Critical Thinking in Online and Campus Instruction: The Role of Technology, Instruction and Practicum in the Preparation of Early Interventionists

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ABSTRACT

Comparisons were made of the class discussions from two graduate courses related to infants with disabilities and home visiting practice. Students were enrolled in either a traditional on-campus course that met weekly or an online course that engaged students asynchronously. Both groups of students also made weekly home visits to a family with an infant/toddler with identified delays/disabilities. Discourse patterns and analyses of the cognitive complexity of student and instructor contributions to class discussions revealed the instructor's domination of discussions on-campus and the students' tendencies to use lower levels of critical thinking. Despite similar student demographics and academic outcomes, the online students initiated more discussions and used significantly longer speaking turns and questions than on-campus students, on par with the online instructor, and had contributions that reflected a closer match to the instructor at the higher levels of critical thinking. Implications are discussed for training early interventionists using distance education.

Key Words: online discussion, asynchronous learning network (ALN), cognitive complexity

The growth of online courses related to early intervention and early childhood special education (EI/ECSE), at the preservice and inservice level, have likely developed in response to a number of factors including advances in technologies, shortages of qualified early interventionists for children with disabilities birth to age 5, increased financial incentives from the federal government, and a need for efficient, economical and high quality access to higher education for employed adult learners (Caro, McLean, Browning & Hains, 2002; Johnson, 2004; Ludlow & Spooner, 2001; Mueller, 2009). Graduate-level programs in EI/ECSE appear to attract both traditional on-campus students as well as students who may be mid-career changers, discipline-specific practitioners looking for specialization, or provisionally certified teachers in special education (Knapczyk, Frey & Wall-Martenick, 2005). The development of online courses has aimed to address the needs of the latter group, either independent of or in a hybrid offering with on-campus students. The challenges for institutions of higher learning that offer these EI/ECSE online courses appear like those reported a decade earlier in the fields of nursing, business, and engineering. Instructors must aim to assure that a) the online version of training is at least equal, if not superior to any on site (campus) offering of the same content and b) the utility of ever-evolving technologies is maximized to support professional standards and instructional objectives and prompt higher levels of critical thinking and desired outcomes for students (Bullock, Gable & Mohr, 2008; Johnson, 2004).

Distance education in the United States often simulates activities of the traditional classroom. Instructors aim to replicate lectures and cooperative learning activities and ultimately, preserve the benefits of live, real-time interactions of face-to-face classrooms. Advances in technology have eased the way instructor and students can now “meet” and interact (Johnson, 2004). Current availability of web-based “online” courses provide multimedia access for students at their chosen location (home, work) and time. With asynchronous learning networks (ALN), students can distribute instruction and learning to fit their schedules (Dede, 1996), without sacrificing the attraction and strength of traditional instructor-student interactions.

Initially, the advent of distance education, and online ALNs sparked both praise and enthusiasm (Peters, 1993), but also some ambivalence from learners and instructors. It was often rationalized that face–to-face classroom instruction was a superior educational experience because of the level of interaction among students and the instructor (Noble, 2001; Pittman, 2003). A related view held that online instruction was less effective and less satisfying than traditional on-campus courses for students of a particular "learning style" (Argon, Johnson & Shahik, 2002) or age (Maushak & Ellis, 2003). However, numerous studies and reviews of the available literature related to on-campus and distance education, and online instruction, in a wide range of professional fields, have refuted most of these concerns and biases (Russell, 1999).

Clearly, there is great variability in distance education courses, and good and bad quality abound. Furthermore, each approach likely offers attractive features and advantages. Students often indicate a preference for on-campus courses, but they also indicate liking distance education for its flexibility and accessibility (Sherry, 2003). ALNs used for distance education, however, tend to show slightly better effect sizes than synchronous modes of instruction in terms of retention of students and academic achievement in several studies (Bernard et al., 2004). The process of constructing a course so content and technology complement each other may be key to improving a course and increasing the variety of positive outcomes (Russell, 1999). So, the question is no longer whether campus and distance education approaches are similar; a theory of equivalency proposes that distance education and traditional on-campus instruction should and can offer similar levels of rigor and outcomes (Bullock et al., 2008). Instead, what is needed is an understanding of the advantages ALNs can provide instructors and distance education students and how to assure those advantages.

The tendency for online courses to often have older, experienced students who are more independent, reflective, and abstract thinkers than students in on-campus courses (Argon, Johnson, & Shaik, 2002; Howland & Moore, 2002) may explain some of the reported online

advantages. What is not clear, however, is whether some aspects of a priori "styles of learning" are the reason for these students choosing or reporting satisfaction with asynchronous instruction or if the students' learning styles are influenced by this mode of instruction. Although style differences in approaches to learning do not generally affect students' academic success in most studies comparing on-campus and distance-delivered courses (Hong, 2002), Grasha and Yangarber-Hicks (2000) suggest that highly participant- and collaborative-learning styles in students lend themselves to better academic performance and course satisfaction, regardless of medium of delivery. Frederiksen, Pickett, Pelz, Shea and Swan (2002) and Swan et al. (2000) also found that students who had the highest levels of perceived learning and satisfaction in online courses, also reported the highest levels of participation and interaction with their instructor and classmates. Therefore, the question remains; can an online course necessarily prompt higher levels of participation than the same course on campus?

The amount of "reading" of text and posted discussion that is called for in online courses also could be viewed as advantageous for students. Some authorities on college teaching believe that students may learn more efficiently from reading. McKeachie (1999), for example, suggests that college instructors need not lecture when concepts are available at an appropriate level in printed form. However, he also advises that instructors must assist students in learning from print by providing questions to guide thoughtful, integrative study and understanding of course material versus mere regurgitation of facts.

Interactions and Critical Thinking

The effectiveness of distance education generally hinges on the quality of the instruction, not the technology, and communication between instructor and students has long been viewed as a critical contributor to that quality (Chickering & Ehrmann, 1996; Holmberg, 1986). It is generally accepted that online students and instructors have more demands than their on-campus peers in terms of amount of time committed (Dutton, Dutton, & Perry, 2002; Patterson, 2002), and number of instructor-student and student-student interactions (Hill, Raven, & Han,

2002). This additional "time as a resource" phenomenon in online courses (Meyer, 2003) is believed to result in higher levels of learning (Miller & Pilcher, 2001; Swan et al., 2000). Extensive data exists to support the fact that students learn more when actively engaged with their instructor, classmates, and course material (McKeachie, 1999). Constructivist forms of teaching, however, where students construct knowledge from active experiences and interactions, and not simply absorb knowledge from the instructors' talking and writing are often time consuming; students need to invest time to activities beyond reading and writing to reap educational benefits.

The available and required "time to reflect" on what was "said" by the instructor, student, or text and to respond clearly in online ALN environments has been reported as an advantage by most students and an explanation for the higher-level of critical thinking evidenced in online versus on-campus class discussions (Landis, Swain, Friehe & Coufal; 2007; Meyer, 2004; Redding & Rotzien, 2001). McCormick and Whittington (2000), however, found that differences in course content, as well as the instructors' use of non-exam type academic challenges also influenced the frequency with which students had opportunity to use higher cognitive levels of critical thinking.

EI/ECSE Fieldwork and Critical Thinking

The Professional Standards for Personnel Preparation from the Division for Early Childhood of the Council for Exceptional Children (DEC 2008) are not specific to on-campus student training; distance education programs must aim to achieve the same standards for their graduates. Programs must assure students ample opportunity to a) *Design, implement, and evaluate home and community-based programs and services* (AEC2S2), b) *Embed learning opportunities in everyday routines, relationships, activities, and places* (EC5S3) and c) *Structure social environments, using peer models and proximity, and responsive adults, to promote interactions among peers, parents, and caregivers* (EC5S4). Creating field experiences for students in natural environments as part of a course or in follow up to a completed course is

highly recommended, despite the challenges in arranging such experiences for EI/ECSE students (Chandler & Maude, 2008; McCollum & Catlett, 1997; Stayton, Miller, & Dinnebeil, 2003). The success of such experience, however, is dependent upon the quality of the placement/setting and the instructor's ability to supervise the activities, prompt reflection and provide adequate timely feedback on student-reported actions and ideas (Miller et al., 2003). Home visiting practica and case method instruction can offer students this experience (McBride & Brotherson 1997; McWilliam, 1992). Family-oriented experiences and case method instruction have been shown to facilitate application of child development and family-centered principles to real-life situations by bridging the gap from classroom and textbook to workplace (McCollum & Catlett, 1997; Munby & Hutchinson, 1998). Working with families during preservice training and having the opportunity to engage in reflection on those experiences with instructors and classmates increases the likelihood of students implementing family-centered services once they enter the EI/ECSE workforce (McCollum, Rowan, & Thorp, 1994).

Employed, distance education students are particularly attracted to these active learning experiences; they more readily link their education to their job and the applied activities with longer utterances than do traditional students in face-to-face classrooms (Harsh & Sohail, 2002). Furthermore, practica or case method discussions have reportedly spurred higher levels of critical thinking among students when engaged online when compared to their discussions of similar experiences in traditional on-campus settings (Heckman & Annabi, 2005). Students and instructors engaged actively in dialogue and exploration of real and hypothesized events, regardless of mode of interaction (synchronous or asynchronous) are believed to be capable of high levels of critical thinking, and subsequently enhanced knowledge and learning outcomes for students.

Assessing Critical Thinking

Higher-order critical thinking is believed to be an index of learning and future application of new information (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The challenges of

prompting and supporting higher-level critical thinking are unique in web-based courses where traditional face-to-face dialogue is not used, and asynchronous discussions stretch over many days.

Although many systems have been promoted for evaluation of online discourse (Landis et al., 2007; Marra, 2006; Meyer, 2004), Bloom's taxonomy (Bloom et. al., 1956) is the most well known for assessing the critical thinking or "cognitive complexity" of any instruction. Bloom's levels of cognitive challenge are often explained in the form of sample questions that an instructor might use to challenge that level of knowledge/skill (McDaniel, 1979); but they have also been explained with descriptors that apply equally to problem tasks, requested action and the complexity of written statements or presentations (McCormick & Whittington, 2000). Recent reviews of Bloom's work and subsequent applications have suggested six levels to include Level I: Knowledge (recall or recognition of information), Level 2: Comprehension (paraphrase, compare, classify by category), Level 3: Application (use information), Level 4: Analysis (dissect, recognize bias, discern relevant from irrelevant), Level 5: Evaluation (judge) and Level 6: Creativity (hypothesize, design, invent) (Anderson et al., 2001).

It is hypothesized that graduate students enrolled in a preservice early intervention course focused on infant-family interventions would be capable of critical thinking at the Application as well as Analyses/Evaluation levels if the course were paired with a home-visiting practicum. Such a training package is intended to prepare the students for transfer of knowledge to the entry-level workforce in early intervention by engaging them in critical thinking that goes beyond the recall of terms and concepts.

To-date, much of the evaluation of synchronous and asynchronous modes of instruction has been limited to reports of course grades and consumer satisfaction to support a" no difference" belief. The present study goes further by exploring similarities and advantages associated with an on-campus and online offering of a graduate-level course that focuses on

infants with disabilities and a home-visiting practicum and that enrolls both traditional and non-traditional students. The study examines a) the possible influence of learning styles and home-visiting practica on course outcomes and b) the levels of critical thinking evidenced in instructor and student contributions to class discussions in the on-campus and online courses.

Methods

Participants

A total of 15 students and one instructor participated as subjects for this study. Seventeen graduate students, enrolled in two offerings of the same course, were invited to participate. All seven students enrolled in the spring term, 15-week, on-campus section agreed to participate, while eight of the ten students from the summer, 8-week offering of the same course online agreed to participate. Students were not assigned to one course over another; each student freely chose to register for the spring on-campus course or summer online offering.

On-campus students. Six of the seven female, on-campus students were EI/ECSE majors (n = 6) working toward completion of a master's degree and state teaching certification to teach children with disabilities, birth to age 5; one student was pursing continuing education credits. Six students had professional experience working as an educator with infants and toddlers with disabilities prior to this course. Three students were currently employed as early interventionists while three others were employed full time as teachers of preschool-age or primary level children with disabilities; one student was unemployed. Four students traveled 60 miles to attend class on campus; the others drove less than 5 miles. All but one student were experienced users of the university's web-based *Blackboard Learning System*, having completed at least one prior course using this technology. These students ranged in age from 23 to 35+, with five under 30 years of age.

Online students. Seven of the eight female students who enrolled in the summer online version of the course had experience with young children with disabilities; five were EI/ECSE

majors pursuing master's degrees and were currently employed in programs with infants and toddlers with disabilities. The remaining students worked with young children with disabilities as a psychologist, occupational therapist, or speech pathologist. One was a doctoral student in psychology and three were non-degree students. The students lived an average of 111 miles from the campus; two lived within 5 miles of campus while others lived from 35 to 323 miles away. Only two students had experience with the university's web-based courses and the *Blackboard Learning System*; five had participated previously in interactive distance education courses using video-conferencing systems. These students ranged in age from 22 to 35+ years with seven over the age of 31.

Instructor. The instructor for both course offerings was a full-time faculty member in the university's Department of Special Education and the academic advisor for all EI/ECSE majors (degree and non-degree). She had 15 years experience as an early interventionist working with infants and toddlers in family homes and had supervised dozens of students in similar practicum contexts. Finally, she had taught this course previously ten times and had four years experience teaching EI/ECSE courses online. The technologies used in this study were not new for the instructor.

Course Description

The graduate level, 3 credit hour methods course was titled *Programs for Infants with Disabilities* and was designed to address both the recommended practices of the Council for Exceptional Children's Division for Early Childhood (Sandall, Hemmeter, Smith, & McLean, 2005) as well as national and state-suggested professional standards for early childhood special education (DEC 2008; Nebraska Department of Education, 2006). Specific course learning objectives included: a) understanding of typical and atypical development and inter-relatedness of developmental domains in children birth to age 3 with disabilities, b) demonstration of home visiting principles with children and family members, c) demonstration of assessment-based

program planning, and d) demonstration of ability to deliver developmentally appropriate practices in natural environments.

Course requirements. Students were required to complete course assignments with a family and child in an approved practicum in their local community. These field experiences were arranged for unemployed students or students not currently working with infants and toddlers with disabilities. The instructor contacted regional, parent-support organizations and directors/supervisors of early intervention programs to identify appropriate and interested families to partner with students. Families with a child under age 3 years who were currently receiving service associated with an Individualized Family Service Plans (IFSP) were invited to participate as "co-instructors" and onsite supervisors for these university students. The instructor used phone interviews to screen all recommended families for appropriate expectations, understanding of responsibilities, available schedules, and travel distance for the students. Selected families were mailed a description of the course and practicum expectations. They returned a signed university agreement acknowledging their role and understanding that students would be coming to their home to interact with them and their child, without the accompaniment of an on-site university supervisor. Families were provided an (unannounced) honorarium at the end of the semester for their cooperative efforts.

Employed students could focus on a child and family from their current early intervention caseload, given their supervisor's approval and family agreement. These families also received a letter from the instructor explaining the field experience requirements for the student and the fact that visits associated with practicum assignments would not replace visits or distract from agendas already scheduled as part of their IFSP services.

Students completed six to ten weekly visits in the family home while enrolled in the course; visits lasted generally 60-75 minutes in length. Most employed early interventionists arranged for two to three additional visits to their already scheduled appointments with families.

Students were also required to complete four applied assignments and a comprehensive final examination. The applied assignments included 1) an *Assessment Report* of their child's and family's strengths and needs, 2) two or more *Home Visit Self-Reflections*, 3) two or more *Home Visit Plans*, and 4) a *Final Progress Report* reflecting the process and growth noted in the child, family, and student over the course of the home visits. Students in both courses took the *Final Exam* online.

Students in both versions of the course were provided with weekly classnotes, video clips and handouts through the web-based course organizer, *Blackboard Learning System* (version 5.0). At a minimum, students were required to have Windows 95 (or later) or OS 8.6 (or later) systems, an Internet service provider, and an email account. All students were directed to access free-download software for viewing video clips (*QuickTime*) and portable-document-formats (.pdf; *Acrobat Reader*); students without current email accounts were provided accounts free through the university. The *Blackboard Learning System* provided a format for text-based lecture/classnotes, a system of threaded asynchronous discussions, document sharing, email exchanges, access to multimedia learning materials, online examinations, and an online gradebook. All students could order textbooks and reading packets via the phone and have them mailed to their home from the University Bookstore, regardless of which section of the course they were enrolled. An 800 toll-free number was available to all students for contacting the instructor between campus sessions or in lieu of online communications.

On-campus course. The on-campus course met weekly over 15 weeks for 3 hours each week. The class met in a computer-lab classroom so that web-based video clips and diagrams/handouts contained in the electronic (*Blackboard*) classnotes could be viewed during scheduled class time. Students were encouraged to complete the weekly assigned readings and review and print the web-based classnotes prior to attending class. The weekly class time was used to engage in small group activities prompted in the classnotes and full group

discussions/elaborations of the classnotes, readings and weekly home visiting experiences. Students could submit assignments electronically or in hard copy when they arrived at class.

Online course. All interactions with the instructor and classmates were conducted online asynchronously for students enrolled in the 8-week summer distance education course. Students were expected to read classnotes weekly, independently review video clips and handouts associated with the classnotes, engage in posted discussions and activities, discuss weekly readings, and share home visit experiences, all through the asynchronous *Blackboard Learning System*. Students submitted all assignments electronically. The instructor made personal contacts (email or phone) with each student at least twice during the term. The group met twice via a phone conferencing system in the second week and final week of the 8-week summer course to provide real-time opportunity for a course orientation and case study presentations.

Data Collection and Analyses

Eight dependent variables were assessed to compare the effects of the two modes of instruction. The sequence and time frame for collection of data were identical in both courses, in that data were collected at the same point in the course (i.e., first week, 4th topic). During the first night of class the on-campus students were handed hard copies of the *Learning Style* and *Computer Literacy Surveys,* and *Demographic Form* before leaving the classroom and asked to return them at the next class session. Online students were mailed these surveys and forms during the first week of the course and provided a self-addressed stamped envelope for returning them when completed. At appropriate points in the term, students completed the *Time Commitment Log* for a two-week/topic period (mid term), and the *Course Evaluation* (final week) to report student perceptions of ease in accessing the instructor and overall course satisfaction. Assigned grades on completed assignments and exams and the discourse and cognitive complexity patterns of discussions between instructor and students were reviewed after the two courses were completed. Simple t-tests and non-parametric statistics (Chi-square, Mann-

Whitney U) were used to analyze the on-campus and online student and instructor data. Correlations (Spearman's rho coefficient) were computed to explore the relationship between the students' levels of cognitive complexity in class discussions with demographic variables, time commitments, and final grades; Fisher's z tests were used to compare correlations for significance of difference ($z > 1.96$)

Learning style profiles. Students were asked to indicate on paper where along a four-point scale they felt they fell for 14 items describing their typical learning behaviors (i.e., talking and acting vs. listening and reacting) and 14 items describing their learning traits (i.e., intuitive, and emotional vs. logical and intellectual) (adaptation of the *Learning Style Inventory* by Kolb, 1984). The items reflected varying degrees of feeling, thinking, doing, and watching. Students' ratings were used to categorize them into one of four cells reflecting these learning qualities; these included the: *Enthusiastic Learner* (feeling doer), *Imaginative Learner* (feeling watcher), *Practical Learner* (thinking doer), and *Logical Learner* (thinking watcher). The two courses were compared for the diversity of learning styles evident in each course and the frequency of any one style among the students enrolled.

Computer literacy. Students completed a one-page survey (19 items) exploring their interests and experiences with computers and computer-based programs/activities. Items were written as short positive statements. Students indicated on a 5-point scale the degree to which they felt each item was "Not at all like me" (1) or "Exactly like me" (5). Sample items included "*I visit computer stores" … "I subscribe to listservs" …. "I play video games" …. "I prefer word processing over handwriting" …. "I regularly use the internet to find information" …*. An overall computer literacy score was calculated for each student and mean rating was computed per item per class.

Time commitments. Students were asked to keep a time log for any two-week period in the course, after they had begun making home visits. Students were to record time spent (in minutes) on a form provided to them that listed 10 tasks associated with the course. These

included reading assigned classnotes, articles and textbook chapters, posting and reading online reactions to assigned readings, working on projects/assignments, making home visits, planning/reflecting on home visits, in-class time, online discussions with instructor and classmates, and private discussions with instructor or with classmates. Since the online students were completing the same content as on-campus students at twice the rate (8 weeks vs. 15 weeks), the data from their time sheets for the 2-week period were adjusted by dividing totals for each item by two to reflect time commitments for a similar amount of course content and assignments as the on-campus students. The mean time commitments reported by the two groups of students for these various activities were compared.

Student satisfaction/perceptions. All students were asked at the end of the term to complete an online survey and rate various components of the course including the instructor, readings, assignments, and activities. The 5-point rating scale reflected a continuum of excellence (excellent/unacceptable) or satisfaction (very satisfied/very unsatisfied). Items were summarized with a mean rating per item and the mean ratings for the on-campus and online courses were compared.

In addition, two participants from each course were randomly selected and invited to provide personal perceptions of the course through a phone interview. All interviews were recorded with the students' knowledge. The second author conducted all interviews using open-ended questions to pursue understanding of students' expectations for the course, most satisfying activities, self-assessment of learning and their perceptions on how the materials, instructor and interactions with classmates influenced their learning. Quotes from these interviews are used to explain quantitative data collected in the study.

Grades. The final course grades assigned to each student were compared across the two groups using non-parametric statistics. A numerical value was assigned to each grade on an 8-point system (includes +/- grades) to compare the two groups' grades statistically. In

addition to the final grade, comparisons were made for the grades assigned for the online *Final Exam* and individual assignments.

Student–Instructor Discussions

The quality of instructor-student discussions in the on-campus or online courses was analyzed for two topics at mid semester in each course. The frequency and percentage of all contributions were calculated for both instructor's and student-initiated interactions, responses, questions, answers, and explanations/comments. Furthermore, all instructor and student speaking turns in these class discussions were coded for the level of critical thinking (cognitive complexity) reflected in each contribution.

In the on-campus course, two class sessions (3 hours each) were audio-taped and the interactions between on-campus students and the instructor were transcribed verbatim, identifying speakers only as "instructor" or "student". In the online course, the asynchronous web postings related to the same course topics (two) that were audio-taped on-campus were printed to capture the online students' interactions with the instructor. Both sets of data were used for coding the quality and complexity of student-instructor discussions on the same learning objectives/topics. These included discussions about the on-line classnotes and video clips, assigned readings and students' home visit experiences.

The unit of analysis was a speaker's contribution on a topic, defined as a subject maintained over one or more utterances. Student and instructor contributions varied in length from one word (e.g., "Yes") or one sentence, to multiple sentences/statements before a new topic was introduced or a new speaker took a turn. A speaker could have one or more topics per speaking turn.

A trained graduate assistant transcribed audiotapes for the 2 weeks of on-campus discussions. Twenty-five percent of the audio-taped transcripts were transcribed a second time by the first author. Inter-transcriber agreement was 98.6%; disagreements were discussed and corrected before data were analyzed.

For the online course, the *Blackboard* threaded discussion board provided a permanent record of the student-instructor discussions. The discussion board identifies each speaker by name and notes the date and time of each student/instructor online posting. Generally, these individual postings were considered a speaker's contribution or "turn" and the unit of analysis. However, if a clear shift in topic was evident within a posting, using a paragraph break or explicit vocabulary shift, then a single posting (turn) would be divided into two or more units for purposes of coding.

Transcripts and online postings were first reviewed for administrative and instructional content. Only content coded as relevant to instructional objectives were used for this study; references to administrative aspects of the course (i.e., procedures for submitting assignments) were excluded. Each unit of analyses related to instructional objectives received four codes noting the 1) identification of the speaker/session, as well as the 2) function (initiation or response), 3) format (question, answer, or comment), and 4) the number of topics per speaking turn. Appendix A provided definitions for these discourse codes. The average number of turns per speaker was also calculated since some students contributed more often than other students, and speakers could address one topic or shift topics multiple times before ending their post (online) or abdicating the speaking role to another speaker (on-campus).

The cognitive complexity of each recorded unit was also analyzed, using a four-level adaptation of Bloom's Taxonomy of critical thinking (Anderson et al., 2001; Bloom et al 1956); two of the authors' suggested levels of complexity were combined for sake of inter-rater reliability. These included Level I: Knowledge/Comprehension, Level II: Application, Level III: Analyses/Evaluation, and Level IV: Creation/Syntheses. Each unit of analysis was coded for the highest level of critical thinking evident in the speaker's contribution. Appendix A contains definitions used for each of these four levels of critical thinking.

Reliability of all coding was established after the first author coded 50% of all units coded by a trained research assistant. Comparisons were made for agreement/disagreement of

assigned codes per unit. Mean agreements for the discourse codes were 93.5% (on-campus sessions) and 92.6% (online sessions). The reliability of coding for each unit's level of critical thinking was 91% for both the on-campus and online data. Following the independent coding, identified differences in assigned codes were discussed with a third person familiar with the study and the code definitions, to establish a consensus for the most appropriate code to assign. Appendix A provides a listing of the inter-rater agreements for each code.

Simple statistics were used to compute the total number of units generated from the on-campus and online sessions and the frequency of each code used. These frequencies were compared across categories and between the two course offerings. Correlations were calculated to analyze the relationship between these dependent variables and their relationship with demographic information, time commitments and academic outcomes within and across the two groups of students.

Results

Overall, the students in the two courses did not differ dramatically on the key variables of demographics, learning styles, time commitments, grades, and course satisfaction. The most notable differences were in their discussion patterns and levels of critical thinking.

Demographics

There were no significant differences between the two groups of students for five demographic variables. Most of the students were majors in the EI/ECSE master's degree program with current or recent experience working with infants with disabilities and were similar in age, despite a slightly older group of students enrolled in the online course (p = .11). Both groups reported a basic familiarity with computers and Internet access and had similarly low mean computer literacy scores of 1.8 (on-campus) and 2.3 (online) on a 5-point scale.

Learning styles. There were no statistical differences between thinking and feeling learning styles or doing versus watching styles for the online and on-campus groups of students. Imaginative learners (Kolb's feeling/watching) were, however, slightly less common in

the on-campus than online course (two vs. five students respectively) and there was a high positive relationship between the on-campus students' learning style profiles and the number of speaking turns (+ .76) and responses (+ .77) they used in class discussions. A more balanced ratio of on-campus to online students was observed for the other learning styles; Enthusiastic Learners (feeling/doing; 1:1), Practical Learners (thinking/doing; 1:2), and Logical Learners (thinking/watching; 2:0).

Time logs. The on-campus group committed time driving to/from campus each week (1.4 hours/week round trip average) ($p < .005$) and sitting in the 3-hour class session each week ($p < .05$) that the online students were spared. The online students, in contrast, invested their time (average 1.35 hrs/week) in reading the online class notes weekly ($p < .05$). Table 1 shows the similar time commitments reported by the two groups of students for the other class-associated tasks over a two-week period. Overall, both groups of students expended an average of 2+ hours/week on reading articles and textbook chapters, 2.5 to 3 hours/week completing course projects/assignments, and 1 to 2 hours/week home visiting and planning and reflecting on these practicum visits. The online students reported an average of .85 hours/week engaged in online discussions.

All the time data listed in Table 1 reflect an adjustment in the reported time commitments for the online students who were taking the accelerated course over 8 weeks (reported time divided by 2); true time commitments for the two-week reporting periods were significantly different between the two groups for most tasks. Despite the aim for once weekly home visits, *many of the online students in the summer session made two to five home visits in a 2-week period compared to most of their on-campus peers who made only one visit weekly in a comparable time. Some of the online students were employed as early interventionists and had reason to visit the family more often; on-campus students were generally not employed as early interventionists and had the liberty of skipping a week and still meeting timelines for class assignments.*

Table 1. Student time commitments in hours per 2-week period

Commitments:	On-campus n =7	Online [a] n = 8
On-campus class time	6.0[*]	.3
Driving to campus	2.8[**]	.8
Online reading of class notes	1.2	2.7[**]
Online activities/discussions	.5	1.7
Reading articles/chapters	4.8	4.3
Discussion of readings	1.8	3.1
Completing class projects/assignments	5.2	5.9
Home visiting with infant	2.2	2.1
Planning/reflecting on home visits	1.5	2.0
Out of class discussions with classmates	1.1	.3
Out of class discussions with instructor	.04	.3

[a] reflects adjusted time commitments (original time reported/2)

[*] $p < .005$

[**] $p < .05$

Course Outcomes

Student satisfaction. Students in the two courses reported comparable satisfaction with the course and the instructor. The students in both classes rated the effective use of class time, presentation of course materials, advancement of own skills and knowledge and instructor's interest, fairness, and knowledge at 4.25 or higher on the 5-point scale. The on-campus and online students rated the course overall a 4.4 and 4.1, respectively. The online students, however, rated the value of discussion of readings significantly higher at 4.25, while the on-campus group rated this activity 3.2 (p = .02). Conversely, it was the on-campus group of students who rated higher their ability to self-evaluate their own effectiveness in home visits; their mean of 4.7 was statistically higher than the 4.25 mean rating from the online students. (p = .02).

Grades. The on-campus group had a mean Final course grade of 3.3 (B+) and the online group a mean of 3.4 (B+) on a 4.0 grade scale. Statistical differences were noted only for one individual assignment; the online group earned higher mean number of points (maximum = 50 points) for the discussion of assigned readings (42 points) than the on-campus group (33 points) (*p* = .03). The two groups were within one to three mean points of one another on all other assignments and differed by only four mean percentage points on the *Final Exam* (83% on-campus vs. 79% online).

Student-Instructor Discussion Patterns

How the students and instructor used their time "in class", whether on-campus or online, was statistically different for the two classes. The focus of each speaker's contribution was coded for a total of 1202 "instructional" speaking units (< 6% administrative) for the on-campus course. Conversely, only 359 total speaking units were instructional in nature (< 3% administrative) and available for coding the online course discussions of comparable course content. The percent of administrative talk was significantly higher in the on-campus course (X^2 = 691.09 (1), *p* = .000). On-campus, the instructor dominated the discussions with significantly

more contributions than students (X^2 = 14.76 (1), p = .000), while the contributions from the students and instructor were similar in number in the online course. Table 2 summarizes the discourse qualities related to students' and instructor's speaking units in each course.

Table 2: Summary of student and instructor discussion discourse patterns on-campus and online

	Students		Instructor	
	On-campus	Online	On-campus	Online
Total Talk (units coded)	495*	189	707*	170
Mean # units/student	71	27	-	-
Total No. of Speaker Turns	478	136	413	96
Mean turn length (*SD*)	1.1 (*.3*)	1.8* (*1.1*)	3.0 (*2.4*)	2.6 (*2.0*)
Range of units/turn	1-3	1-6	1-9	1-9
% Initiations	14.5	21.6*	53.7*	34.7
% Responses	85.5	78.4	46.3	65.3*
% Questions	8.7	24.2*	37.1	31.7
% Answers	46.4	48.9	2.6	12.0*
% Comments	45*	26.8	60.4	56.3

* $p < .04$

Speaking turns. There was significantly more "talk" from students and the instructor during the on-campus class discussions than during the online class. The seven on-campus students had 478 speaking turns compared to 136 speaking turns from the eight online students (z = -12.65, p = .000). In both courses, there was significant variance in how much any one student contributed to those discussions. The number of speaking turns ranged from 29 to135 from the on-campus students and 8 to 60 speaking turns for the online students, over the same topical content. No one student in either course, however, dominated the discussions; rather it was more common that one or two students contributed very little and infrequently.

The online students were more efficient with each speaking turn than their on-campus colleagues, using a mean of 1.8 units (topics) per turn compared to the on-campus students' 1.1 units (topics) per turn (X^2 = 378.76 (1), p = .000). The online students shifted topics up to six times in a single posting (turn), thereby maximizing their time and access to the instructor and classmates; 46% of their posted "talk' consisted of multiple topics (units). The on-campus students seldom elaborated when they had the floor; only 6% of all their contributions to class discussions were speaking turns with multiple topics or shifts.

The instructor's contributions to class discussions were similarly more evident on-campus; 413 speaking turns were noted for the instructor on-campus compared to 96 online. The instructor was balanced, however, in terms of units per speaking turn, using 2.3 units/turn on-campus and 2.6 units/turn in the asynchronous online discussions.

Speakers' function and form. Over one-half of the instructor's speaking turns in both courses were primarily comments or statements, followed by questions and answers. The instructor dominated the discussions in the on-campus course, however; the instructor initiated significantly more topics with the students on-campus than in the online course (X^2 = 20.17 (1), p = .000). Although the instructor showed a similar pattern in her use of questions and comments in both courses, she used significantly more answers and responses with online

students (X^2 = 29.65 (1), *p* = .000) than with the on-campus group of students. Table 2 summarizes the contributions of students and instructors in both courses.

Not surprising, over three-fourths of the contributions to class discussions by students in both courses were in the form of responses; answers surpassed the use of questions in both groups. However, the online students initiated significantly more discussions (X^2 = 4.37 (1), *p* = .03), and used significantly more questions than the on-campus students (X^2 = 30.54 (1), *p* = .000). The on-campus students were more likely to comment or explain than raise new questions for discussion.

Cognitive Complexity of Class Discussions

The students in the online course contributed a significantly greater percentage of speaking turns at the higher-levels of critical thinking (levels III & IV) than the on-campus students (X^2 = 64.98 (3), *p* = .000). Table 3 shows the percentage of speaking turns each group of students contributed to class discussions at the Analyses/Evaluation and Creation/Synthesis levels. Over 72% of all student contributions to class discussions in the online course were at these higher levels. The on-campus students in contrast, despite the greater number of speaking turns in class discussions, contributed a significantly higher percentage of turns at the lowest level of cognitive complexity (level I) than the online students with over 50% of the on-campus students' speaking turns reflecting critical thinking at the Knowledge/Comprehension and Application levels in this course. There were no statistical differences among the students in each course for the use of critical thinking at various levels and no differences between EI/ECSE majors and non-majors enrolled in the courses.

Unlike the students, the instructor did not show a statistical difference in cognitive complexity between the two courses. The largest percentage of instructor speaking turns (over 50%) were coded at the Analysis/Evaluation level (level III) in both courses; the smallest percentage of instructor contributions to class discussions reflected critical thinking at the level of Creation/Synthesis (level IV).

Table 3*: Percent of Student and Instructor Contributions to Class Discussion at Four Levels of Cognitive Complexity (critical thinking)*

	Students		Instructor	
Critical Thinking Levels	On-campus	Online	On-campus	Online
Level- I Knowledge/Comprehension	41.8%*	10%	28.3%	13.1%
Level–II Application	13.3%	17.4%	17.8%	19.0%
Level-III Analysis/Evaluation	43.2%	68.4%*	52.3%	65.5%
Level-IV Creation/Synthesis	1.6%	4.2%*	1.6%	2.4%

* $p < .001$

Despite the significant differences at three of the four levels of critical thinking, the students in both courses had similar profiles. In addition, there appeared to be a similar profile for the instructor in each course as to the percent of speaking turns at the various levels of cognitive complexity. However, the match between instructor and students was tighter for the online course; there were no significant differences in the percent of speaking turns at each level of cognitive complexity between the students and instructor. Whereas both the instructor and students in the on-campus course offered more contributions to discussions that focused on Knowledge/Comprehension (level I), the students on-campus used significantly more turns at this level than their instructor. The instructor on-campus contributed a significantly higher percentage of speaking turns that reflected critical thinking at a level of Analyses/Evaluation (level III) than did the students in this course (X^2 = 17.36 (3), p = .001).

Relationship with student demographics and course outcomes. Overall, there were mostly low-to-moderate, non-significant correlations between the students' level of critical

thinking in class discussions and their demographic qualities and course grades. There was some relationship between the students' computer literacy scores and their level of critical thinking; a high-positive, non-significant correlation (r = + .73) was noted for the on-campus group and a high negative, but significant correlation (r = - .77, p = .025) was noted for the online group (Fisher's z = -2.67). In addition, the grades assigned to the online students for their Home Visit Self Reflections were significantly correlated with the cognitive complexity of their class discussions (r = + .91, p = .011). The online students' level of critical thinking during class discussions was also highly correlated (r = + .71) with their final grades, although this relationship was not statistically significant.

Low, but significant correlations were identified for both the students' and instructor's level of critical thinking in class discussions and their discourse qualities (see Table 4). In the online course, the students' number of speaking turns in class discussions were significantly, albeit minimally, related to their level of critical thinking (r = + .16, p = .03) and significantly more so than for the on-campus students (z = 1.27). Conversely, the online instructor's number of speaking turns was negatively but significantly correlated to her level of critical thinking in class discussions with the students (r = -.31, p = .000); the fewer turns taken, the higher the instructor's critical thinking levels. This was not true in the on-campus course (z = -5.95). Finally, the percent of answers online students gave during class discussions was also negatively and significantly correlated to their levels of critical thinking (r = -.15, p = .035); the fewer answers given, the higher the students' level of critical thinking. Again, this pattern was not true for the on-campus students (z = -2.05).

In the on-campus course, the cognitive complexity of the instructor's contributions to class discussions appeared positively and significantly related to the number of initiations and

Table 4: Selected Correlations for Student and Instructor discourse patterns.

	Initiations	Responses	Questions	Answers	Comments	Turns
Learning Profiles						
On-campus	.46	.77*	.66	.62	.75	.76*
Online	.59	.31	.50	.50	.29	.45
Cognitive Complexity						
Students						
On-campus	.11*	-.11*	-.07	.02	.02	.05
Online	.14	-.14	.08	-.15*	.10*	.16*
Instructor						
On-campus	.15*	-.15*	-.19*	-.05*	.20*	.19*
Online	.14	-.14	.09	.04	.06	-.31*

* $p < .05$

comments she made but negatively correlated to the number of responses and questions she used. The students in this face-to-face class showed inverse relationships between the levels of critical thinking reflected in their class discussions and the number of initiations they used (r = + .112) and their use of responses (r = - .112) (p = .013). The lower the levels of critical thinking, the more likely the on-campus students' contributions were an initiation; the higher the critical thinking level, the more likely a contribution was a response.

Discussion

The theory of equivalency (Bullock, Gable & Mohr, 2008) would appear to be generally supported in the current study. Given similar groups of students in terms of age, academic major, learning styles and computer literacy, the online and on-campus courses required comparable rigor in the form of time commitments from students and offered similar final outcomes in terms of grades and course satisfaction. The difference in the reported time committed to online reading (e.g., classnotes, reading discussions) may explain the online students' greater satisfaction with the discussions related to class readings and their higher grades for this assignment. In addition, the on-campus students' higher rating of confidence in being able to self-evaluate their home visit effectiveness could also be due to the extended time (15 weeks vs. 8 weeks), over which they had to reflect on their efforts. An investment of time equates to valued time for both these findings if the "time as a resource" phenomenon is true (Meyer, 2003). The added time investment, however, in the current study did not pay-off with greater academic benefit for the online students in terms of grades for other assignments, the *Final Exam*, nor the final course grade. The single instructor for both courses, however, may play a role in explaining this similarity in grading across courses; rubrics for "acceptable" performance on narrative assignments may have been too broad and flexible and students did not vary enough for the instructor to grade differentially. The use of the same objective *Final*

Exam however does allow for one check of unbiased evaluation, and the students performed comparably in the two courses on this assessment.

The practicum requirement in both courses appears to have confirmed the suggestion by Heckman and Annabi (2005), that case study discussions can prompt critical thinking at levels higher than simple knowledge and comprehension of facts and concepts. The students in both courses engaged in discussions at the Application level or higher for more than 50% of their speaking turns. The instructor in both courses as well contributed to these higher levels of critical thinking with over 70% of her initiations or responses. The predominance of critical thinking at the level of Analysis/Evaluation in both courses, by students and instructor, suggests that references to practicum experiences did not limit class discussions to only case reports of strategy applications. More likely, the students' various experiences provided fodder for fueling consideration of key concepts and strategies introduced in the course by allowing for reflection on relevant and irrelevant applications across the various students' home visit situations, children, and families. Although the use of a single case example for all students to refer discuss can provide a useful focus for demonstrating application of select strategies and concepts (McWilliam, 1992), the diversity of multiple case examples likely provided the students and the instructor in the current study added opportunity to justify one application over another and repeatedly dissect and evaluate the reported practices of students in uniquely different situations. Furthermore, the evidence of critical thinking at the level of Creativity (level IV) in both courses, albeit limited, would suggest that students and the instructor had some opportunity to engage in or witness exchanges that led to designing, inventing and/or hypothesizing possible applications, which would move some students beyond their own practicum situation.

The online course, however, did appear to prompt more discussion among students at the higher levels of critical thinking than the on-campus course. Critical thinking at levels of Analysis/Evaluation and Creativity/Synthesis were significantly more evident among students

online. In contrast, the on-campus students contributed to discussions at the lowest levels of critical thinking at four times the rate of online students, despite comparable instructor contributions in both courses at higher levels. The instructor aimed to initiate and respond to students in both courses at levels that would encourage higher levels of thinking and that reflected the objectives of the course. Students on-campus, however, did not always respond; accordingly, the frequency of low-level contributions focused on immediate recall and possibly the need for clarification of terms and examples, along with their failure to frequently initiate or elaborate with higher level expansions may have prompted the need for more speaking turns by the instructor (and classmates) to achieve the same academic understanding. The correlations between student initiations and critical thinking levels would suggest that students on-campus were either dependent upon the instructor to facilitate most of their advanced thinking or limited by the instructor's dominating role. The instructor on-campus spent most of her class time in a traditional role of lecturer, informant, or evaluator; over half her speaking turns were initiations and only 2% were used to answer students' questions; further analyses of the data would be needed to explore the content and critical thinking levels of those few student questions.

In contrast, the online instructor spent more than half her speaking turns responding to student-initiated discussions and six times more speaking turns answering questions than in the on-campus course. The correlations between student turns and critical thinking for online students suggest that the higher levels of critical thinking may have been related to the students' active engagement in online discussions evidenced by the longer and more elaborated speaking turns. However, this relationship cannot be considered causal since the higher order thinking may have necessitated students' longer and more complex contributions, thus engaging the students more.

The online delivery of this early intervention course offered students a more equitable relationship with the instructor and each other. Energies were directed toward content understanding and analyses instead of role identities; it did not matter who raised the question

or who answered it. As reported by Harsh and Sohail (2002), the online students had speaking turns that were significantly longer than those provided by on-campus students. These extended contributions from students likely played a significant role in helping classmates understand the application of course content, since the instructor talk time online was proportionally less than was witnessed in the on-campus course and yet course grades and student satisfaction were not notably different for the two groups of students.

However, it is not clear from the current data analyzed whether the online students prompted the instructor or vice versa in terms of challenging critical thinking. Future research is needed to explore the role the instructor plays specifically in fostering productive online discussions at various levels of cognitive complexity. A review of the online students' and instructor's questions, comments, initiations, and responses, sorted by lower and higher levels of critical thinking, as well as the number of speaking turns collectively needed to achieve higher levels of critical thinking per topic might reveal the efforts needed to maximize learning in this ALN format. This mode of course delivery appears to maximize the students' abilities and preferences for active learning approaches since the students online initiated discussions at rates comparable to the instructor. Further analyses would be needed to examine whether these student initiations were at the higher or lower levels of critical thinking before conclusions can be made about the influence the ALN format itself has on the students. Finally, further study is needed to understand the role a practicum plays in enhancing course discussions and learning outcomes for EI/ECSE students and content; the current study did not offer a no-practicum condition that could be used as a comparison of student outcomes and discussions for the online and on-campus courses.

Until then, the use of online instruction for graduate-level EI/ECSE preservice education is encouraged. Clearly the possibility exists that ALNs are comparable to on-campus face-to-face instruction and may even excel in efficiently meeting the needs of non-traditional students who otherwise would not be able to secure needed education for entering the field and reducing

the shortages of trained qualified personnel in EI/ECSE programs. The success of such efforts, however, would appear to be dependent upon how the instructor develops the course and facilitates and responds to the students' interactions/discussions.

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Appendix A:

Discourse and Cognitive Complexity Code Definitions

Code	Definition	Coding Reliability	
		On-campus	Online
Focus	1 = administrative topic related to course mechanics (assignments, due dates, grading, etc.) 2 = statement/question related to instructional content/objectives	80%	100%
Location	1 = on-campus 2 = online	100%	100%
Speaker	1 = Instructor 2 = Student	100%	99%
Topics per Turn	1 = single topic/turn 2 = two topics/turn ….9 = nine or more topics/turn	97%	80%
Function	1 = Initiation 2 = Response	88%	88%
Format	1 = Comment/elaboration/ explanation of concepts or terms 2 = Question (direct or indirect) 3 = Answer to a posed question	90%	82%
Critical Thinking Level	I = *Knowledge/Comprehension* statement of facts or recall of recent memory II = *Application* use of knowledge in novel situation III = *Analyze/Evaluate* explain/justify, discuss parts, judge, detect cause/effect or pros/cons, deduce IV = *Creativity/Syntheses* construct, compose, design; anticipate/predict	91%	91%