Analysis of ill-structured problem solving, mentoring functions, and perceptions of practicum teachers and mentors toward online mentoring in a field-based practicum

KHE FOON HEW[1],* & DENNIS KNAPCZYK[2]
[1]*Department of Instructional Systems Technology, Indiana University, Bloomington, W.W. Wright Education Building, 201 North Rose Avenue, Bloomington, IN, 47405, USA;* [2]*Department of Curriculum and Instruction, Indiana University, Bloomington, Bloomington, IN, USA*
*(*Author for correspondence, e-mail: khew@indiana.edu or timhkf@yahoo.com)*

Abstract. This article describes an exploratory study of question prompts and online mentoring (specifically a lateral or peer mentoring experience) in a field-based practicum that focused on teaching ill-structured problem solving of classroom discipline. Data were gathered on 26 in-service practicum teachers through online observations, online journal reports, questionnaires, and reflection logs. Results showed that the practicum teachers were successful in using the approach to plan and implement effective interventions for their students and that they perceived the online mentoring approach as being very beneficial in supporting their learning. A more detail analysis of seven practicum teachers and their mentors indicated that their mentors engaged in eight types of online mentoring functions; the most frequently used were asking practicum teachers to elaborate, and valuing the practicum teachers' contributions. The influence of the mentoring functions on the seven practicum teachers' ill-structured problem solving is also discussed. The study offers evidence that asynchronous online mentoring and question prompts can enhance the professional development of both practicum teachers and mentors by helping them learn about and apply intervention strategies in solving real-world teaching problems.

Keywords: Online mentoring, question prompts, problem solving, teacher practicum

Introduction

Ill-structured problems are complex, poorly defined and open-ended. The goals associated with solving these problems can change from circumstance to circumstance and they are often vague or unstated (Voss, 1988; Voss & Post, 1988). Ill-structured problems may have multiple solutions or no solution at all, and may possess multiple criteria for evaluating their outcome (Kitchner, 1983). Oftentimes, there is uncertainty about the concepts, rules, and principles for

generating their solution and about the way to organize and apply these elements (Shin et al., 2003). They usually require learners to express personal opinions and beliefs about the issues involved and to make judgments about solution paths and outcomes (Jonassen, 1997; Meacham & Emont, 1989). Unlike well-defined problems, such as those that have single solutions, optimal solution paths and clearly defined goals, ill-structured problems require an approach that takes into account the complexity of the processes involved and considers both problem formulation and resolution (Murphy, 2004; Sinnott, 1989).

The major steps in ill-structured problem solving typically involve: (1) problem representation, (2) problem solution, (3) making justifications, and (4) monitoring and evaluation (e.g., Jonassen, 1997; Sinnott, 1989; Voss, 1988; Voss & Post, 1988). In problem representation, the solver first decides if there is a problem because it may not be directly visible (Jonassen, 1997). If a problem does exist, the solver constructs a representation based on its possible causes and contextual constraints (Sinnott, 1989; Voss & Post, 1988). Then the solver generates potential solutions and ''develops a justification or an argument for supporting selection of a particular cause and solution because ill-structured problems usually have divergent or alternative solutions'' (Shin et al., 2003, p. 8). The solution is then implemented, monitored and evaluated. If the solution does not solve the problem, the solver can either adapt the initial solution based on the results obtained, or revisit the problem to generate and test an alternative solution (Voss & Means, 1989).

Teachers confront ill-structured problems everyday in their classrooms. The solutions might involve decision-making (e.g., Should I use a hands-on method to teach fractions?), trouble-shooting (e.g., How do I adapt a reading lesson for the students who are struggling?), instructional design (e.g., How can I organize a weather forecasting activity for a 40-minute class period?) and many other approaches. Of particular concern to most teachers is solving ill-structured problems that pertain to discipline and management of student behavior and these can vary widely depending on the circumstance. Some are fairly straightforward, like settling down the class after recess, working out grouping arrangements to minimize arguments and conflicts, and making adjustments in lessons to increase attention and motivation. But others can be much more difficult and challenging, such as dealing with severe non-compliance, channeling confrontations, handling aggressive behavior, and responding to violence. A poll by Phi

Delta Kappa showed that nearly two-thirds of teachers listed problems of behavior management and discipline as being very serious or fairly serious (Langdon, 1999). A survey of elementary teachers indicated that 90% of them did not feel adequately prepared to handle the severe behavior problems their students might display (Wolery et al., 1995). Studies such as these suggest that preparing teachers to solve ill-structured problems, especially those associated with managing student behavior, should be an important part of their preparation.

In order to help someone solve ill-structured problems, Ge & Land (2004) propose a scaffolding approach that combines question prompts with a dialogue on generating solutions. Question prompts are a series of pointed questions whose answers lead someone sequentially and systematically to a conceptual or procedural outcome. Question prompts can elicit thoughtful responses, explanations and inferences (King & Rosenshine, 1993), and lead to cogent arguments and potential solutions (Kitchner & King, 1981). In a quasi-experimental study involving 117 students in an introductory course on information sciences and technology, Ge & Land (2003) found that question prompts had significant positive effects on performance of ill-structured problem solving. Their subjects were undergraduate students and the ill-structured problem solving took place in a face-to-face environment. By comparison, our study investigates ill-structured problem solving in the context of preparing in-service teacher to address problems of discipline in their own classrooms using an online environment.

Combining question prompts with dialogue on answering them may have applicability to teacher preparation programs because it is natural for teachers to address instructional problems by asking and answering questions of colleagues. Moreover, a series of well-formed question prompts related to problem solving can readily be incorporated in a variety of teacher education activities. An instructor can use question prompts to focus teacher interaction on important aspects of solving ill-structured problems and guide them progressively through a best practices process.

Another important element in solving ill-structured problems is to establish a context for the problem solving process. That is, in order to understand how to approach a particular problem situation, both the question prompts and solution dialogue need to focus on circumstances that are clearly defined, realistic and relevant to those engaged in learning the process. Jonassen and Hernandez-Serrano

(2002) indicated that storytelling is a natural, time-honored way of structuring a social dialogue that adds realism and relevance to problem solving. The storyteller's task is to explain the background and nature of a problem in everyday straightforward terms, while the listener's task is to understand the problem and help generate a solution. In this type of interaction, both parties tend to develop a vested interest in solving the problem because they see relevance in its solution.

It would seem that storytelling could create a natural context for teachers to learn about solving ill-structured problems in managing student behavior. For example, an instructor could have a teacher tell her ''management problem story'' to a mentor who could be another teacher or school staff member. The story could narrate the teacher's experiences in working with a student who is non-compliant or disruptive. The mentor's role would be to clarify and pinpoint elements of the problem, such as factors that contribute to the student's inappropriate behavior, and offer suggestions for planning an intervention. Moreover, this instructional approach would lend itself well to an online environment where the question prompts could be used to structure a journal format for a teacher to relate her problem story and engage in a solution dialogue with a mentor. In an online environment the teacher and mentor could interact more conveniently, engage in more thoughtful and task oriented discussions, and maintain greater privacy (Ensher et al., 2003; Knouse, 2001; Wade et al., 2001; and Walther, 1992).

This article reports on a study that involved showing teachers how to solve ill-structured problems using an online mentoring approach. The teachers conducted semester-long projects in which they were to generate solutions to ill-structured problems of behavior management in their own classrooms. These projects, chosen by the teachers themselves, constituted the teachers' practical field experiences or practicum. Teachers who conducted the projects were thus referred to as practicum teachers. Question prompts provided by instructors were used to help the teachers formulate a weekly journal of their activities and to guide the problem solving process. The results of this study explain how practicum teachers and their mentors interacted with one another in generating solutions to management problems in an asynchronous web-based discussion environment. They also describe the practicum teachers' and mentors' perceptions on the online problem solving process.

Literature review on mentoring

This section describes mentoring and discusses its benefits in teacher education. It also presents some advantages and limitations of online mentoring in professional development.

A mentor can be described as a readily available person to a novice or unskilled practitioner. Kram & Isabella (1985) suggested that mentors perform two major functions for their protégés: (1) psychosocial and (2) instrumental. In teacher education, psychosocial aspects of mentoring include providing encouragement, explaining professional expectations and outcomes, clarifying teaching practices and standards, and validating classroom goals (Ensher et al., 2003). Instrumental aspects of mentoring involve giving direct career-enhancing support, such as by modeling teaching methods, providing coaching and directed feedback, and facilitating access to resources (Ensher et al., 2003; Kram & Isabella, 1985). Brescia (2002) in his study of 35 students in an online master's level course proposed a taxonomy of mentoring functions that includes three major meta-functions: coaching through participation, providing structure, and giving individualized support. Each of these meta-functions consists of sub-functions. For example, "coaching through participation" consists of modeling good analysis, clarifying, challenging hypotheses, and questioning. "Providing structure" consists of framing task, summarizing, and encouraging reflection; while "giving individualized support" consists of nourishing good ideas, and championing lost ideas.

In the past, a mentor was usually described as someone senior in age, experience and expertise to the practicum teacher (Hunt & Michael, 1983). Current views of mentoring, however, have broadened to include lateral or peer interpersonal relationships, such as those that are collegial and collaborative in nature, including peers and individuals in different organizations (Eby, 1997; Ensher et al., 2001; Kram, 1985; Kram & Isabella, 1985). Thus, in teacher education, a mentor could be a colleague who has sufficient background and expertise in the practicum teacher's certification area and is readily available to answer questions, brainstorm teaching activities, plan interventions, provide feedback and give other forms of guidance (Knapczyk et al., 2005).

With the advent of computer technology, interaction between practicum teachers and mentors need not be confined to any specific geographical locations as it can now take place at any place and time convenient to them. This gives rise to the use of the Internet as a

means of mentoring; variously termed "virtual mentoring," "telementoring" (Brescia, 2002; Knouse, 2001), and "online mentoring." O'Neill et al., (1996, p. 39) described online mentoring as "the use of email or computer conferencing systems to support a mentoring relationship when a face-to-face relationship would be impractical." This definition for online mentoring was adopted for our current study. Specifically, we used an asynchronous discussion forum (see section on Communication tool used by practicum teachers and mentors) where practicum teachers and mentors did not need to be online at the same time to communicate.

Researchers are beginning to show that online mentoring has some unique advantages over traditional face-to-face mentoring. For example, an online mentoring format allows practicum teachers to have mentors who are geographically distant from them, and it gives them access to professional expertise and assistance that might not otherwise be available in the school or community where field experiences take place (Knapczyk et al., 2005). Practicum teachers and mentors can interact more frequently and at more convenient times online instead of trying to fit meetings into busy work schedules (Ensher et al., 2003). The delayed or asynchronous aspects of online mentoring can facilitate more thoughtful, task-oriented interaction than face-to-face discussion that can sometimes be too spontaneous, fragmented and incomplete to address complex problems (Wade et al., 2001; Walther, 1992). Finally, online mentoring offers greater privacy and anonymity than face-to-face communication so practicum teachers are more apt to address sensitive and personal concerns (Knouse, 2001).

Although research generally indicates that positive results occur in an online mentoring environment, there is some evidence that mentoring may have negative aspects as well. This is not surprising because mentoring can evolve into a close personal relationship (Kram, 1985). Following Duck's (1994) claim that a simple dichotomy of positive and negative relationship is ultimately misleading, Eby et al., (2000) suggested that researchers examine both aspects to capture the essence of mentoring. An exclusive focus on positive aspects could paint an unreal picture of relationships and nurture the perception that any negative experience is an aberrant rather than possible aspect of mentoring (Wood & Duck, 1995). For example, in a recent study by Eby et al., (2000), 84 of 156 protégés in two executive professional development programs reported at least one negative mentoring experience. Analysis of the protégés' responses revealed 15 types of negative

mentoring experiences nested within five broad metathemes: mismatch between protégé and mentor, distancing behavior, manipulative behavior, lack of mentor expertise, and general dysfunctionality of the dyad. It was not clear from the study whether the responses of the 156 protégés were related to face-to-face or to online mentoring; however, it is likely that they did include at least some portions of online mentoring activities. Finally, it was noted in the literature that while studies on mentoring focus primarily on whether protégés benefit from having a mentor, there is little evidence on whether mentors themselves gain professionally from supporting a novice (Lopez-Real & Kwan, 2005). Given the time and effort expended by mentors, it would be interesting to know if mentoring furthers their skills.

Research focus and questions

The study used an online mentoring approach with practicum teachers that was lateral and collegial (mentors who were teachers at other schools), and it investigated how this approach combined with question prompts helped practicum teachers solve ill-structured problems of behavior management in their classrooms. Specifically, the research questions were:

1. Did a combination of question prompts and online mentoring help practicum teachers solve ill-structured problems of discipline in their classrooms? How did the ill-structured problem solving steps change over time?
2. What types of mentoring functions did online mentors provide in the asynchronous online environment? Did these functions change over time?
3. What perceptions did the practicum teachers and mentors have toward online mentoring in general?

Method

A qualitative case study methodology was used to investigate the three research questions. According to Merriam (2001), a case study methodology is utilized when the researcher seeks to gain an in-depth understanding of a particular situation. This approach was chosen for this study because its purpose was to obtain a clear understanding of the problem solving processes practicum teachers used, the functions

mentor interactions served to the practicum teachers, and the perceptions practicum teachers and mentors had toward online mentoring. The study relied on four sources of data: (1) online observations of the interactions between practicum teachers and their mentors, (2) online journal reports of practicum teachers, and (3) end-of-practicum questionnaire survey of teachers and mentors, and (4) final reflection logs of practicum teachers.

Participants

The study was conducted in a 15-week graduate level practicum offered at a large Midwestern university in the United States. Twenty-six teachers (6 males, 20 females) enrolled in the practicum and their ages fell into four groupings: three were from 18 to 25 years of age, 14 from 26 to 35 years, eight between 36 and 45, and one between 46 and 55. All were working on limited (temporary) licenses in special education. Twelve were teaching at the elementary level, four in middle schools, and ten in high schools. One was in a residential facility and the others in public school programs. All were admitted to a graduate program and taking the practicum to fulfill certification requirements in special education. Practicum teachers were to complete a semester-long project in which they planned, carried out and evaluated an intervention for one student in their classroom who displayed longstanding and severe emotional or behavior problems. Examples of such problems were explosive displays of temper, physical aggression toward classmates, refusal to comply with adult directions, extended lack of attention or motivation in classroom activities, and obsessive–compulsive disorders. Thus, completing practicum projects had the attributes of solving ill-structured problems because the process (1) was complex, (2) was open-ended, (3) had potentially changing outcomes, (4) had several possible solutions, and (5) was governed by the practicum teacher's own beliefs and orientation.

The mentors were 33 teachers enrolled in a *Management of Behavior Disorders* course which was offered in the same semester as the practicum. This course was also offered online and it focused on instructional and motivational methods for changing student behavior and on procedures for planning, implementing and evaluating interventions. Mentors were currently teaching in a classroom and were randomly assigned to practicum teachers. Each practicum teacher had one or two mentors and a faculty instructor who oversaw the teacher's work and interactions with mentors.

Data collection

Online observation
Online observation of interactions between practicum teachers and their mentors was one of the main data collection methods used. According to Foster (1996), the advantages of observation are that (1) information about behavior is recorded directly without having to rely on retrospective or anticipatory accounts of others; (2) patterns and regularities in the environment can be recorded and analyzed over time; and (3) access to information can be obtained about people who are busy, deviant or hostile to taking part in research (p. 58). In this study, online observation was suitable because the recording of practicum activities took place online and without face-to-face contacts between practicum teachers and mentors. The term ''online observation'' is adapted from the works of Mann & Stewart (2000), who argued that qualitative researchers can observe the linguistic behavior (both of what is said and how) in various types of computer-mediated communication usage, including *both* asynchronous and synchronous environments. As Mann and Stewart noted, ''clearly CMC [computer-mediated communication] offers an excellent site for qualitative researchers who observe discourse online'' (p. 87). The observation of such discourse or interaction can help reveal participants' ideas and attitudes toward a situation. Some examples of studies that have employed online observation are: Denzin (1999) in his study of gendered ''narratives of self'' in an asynchronous environment focusing on alcoholic recovery; and Sharf (1999) in her examination of members' conversations in a Breast Cancer listserv. In this study, online discussion transcripts of practicum teachers and mentors were printed once every fortnight and their content was used to analyze the interactions. The unit of analysis was the individual idea or theme communicated by the practicum teachers and mentors in their message postings. Using this unit is consistent with Lincoln & Guba's (1985) suggestion that a unit of analysis should be heuristic and able to stand by itself, as well as Merriam's (2001) recommendation that ''communication of meaning'' (p. 160) should be a unit's main focus.

Practicum teachers' journal reports
The practicum teachers were to maintain an online journal giving an ongoing, running account of their work on each question prompt throughout the study. Journal reports were posted online about once a week for the mentors and instructor to review and comment on.

They were another important source of data about online interaction because they helped to determine whether the practicum teachers followed the question prompts in giving their reports and to assess the frequency and timeliness of postings by both the practicum teachers and mentors. All 26 practicum teachers completed their journal reports.

Questionnaire survey
A questionnaire survey was used to measure the practicum teachers' and mentors' perceptions of online mentoring and other aspects of the practicum. It was simply an end of course evaluation survey that practicum teachers and mentors completed. The questionnaire consisted of several closed-ended items that practicum teachers and mentors rated on a four-point scale (4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree). A four-point scale was chosen to force the participants to select one of the available options, but they could choose not to answer a particular item if they had no opinion or thought the question was not applicable. The close-ended items are shown in Tables 6 and 7. In addition, there were three open-ended questions that allowed practicum teachers and mentors to elaborate on such areas as their views on participating in online mentoring and on the usefulness interacting with mentors or the practicum teacher. The open-ended were:

- What comments do you have about your interactions with the practicum teacher (with your mentors)?
- What are your overall thoughts on the online mentoring approach?
- What additional feedback can you give regarding the online mentoring program?

Ninety-seven percent of the 26-practicum teachers and 33 mentors completed the questionnaire.

Practicum teachers' reflection logs
Practicum teachers posted a statement at the end of the course that summarized their reactions to the practicum and online mentoring. The practicum teachers' reflection logs were guided by the study's research questions, as well as other considerations related to the process of developing successful interventions. The purpose of the reflection logs was threefold: (1) to comment on the efficacy of the interventions they developed in their project, (2) to describe the learning they

achieved from responding to the question prompts, and (3) to give their reactions to the mentoring experience. All 26 practicum teachers completed the reflection logs.

Procedure

At the start of the practicum, practicum teachers and mentors were given written project directions that (1) described the roles and responsibilities of practicum teachers and mentors, (2) explained the outcome and parameters of the project, and (3) gave deadlines for specific tasks. In addition, the directions gave a sequential list of 20 question prompts that were organized into four aspects of problem solving: (1) problem formulation prompts, (2) solution planning and generating prompts, (3) monitoring and evaluation prompts, and (4) reflecting on the solution prompts (see Appendix 1). The four types of question prompts closely paralleled four common processes of ill-structured problem solving: (1) problem presentation, (2) problem solution, (3) making justification, and (4) monitoring and evaluation (e.g., Jonassen, 1997; Sinnott, 1989; Voss & Post, 1988). That is, problem formulation prompts, solution planning and generating prompts, monitoring and evaluation prompts, and reflecting on the solution prompts paralleled problem presentation, problem solution, making justification, and monitoring and evaluation, respectively.

In addition, practicum teachers were given a grading rubric showing how their final grades would be determined by the content, organization, writing style, creativity and timeliness of their work. Practicum teachers were told to maintain an online journal giving an ongoing, running account of their work on each question prompt and to post the journal entries for their mentors and instructor to review. Journal postings were scheduled for about once a week. Practicum teachers were also to engage in an online dialogue with their mentors and instructor by asking questions, seeking their input, responding to their questions and ideas, and interacting in other ways. These weekly online interactions were in addition to the regularly scheduled journal entries.

The directions to the mentors explained that they were to serve as online consultants to the practicum teachers by keeping informed on the practicum teachers' progress, asking questions to clarify decisions and activities, offering suggestions and critical feedback, and in other ways acting as a professional resource. The importance of showing timeliness, responsiveness and initiative in interactions with the

practicum teachers was emphasized. Mentors were also given a schedule for their postings which was to respond within 3 days to each of the practicum teachers' journal entries. Twenty percent of the mentors' final course grade was allocated to the quality and timeliness of their interactions with practicum teachers.

Role of instructors

In an online environment, research suggests that instructors play more of a facilitative role than a direct teaching role in learning activities (Grabinger & Dunlap, 1996; Honebein, 1996; Relan & Gillani, 1997). This means that rather than being the major focus of online discussions, instructors should instead strive to stimulate a thoughtful dialogue among their students and moderate their interactions on course-related topics and issues. Accordingly, the five instructors involved in the practicum. began the semester with ''ice-breaker'' activities that encouraged socialization among practicum teachers and mentors, helped give each a personal identity and built comfort and trust among them. They also modeled use of personal greetings, conversational language and other online strategies for enhancing communication. During the rest of the semester, they reviewed the practicum teachers' journal postings; participated in the discussions of project tasks; and offered suggestions, encouragement and constructive feedback to both practicum teachers and mentors.

Communication tool used by practicum teachers and mentors

Practicum teachers and mentors needed access to the Internet from their homes, school work stations, or public access terminals in order to interact with one another. The study used the ''Oncourse'' software program which is a web-based course shell developed by the university to assist its faculty and students with a variety of course-related functions. Oncourse has six components: *Syllabus*, *Schedule*, *Class*, *In Touch*, *Tools* and *Help* (see Figure 1). An instructor uses the *Syllabus* and *Schedule* sections to explain the structure and organization of a course and these sections have links to additional course-related resources. The *Class* section gives students a space for information about themselves and has links to personal web sites and photographs. The *Tools* section provides an instructor with authoring, database, and course management tools. The *Help* section offers assistance
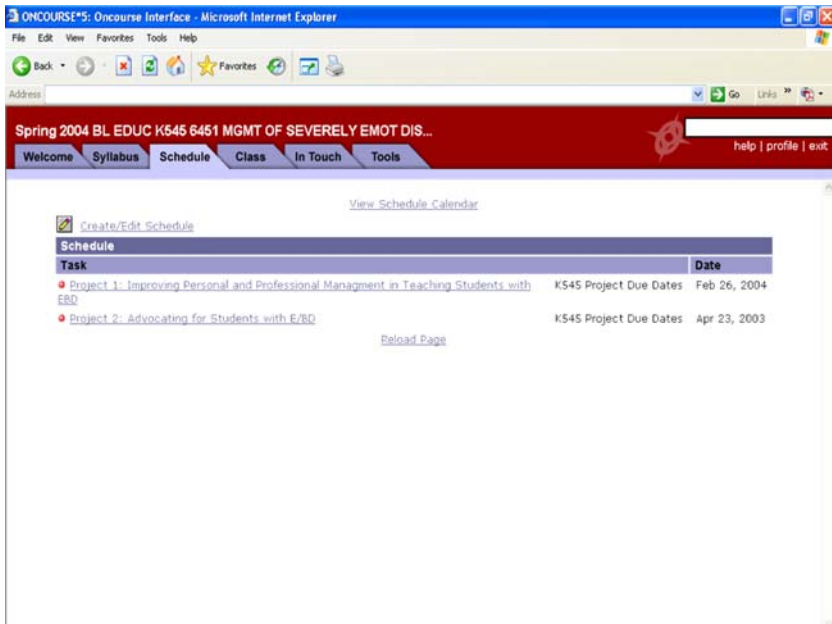
Figure 1. A snapshot of the Oncourse program.

to the specific section of Oncourse that a student is in when he or she needs help. The *In Touch* section provides communication tools for the instructor and students, such as email and asynchronous discussion forums. Practicum teachers and mentors carried on their problem solving dialogue using *In Touch* asynchronous discussion forums. There are a variety of other web tools that support asynchronous communication among a group of users such as Sitescape Forum, Knowledge Form, and Blackboard. Any of them could be used or adapted for online mentoring.

At the start of the practicum, each practicum teacher was designated team leader for his/her project and the practicum teacher's mentors and instructor were the other team members. Each team was given its own *In Touch* discussion forum and team members used it to hold a semester-long dialogue regarding practicum activities and other pertinent topics. For example, members used the forum to describe their personal backgrounds, share professional experiences, provide progress reports on question prompts, ask for clarification of activities, offer suggestions, give critical feedback, and socialize. A practicum teacher's journal postings and the interactions among the

teacher, mentors and instructor were organized into one semester-long discussion thread. That is, each person's next posting was added at the end of the previous postings so everyone could easily review all of the journal entries and comments in chronological order. These weekly journal entries and discussions were used as the online observations and journal reports for data collection. Near the end of semester, a graduate student who was not an instructor sent the questionnaire survey in electric form to practicum teachers and mentors. Completed surveys were emailed directly to this student so instructors could not see individual responses. Practicum teachers posted their reflection logs as their last posting for the course.

Completed surveys from 97% of practicum teachers and mentors, as well as reflection logs from all 26 practicum teachers were analyzed in the study. Data from these sources provided insights about the practicum teachers' and mentors' overall perceptions toward online mentoring. In addition, the researchers selected a stratified random sample of seven practicum teacher from the initial pool of 26 for further analysis in order to gain an even greater understanding of mentoring functions and ill-structured problem solving while still keeping the analysis manageable. Stratified random sampling was used to ensure an equal distribution of practicum teachers from different teaching levels and different schools. Two practicum teachers taught at the secondary level, two at the middle school level, three at the elementary or kindergarten level, and they all worked at different schools (see Table 1). We looked more closely at the interactions between these seven practicum teachers and their mentors and did a content analysis of their journal reports.

Table 1. Characteristics of the seven practicum teachers participating in the study

Practicum teacher	Gender	Age group of practicum teacher	Grade level taught	Schools
Teacher A	F	36–45	9	High (public)
Teacher B	F	36–45	Pre-school	Kindergarten (public)
Teacher C	F	26–35	10	High (public)
Teacher D	F	26–35	7	Middle (public)
Teacher E	F	26–35	6	Elementary (public)
Teacher F	F	26–35	3	Elementary (public)
Teacher G	F	26–35	7	Middle (public)

Data analysis and results

Did a combination of question prompts and online mentoring help practicum teachers solve ill-structured problems of behavior management in their classrooms? How did the ill-structured problem solving steps change over time?

Evidence from online observations, practicum teachers' reflection logs and responses to open ended survey questions indicated that 24 practicum teachers (95%) were successful in developing effective interventions for their students. Some examples of interventions used by the practicum teachers were: social skills training, student self-monitoring or recording procedure, and teacher prompting of appropriate or replacement behavior. Twenty-three practicum teachers (92%) reported that the process outlined in the question prompts served as a very useful guide for addressing the longstanding problems of their student. In addition, twenty-five (98%) agreed or strongly agreed that interaction with the online mentors encouraged them to be more thoughtful with their project tasks. The following comments exemplify this finding:

> This is a highly effective way to complete practicum work. [The question prompts] provide just the right amount of guidance and structure to maximize learning.

> I enjoyed having an online mentor. It keeps me focused and I want to keep going. My mentor asked good questions that got me thinking and made excellent suggestions which I tried.

> The process of choosing a student, identifying a behavior, and then creating an intervention plan, as outlined in the prompts, is a process that all teachers should do. When you do this, you get a chance to really know a particular student. You also get a chance to reflect on all the other things going on in your room that may be causing the problematic behavior. It also allows you to try something out and then have the data to support whether it worked or not.

Twenty-four practicum teachers (95%) also stated that they planned to continue with the interventions they developed after the course and that they would use the problem solving process with other students they teach. The two practicum teachers (5%) who did not have a

successful intervention attributed the lack of success to an uncoopera-
tive staff member (i.e., another teacher who did not complete behavior
charts on the student), or to unsupportive parents (i.e., a mother who
frequently covered for the student by giving excuses for his problem
behavior) rather than to the problem solving process itself.

In order to determine how the ill-structured problem solving steps
changed over time, we initially used a coding scheme that consisted of
four major categories: (1) problem presentation, (2) problem solution,
(3) making justifications for generating or selection solutions, and
(4) monitoring and evaluation (e.g., Jonassen, 1997; Sinnott, 1989;
Voss & Post, 1988). We used this scheme to examine the journal re-
ports, and online observation data from a stratified random sample of
seven practicum teachers from the initial pool of 26 practicum teach-
ers. It is important to note that although we employed the coding
scheme *a priori*, we did not forcefully impose any of the four major
coding categories onto our data corpus, but allowing also for the
steps of ill-structured problem solving to emerge inductively during
the coding process. To increase the consistency of the classifications,
we identified exemplary data that clearly illustrated the different steps
of ill-structured problem solving. These examples were then used as
templates or initial codes to guide the continued analysis efforts. As
we read each journal report and online messages of the seven practi-
cum teachers, we compared it to the existing templates and, at the
same time reflect on the meaning of the categories. This process is re-
ferred to as the constant-comparative method (Lincoln & Guba,
1985). We continued to move back and forth among our data sets to
discover new codes and categories until each category was saturated –
that is, until new data began to confirm rather than shed new light on
the categories.

Through this process of constant comparison, we discovered that
the four major categories could be separated into sub-categories to
give a finer analysis. For example, we found the ''problem presen-
tation'' construct actually consisted of four sub-steps: (1) articulat-
ing problem context and parameters, (2) accommodating alternative
opinions, (3) describing problem areas to solve, and (4) reporting
baseline data. At the conclusion of our analysis, we had eight
problem solving steps. These eight steps were arrived at after we
had discussed among ourselves and a mutual consensus was
reached. However, in order to determine the consistency of our
analysis, we had an independent coder to code approximately 10%
of the journal reports and online messages. These 10% of journal

reports and online messages were randomly chosen from the data corpus of the seven practicum teachers. The independent coder was not involved in the practicum project at all, and thus did not know the identity of the participants. Inter-rater reliability of the coding was fairly high (88.2%). Table 2 describes each of the eight ill-structured problem solving steps, provides an example from a practicum teacher's transcript and gives a frequency of the times the sample of seven practicum teachers used the process in their online interactions.

The frequency counts in Table 2 show that during the semester the seven practicum teachers distributed their comments fairly equally across categories of problem solving. The exception was "Adapting the solution" (AS) and a review of teachers' transcripts revealed that the time constraints of a 15-week semester may have prevented them from progressing far enough in their projects to allow adaptation of the intervention plans they designed. Table 2 also indicates that "Articulating problem context and parameters" (AP) was the process the practicum teachers used most often ($n = 78$). Other frequently used processes were "Monitoring solutions" (MS) ($n = 67$), "Describing possible solutions" (PS) ($n = 56$), "Describing problem areas to solve" (TB) ($n = 49$), and "Reporting baseline data" (BD) ($n = 45$).

Results also show that the sample of seven practicum teachers engaged in different aspects of problem solving depending on the question prompts they were following in their projects; so we examined changes in the frequency of each process across a 2–3 week interval over the semester. We used an interval approach to summarize the data so that the presentation of the results was more manageable and easier for the reader to interpret. These data are presented in Table 3 and they indicate that the processes teachers used changed over time depending on problem solving activities. For example during the first weeks most postings centered on describing the problem solving context. They then shifted to describing the problem area, then to describing solutions, and finally to critiquing and monitor solutions. For example, early in their project, practicum teachers most frequently engaged in problem formulation, such as by presenting their views on the student and problem behavior and by describing potential areas for intervention. Postings on these topics decreased overtime and were replaced with those pertaining to problem resolution, such as describing possible solutions, formulating a solution and monitoring the solution.

Table 2. Ill-structured problem solving processes exhibited by the practicum teachers

Phase	Process	Description	Count	Example
Problem representation	Articulating problem context and parameters (AP)	Stating the context relevant to the problem. Stating the extent of the problem	78	"The target student is Alex, an 11-year old male. He was identified as having Asperger's Syndrome... The frequency we have to redirect him is two times per class period which multiples into 10 times per day, 5 days per week. The behavior occurs in all classrooms during instructional time"
	Accommodating alternative opinions (VP)	Indicating views of other people (including mentors), and mentioning whether he or she agrees or disagrees with them	53	"I was talking to another educator the other day and we were both amazed at how much depends on the teacher's buy-in of a suggestion"
	Describing problem areas to solve (TB)	Describing primary problem areas to be solved, the rationale for choosing them	49	"The first behavior I would target would be Alex's lack of organization. My rationale for choosing this behavior is because it is an area that Alex needs constant help with. Alex leaves one class walking away with a trail of completed papers behind him"

Reporting baseline data (BD)		Describing procedures for collecting and baseline data on specific target problem areas. Also providing a summary of the data and conclusions drawn from them	45	"Data were collected by observations made by teachers and paraprofessionals via a checklist for inappropriate behaviors such as swearing, and back talking. After reviewing the data, I found that he receives 15 back-talking fines a day"
Describing possible solutions (PS)	Problem solution	Proposing new solutions. Adding on to someone's suggestions. Describing potential outcomes of the solutions	56	"To encourage James' participation, I will use a behavioral contract...set up a reward (probably lunch) as the result of x number of days of self monitoring and working during homeroom"
Critiquing the solutions (JS)	Making justifications for generating or selection solutions	Giving reasons (justification) for the proposed solutions or potential outcomes. Providing rationale to accept or reject a solution	43	"Alex does not like to be "hovered" over by any adult. This is one of the reasons why I thought using a non-verbal indicator (colored cards sort of like social story pictures) would be a good intervention. I felt they were quick, and didn't require a teacher to use, but a responsible peer-buddy"

Table 2. Continued

Phase	Process	Description	Count	Example
Monitoring and evaluation	Monitoring the solution (MS)	Providing evidence of the fidelity of the solution. Reporting on the outcomes of the solution. Indicating which aspects of the solution worked well and did not work well	67	"Joe is up from his baseline data. His personal Countoon percentage has increased to 46% match rate when compared with my observational data"
	Adapting the solution (AS)	Reflecting and describing what the next course of action is. Reflecting and describing how the solution can be used on a different student	13	"I noted a cycle of crisis behavior when his point totals were under goal. I have met with his mother and we have decided that he will be required to go to bed 30 min early if we report this cycle. We will continue to monitor and chart behavior to make pacing adjustments through the end of the school year with Joe"

Table 3. Changes of ill-structured problem solving processes over time

Problem solving process	Weeks 1–3	Weeks 4–5	Weeks 6–7	Weeks 8–10	Weeks 11–12	Weeks 13–15
Articulating problem context and parameters	75	3	0	0	0	0
Accommodating alternative opinions	33	12	7	1	0	0
Describing problem areas to solve	0	35	4	10	0	0
Reporting baseline data	0	3	39	2	1	0
Describing possible solutions	1	4	3	45	3	0
Critiquing the solutions	0	1	0	37	5	0
Monitoring the solution	0	0	0	1	66	0
Adapting the solution	0	0	0	0	0	13

What types of mentoring functions did online mentors provide in the asynchronous online environment? Did these functions change over time?

The results from the analysis of ill-structured problem solving carried out by the seven-practicum teachers led to examination of the types of interactions mentors had with them. We identified statements in mentor postings that clearly illustrated the function for each category shown in the first column of Table 4. We used these examples as templates to guide the analysis of the mentors' postings. We generated the codes using the constant-comparison method (Lincoln & Guba, 1985). This involved moving back and forth among the mentors' online messages and identifying distinct functions until no new ones were found – that is, until analysis of data confirmed rather than added new categories. At the conclusion of our analysis, we had eight mentoring functions. These eight functions were arrived at after we had a discussion among ourselves and a mutual consensus was reached. However, in order to determine the consistency of our analysis, we also had an independent coder to code approximately 10% of the mentor postings. These 10% of mentor postings were randomly chosen from the mentor postings related to the seven practicum teachers. The independent coder was not involved in the practicum project at all, and thus did not know

Table 4. Mentoring functions provided by the mentors

Mentoring function	Description	Count	Example
Valuing the practicum teachers' contributions (PV)	Statements that make participants feel valued, such as praise, thanks, and empathy	142	"Overall, I think you have presented a good picture of Andrew and his academic situation"
Offering information about resources or sharing resources (IOR)	Statements that inform practicum teachers about a particular resource or ways to access the resources	23	"The Problem Behavior Questionnaire looks at the variables that reinforce the behavior"
Offering solutions or providing advice on solutions (IPS)	Statements that provide solutions or give feedback on intervention ideas	106	"With the other students, simply continue their instruction and make sure you reward them in front of Jake. Let Jake know that every time he misbehaves, he's rewarding the others"
Offering suggestions specific to the collection/reporting of data (IBD)	Statements that guide practicum teachers in the data collection or reporting process	21	"Here is one idea on the data collection – an A-B-C student observation form. An example might be: A – math assignment, B – Jack is non-compliant..."
Providing information on specific principles, concepts or theories (II)	Statements that inform practicum teachers about specific principles, concepts or theories	10	"Reinforcement could include just praise and positive feedback; it does not always have to be a tangible item or activity"

Giving advice about the problem context (IH)	Statements that offer opinions about the problem or student	84	"Let me throw out another possibility – a skill deficit"
Asking practicum teachers to clarify or elaborate (IP)	Statements/questions that encourage participants to elaborate on their statements	207	"Explain more about the school climate as it pertains to special education and specifically to your students"
Sharing personal experiences or stories (IS)	Telling personal stories or experiences to illustrate an issue or a meaning	29	"I worked with a 12-year old boy last year who instigated confrontations with his classmates. He made some incredible statements that everyone was out to get him"

the identity of the mentors. Inter-rater reliability of the coding was fairly high (86.8%).

Table 4 shows that the most frequently occurring functions were "Asking practicum teachers to clarify or elaborate" (IP) ($n = 207$), "Valuing (supporting) the practicum teachers' contributions" (IV) ($n = 142$), "Offering solutions and providing advice on solutions" (IPS) ($n = 106$), and "Giving advice about the problem context" (IH) ($n = 84$).

To determine whether the functions mentors used during the practicum changed over time, we examined the frequency of each mentoring function across a 2–3 week interval over the semester. Table 5 presents data showing the variations in the eight functions over the 15-week practicum.

The data reveal that the area of "Asking practicum teachers to clarify or elaborate" (IP) occurred at a high frequency during the first weeks of the semester as mentors sought to gain an understanding of the practicum teachers' projects, and the category steadily decreased over the semester. However, it rose slightly during the middle of the semester (weeks 8–10) when the practicum teachers

Table 5. Changes of mentoring functions over time

Mentoring function	Weeks 1–3	Weeks 4–5	Weeks 6–7	Weeks 8–10	Weeks 11–12	Weeks 13–15
Valuing the practicum teachers' contributions	24	24	19	35	39	1
Offering information about resources or sharing resources		5	11	6	1	0
Offering solutions or providing advice on solutions	3	6	6	44	46	1
Offering suggestions specific to the collection or reporting of data	0	5	15	1	0	0
Providing information on specific principles, concepts or theories	2	0	3	4	1	0
Giving advice about the problem context	19	16	15	10	22	2
Asking practicum teachers to clarify or elaborate	68	44	34	42	17	2
Sharing personal experiences or stories	7	4	9	6	3	0

were selecting intervention procedures for students, a particularly complicated step in the problem solving process where mentors often needed clarification. By comparison, "Offering solutions or providing advice on solutions" (IPS) was more frequent in the middle and later weeks when practicum teachers were exploring intervention ideas and mentors were giving suggestions about methods they could use. This trend was similarly noted with "Valuing the practicum teachers' contributions" (PV) and "Giving advice about the problem context or the student at hand" (IH) which both peaked towards the end of the practicum. Online messages showed that mentors were engaged in the work of the practicum teachers and frequently offered words of encouragement and ideas for further application of intervention procedures. Also, as their understanding of the context of problem solving increased, mentors appeared to be more confident in offering problem solutions and in suggesting ways to implement them. The other mentoring functions (IOR, IBD, II and IS) peaked near the middle of the practicum although mentors used these functions very infrequently in their interactions. These functions pertained to such areas as suggesting resources, collecting data on the students, and clarifying principles and concepts.

What perceptions did the practicum teachers and mentors have toward online mentoring in general?

We analyzed the questionnaire survey responses of all 26-practicum teachers and 33 mentors in order to answer the research question on their perceptions toward online mentoring. Responses to the close-ended questions were downloaded to an Excel spreadsheet and tallied according the four-point rating categories: "Strongly Agree," "Agree," "Disagree" and "Strongly Disagree." Responses to open-ended questions were coded according to key statements participants gave on perceived benefits or limitations of online mentoring.

Practicum teachers' perceptions

Results pertaining to the 26 practicum teachers' perceptions of online mentoring are presented in Table 6. One important indicator of the effectiveness of online mentoring is whether practicum teachers viewed interacting with their mentors as time well spent. In the study, the practicum teachers posted weekly journal entries and held regular online discussions with their mentors and often prepared long,

Table 6. Practicum students' perception of the online mentoring process

Items	Strongly agree	Agree	Disagree	Strongly disagree
1. The teacher-mentor interactions were sufficient to help me with my project	9		3	0
2. The mentor encouraged me to be thoughtful in my project	8	17	1	0
3. The mentor motivated me to post my messages on time	9	15	1	1
4. The mentor responded quickly to my inquiries	11	14	1	0
5. I benefited from interacting with my mentor	7	17	2	0
6. I received enough constructive feedback from my mentor in doing my project	9	13	4	0
7. My mentor provided useful suggestions on how to carry out project activities	5	19	1	1
8. My mentor served as a strong model for how to do an intervention project	6	18	1	1

detailed statements so mentors could understand the context and rationale for activities and tasks. They also answered mentors' questions, prepared graphs and charts, responded to feedback, integrated new ideas into plans, and addressed suggestions and concerns in other ways.

The survey results suggest that practicum teachers felt that working with a mentor was a very worthwhile experience. For example on item one of the survey, 23 practicum teachers (87%) agreed or strongly agreed that interaction with mentors was sufficient to help them with their projects. On item two of the survey, 25 practicum teachers (96%) agreed or strongly agreed that working regularly with mentors encouraged them to be more thoughtful with their project tasks, and on item three of the survey, 24 practicum teachers (92%) agreed that having mentors motivated them to do their work and make postings on time. Results for item four of

the survey show that 25 practicum teachers (96%) agreed their mentors responded quickly to inquiries so it was apparent that interacting with them did not substantially slow down work on projects.

Another measure of the effectiveness of online mentoring is how the practicum teachers viewed the support and input mentors contributed to their [practicum teachers'] professional development. In mentoring there is the possibility that even when practicum teachers ask their mentors questions, the mentors might not supply useful ideas. In this study, however, the results for item five of the survey showed that 24 practicum teachers (92%) agreed or strongly agreed they benefited professionally from their interactions with mentors. Item seven of the survey indicated that 24 practicum teachers (92%) agreed their mentors provided useful suggestions for doing project activities, and item eight of the survey showed that 24 practicum teachers (92%) agreed their mentors provided a strong role model for applying intervention methods to their teaching situation. For example, one practicum teacher commented:

> I appreciated my mentors and their insights and suggestions. It is always good to get a neutral perspective and to have questions asked so that you can practice appropriate communication of ideas and experiences.

Another said:

> Overall, this [practicum] project was very helpful as it made me apply the information that I had into practical work with a student. I enjoyed the mentor aspect as it gave me ideas from other professionals that I might not have considered or points that I may have overlooked. The impression that I am left with is that this is a good illustration of what every intervention should look like.

Mentors can also provide practicum teachers with social and emotional support in addition to professional guidance, and in the present study, practicum teachers seemed to appreciate receiving this kind of support from mentors. One practicum teacher stated that "I enjoyed having both of my mentors. I felt we developed a good rapport and support system." Another practicum teacher summed up her experience by commenting:

> The overall interactions (were) very positive and supportive. The real-life situation of an intervention project can be quite messy.

The mentors all seem to be very understanding and [they] tried to provide positive emotional support.

Although the large majority of practicum teachers reported positive experiences in the online mentoring process, examination of the practicum teachers' reflection logs indicated some difficulties. One concern expressed by four practicum teachers was that their mentors seemed to lack the experience needed to provide helpful feedback. One wrote:

I did not think the mentor was very helpful. There were times that I felt like I was just repeating myself. I also did not think that my mentor did a very good job of supporting me or giving me feedback.

Closer inspection of interactions in these team sites lent support to this comment. It showed that these particular mentors repeatedly made comments like "Great job! You have some fantastic ideas and a good plan. I hope it works and keep up the good work!" without providing specific suggestions or constructive feedback when the practicum teachers asked for it.

Another difficulty encountered by practicum teachers was mentors who skipped a posting or made it too late to aid project tasks. One practicum teacher wrote in her reflection log, "The mentors provided great feedback when they completed it, but it [feedback] wasn't always very consistent. The feedback was missing at times."

Finally, one practicum teacher commented on the need to constantly addressed questions posed by her mentor and instructor:

I am not sure if I liked the mentoring process. When doing assignments for the practicum, I would answer the questions from the journal entries and then it seemed like I had to answer a lot more asked by the mentor and instructor.

Observation of this team site showed that the practicum teacher was asked an unusually large number of questions throughout her practicum which seemed to overwhelm her.

Mentors' perceptions

Table 7 summarizes the survey results of the 33 mentors on their perceptions toward online mentoring. Mentors must feel they are serving an important and useful function in a practicum teacher's professional

Table 7. Mentors' perception of the online mentoring process

Items	Strongly agree	Agree	Disagree	Strongly disagree
1. I felt that I played an important role as a mentor in helping someone with his/her project	3		5	0
2. I felt comfortable interacting in a mentor format	5	17	4	0
3. The mentor format helped me learn concepts and procedures for working with students displaying behavior problems	8	14	4	0
4. Being a mentor helped me learn how to apply concepts and methods to real life situations	7	14	5	0

development in order for mentoring to be effective (Ensher et al., 2003). When mentors have this perspective, they will be more inclined to ask questions, offer suggestions, provide critical feedback and in other ways be actively involved in the practicum teacher's activities. Results from item one in the questionnaire indicated that 21 mentors (80%) agreed or strongly agreed that they played an important role in the practicum teachers' projects. One mentor remarked:

> I see how this [mentoring] benefited others [practicum teachers] by giving them feedback as they ran into problems with their project.

As noted earlier, the concept of mentoring has broadened to include relationships between practicum teachers and colleagues or peers. In our study, mentors were special education teachers in training and we were concerned about whether they would feel comfortable supporting and advising a fellow teacher on a practicum project. The survey results for item two showed that 22 mentors (85%) agreed or strong agreed they were at ease serving as mentor to another teacher. One mentor stated:

> I very much enjoyed serving as a mentor. The arrangement provides me with further, contextual learning for the [behavior/ classroom management] concepts, albeit through a practicum teacher's experience.

Finally, we wanted to know whether being a mentor furthered the mentor's own professional development. In the *Management of Behavior Disorders* course, mentors were learning about approaches for planning interventions for learners who displayed emotional/behavior disorders but many could not apply these approaches in real life teaching situations. Survey results from item three and four indicated 22 mentors (85%) agreed or strongly agreed that being a mentor furthered their learning of concepts and procedures for handling classroom behavior problems and 21 mentors (80%) agreed or strongly agreed that mentoring aided them in learning how intervention methods could be used with their own students. One mentor wrote:

> I really appreciate the in-depth insight offered by the practicum teachers. They've illuminated perspectives that I've overlooked or not even considered. It's very casual and supportive, but effective!

Analysis of mentors' responses to the open-ended questions revealed generally very positive perceptions on the mentoring experience with comments on benefits such as increasing their knowledge of classroom management procedures, improving their ability to solve behavior problems in their own classroom, and having opportunities to work with a practicum teacher on similar problems. However, responses of a few mentors centered on two difficulties. One was anticipating when a practicum teacher would post a journal entry for review. Practicum teachers were given a deadline for each entry in the project directions and were told to notify mentors if a posting would be early or late. However, not all of them followed this directive. Two mentors expressed this difficulty and one commented that:

> It [online mentoring process] works really well, as long as you are not working with someone who is way ahead of the schedule. When she [practicum teacher] is far ahead, the mentors have to post before the due date in order to help the practicum student. This can be challenging, when the timeline shows differently.

The other concern expressed by two mentors was being unsure whether their postings were useful to the practicum teachers. One wrote, "I liked being a mentor because I could see what the practicum teacher is doing. However, I am not sure how helpful I was." Online observation of the practicum team interactions lent support to this view. Their practicum teachers often did not give feedback on the

usefulness of the mentors' ideas and when they did, they made broad statements such as, "Thank you for the suggestion," or "Thanks for the feedback. I agree with you." They rarely gave explicit feedback on how helpful the ideas were.

Discussion and conclusions

In teacher education, providing high quality practicum experiences to in-service teachers hired on temporary licenses can be very problematic because they usually work full time and are often scattered geographically. Online mentoring offers the possibility of providing these teachers with professional guidance as well as social support benefit that otherwise might not be available to them. In this study, we investigated the use of question prompts and online peer mentors who worked with 26 practicum teachers on solving ill-structured problems of discipline displayed by students in the practicum teachers' classrooms. We provided the practicum teachers with a sequence of question prompts to guide the problem solving process and had them maintain online journals and engage in on-line interactions with mentors during the activities. We examined the ill-structured problem solving processes used by seven of these practicum teachers, analyzed mentoring functions of their mentors, and surveyed the perceptions of all the practicum teachers and mentors to the online approach.

The results suggest that online mentoring, coupled with question prompts, helped the practicum teachers to solve ill-structured problems of behavior management in their classrooms. Practicum teachers also received social and emotional support benefit from their mentors. Mentors had also benefited because the process of mentoring the practicum teachers helped to further the mentors' own learning of concepts and procedures for handling classroom behavior problems. Results also showed that practicum teachers generally followed the steps of ill-structured problem solving sequentially from the first step of problem representation to the last step of solution monitoring and evaluation. From the results, we identified two particular areas in which practicum teachers' ill-structured problem solving ability seemed to improve from the study's approach. One was that practicum teachers consistently reported that

the question prompts successfully guided them through the process of planning and carrying out interventions for one of their students. The students they selected for their projects displayed long-standing and severe discipline problems that defied their and other teachers' attempts to change those behaviors.

Second, having mentors from different schools than the practicum teachers seemed to provide a fresh perspective on carrying out the steps in the problem solving process (Jonassen, 1997), which in turn, helped the practicum teachers select the most useful solutions (Sinnott, 1989). In addition, the practicum teachers indicated that having a mentor added to their motivation and perseverance in carrying out project activities, critical elements in solving ill-structured problems. For example, peer mentoring may have helped the practicum teachers sustain their work through difficult and complex tasks such as when their data collection activities seemed daunting or when their solutions appeared at first to be ineffective. Thus, the mentorship component of the field experience may have encouraged teachers to develop a sense of fortitude and professional determination. From the standpoint of solving ill-structured problems of discipline, this result was very important because it emphasized the elements of timeliness, consistency and coherence in carrying out problem solving tasks, essential attributes in generating a successful intervention.

The results of the study are also significant because they add to the body of literature on how online mentors themselves can benefit from being a mentor, an area rarely investigated before. Mentors reported that they felt comfortable in this role and that their participation in practicum projects helped them both to learn methods of classroom management and to apply these methods to their own teaching circumstances. This finding is consistent with that of Lopez-Real & Kwan (2005) who reported that mentors, in the direct sense, can learn from the innovative ideas and strategies employed by protégés; while in the indirect sense, can learn from collaborating and sharing of ideas with protégés (p. 23).

Findings regarding mentoring functions reveal that mentors tended to use more instrumental-type (Kram & Isabella, 1985) or coaching-through-participation and providing-structure functions (Brescia (2002) than psychosocial functions (see Table 8). This may have been because mentors were awarded points for their grades based on the quality of suggestions and feedback they gave to

Table 8. Comparison of mentoring functions

Kram & Isabella (1985)	Brescia (2002)	Findings from this study
Instrumental	Coaching through participation	Offering solutions or advice on solutions
		Giving opinions about the problem context
		Offering information about resources or sharing resources
		Offering suggestions specific to the collection or reporting of data
		Providing information on specific principles, concepts or theories
		Sharing personal experiences or stories
	Providing structure	Encourage practicum teachers to clarify or elaborate
Psychosocial	Supporting individual students	Valuing the practicum teachers' contributions

practicum teachers. This may have fostered a more task-oriented approach to mentoring than might otherwise have occurred. A review of Table 5 shows that certain expected trends of mentoring functions tended to hold. For instance, ''Encouraging practicum teachers to elaborate'' decreased over time as the mentors become better acquainted with the teachers' problem contexts. The slight rise of this function in the middle of the semester corresponded to the time when the teachers began to formulate solutions to address their problem situations. Many mentors encouraged their practicum teachers to elaborate on proposed ideas in order to ensure that they formulated the best solutions. Also at this time, mentors began in earnest to propose their own solutions or give advice on the teachers' solutions, topics that were then being covered in the course.

A finding of interest was an increase in the ''Valuing the practicum teachers' contributions'' and ''Providing advice about the problem context'' functions near the end of the practicum (week 11–12). These changes may be explained by the practicum teachers reflecting on the fidelity of their problem solutions and describing the follow-up steps they would take based on their current results. The

mentors responded by expressing their appreciation for the practicum teachers' report on the outcomes of their solutions and gave their own insights on future directions the practicum teachers might take, also topics covered in the course.

Nonetheless, it is also clear from the study that online mentoring can pose some challenges as well. Its effectiveness seems to depend on having mentors who provide consistent, task-oriented and timely feedback. For example, a practicum teacher may appreciate a mentor who sometimes acts as an online ''cheerleader,'' but she expects the mentor to also have the experience, expertise and confidence to provide worthwhile suggestions and substantive feedback when she needs them. Mentors must also be sensitive to the practicum teacher's ability to respond to questions and make supplemental postings so she does not become overwhelmed by demands which may not always be task related. Similarly, practicum teachers themselves must be sensitive to the expectations they place on mentors and keep mentors informed on such things as the type of feedback they would like to receive and changes in their posting schedule.

One limitation of the study is that it did not attend to differences among the practicum teachers and mentors with regard to their knowledge level, teaching experience, and culture of their work place. For example, there is an implicit assumption in most approaches to mentoring that mentors are more skilled and experienced in the professional area than the protégés. However, our strategy was to randomly assign mentors to practicum teachers because we had little information at the start of the practicum about the skills individuals possessed and because we assumed that taking a methods course in behavior management would overcome any gross differences in skill level between practicum teachers and mentors. However, there is some indication from the survey that at least a couple of practicum teachers felt their mentors did not have sufficient expertise to contribute to their projects. Research on such factors as matching skill level or experience of mentors to practicum teachers should be performed in order to further understand the dynamics of online mentoring.

A second limitation is that we did not compare online mentoring to more conventional approaches for supervising field experiences. Many graduate education programs for limited licensed teachers have fulltime, part time or adjunct faculty observe practicum teachers on a regular schedule and provide guidance, support and feedback in person. These individuals can see first hand the circumstances under which a practicum teacher is providing instruction and can offer

individualized attention and support in face-to-face interaction. Our mentors and instructors did not visit the practicum teachers' classrooms and relied exclusively on the online journals to gain knowledge of the circumstances under which they were doing their field projects. With the increasing use of online technology in teacher education, it would be beneficial to compare conventional and online models of supervision to determine which approach enhances key aspects of professional development. Perhaps an integrated model of supervision that includes elements of onsite and online mentoring would offer the best oversight and support of limited licensed teachers.

Another area of future research is comparing online mentoring with a mentoring approach that involves a staff member in the practicum teacher's school building. Many states in the USA required limited licensed and first year teachers to work under a mentor teacher as a condition of their employment, and typically this is someone in their school building with expertise in their certification area. A problem that many schools have with this model, especially those in rural and urban settings, is that there may not be a sufficient number of fully certified teachers or other staff members to provide high qualify professional development of novice and limited licensed teachers. Perhaps in these circumstances an online mentoring approach that draws on expertise from neighboring schools or corporations would provide an alternate way of providing support and supervision in some key aspects of the novice teachers' professional development. Such an approach could also provide support to isolated experienced teachers who may be faced with difficult situations.

Future study should also investigate online mentoring under different design strategies that would give instructors clearer guidelines for its use. For example, it was found that some mentors lacked the guidance to give helpful feedback to practicum teachers and sometimes resorted to generalized cheerleading, such as simply saying to the practicum teachers: "You're doing a great job(" Perhaps one suggestion is to have the practicum teachers select out the most useful comments from their mentors and explain why they are useful and share this with the mentors as a way to move the mentors toward more meaningful constructive feedback. In addition, since mentors need feedback to overcome the uncertainty of the utility of their comments to the practicum teachers, practicum teachers need to provide feedback in some structured way (perhaps at certain specific time) to their mentors. It would thus be helpful to determine

the impact of providing mentors with such guidance or feedback from the practicum teachers on the mentors' quality of comments to the practicum teachers.

Finally, it would be useful to study whether adding one or two face-to-face meetings between practicum teachers and mentors or structuring onsite visits of mentors to the teachers' classrooms would have been helpful. In our study, few practicum teachers and mentors had met one another and none of the mentors visited the teachers' schools. It might be worthwhile for the practicum teachers and mentors to meet in person to share personal and professional backgrounds at the start of the practicum or to brainstorm the intervention process part way through projects. Similarly, a classroom visitation might have provided a stronger context than an online description for understanding the behavioral difficulties of the student the practicum teachers was working with and the circumstances for the intervention.

Teachers frequently encounter ill-structured problems in their everyday teaching and the problems that involve managing classroom behavior can be among the most difficult to solve. This study was conducted in a field-based practicum in which practicum teachers planned and carried out a behavioral intervention for an actual student in their classrooms who displayed severe behavior problems. The results showed that combining question prompts for problem solving with an online mentoring component can be an effective approach for showing practicum teachers how to generate solutions to such problems. Results also showed the functions that mentors exhibited with the practicum teachers as the practicum teachers carried out the problem solving process. Practicum teachers and mentors gave very high ratings to various aspects of the problem solving process and online mentoring.

Appendix

Table A1. Question prompts and timeline for answering them

Read and consider the following questions as you work through your practicum	
Prompts for problem formulation	
Week 1	What are the settings and circumstances in which you teach?
	What is the student like?
	What are the student's strength and weaknesses?
	What is the general description of the problem behaviors and how these behaviors impact the student and those around him or her?
Week 2	What are your reasons for choosing the student and problem behaviors?
	What do you hope to accomplish?
	What kinds of support would you or the student need in order to improve the problem behaviors?
Prompts for problem solution	
Week 3	What is your priority among the problem behaviors?
Week 4	What is the behavior that will be the target or primary focus of your intervention?
	What other behavioral areas or conditions need to be attended to along with the target behavior?
	What will you do so these areas are attended to?
Week 5	What is the baseline level of the target behavioral areas?
Week 6	Have you provided a detailed summary of the data?
Week 7	What is your proposed intervention solution?
Week 8	Have you considered how the student will be involved in the intervention solution?
Prompts for justifying and selecting solution	
Weeks 9 and 10	Have you reported objective and anecdotal data from your record keeping/monitoring plan before procedures are implemented?
Week 11	What is the evidence of the fidelity of the intervention?

Table A1. Continued

Week 12	Have you explained the intervention successes and failures?
Week 13	Have you given a detailed report evaluating the intervention?
Prompts for reflection on solution	
Week 14	Did you assess the social validity of your intervention?
	What are the student's current circumstances relative to the initial description?
	What is your plan for carrying on with the intervention?
	What are your thoughts on the entire intervention planning process?

References

Brescia W.F. (2002). Using a Telementoring Taxonomy in a World Wide Web Instructional Environment: A Case Study. Unpublished doctoral dissertation, Indiana University, Bloomington.

Denzin, N. (1999). Cybertalk and the method of instances. In S. Jones, (ed.), *Doing internet research: Critical issues and methods for examining the net*, pp. 107–125. Sage: Thousand Oaks, CA.

Duck, S. (1994). Strategems, spoils, and a serpent's tooth: On the delights and dilemmas of personal relationships. In W.R. Cupach and B.H. Spitzberg, (eds), *The dark side of interpersonal communication*, pp. 3–24. Erlbaum: Hillsdale, NJ.

Eby, L.T. (1997). Alternative forms of mentoring in changing organization environments: A conceptual extension of the mentoring literature. *Journal of Vocational Behavior* 51(1): 125–144.

Eby, L.T., McManus, S.E., Simon, S.A. & Russell, J.E.A. (2000). The protégé's perspective regarding negative mentoring experiences: The development of a taxonomy. *Journal of Vocational Behavior* 57(1): 1–21.

Ensher, E.A., Heun, C. & Blanchard, A. (2003). Online mentoring and computer-mediated communication: New directions in research. *Journal of Vocational Behavior* 63(2): 264–288.

Ensher, E., Thomas, C. & Murphy, S.E. (2001). Comparison of traditional, step-ahead, and peer mentoring on proteges' support, satisfaction and perception of career success: A social exchange perspective. *Journal of Business and Psychology* 15(3): 419–438.

Foster, P. (1996). Observational research. In R. Sapsford and V. Jupp, (eds), *Data collection and analysis*, Sage: London and Thousand Oaks, CA.

Ge, X. & Land, S.M. (2003). Scaffolding students' problem solving processes in an ill-structured task using question prompts and peer interactions. *Educational Technology Research and Development* 51(1): 21–38.

Ge, X. & Land, S.M. (2004). A conceptual framework for scaffolding ill-structured problem-solving processes using question prompts and peer interactions. *Educational Technology Research and Development* 52(2): 5–22.

Glaser, B. & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Grabinger, S. & Dunlap, J.C. (1996). Encourage student responsibility. In P.A. Kommers, S. Grabinger and J.C. Dunlap, (eds), *Hypermedia learning environments: Instructional design and integration*, pp. 211–225. Lawrence Erlbaum: Mahwah, NJ.

Honebein, P.C. (1996). Seven goals for the design of constructivist learning environments. In B. Wilson, (ed.), *Constructivist learning environments: Case studies in instructional design*, pp. 11–24. Educational Technology Publications: Englewood Cliffs, NJ.

Hunt, D.M. & Michael, C. (1983). Mentorship: A career training and development tool. *Academy of Management Review* 8(3): 475–485.

Jonassen, D.H. (1997). Instructional design models for well-structured and ill-structured problem solving learning outcomes. *Educational Technology, Research & Development* 45(1): 65–94.

Jonassen, D.H. & Hernandez-Serrano, J. (2002). Case-based reasoning and instructional design: Using stories to support problem solving. *Educational Technology Research and Development* 50(2): 65–77.

King, A. & Rosenshine, B. (1993). Effect of guided cooperative questioning on children's knowledge construction. *Journal of Experimental Education* 61(2): 127–148.

Kitchner, K.S. (1983). Cognition, metacognition, and epistemic cognition: A three-level model of cognitive processing. *Human Development* 26: 222–232.

Kitchner, K.S. & King, P.M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. *Journal of Applied Developmental Psychology* 2: 89–116.

Knapczyk, D.R., Hew Frey, K. T. & Wall-Marencik, W. (2005). Evaluation of online mentoring of practicum for limited licensed teachers. *Teacher Education and Special Education* 28(3/4): 207–220.

Knouse, S.B. (2001). Virtual mentors: Mentoring on the Internet. *Journal of Employment Counseling* 38(4): 162–169.

Kram, K.E. (1985). *Mentoring at work*. Glenview, IL: Scott, Foresman.

Kram, K.E. & Isabella, L.A. (1985). Mentoring alternatives: The role of peer relationships in career development. *Academy of Management Journal* 28(1): 110–132.

Langdon, C.A. (1999). The fifth Phi Delta Kappa poll of teachers' attitudes toward the public schools. *Phi Delta Kappan* 80(8): 611–618.

Lincoln, Y.S. & Guba, E.G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Lopez-Real, F. & Kwan, T. (2005). Mentors' perceptions of their own professional development during mentoring. *Journal of Education for Teaching* 31(1): 15–24.

Mann, C. & Stewart, F. (2000). *Internet communication and qualitative research: A handbook for researching online*. London: Sage.

Meacham, J.A. & Emont, N.C. (1989). The interpersonal basis of everyday problem solving. In J.D. Sinnott, (ed.), *Everyday problem solving: Theory and applications*, pp. 7–23. Praeger: New York.

Merriam, S.B. (2001). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Murphy, E. (2004). Identifying and measuring ill-structured problem formulation and resolution in online asynchronous discussions. *Canadian Journal of Learning and Technology* 30(1): 5–20.

O'Neill, D.K., Wagner, R. & Gomez, L.M. (1996). Online mentors: Experimenting in science class. *Educational Leadership* 54(3): 39–42.

Relan, A. & Gillani, B.B. (1997). Web-based instruction and the traditional classroom: Similarities and differences. In B.H. Khan, (ed.), *Web-based Instruction*, pp. 41–46. Educational Technology Publications: Englewood Cliffs, New Jersey.

Sharf, B.F. (1999). Beyond netiquette. The ethics of doing naturalistic discourse research on the Internet. In S. Jones, (ed.), *Doing internet research: Critical issues and methods for examining the net*, pp. 243–256. Sage: Thousand Oaks, CA.

Shin, N., Jonassen, D.H. & McGee, S. (2003). Predictors of well-structured and ill-structured problem solving in an astronomy simulation. *Journal of Research in Science Teaching* 40(1): 6–33.

Sinnott, J.D. (1989). A model for solution of ill-structured problems: Implications for everyday and abstract problem solving. In J.D. Sinnott, (ed.), *Everyday problem solving: Theory and applications*, pp. 72–99. Praeger: New York.

Voss, J.F. (1988). Learning and transfer in subject-matter learning: A problem solving model. *International Journal of Educational Research* 11: 607–622.

Voss, J.F. & Means, M.L. (1989). Toward a model of creativity based upon problem solving in the social sciences. In J.A. Glover, R.R. Ronning and C.R. Reynolds, (eds), *Handbook of creativity*, pp. 399–410. Plenum: New York.

Voss, J.F. & Post, T.A. (1988). On the solving of ill-structured problems. In M.H. Chi, R. Glaser and M.J. Farr, (eds), *The nature of expertise*, pp. 261–285. Lawrence Erlbaum Associates: Hillsdale, NJ.

Wade, S., Niederhauser, D.S., Cannon, M. & Long, T. (2001). Electronic discussions in an issue course: Expanding the boundaries of the classroom. *Journal of Computing in Teacher Education* 17: 4–9.

Walther, J.B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research* 19: 52–90.

Wolery, M., Werts, M., Caldwell, M., Snyder, N. & Lisowski, L. (1995). Experienced teachers' perceptions of resources and supports for inclusion. *Education and Training in Mental retardation and Developmental Disabilities* 30: 15–26.

Wood, J.T. & Duck, S. (1995). Off the beaten track: New shores for relationship research. In J.T. Wood and S. Duck, (eds), *Under-studied relationships: Off the beaten track*, pp. 1–21. Sage: Thousand Oaks, CA.