. For Ruth, having her learning style recognized, valued, and accommodated led to increased motivation for learning. The "supportive and risk-free on-line environment" enabled her to co-reflect. Sarah also appreciated the cognitive and affective support from the instructor. Like Ruth, she also felt valued as a learner and felt that this was "crucial for learning to occur."

The co-reflection that helped the students make important learning transformations was not only supported by relationship building but may even have been difficult without it. Ruth noted that without the "caring and nonjudgmental relationship" with the instructor she would not have considered submitting the sketchy draft of her final paper for review and comments. Sarah noted that she was able to freely express herself through email because she trusted the instructor. Thus, co-reflection involving affect and relationship building was critical to the learning that was most valued by the students. In turn, these unique, student-driven, inquiry-learning processes led to the attainment of course goals—understanding and effectively using action research.

The simple, flexible software tools effectively supported inquiry learning and co-reflection by allowing the students to express themselves through a variety of modes, to freely and easily create new web pages, and to adapt the tools to their different communication and learning styles. Ruth presented polished writings that indicated careful thought and reflection. She also noted that in contrast to face-to-face situations, "When distance is involved (physical or emotional), online communication allows you to continue to dialogue." Sarah, also reflective, tended to use a spontaneous, conversational style in all her writings except the final paper. While courseware such as WebCT generally requires learners to adapt their learning and communication strategies to a static course presentation and software functions, social software (Allen, 2004), such as the tools used in this study, supports group interactions by allowing users to more easily adapt the software for their needs.

With only three co-learners, a high degree of online engagement and interaction was possible. Application to larger classes suggests the need to form small learning groups or communities that co-reflect through peer coaching under the guidance of a course facilitator, within an overall framework of social constructionist learning. Because of its focus on learning transformations and its sensitivity to intersubjective meaning making in context, the narrative approach to reflection and co-reflection may be useful for learning facilitators conducting in-depth formative and summative assessments. Research is currently underway on the use of co-reflection in an online class with over 20 students.

The use of narrative analysis was valuable for understanding the complex means by which discovery learning occurs. The focus on intentions, action, and agency afforded by narrative analysis supported this in a way that other theoretical perspectives do not. While activity theory has been shown to be an appropriate means to systematically assess the variables in the sociocultural environment that influence learning (e.g., Barab, Schatz, & Scheckler 2004; Issroff & Scanlon, 2002), it is less helpful for examining the process of learning. While the situated learning approach aids in perceiving how learning occurs through relationships within established communities of practice, it is less useful for examining inquiry learning

in classroom-like settings where participants form temporary learning groups. Distributed cognition analyzes the larger cognitive system, not individual or small group learning processes. In contrast to these approaches, the narrative serves as an analytical tool for understanding and tracing how individual and group learning transformations occur, encompassing cognitive, affective, and relational dimensions. This study provides evidence that narrative analysis can be a valuable addition to the methodological toolbox of collaborative learning researchers.

Conclusion

This comparative case study of the different learning experiences of two graduate students in an online action research course has illuminated the key roles that reflection and co-reflection, an emerging concept, played in online learning. Co-reflection is a collaborative critical thinking process that involves cognitive and affective interactions in synergy with relationship building. Co-reflection was central to both individual and group cognition for these participants. Two types of co-reflection were proposed: tacit and active. To the work on group cognition, this study contributes evidence of the potential of co-reflection as a core process. Co-reflection is mediated by language, broadly construed to include all meaningful signs. One example is the use of metaphor, which, while expressed verbally, can extend understanding beyond explicit verbal description and cognitive processes to connote cultural symbols and affective dimensions.

The combination of simple, flexible software tools used in the course effectively supported complex learning processes by allowing learners to freely and easily create their own web pages and to adapt the tools to their different communication and learning styles. Though the students were exposed to the same course content, requirements, online tools, and instructor, they used these resources in markedly different ways toward the goal of understanding and practicing action research. The focus on human action and agency afforded by narrative analysis provided a means to apprehend and interpret the affective and relational as well as cognitive dimensions of these richly different learning experiences.

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AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES.

Q1. Please provide history dates.
Q2. Van Manen (1977) was cited in the text but was not found in the reference list.