

The integration of synchronous communication technology into service learning for pre-service teachers' online tutoring of middle school students

Chao-Hsiu Chen^{*}, Chen-Hung Liao, Yi-Chieh Chen, Chen-Feng Lee

Institute of Education, National Chiao Tung University, Taiwan, 1001 Ta-Hsueh Road, Hsinchu 30010, Taiwan

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ABSTRACT

To well prepare pre-service teachers for their future teaching, researchers and teacher-educators have been employing information and communication technology to improve pre-service teachers' learning of subject-matter knowledge, pedagogies, classroom-management skills, and so on. This study illustrates a service-learning project we conducted to engage 18 Taiwanese pre-service teachers in tutoring middle school students by means of synchronous communication tools. To evaluate this project, we collected data from observations, surveys, postings on a discussion forum, teaching journals, and learning journals. Although the pre-service teachers and students generally held positive attitudes toward the tutoring experience and the pre-service teachers reported various benefits from participating in this project, some tutors were concerned with the effectiveness of online tutoring. Most of the tutors tried to motivate their students by providing appealing materials to, and by facilitating interaction with, the students. Yet, some tutors were troubled by students' misbehavior and low motivation.

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1. Introduction

To prepare pre-service teachers to be competent teachers, teacher-educators strive to foster all kinds of knowledge and skills including subject-matter knowledge, pedagogical knowledge, pedagogical content knowledge, appropriate assessment skills, and effective communication skills (Darling-Hammond & Bransford, 2005). More and more teacher-educators are employing various technological tools to support pre-service teachers' learning. Gomez, Sherin, Griesdorn, and Finn (2008) recommended that technology serve to create connections among teacher-education faculty, pre-service teachers, and other stakeholders, and to engage pre-service teachers in meaningful learning tasks. These researchers also specified four benefits of technological application in teacher education: (1) preparing technically literate teachers, (2) helping pre-service teachers bridge the gap between theories learned in university and teaching practices observed in real classrooms, (3) facilitating practice-centered professional development, and (4) encouraging reflection on teaching knowledge and teaching practice.

A frequently mentioned problem in helping teachers learn to teach is the discrepancy between the theories emphasized in teacher-education programs and the practices observed in classrooms. To most teachers, it is a challenging task to effectively put their

knowledge and beliefs about teaching into practice while facing the complexity of classroom situations such as interacting with many students and arranging and implementing various instructional events simultaneously (Hammerness et al., 2005). Allen (2009) interviewed fourteen first-year teachers graduating from a teacher-education program, and found that pre-service teachers value both the theories learned in their training and the practices observed in schools, but that new teachers tend to prioritize practices in the workplace. Researchers have stressed that teacher-education programs should acknowledge this type of inconsistency and should find ways to effectively assist pre-service teachers in connecting theory with practice (Kennedy, 2006; Korthagen, Loughran, & Russell, 2006).

This article presents a project in which, during the summer of 2008, the researchers employed synchronous communication technology to engage 18 Taiwanese pre-service teachers in a task of tutoring middle school students online. The purpose of this project was to enhance pre-service teachers' understanding of how to apply instructional theories and pedagogical knowledge to the real practice of tutoring students with whom the teachers rarely had a chance to interact during their teacher-education coursework. Meanwhile, the synchronous communication tools provided the pre-service teachers and the students with a means for real-time interaction without face-to-face meetings, and the university faculty did not have to be concerned with safety issues (e.g., the high incidence of automobile accidents in Taiwan) characterizing pre-service teachers' travel to and from school. It was expected that this project would enable the pre-service teachers to obtain web-enabled field experience. Data were collected from observations, surveys, tutors' and students' journals,

^{*} Corresponding author. Tel.: +886 3 5712121x58056; fax: +886 3 5738083.

E-mail addresses: chaohsiuchen@mail.nctu.edu.tw (C.-H. Chen), nowordson@gmail.com (C.-H. Liao), always811154@gmail.com (Y.-C. Chen), nctupaullee@gmail.com (C.-F. Lee).

and discussion-forum postings to evaluate the effectiveness of this project. This article reports the preliminary findings derived from the data collected for evaluating this project, and two research questions follow: (1) What were the pre-service teachers' and the students' attitudes toward the online-tutoring experience? (2) What are the factors influencing the effectiveness of the online-tutoring process?

2. Literature review

2.1. Technology supporting teacher education

Technology is an important part of contemporary teachers' and students' lives, indeed becoming an indispensable tool for teaching and learning. In particular, teachers rely on technology because they have to view their profession from a curricular perspective, which means comprehensively considering contextualized instruction, and have to employ appropriate technological tools to achieve their instructional objectives. Hence, because pre-service teachers should learn how to adequately apply technology to instruction, teacher education should foster pre-service teachers' technology literacy, including an ability to operate new technologies proficiently, to access and to use information efficiently and critically, and to participate appropriately in communities and to collaborate with others via networks (Darling-Hammond et al., 2005). In addition, teacher-educators nowadays are paying more attention to the affordability of technology in enhancing pre-service teachers' learning. Technology such as databases, digital storage systems, and synchronous and asynchronous communication tools allow students to efficiently and effectively access a vast amount of information resources, and these tools facilitate students' critical reflections on the complexity of learning experiences without time-constraint and location-constraint problems. Consequently, pre-service teachers are able to undertake learning tasks more efficiently and effectively in university coursework and field experience (Borko, Whitcomb, & Liston, 2009).

Teacher-educators employ various pedagogies and tools to educate their students, who in turn can develop adaptive expertise in their future profession as teachers. These pedagogies and tools have their specific strengths and limitations. According to their teaching goals, teacher-educators choose certain pedagogies and tools. For instance, a focus of current teacher education is to encourage pre-service teachers to analyze and reflect on the processes and outcomes of authentic incidents in classrooms; in this way, the pre-service teachers can gradually acquire the necessary knowledge, skills, and dispositions for adequate teaching practice. However, the complexity and fast pace of classroom activities make meaningful analysis and reflection difficult to achieve. Teacher-educators may ask pre-service teachers to watch and analyze videos of teaching and learning incidents, from which they can experience authentic teaching practices, share their understandings with others, and reflect on and revise their own perspectives, but without being overwhelmed by the complexity of the teaching practices (Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005).

Technology can provide educators and pre-service teachers with convenient and effective tools to support a variety of teaching approaches and learning tasks. For example, Barnett (2006) developed a web-based system combining videos of teaching practice and discussion forums, and within the system, pre-service teachers taking a science-methods course strengthened their understanding of learning theories and reform-based teaching practices by watching videotaped classroom practices online and by discussing these videos with in-service teachers on asynchronous discussion forums. Before participating in the study, the 60 pre-service teachers felt little confidence in their own subject-matter knowledge, and the 16 in-service teachers—despite being more experienced in teaching science—were unfamiliar with inquiry-based science teaching. After the completion of the study, however, the pre-service teachers reported deeper understanding of science teaching and of how to put theories

and inquiry-based science teaching into practice, and they valued opinions given by the in-service teachers in the discussion forums. Also, being involved in the asynchronous discussion, the in-service teachers reflected on their own knowledge and beliefs about science teaching.

Lord and Lomicka (2007) found that computer-mediated communication (CMC) technologies such as e-mail and discussion forums helped create social-reflection environments in which pre-service teachers of foreign languages undertook reflective-journal writing, shared thoughts and experiences, commented on each other's journal entries, and grew proficient in using technological tools. The CMC tools can strengthen connections among pre-service teachers, school teachers, and teacher-education faculty, and the pre-service teachers can improve their teaching skills (Hedrick, McGee, & Mittag, 2000; Makinster, Barab, Harwood, & Andersen, 2006) and receive or give social and emotional support (Paulus and Scherff, 2008) by sharing and reflecting on their student-teaching experiences.

Technology has the unique capacity of rendering a web-enabled practicum achievable. Mouza (2007) described a case in which faculty and school teachers cooperated with one another to engage pre-service teachers in a social-studies learning project targeting school students. The pre-service teachers served as tutors and learning peers of small-group students, and the task was to investigate Irish literature, history, and culture via various online tools. For example, a trip calendar (i.e., an itinerary) ensured that the pre-service teachers and the students would work on learning tasks in similar phases, and a webpage consisting of useful resources and information about Ireland enabled the learners to effectively locate useful information. Tools for asynchronous communication and file uploading gave the pre-service teachers and students the flexibility of communicating and sharing information and ideas with one another without time- and space-constraints. Besides answering the students' questions in discussion forums, the pre-service teachers traveled as a group to meet their students face-to-face.

Mouza (2007) argued that the web-enabled practicum design gave the pre-service teachers opportunities (1) to apply theories learned in the teacher-education program to the field experience of tutoring school students in specific subject matter, and (2) to form a community of learners in the teaching profession. The community members included pre-service teachers, in-service teachers, teacher-educators, and students. To the pre-service teachers, the online practicum presented strengths such as facilitating collaborative learning, concentrating on student learning, and assuming ownership of their field experiences. Yet, the practicum did not provide the pre-service teachers with opportunities of interacting with experienced teachers, and the interaction with students was mainly related to the learning tasks, so the pre-service teachers knew very little about the students' social and emotional needs.

2.2. Tutoring and pre-service teachers' learning to teach

Clift and Brady (2005) reviewed much teacher-education research on methods courses and field experiences, and they concluded that although methods courses and field experiences as offered in most teacher-education programs influence pre-service teachers' knowledge and beliefs about subject matter, teaching, and learning, pre-service teachers could demonstrate knowledge and beliefs quite different from those that university faculty try to foster. Researchers caution that pre-service teachers often face a conflict between teacher-educators' instruction and their school-based field experiences; however, research findings indicate that pre-service teachers may decline to change their existing beliefs or practices, even when their teacher-education courses and field experiences promote consistent concepts and actions.

To soften pre-service teachers' resistance to changing knowledge and beliefs, and to narrow the theory-practice gap, teacher-educators

make efforts to form university-school partnerships that provide pre-service teachers with opportunities both to interact with school students and to apply instructional theories and advocated practices to instructional events. Among these endeavors, integrating service learning into teacher education is advocated for various rationales, including fostering pre-service teachers' critical reflection on and understanding of academic course content and pedagogical skills, preparing pre-service teachers for using service learning as a promising teaching method, and promoting such matters as social understanding, civic engagement, and commitment to social justice (Anderson, 1998; Guadarrama, 2000; Verducci & Pope, 2001; Wade, 1997). Combining early-childhood teacher education with service learning, Lake and Jones (2008) asked pre-service teachers to work with classroom children in conducting service-learning projects that covered issues such as community outreach for the disadvantaged and environmental awareness. The research results indicate that the experience helped the pre-service teachers transform their instruction in a more constructivist manner.

A common approach to integrating service learning into teacher education is to conduct tutoring programs that take place in either practicum placement or student teaching, and that feature pre-service teachers who hone their teaching knowledge, teaching skills, and service-learning pedagogy by tutoring children (Cobb, 2001; Hart & King, 2007; Wade, 1997). Two meta-analysis articles reviewed, in total, 86 tutoring programs, and the overall results indicate that the tutoring programs helped the tutored students to improve their academic performance (Ritter, Barnett, Denny, & Albin, 2009; Cohen, Kulik, & Kulik, 1982). In addition, tutoring experiences appear to be beneficial to pre-service teachers (Hart & King, 2007; Malone, Jones, & Stallings, 2002). For instance, Malone and his colleagues investigated the attitude change in 108 pre-service teachers when they took teacher-education courses to tutor at-risk elementary school students, and the researchers found that the tutoring experiences significantly transformed the pre-service teachers' perspectives on identity and personal development, teaching and learning, and service and responsibility to the community. Also, the tutors viewed the tutoring experience of helping and interacting with children as satisfying and enjoyable.

Hart and King (2007) arranged for pre-service teachers who took a course entitled "Linking Literacy Assessment and Instruction" to tutor in the field of children's literacy. The pre-service teachers employed comparable literacy-assessment tools to understand their tutees' needs, and the pre-service teachers designed and executed literacy-teaching strategies according to the diagnosis of the assessment results. The researchers found that in tutoring the children, the pre-service teachers (1) took responsibility for their actions, (2) viewed the tutoring experience as an opportunity to practice what they were learning, and (3) exhibited and experienced an enhanced motivation to learn the course content.

Wade (1997) suggested that pre-service teachers not only participate in service activities, but also develop the knowledge and skills necessary for classroom use of service learning because, by providing such services, the pre-service teachers could experience frustrations and rewards and understand how to manage classrooms, how to interact with the community, and how to supervise students. Given the aforementioned advantages of service learning in teacher education, Wade further suggested that teacher-educators, if lacking the time or the energy to undertake multiple types of learning projects, should prioritize involving pre-service teachers in service-learning activities geared toward helping K-12 students. Additionally, although asynchronous communication tools have gradually emerged in teacher-education coursework and teacher professional development, little research focuses on the use of synchronous technology for pre-service teachers' teaching and learning tasks. Hence, the researchers conducted a service-learning project where pre-service teachers tutored economically and academically disadvantaged middle school students via online syn-

chronous tools, and this article describes the implementation and evaluation of this project. The findings should provide researchers and teacher-educators with different perspectives on how technology can support pre-service teachers' teaching and learning.

3. Methods

3.1. Research contexts and participants

In the summer of 2008, 18 Taiwanese pre-service teachers (eleven females and seven males) were recruited to tutor 22 middle school students (eleven girls and eleven boys) online via synchronous communication tools during four 50-minute weekday sessions for four weeks. The researchers deliberately recruited students who were disadvantaged learners or from low-SES families including aboriginal families, low-income and tax-exempt families, and single-parent and foreign-nationality families. Because not all tutors could participate in all tutoring sessions, the tutoring schedule was arranged on the basis of requests from the pre-service teachers. According to their majors, nine of the pre-service teachers served as math tutors and the remaining nine as English tutors. At first, the 22 middle school students were divided into eleven groups, and each tutor taught two students at a time. Three students quit the project during the first week, and some pairs of students had very different academic levels, so some adjustments in the tutor-student assignment were made. Finally in each session, there were eleven tutors teaching eight pairs of students and three individual students. The students participated in two-hour math sessions and two-hour English sessions every weekday during the tutoring-project period.

Each tutor had a microphone-equipped headset, a pen tablet, and a webcam to communicate with his or her student(s), who had a similarly equipped headset and a pen tablet. Owing to the limited budget, only one hearing-impaired student was equipped with a webcam. Math and English textbooks used in the schools were provided for the tutors' reference. The tutors convened the tutoring sessions in a computer lab that was located in the participants' teacher-education center and that featured technical support from a graduate student. Meanwhile, the middle school students were in their own school's computer lab, itself also technically supported by a graduate student. The tutors and the students met in an online meeting room using an application called xLearn. The online meeting room included functions such as instant messaging, whiteboards for typing and drawing, document uploading and sharing, and screen broadcasting. Fig. 1 shows a tutor explaining a math concept via the

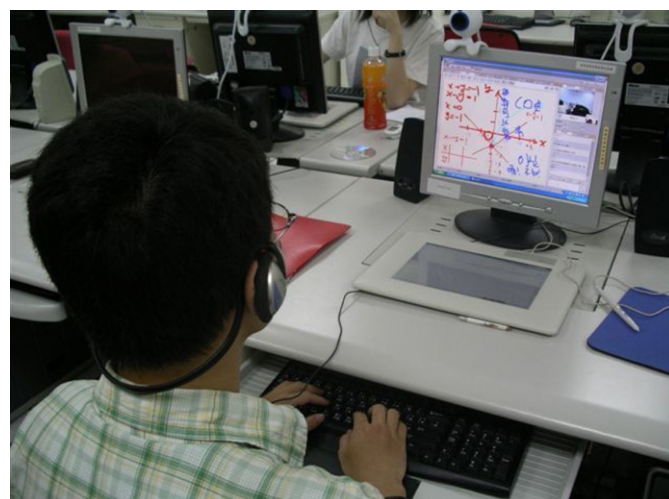


Fig. 1. A tutor demonstrating a math concept using the synchronous communication tools.

tools provided in the meeting classroom. Fig. 2 presents a group of students listening to their tutor's instructions.

3.2. Data collection and data analysis

Before starting the tutoring sessions, two workshops in which the pre-service teachers witnessed demonstrations of how to use the synchronous communication tools were held; in addition, the workshop sessions highlighted the limitations of online interaction and served as a forum in which the researchers distributed questionnaires to the pre-service teachers in the hopes of better understanding their technology use. The purpose of distributing the questionnaires was to understand the pre-service teachers' habits of using computers and network technology, their ability to operate computers and to search for useful information, and general attitudes toward online tutoring. A 45-minute orientation was also held in the middle school, enabling the students to become familiar with the login procedure and the xLearn system's operation.

During the tutoring sessions, the researchers observed the tutors and the students and kept field notes about events in the computer labs. The tutors updated their own teaching journals and the students updated their own learning journals after finishing each weekday's tutoring. The pre-service teachers were also encouraged to discuss, in a discussion forum, their experiences and difficulties in tutoring the middle school students. At first, the researchers planned to distribute another survey after a completion ceremony to understand whether the pre-service teachers' general attitudes toward the activity had changed, but a typhoon warning was issued on that day and the ceremony was called off. Therefore, the survey was distributed to the pre-service teachers via e-mail, and only four pre-service teachers completed and returned the survey. Only responses to the open-ended questions were used for data analysis.

The quantitative data collected from the survey were analyzed with descriptive statistics. Most collected data, including journal entries, field notes, and discussion-forum postings were qualitative, and the coding strategies specified by Merriam (2001) were used to code and categorize the qualitative data. The researchers added, modified, and deleted categories while main patterns were emerging. For instance, after finding that the students' misbehavior negatively affected the tutors' spirits and, indeed, motivated some tutors to change their instruction, the researchers added the category "student misbehavior" to the existing categories in order to highlight this issue. After multiple additions, deletions, and revisions of categories, the researchers confirmed the coding results and reported major findings.



Fig. 2. Two students listening to their tutor's instructions.

4. Findings

Before participating in the project, the 18 pre-service teachers reported that they regularly used MSN or Skype to communicate with friends and family members, and ten of them were confident that they would be sufficiently skilled in using the synchronous communication tools to tutor the students. Of the 18 tutors, 16 stated that they were proficient in operating a computer, installing software, using a word processor, and creating slides. Except for the first chaotic day of tutoring, during the whole project period the tutors rarely had difficulties with equipment operation or the Internet connection, thanks in large measure to the technical assistance of the graduate student in the teacher-education center's computer lab. However, the computers in the middle school were quite dated, and the tutors sometimes had to wait for the students' computers to recover from inexplicable breakdowns. Seven tutors stated that the issue of equipment stability was a major flaw of this project. The field notes show that the problem of equipment breakdown sometimes interrupted the tutoring.

A student kept raising his hand to report that a computer had crashed, and the problem was not resolved after he had twice switched computers. The computers in this lab were too dated and had too many problems. Although in general, the students could switch to another computer to continue the tutoring, much time would be wasted in these transitions (field notes in the school, 07/16/08).

Table 1 lists the survey-question responses from the tutors regarding their general attitudes toward the tutoring experience. Most tutors agreed on the benefits of conducting this project for disadvantaged students and were willing to continue to tutor the students after the project's completion. Most tutors' responses to the open-ended questions showed that the benefits of participating in this project included getting familiar with subject-matter content, having opportunities to interact with middle school students, being able to help disadvantaged students, practicing how to motivate students, and experiencing inspiration and enthusiasm as a result of the teaching. However, the tutors' responses to the survey questions indicate some limitations of online tutoring such as instruction effectiveness and student discipline.

In responding to the open-ended questions, seven tutors stated that their inability to see their students' faces might have compromised the effectiveness of the tutor–student interactions, and their responses included "I couldn't see my students' expressions so I couldn't exactly know what they were doing", "If I could have seen my students' expressions, it would have been much easier to understand their learning situations", and "I couldn't see their faces; I felt distant from my students". Not being able to see the students' faces could even cause misunderstanding, and the field notes recorded a misbehavior incident.

Today, a student paid no attention to his tutor's continual questioning, and the other student in the same group lost his patience and typed a bad word with the instant messaging function. The tutor thought the word was attacking her and felt offended so she wanted to quit.... Later, the instructor called my cell, and I explained the whole situation. Finally, the tutor was pacified and continued to teach (field notes in the school, 07/09/08).

Because only one student (who was hearing-impaired) was equipped with a webcam, most tutors experienced various levels of trouble communicating with the students and handling their misbehavior. From the second day, the researchers kept observing that some students would open multiple windows to watch video clips, to play games, or to browse websites they were interested in.

Table 1
Numbers and percentages of the 18 tutors' agreement levels on survey items.

Item statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Face-to-face tutoring is more effective than online tutoring.	0(0)	3(16.7)	2(11.1)	11(61.1)	2(11.1)
Online tutoring makes me more stressed than face-to-face tutoring.	0(0)	1(5.6)	12(66.7)	5(27.8)	0(0)
While tutoring online, I expect to spend much time handling issues irrelevant to teaching.	0(0)	0(0)	5(27.8)	9(50)	4(22.2)
It is more pleasant to sit in a computer lab tutoring students online with air conditioning than to tutor students face-to-face in a middle school classroom.	0(0)	4(22.2)	5(27.8)	7(38.9)	2(11.1)
Online tutoring alleviates the worries of my family and my teachers regarding the safety issues of traveling to school.	0(0)	1(5.6)	3(16.7)	10(55.6)	4(22.2)
I am willing to tutor the student(s) via telephone, e-mail, or MSN after finishing this project.	0(0)	1(5.6)	3(16.7)	10(55.6)	4(22.2)
Overall, I think this project is helpful to the disadvantaged students.	0(0)	0(0)	2(11.1)	13(72.2)	3(16.7)

From the tutors' journal entries, ten students progressively paid less attention to their tutors and became less active and responsive. With the novelty of online tutoring gradually fading, the tutors needed to make an effort to discipline students and to regain their attention. For example, in his journal one tutor wrote, "I caught my student downloading files and not paying attention to me", and on the next day he wrote, "My student didn't cooperate with me at first, but the situation got better after I gave him a serious warning". The observation field notes showed similar findings.

Because we cannot lock the windows, the students can do whatever they want: for example, they can browse interesting websites. If they are not interested in the tutors' teaching, they simply perfunctorily react to the tutors' requests but actually engage in activities they enjoy. This problem is difficult to handle and control in online tutoring (field notes in the school, 07/02/08).

One tutor bargained with his students that if they paid attention to his teaching, they could have a longer break. Gradually, more tutors traded longer breaks for more attention from students. I guess this is because the motivation of the tutors' students was getting lower and lower, and therefore, the tutors needed to use some novel strategies (field notes in the school, 07/09/08).

In their teaching journals, most tutors confirmed that they (1) usually experienced diligent cooperation with their students regarding the studies, and (2) could strategically regain the attention of any distracted students by employing multiple types of instructional activities and materials. For example, the tutors recorded such entries as the following: "Today, a student of mine seemed to be distracted and passive, so I gave him more real-life problems", "He [a tutor's student] would be more focused if I encouraged him more often", "A student's spirits were low, so we played math games after completing some math problems", "We listened to English songs together, and I explained the lyrics afterward", and "I talked with him [a student] patiently for quite a while, and he finally cooperated with me in the following session". The field notes recorded that, in addition to or in place of the textbooks, most English tutors and some math tutors employed such materials as videos, educational games, websites, and books full of illustrations in order to motivate their students.

Most of the math tutors reviewed and explained the math concepts in the textbooks, modeled how to solve problems, monitored the students' problem-solving process, and gave the students feedback; the pen tablets were critical in facilitating this instructional style. More English tutors than math tutors reported the necessity of providing alternative teaching materials because the English tutors thought the textbook content had been covered by the school teachers in the previous semester, so the students' motivation to review the content was low. Therefore, most English tutors searched for materials outside the given textbook, and their instruction focused on modeling pronunciation, on providing student-performance feedback, and on explaining vocabulary, sentence structures, and

grammar rules. The English tutors tended to prepare their own teaching materials including slides, documents, and websites for the instruction.

Most math tutors used pen tablets a lot. They wrote and drew math formulas, problems, and graphics on the whiteboards using pen tablets, and their students would give responses using the same method. The tutors also provided their students with supplementary materials that they [the tutors] had created and that included accumulated lists of graphics and formulas (field notes in the university, 07/16/08).

Most English tutors created their own teaching materials including slides and documents. They also asked the students to browse various websites (field notes in the university, 07/04/08).

In their journal entries, fourteen students revealed their positive attitudes toward participation in this project and enthusiastically inquired as to whether this project would continue after the start of the new semester. Even on a day during which government authorities issued a typhoon warning, all students were present at the computer lab in the school. The learning journal on the last tutoring day highlighted the students' self-evaluated improvement and eagerness to learn more with their tutors.

Today, my math tutor taught me new math problems. If I know how to solve these problems, I can establish a good foundation to learn the new semester's math and I can learn difficult things faster. Therefore, we need to take the first step [in this direction] (Student A's journals, 07/25/08).

Today is the last tutoring day. I learned pretty well. I don't want the tutoring activities to end (Student B's journals, 07/25/08).

At first I didn't understand what my English tutor was showing me and talking about, but I gradually got it after her repeated explanations. The same with math, because now I really understand first-degree polynomials with one variable, which we first tried learning in the seventh grade (Student C's journals, 07/25/08).

Although most tutors tried to motivate their students by providing interesting instructional materials and by promoting more student responses, some tutors obviously felt frustrated by some of the students' reactions. The observations revealed that the students' attention and motivation could not remain high for four 50-minute sessions a day, not to mention that fact that this project was held during the summer vacation.

Today, my students didn't respond to my questions from the outset. Using microphones to communicate was troublesome enough, and regardless, they didn't answer my questions at all. I asked whether they understood me, but they didn't give me a response. I asked whether the question was too difficult, and I got no response either. Later, a student asked for a break, but we were

only 25 minutes into the session. I asked him why, and he didn't reply. I kept silent for about five minutes and then called a break. I'm pissed off by their reaction. It is not fun to get up early to deal with two of the kids (A tutor's message on the discussion forum, 07/03/08).

A tutor was nearly driven crazy because he couldn't manage a student's behavior and get her attention. I asked this student why she wasn't cooperating with her tutor. She told me that she hadn't liked math and English before because her former math and English teachers hadn't really cared [about her learning]. She said the online tutors were pretty good. Although the student thought her tutors were good, sometimes she couldn't force herself to remain focused (field notes in the school, 07/25/08).

On the fifteenth tutoring day, two tutors reported that they were sick, and one tutor's motorcycle had broken down. The three tutors were absent on very short notice so the researchers could not find substitute tutors right away. The researchers had to undertake an impromptu rearrangement of groups so that the otherwise unattended students would have some assigned work.

Three tutors reported their absence on very short notice this morning. We had to reassign groups and call other available tutors to come in to help. We asked four students without tutors to go to the school office to help the staff, and we didn't find all the substitute tutors until the third session. Irritated, the students asked why their tutors hadn't shown up (field notes in the school, 07/21/08).

Although the service-learning experiences were not always rewarding, some tutors reflected on the tutoring experiences and raised alternative perspectives on how to help the students. Three tutors suggested that similar tutoring services be frequently provided during semester time so students can receive just-in-time help rather than review a large amount of content in a short period of time. Three tutors argued that had more interesting activities been integrated into the summer project, the students could have had more enjoyable learning experiences. Four tutors mentioned the alternative of blending face-to-face tutoring with online tutoring to get the benefits of both tutoring methods.

Table 2 summarizes factors influencing the effectiveness of synchronous online instruction and tutor–tutee interaction according to the findings. The enablers include the availability of technical assistance, tutors' technology literacy, students' cooperation and diligence, and tutors' willingness and ability to employ different instructional strategies. The disablers are dated equipment, shortage of webcams, overly long tutoring sessions, diminished novelty of online tutoring, student-discipline issues, and tutors' absence.

Table 2
Factors influencing the effectiveness of online tutoring.

Enablers	Disablers
Technical assistance on both the tutors' side and the students' side	Dated equipment
Tutors' technology literacy (i.e., proficiency in operating technology, in searching for useful information, and in creating teaching materials with technology)	No webcam on the students' side Overly long tutoring sessions Students' feeling of the novelty of online tutoring fading
Students' cooperation and diligence Tutors' willingness and ability to employ different instructional strategies	Students' discipline issues Tutors' absence

5. Discussion and conclusion

This article describes pre-service teachers' and middle school students' attitudes toward an online-tutoring project, and factors influencing the effectiveness of the synchronous online instruction and interaction. Consistent with the arguments reviewed in the aforementioned studies, the findings show that this online-tutoring experience could help the pre-service teachers both improve their teaching skills and apply what they had learned in their coursework to teaching their own students. The tutors generally agreed on the benefits of participating in this project insofar as it enhanced their understanding of subject matter, of middle school students, of student-behavior management, and of pedagogical skills. The tutors confirmed that the disadvantaged students benefited from receiving online tutoring, and they were willing to continue to tutor the students after this project's completion. Furthermore, some tutors commented on such ways to improve this service-learning project as including activities of greater interest, providing face-to-face tutoring, and employing similar projects in contiguous semesters. While most students reported positive attitudes toward the tutoring experience and eagerness to participate in similar tutoring projects in the future, the findings could not explicitly explain whether the students preferred online tutoring to face-to-face tutoring, and it is worth noting that some students' attention and motivation lessened over time as the novelty of online tutoring itself faded. Researchers should further investigate what it is that students specifically benefit from in online tutoring and how these benefits take hold.

Wade (1997) argued that the integration of service learning into teacher-education programs gives pre-service teachers chances to experience the frustrations and the rewards of being a teacher, and in this same sense, this study found that the tutors were inspired but sometimes discouraged by student reactions. The findings indicate that most tutors endeavored to enhance their instruction by providing their students with various materials and by facilitating interaction with the students. Yet, some tutors were troubled by the students' misbehavior and low motivation, and the fact that they had to communicate with students online without seeing their faces made the tutoring even more challenging. The students might perfunctorily respond to their tutors' questions while watching video clips, playing games, or browsing websites. This particular result suggests (1) the importance of equipping both tutors and students with webcams that allow all such individuals to see each other, and (2) the limitations of online tutoring such as less effective communication means and difficulty in managing student misbehavior. Other results highlight the importance of equipment stability, technical support, substitute plans, and substitute tutors in efforts to undertake similar projects.

Regarding future work, the researchers plan to redesign this project on the basis of what was learned, and the researchers are implementing a new tutoring project in a teacher-education course. The pre-service teachers taking the course teach students online for 2 h every two weeks, and the tutors and students are all equipped with webcams. Following the tutoring week, the instructor discusses with the pre-service teachers how to interact with students online and how to incorporate various online resources and instructional strategies to motivate students. The pre-service teachers reflect on their tutoring experiences frequently. The study has two important focuses: to understand whether pre-service teachers' knowledge of and beliefs about teaching and classroom conduct will change through involvement in such tutoring activities, and to identify through the detailed analysis of tutor–student interactions various patterns of effective synchronous online tutoring.

Additionally, this paper has used self-reported data to draw conclusions about the tutors' and students' attitudes toward tutoring experiences, and about what these individuals learned. The limitation of deriving findings from self-reports is evident, so multiple sources of data should be collected to verify research findings. Practical data-

collection methods include asking tutors to fill out inventories for the evaluation of pre-service teachers' knowledge and beliefs, and recording the online-tutoring processes.

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