

# **Collaboration and Unintentional Teacher Learning in Telementoring Contexts**

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## Introduction

Teaching is a profession in transition. Over the past 20 years teachers have been faced with curriculum reforms, new instructional practices, infusion of national standards, site-based goals, the integration of technology and collaboration with people and organizations outside of the school (*Introducing Goals 2000*, 1994; Cawelti, 1993; Hodas, 1993; Shubert, 1993; Perelman, 1988). The role of teacher as director of learning and acceptor of state mandates is shifting. Teachers are now encouraged to be facilitators of learning who engage with students, parents and community members, as well as their peers, to create enriching, real-world learning experiences for students (Fosnot, 1996; Resnick, 1989). The teacher is seen as a collaborator with students in their learning. The teacher also collaborates with other adults to increase professional learning (Johnson, 1990), find and provide new resources for students and ensure that students are prepared to meet the expectations of the world outside the classroom (Stuhlman, 1994; Fullan, 1993).

Collaboration with others can be a difficult task for the teacher. *Within* the school, most teachers have little time to meet with peers, especially for the extended periods of time necessary for long-term planning. Collaboration can facilitate better performance through sharing expertise (Johnson, 1990) and stimulating reflection about practices (Feiman & Folden, 1981). Collaboration with adults *outside* of the school is also difficult. Lack of external contact can isolate teachers from society in general (Levin, Riel, Miyake, & Cohen, 1987). Many factors hinder or prevent this; inflexible teacher office hours and lack of resources, such as meeting places or telephones (Darling-Hammond, 1993; Johnson, 1990).

Technological tools have provided teachers with a means to access resources and people within the school context. Computers can, for example, allow teachers to: print messages to parents quickly; calculate grades efficiently; create instructional materials that fit the curriculum in a personal and relevant manner; and record student work electronically (US Congress, Office of Technology Assessment, 1995). The Internet has provided teachers with a new means of communication with peers both within and outside of the school. Electronic-mail (e-mail) has, in a sense, given the teacher an office, personal message service, a forum for collaboration and a place for professional development. The asynchronous nature of e-mail gives teachers flexibility in when and how they respond to messages from others, diminishing the inflexible nature of the day-to-day scheduling of time (McClintock, 1992). The use of e-mail is typically a self-generated and maintained function of the teacher's activities, rather than one that comes from administrative mandates (US Congress, Office of Technology Assessment, 1995; Ruberg & Sherman, 1992). One such program that allows flexible and convenient interaction with others as collaborator is the Electronic Emissary project.

The Electronic Emissary is a nonprofit service that assists K-12 teachers in locating subject matter experts (SMEs) via a database accessible through the Internet (Sanchez & Harris, 1996; Ferneding Lenert & Harris, 1994). Teachers, SMEs and students work together in a form of telementoring through electronic mail (Education Development Center, Inc., 1996) with the assistance of a facilitator from the Electronic Emissary's staff. Teachers decide in what ways their student(s) might benefit from interacting with a SME and then search the Emissary's electronic database for someone who has the expertise that best fits the target class or individual student's curricular needs. For example, a teacher who begins a unit on genealogy writing might choose a

historical writer who can help students write their own biographies which draw on and reflect their own cultural and familial heritage. Once the teacher has found a match, an on-line Electronic Emissary facilitator contacts both the SME and the teacher to be sure both are willing to participate. Then an electronic mail address is provided for each group that automatically generates an ongoing mail log of messages. Everyone involved in the project (teacher, students, SME and facilitator) uses this address. Once a message is received, it is logged and forwarded to all other participants.

At first the teacher and the SME begin to discuss the project topic, logistics and frequency of communication. Throughout the project, and especially as communication is beginning, the team facilitator assists in both technical problem solving and project implementation, as needed. Once the team has finished their collaboration, the teacher and the SME together write a description of their instructional project, to be posted for future participants to use, as well as separately written evaluations of the Emissary experience itself. The team facilitator monitors the ongoing project and requests the final project assessments.

The author worked as a facilitator for the Electronic Emissary project and subsequently began to research participating teachers' perspectives. Although Emissary projects are designed to be student-oriented, the author wondered how the teachers perceived the unique collaboration with SMEs, a collaboration uncommon in the traditional classroom. Research indicates that e-mail can facilitate learner *and* teacher growth by providing ready access and interaction with content, peers and each other (US Congress, Office of Technology Assessment, 1995; Papert, 1993). The author's early studies focused on the nature of the roles of the adult Emissary participants and the teacher's perceived outcomes of the project. Many teachers perceived professional and

personal benefits for themselves as well as for their students (McGee, 1995). Teacher learning appeared to be unintentional rather than intentional, as the student learning was. If this is the case, the author wondered how the other adult members perceive the experience. The question for this inquiry therefore became: Do teachers, facilitators and SMEs perceive professional development occurring for teachers while participating in Electronic Emissary projects, and if so, what is the nature of this professional development?

### **Methods**

The purpose of the study was to inquire about possible professional development for teachers during an Electronic Emissary sponsored on-line project. The Emissary is designed for collaboration but the intent is to facilitate instruction for students, not teachers' professional development, learning that results in professional skills or knowledge. A nonpositivistic approach to inquiry allowed the study participants to verbalize their beliefs and experiences as Emissary participants. Naturalistic inquiry methods were used in the generation of data that came from the participants' own words (Erlandson, Harris, Skipper & Allen, 1993; Lincoln & Guba, 1985) and which included a survey with open-ended questions, interviews, and examination of team correspondence records, final project descriptions and project evaluations. The author provided the focus of teacher perceptions of professional development but did not suggest to the participants that all teachers experience this.

The purposive sample was selected from teams that facilitators knew were finishing their e-mail dialogues at the end of the spring 1996 semester. A previous study (McGee, 1995) and the literature on teacher learning suggests that teachers perceive experiences differently when given time to reflect -- time is needed to digest

and make information relevant to the teacher's practice (Joyce & Showers: 1995; Lieberman, 1995; Watts & Castle, 1993). It was the intent to allow teachers time to have reflected about their Emissary experiences, so only teams who were already finished with their Emissary-facilitated communication were sampled. The author e-mailed all 64 adult members of 29 teams -- teachers, SMEs and facilitators -- with a letter of solicitation that explained the nature and scope of the study and commitment required to participate. From this solicitation, five complete teams responded and four agreed to participate. Four teachers, four SMEs and three facilitators (one facilitator moderated two of the teams) were then sent e-mail surveys to provide for interview questions. (See Appendix A: "Teacher E-mail Survey;" Appendix B: "SME E-mail Survey;" and Appendix C: "Facilitator E-mail Survey.") The open-ended questions on the survey were free of preferred response and provided a basis for further dialogue (Patton, 1990). Patton's item typology from which the questions were written included: experience, opinion, feeling; knowledge; sensory; and demographic.

Before interviewing the participants, the author reviewed the survey responses as well as the mail logs of the four teams' projects. The mail logs contained all the messages exchanged for the durations of the projects. These provided the author with information that, although not tacit in the sense that she had experienced the project as a participant, was as much information as any of the team members had during the project, since none of the team members had communicated by any other means. In this way the author began to "know" the participants by "virtual observation," in addition to reviewing information from the responses to the survey. This allowed her to ask specific questions and recognize specific examples that the participants gave in their interviews. The mail logs and the survey also provided starting points for the

interviews.

Each informant participated in a one-hour telephone interview. Conversations were recorded over a three-month period. Because the study began at the end of the academic year, there were many delays related to the time constraints that accompany the closing of school. Once the interviews were transcribed, the author coded the transcribed conversations, identifying initial thematic strands that appeared throughout the conversations. Data were triangulated through a comparisons of the team members' survey and interview responses (Erlandson, Harris, Skipper & Allen, 1993). The author then summarized the interviews and e-mailed the summaries to the participants or telephoned the informants and discussed the summaries to seek changes or verifications of the summary content. This feedback clarified and validated the author's own analysis. A colleague working at a regional educational laboratory served as a peer debriefer throughout the study, providing feedback concerning survey questions, method, emerging themes and substantiating literature.

After revising the summaries according to participants' feedback, the author began to analyze the similarities and differences between and among team members' conceptions. At this point thematic relationships among the teams began to emerge. These became the themes that are reported in this paper. In order to ensure valid data analysis, the author sent each team member a copy of the theme narrative via e-mail. The participants responded with comments or elucidation on specific instances that reflected their experiences accurately or inaccurately and the author then incorporated these changes into the sections that follow.

### **The Participants**

In order to better understand the unique experiences that occurred within each

team, it is important to know the participants. Each team and its individual members had goals, personality, processes and outcomes that reflected the cooperative nature of the project. The following narratives describe the teams' members in the contexts of the teams and the projects in which the teams were involved. The names of the teams are not those used in the actual Emissary dialogues (which were chosen by the facilitators and reflected the content of the project). The pseudonyms used in this paper reflect the content of the projects while preserving the confidentiality of the teams' identities.

### ***The Ecology Team***

The Ecology teacher has taught for 21 years in grades K-12 and currently teaches at the elementary school level. She has a master's degree in education and is very knowledgeable and active in instructional technology projects, although her school resources are very limited. She has been on-line for 11 years, is married to a college professor and has two teenage sons. Her husband's job allows her to have direct Internet access from her home.

The school in which she teaches is in a large inner-city urban school district on the west coast of the US. The students qualify for school-provided meals and other subsidized services. During her Emissary experience she taught sixth grade in a school of 390 students. There were no computers with on-line connections in her classroom so the students used a non-networked classroom computer to write their questions and responses to the SME with a word processing program. The teacher saved these writings to a disk and e-mailed them from home after school. When a response was received, she printed it and brought a hard copy to share with the class.

The Ecology SME is an entrepreneur who owns a business in the central region

of the US. His company does “environmental construction and ecological consulting.” He has a master's degree in Biology and has worked for 20 years in this field. There are two partners in his company who were part of the expert team for this project. The older of the two serves as “personnel liaison and Chief Financial Officer.” The youngest and newest member of the company is still working on his undergraduate degree in environmental management.

The first SME is the one who had the strongest “presence” of the three in the dialogue and the only member interviewed for this research. He contributed more frequently to on-line discussions and was involved in more of the teacher-SME interactions than the other two company members. He has been on-line for ten years, is married, and has two children whom his spouse homeschools.

The Ecology facilitator is originally from Brazil, where she had completed her coursework toward a doctorate in physics. She is now completing a master's degree in instructional technology at a large southwestern urban university that all of the facilitators attend. She has taught and tutored at various levels of education in both Brazil and the US. She has since left the Southwest to write curriculum for Internet-based adult courses. She has been on-line for four years and is divorced and has no children.

The initial goal of the Ecology teacher was to provide students with an opportunity to talk one-on-one with experts about environmental issues. The three partners sent introductory messages to which students replied after choosing a SME that seemed interesting to them. Not all students in the class were involved in the project because the teacher could not secure parental permission for all students to participate. The teacher did share the SME responses with the class as a whole, even

though only a few students directly corresponded. Communication between students and SMEs gradually shifted away from the environment to personal or as the project period went on, other science-related topics.

### ***The Electricity Team***

The Electricity teacher teaches in a small rural geographically isolated community in the central region of the US. The school serves grades K-6, has only 38 students and is the only school in the school district. The teacher has 20 years of teaching experience in elementary schools and currently teaches a combined classroom of fourth, fifth and sixth grades with a total of 14 students. She has a BA in elementary education and psychology and her areas of specialization are computer science, language arts and general science. She has been on-line for two years and is married with no children.

The Electricity team's communication was the teacher's second Emissary project during the past year. Her classroom does not have Internet access. Her students posed questions to the SME in class discussion and these questions were then sent to the SME by the teacher from her home after school.

The Electricity SME teaches at small midwestern school that is a satellite campus for a large, statewide university system. He teaches introductory physics to both science and non-science majors. He has a doctorate in physics and taught for two years in the Peace Corps and 19 years at the university level. He has been on-line for ten years, is married, has two teenage children and is very active in sporting pastimes.

The Electricity facilitator also assisted the Sea Critter team described next. She had just completed a master's degree in foreign language education and is now teaching secondary French. She worked for seven years for a software company and is interested in the use of computers in foreign language education. She has lived all over

the US and enjoys recreational sports. She has been on-line for three years and has facilitated Emissary teams for a year and a half. She is married and has no children.

The Electricity team's project focused on the nature of energy. The teacher posed questions of her own to the SME and also sent questions from the students. The SME's messages were shared with the entire class and became a foci for classroom discussion or inquiry.

### ***The Sea Critter Team***

The Sea Critter teacher teaches gifted and talented elementary students in a suburban northeast coastal city. Her school has about 525 students in grades K-5. She has taught for 25 years, has a master's degree in education and often takes courses via the Internet or on location to learn more about science. She has been on-line for two years and has been involved with three previous Emissary projects. She is married with no children.

The Sea Critter team initially focused on creating a salt water aquarium as a result of their studies of coral reefs with the JASON Project. The teacher, along with seven gifted and talented students and 105 other third graders, worked on the aquarium. The students' queries were shared through teacher-generated e-mail messages to the SME, sent from the teacher's home after school.

The SME for this team teaches in a large urban, west coast state university. He has a doctorate in oceanography and during the past ten years has taught marine biology, marine data systems and, most recently, computer science. He has been on-line for ten years and has been involved in two previous Emissary projects. He is married and has two daughters, one of college age the other in elementary school.

Initially the Sea Critter team's goal was to construct a salt-water aquarium. The

dialogue was teacher-mediated but questions posed to the SME generally came from the students as they made decisions and sought answers. The team eventually switched to a fresh-water aquarium and even caught animals for it from a stream within walking distance of the school.

### ***The Gene Team***

The Gene teacher works in a private Catholic girls school in the eastern US. She has a master of science degree with a specialization in biology and genetics. The school has 526 students in a suburban community located near a large metropolitan area. The teacher has 31 years of educational experience, 22 of those years at the secondary level. She has been on-line for three years and is unmarried.

The Gene team students used the teacher's account to send messages from a school computer lab and the teacher printed received messages for each student.

The Gene SME was finishing her doctorate in research pathobiology during the time of the project. She had been teaching part time for two years in a K-12 science outreach program as well as teaching graduate courses in general science, biology, chemistry, genetics and molecular biology. She also worked several part-time jobs, including one at the local science museum in which she developed "hands-on experiments for the human biology hall." She has been on-line for four years and she and her spouse have a six-year old daughter.

The Gene facilitator is a doctoral student in instructional technology at the same university as the other two facilitators. She has finished her coursework and is now beginning the dissertation process. She has a master's degree in instructional technology and taught an undergraduate computer literacy course for preservice education students for two years. She has two undergraduate degrees in fine arts as

well as three years of undergraduate coursework in zoology with an emphasis in genetics. She has facilitated Emissary teams for a year, has been on-line for three years, is divorced and has a teenage daughter.

The Gene team focused on student exploration of issues related to genetics. The students were divided into teams and each one selected a specific topic for inquiry. The students e-mailed the SME through the teacher's e-mail account. The teacher printed responses from the SME and gave them to the students. The SME suggested resources to the students and also posed questions to them. Students kept a journal that illustrated the process of their inquiry. They completed the project with a written synopsis of what they had learned about genetics as well as a reflection about the on-line experience.

These descriptions of the teams examined in this study should provide the reader with a sense of their diverse nature. In traditional teaching situations, people such as these probably would not have come together to collaborate. The findings that emerged from their experiences are contextually bound to the unique combinations of personalities and dynamics of their on-line interactions but may help to inform other telementoring efforts.

### **The Themes**

Each team's unique composition did not result in singular or isolated experience when the teams were compared. The themes reported here reflect the commonalities among teams, which reveal subtle variations within each topical area. The themes described are: building sense, presence of SME, SME awareness, restraints, presence of teacher, perceptions of facilitators, "the kids were the ones," and expertise and learning

#### ***Building Sense***

The teams all developed on-line discussions that, by adult participants' estimation, were successful for the students. This is important to keep in mind since what happens in the classroom may or may not be evident to the other on-line participants, limiting the 'big' picture perceived and resulting in failure of the mentoring relationship (O'Neill, 1996). In order to make sense of the project, the adult participants had to develop a sense of each other's perceptions, personalities and ways of communicating on-line. Building sense through responsiveness was achieved in several different ways.

All of the teachers, even though they each had specific goals, said that they allowed the SMEs to direct the course of the on-line conversations. This is particularly interesting because the SMEs and facilitators felt that the teacher directed the project, a phenomena that may reflect a characteristic of e-mail communication in which lack of nonverbal information limits the users perceptions of others (Dubrovsky, Kiesler, & Sethna, 1991; McGuire, Kiesler, & Siegel, 1987). It may also reflect the reassurance and trust felt by the teachers in collaborating with an expert. Building sense appeared to be a result of decisions by the teacher and SME, independently and cooperatively, and the nature of each individual dialogue was unique to the teams' characters and goals.

For the Ecology students, the conversations hinged on what the SME said about himself or his works. This often drifted away from the original topic of recycling, but the teacher never intervened to ask the SME to re-direct. The Electricity teacher relied on the response of the SME to the students' questions to direct her activities in class. This led to a "Jumping Wire Experiment" which demonstrated magnetic and electrical energy with the use of magnets, which was a new activity for her and from which she as well as the students learned.

The Sea Critter teacher maintained a role of facilitator and brought the SME's comments and suggestions to the students for them to discuss and act upon. This led to a change from creating a saltwater to a freshwater aquarium once students analyzed and discussed the SME's comments. The Gene teacher experienced a more indirect connection with her SME. "I mean if [she] had been sitting there in my classroom not talking to them from the Internet, it couldn't have worked any better!" Here the immediacy of the teaching experience led to a kind of symbiotic responsiveness between the teacher and the SME, a relationship more typical perhaps of face-to-face interactions.

For all of the teams, the responsive nature of the SME seemed to allow the teacher freedom to "go with the flow" of the dialogue in a way that might not occur in a non-computer-mediated classroom activity. In describing the nature of professional knowledge Clandinin and Connelly (1996) use a metaphor of landscape to illustrate the changing scenery of the classroom. They note that "as this landscape shifts, what they know shifts as, indeed, do the values attached to that knowledge " (p. 29). The teachers relied on the SME to provide information and drew upon that to build connections with what went on in the classroom to reconsider their own instructional practices.

### ***Presence of SME***

The acknowledged role of the SME is determined through discussions between the teacher and the SME, and occasionally, with the facilitator. The SME serves as an expert in his or her content area. Who the SME really is and how he or she is perceived by the other team members varies among teams, as does the SME's own perception of the Emissary experience. Yet there are many characteristics of the SME role that are common to all teams.

All of the SMEs were motivated to volunteer for the Electronic Emissary out of a desire to share their knowledge with students. The Sea Critter SME had a mentor in college who encouraged him to mentor others. He felt that as little time as it took him to reply to messages in the dialogue, it was well worth the benefit to those he was assisting and it also helped him learn. The Ecology SME volunteered because he and his spouse homeschool their children and feel that “education in our country is going downhill” and they want to contribute to bettering it. The Electricity SME felt that “too often professors stay in their ivory towers and do not do a good job of advertising.” He, as had the Gene and Sea Critter SME, worked with students in school-based programs and had experienced the impact he could have on children.

None of the teachers in the teams that participated in this study interacted as much with the SMEs as did the students. The four teachers saw the SME as a content resource who supplemented their curriculum. The Electricity teacher commented, “. . . we could have done research in some encyclopedia in some other capacity but . . . a SME is a valid way to do it also.” The Electricity teacher felt that the SME served as a current, up-to-date resource that was better than other available resources, especially in her rural community. She would read and discuss messages from the SME with her students as a focus for discussion. This was also the approach used for the Ecology team. The Sea Critter SME gave the teacher and students direction for their aquarium, focusing on content knowledge. This teacher saw the SME as “more of an advisor to me” and a “motivator.” The teacher’s describe how the SME provided them information and assistance that resulted in effective learning experiences for students.

Three of the SMEs admitted that they did not know the answers to all of the students’ questions and, in the words of the Gene SME, sometimes she “just didn’t

know what they were talking about!” The Sea Critter SME noted that “the kids do ask questions I don’t *know* anything about and I *do* have to go and do some research. . .” The Electricity SME felt that some of the questions posed could have been answered by consulting other sources but believed that the “best learning occurs when somebody has a question in mind when you start.” He never was sure if he was responding at the appropriate level for the students or if he was giving too much information, but he did not ask about this.

All of the SMEs directly addressed specific students or their questions and included student comments in their responses, personalizing the interaction. The Ecology teacher noted that the students, “. . . think it’s so cool when the SME writes them back personally.” By responding to and acknowledging personal interest and characteristics of the students, the SME was able to facilitate the discussion, enhance their receptivity and demonstrate acceptance of their ideas in their responsive interaction with the students (McGee & Dimock, 1994; Steeples, 1993; Weir, 1992).

The SMEs shared personal information in varying degrees. Each team came to “know” the SME in different ways. The Gene team SME shared more personal information with the teacher and the facilitator but the high school students became very close to her after many one-on-one messages. They came to know her as they wondered “. . . about what she should look like and . . . they love the idea she is a mom . . . and [of her] taking time out from being a student and a mom to be a teacher with them.” The Gene facilitator corroborated the personable nature of the Gene SME. She felt the SME made her research real by sharing real life stories. The SME’s manner made the stereotypical “cold and insensitive” researcher into a warm and humane person who “. . . responded to something each [student] had said about her project and each

girl felt important from the beginning. . . it was a real honest-to-goodness scientist out there writing to [the students].” The social presence -- the perceived social and psychological acceptance of computer-mediated partners -- of the SME was evident in these teams (Gunawardena, 1994; Short, Williams & Christie, 1976).

The Sea Critter SME did not directly interact with the elementary students and did not develop a personal relationship anyone due to “limited access” of computers and the Internet, although the students seemed to, by the teacher’s estimation “look forward” to his messages. The Ecology team elementary children did not interact with the SME frequently but they did receive individualized messages. Students carried on conversations based on their interests with the three SMEs in this team. The teacher perceived this made the students feel like they were getting a “3-D character” that they could “hook into.”

The Ecology teacher saw each of the SMEs that worked with her team very differently. The most “dominant” SME was the one she discussed. This SME revealed himself in many different ways to her. For example, she felt he lacked understanding of the Hispanic culture when he told a lonely boy that he would eventually find a “little seniorita.” Later when the SME did not pursue a conversation about radiation because he felt there were many other resources for students to answer their questions, the teacher felt that he was “copping out” on his commitment as a SME. This is not to say that she did not feel the SMEs contributed to student learning and her curriculum. But her perception of the SME reflected her analysis of his text and on-line “behavior,” and led her to draw certain conclusions about him as a person.

The Ecology facilitator did not perceive the SME in the same way as the teacher did, although she admitted that she was not reading his messages in the same way that

the teacher was. She felt that the SME possibly had high expectations for the project that focused on getting the students to become more interested in science. The SME expected to “get a lot more out of it” in terms of frequency of messages. He thought there would be more interaction and was surprised when things seemed to suddenly stop. A prolonged discussion ensued at the conclusion of the project in which the teacher shared her impression of the SME, to which he responded. The three adults - - teacher, SME and facilitator - - each had different perceptions of the project as discussed later in this paper. Nonetheless, the teacher did not change her perceptions of the SME. The SMEs in the other teams did not seem to have as well-defined expectations for project involvement, although they also were surprised by how few messages were exchanged. The variations in perceptions may reflect the nature of computer-mediated communication in which users must accommodate for missing visual and expressive information and, in a sense, requires that they ‘read between the lines’ (Endigo, 1990; Short, Williams & Christie, 1976 ).

The Electricity students probably had little sense of the SME, since the teacher shared his messages with the class and used them to focus discussions and activities. The teacher did talk about him as a ‘real’ person, including his hobbies and idiosyncrasies, but “it didn’t seem to be important to [the project].” This lack of personal dimension relates to the instructional need of the teacher (Johnson, 1990), which for the electricity project was not necessary. In a previous Emissary project, another SME had shared a lot of personal information and wanted to know the students in personal ways too. The teacher felt this might reflect the personality of the SME, the fact that the current SME was having a very busy semester or that knowing the SME personally was not critical to student learning.

Some of the SMEs used specific strategies to keep the on-line conversation going. The Gene SME always asked questions at the end of each message that prompted inquiry in the classroom. She did this consciously, giving her a sense of involvement and the teacher a sense of direction in the conversation.

I was billed as the expert so I wanted to fulfill that role but at the same time I wanted to be sure they were getting something out of it. . . So somehow they needed to be invited and welcomed in and welcomed to continue or change directions or have . . . some ownership of it themselves.

The Ecology and Gene SMEs interacted directly with the students and felt that they got to know them quite well. The Ecology students focused on their own interests and responded to the SME's interests. The conversation followed story lines from the student's experiences and was personalized. For example, Thomas talked about his "missing dog and his good friend who died," which were very important to him. They were therefore also important to the SME, even though they were different from the topic of discussion. The Ecology SME commented that ". . . the information from the kids made us feel like we knew them . . . [student information was] therefore weighted somewhat by us as more important to us even though somewhat off the subject." The sense of rapport and connection felt by the SME was contradicted by the restraint they demonstrated in not making instructional suggestions or asking pedagogically related questions to the teacher.

### ***Restraints***

All of the teams engaged in prolonged dialogues which, from the participants' perspectives, accomplished goals. There were, however, instances in which three of the four SMEs might have suggested changes in the project, but did not. All of the SMEs seemed to feel that the teacher was the project leader and they were participating in an ancillary way.

The Ecology SME felt that spelling should be corrected and that the project should be more structured, which for him meant that correspondence should be more regular. The Gene SME wondered if the "focus on cancer research might be a little too narrow for the needs of these students" and she wished the students could "develop more thoughts and work around the work we shared." The Electricity SME would have liked to correspond "more regularly [to provide] more of a feeling [of] what was going on" for both himself and the students. This may reflect the working contexts and expectations of the SMEs, all of who had offices and ready access to e-mail during their work day, in contrast to working conditions for the teachers and students with whom they communicated.

Considering her previous experience with high school students, the Gene SME wondered if the students with whom she corresponded understood the "difference between a clinician and a researcher" and was not sure if she should mention the idea. She did broach the topic with the teacher, and when asked about it, the teacher had not considered the idea but thought it would be helpful, especially for those students considering careers in science.

The picture of the SME presented here reflects a willing resource. This willingness is illustrated in their motivation to share their knowledge and motivate students' learning (O'Neill, Wagner & Gomez, 1997; O'Neill, et al. 1996). The SMEs that

directly interacted with students also had the highest perceived degree of familiarity, although the lack of this was not felt to be detrimental to the overall success of the project in which the SMEs were not known personally by students. The sense of SMEs developed by the teachers and facilitators was drawn indirectly from the content and sometimes frequency of their messages.

### ***SME's Awareness***

None of the SMEs really knew what was going on in the classrooms but this did not seem to concern them. The Electricity SME described this best as he felt “there were certainly some flashes” about what was happening in the classroom and felt like “everything was working good.”

The Electricity SME was curious about the teacher’s curriculum, although he did not seek more detailed explanations from her explanations. He wondered if the way in which he felt rushed in responding to the messages came across in his responses. The teacher did, in fact, perceive him to be very busy.

The Gene SME was surprised by how closely the on-line discussion seemed to follow what was going on in class. She was unaware that the teacher read all of the messages and used these to direct and organize her own curriculum sequence.

The Sea Critter SME did not feel that he knew what general student activities were going on, but he did feel very aware of the aquarium-building process. He did not feel that he needed more information though. He compared himself to a visiting music teacher who “. . . sees that class when she’s in there teaching music and what goes on the rest of time, I imagine she doesn’t really know that well.” The facilitators, however, all felt that they had some idea of what was going on in the classroom, from

the teachers' descriptions to the SMEs. This information was primarily focused on schedules and broad statements of student activities, rather than detailed descriptions of students' responses or behaviors.

The Gene SME was often surprised by the quality of responses from the high school girls because she had no idea of how the teacher was guiding them in apparently extensive research. "I was surprised by the lack of discussion with the teacher and the well-thought out work of the students (obviously under the direction of the teacher)." She deduced this from the content of the e-mail messages, not from direct summaries of activities or projects by the teacher or the students. The SMEs appeared to have a sense of trust and understanding of the teacher's role and responsiveness to the dynamic qualities of the dialogue. The SMEs relied on the teachers for their practical knowledge of how best to structure and respond to classroom events (Carter, 1990).

Although the SMEs were all unsure of what was going on in the classroom, they were comfortable and adamant in allowing the teacher to make decisions about interaction, even though they all had opinions about alternative ways of doing things. This analysis suggests that the SME, as a content expert, plays a role that is complementary to that of the teacher who is the learning expert. Their expertise was seen as their strongest asset by the teacher and reflects teacher motivation for collaboration identified by Johnson (1990) -- personal (development and learning), instructional and organizational. Each teacher drew upon the SME for different motivations. The SME provided reciprocal response as described by Kram (1985) in four psychosocial functions of mentoring: role modeling, acceptance and confirmation, counseling and friendship. These SME's appear to assume both acceptance and confirmation and counseling functions as they guide and provide feedback to the

teacher and/or students. The teacher's presence is clearly articulated by the adult participants and supports the SME's deference to the teacher's role as a learning expert as a personal, instructional and organizational support.

### ***Presence of Teacher***

The teacher's role is self-evident in the Emissary project in that he or she is the primary contact with the students, for whom the project is designed. The teachers interviewed did perceive their roles as unique to the project itself and not necessary reflective of the roles they play in regular classroom activities. The Sea Critter teacher asked the SME "Where do you want me in this" deferring her role as director of learning to the SME and contradicting the SMEs' and facilitators' perceptions of the teacher as learning expert. This discrepancy may reflect the lack of non-verbal information available or it may reflect the teacher's own self-reflection prompted by the atypical requirement to talk with others about instruction.

The Gene teacher saw herself moving to a child-oriented classroom rather than a teacher-oriented [classroom]." Whether these changes become permanent remains to be seen but indicate the teacher's reflection about her role in the course of the instructional on-line project. There is evidence that teacher learning can be facilitated through on-line experience (Riel & Levin, 1990) and that teacher reflection can promote professional development (Feiman & Folden, 1981).

The SMEs all deferred to the teachers' expertise and plans for the project, even though there were times when they might have seen other, possibly different directions in which to take the discussion. The Gene SME saw the teacher as very knowledgeable in the content area being studied, much more so than other teachers

with whom she had worked. The Electricity SME felt that the teacher was able “to ask questions when there was something she was not aware of.” The Sea Critter SME agreed that the teacher would respond to his messages with questions of her own, mostly for clarification purposes -- of procedure or content with which she was unfamiliar, reflecting the teacher’s learning. The Ecology and Gene SMEs did not ask for content information for different reasons. In the Ecology team the dialogue became more personal and did not require the teacher to ask content-related clarification questions. In the Gene team, the teacher already knew a great deal about the discussion topic and therefore did not require content information.

The role of the teacher in these Emissary projects appeared to be one of facilitator or intermediary between the students and the SME, reflecting a constructivist approach to teaching in which the teacher supports and guides students learning rather than directs it (Fosnot, 1996). The Gene SME mentions that “[the teacher] was fairly silent.” She was “surprised by how well the teacher organized {the project}.” The Gene teacher commented on shifting from a teacher-centered to student-centered classroom and acknowledged that this project took much more time and organization than a traditional course of study would have taken. The Electricity teacher said “I try to stay kind of in the background, as a typist.” The Sea Critter teacher also relayed student questions as they were posed. The Ecology teacher even let her students’ typographical and grammatical errors go uncorrected, so the SME would get a more accurate picture of her students.

The Sea Critter SME said that all of the teachers with whom he has worked have been :

. . .well organized. . . ready to do whatever it was that was

necessary as any high school or college teacher I had been around, they knew pretty much what they wanted to do, they knew the direction they wanted to go in . . .

The teachers were also seen, at least by the facilitators and SMEs, as the designers of the projects. The SMEs mostly recognized that the teachers “did a fair amount of preliminary work with the students before coming to me,” as noted by the Electricity SME.

There was less a personal sense of the teacher expressed by the SMEs for all but one team which may be reflected the lower number of messages from the teachers in team mail logs. The Ecology teacher was described the most in terms of personality by the SME and facilitator, no doubt due to her regular supplements to students' messages in which she clarified student comments or gave schedule updates. This team also had a prolonged personal exchange between the SME and teacher after the students had stopped corresponding, which might have revealed more about the teacher than the SME. The SME described his perceptions of the teacher as follows:

I can tell by her attitude and by the things that come through between the lines in her notes that she's kind of at the edge of her line dealing with these kids. . . it looks like she's trying to do too much.

The teacher agreed that the busy nature of the end of the school year was a distraction and perhaps she had started the projects with unrealistic expectations about what could be accomplished.

The sense of teacher presented reflects the teacher as the acknowledged director and designer of both learning and the on-line discussion. Two of the teachers relied on

the SME for their own content understanding while the other two used the SME to direct and reinforce their students' learning. The teachers served as facilitators and intermediaries among the SMEs, the students and the classroom activities. This role resulted in a limited sense of the personal nature of the teacher who, except for one, did not really pursue personal exchanges. This may be seen to reflect the changing nature of the teacher's role in instruction. Constructivist practices require that the teacher facilitates and guides student construction of knowledge, which is built after assembling information (Fosnot, 1996; Brooks & Brooks, 1993). Working from student interests, the teacher provides support and direction as necessary, just as the teachers described here did with their own students. From the teacher's eyes, the success of the projects built on the teacher and SME collaboration which was contributed to, in a different way, by the facilitator.

### *Perceptions of Facilitators*

The teachers and SMEs had little to say about the facilitators. The facilitators themselves, however, were very clear and communicative of their beliefs about their teams and their own approaches to facilitation.

The facilitators were all motivated to work with the Emissary project for different reasons. The Gene facilitator saw a connection between the Emissary and "individualized instruction" in which she has a great interest. The facilitator for the Sea Critter and Electricity teams thought it would be "really fun" to facilitate after hearing about the project in a course. She was even more excited to find out that she could be paid for facilitating. The Ecology facilitator was fascinated with the idea of computer-mediated communication and wanted to learn more about how it worked.

The teachers and SMEs all seemed to see the facilitator as a "perk," someone

who just, according to the Gene teacher, “looked over your shoulder” throughout the project. This was reflected in descriptions of each of the facilitators with very minimal distinction among the persons interviewed. The Electricity SME described the facilitator as someone who prompted the teams so they did not “lapse or go off on a tangent.” He felt the facilitator’s role and degree of participation were important in keeping an asynchronous conversation going.

I thought she was good about things for being in the background. I mean you know when it was important it seemed like [she] would come in and clarify something but mostly we didn’t hear much. And except the occasional message she’d send, keep up the good work, she was kind of checking on things, it was kind of nice to know that she was available and around. And I thought that she handled it well because she did not interfere.

The Ecology facilitator noted that often it seemed like facilitation was like “working in the dark;” she spent a lot of time anticipating. Since the facilitators really don’t know what is going on in the classroom or “in the SME’s mind,” the message text give the only clues for how the project is “going.” Sometimes the facilitator may “hear” something intuitively the other adults in a team do not, and she or he will step in and clarify that to the other team member, or give private feedback to the member who may be off-track or insecure.

The facilitators all talked at length about their roles, their beliefs about how a team should be facilitated, what a successful team means and their learning in the context of assisting teams. Strategies for facilitation was a less often discussed topic,

although one facilitator had clearly defined approaches to keeping organized and interacting with the teams. The process of facilitation appeared to relate to what the facilitator believed to be her role. The Gene facilitator made this clear. “I don’t like to force my particular philosophy or perspective on teachers or SMEs . . . people get things out of their instructional experiences and it’s not my place.”

All of the facilitators believed that their primary role was to support the teams with information and help, as they needed or requested it. The Ecology facilitator tried to “go with each team’s flow, which I intuit. This ‘flow’ depends mostly on what I glean from the personalities of participants from their posts, and on occasion from their stated project objectives.”

Technological support was the most common area of information that the facilitators thought was needed by the teams. All of the facilitators felt that the teams needed to share some personal information in order to create rapport and feel more comfortable in making decisions together. According to the Gene facilitator, this helps to diminish the effects of “mechanomorphism” or the depersonalization which can occur through computer-mediated communication (Shamp, 1991).

The teams that required the least facilitation were those which appeared to have clear goals for their projects. The facilitators identified specific criteria for successful teams, formed from their on-line observations. The more organized the teacher is and the more clearly conceived the long range goals, the more likely the project will be successful (Sanchez & Harris, 1996; Riel & Levin, 1991). The Gene facilitator added that when the “students ask informed questions” it reveals the teacher’s planning. The Sea Critter/Electricity facilitator suggested sending messages more regularly, “. . . even if they aren’t talking about the project stuff, just talking.” This facilitator felt that the flow

of messages was related to the “presence” of the project in the teacher’s instructional planning. It is easy to ignore, forget or postpone an e-mail message and the regularity of messages appeared to keep the project in the forefront of the teacher’s mind.

The Ecology facilitator qualified a team’s success as to whether or not the expectations of the teacher, SME and students have been met. She found that there are exceptions to generalized criteria for success and it was difficult for her to say what is successful based on her perceptions alone.

The facilitators all said they had a hard time remembering the details of a team’s communications but they each had “favorite” teams which held special interest for them. The facilitator of the Sea Critter and Electricity teams was a student of French and was “more interested in the Humanities. . . I really enjoyed the Middle Ages and King Arthur topics, because I have an interest in them.” The Gene facilitator was well versed in basic genetics and this sparked her interest in the team’s dialogue. She occasionally posed questions to the team, one of which concerned her daughter’s search for information on Rosey Franklin, a contributor to the discovery of the structure of DNA. The Ecology facilitator reflected on her past teams’ communications and saw that the groups that dealt with topics about which she had knowledge helped her to establish rapport. She added that “as much as my brain tries to classify them [the teams] . . . the situation is never really ‘just like what happened’ to anyone before.”

The sense of facilitator comes mostly from the facilitators themselves, whose self-proclaimed roles supports the limited perception of the facilitator by the teacher and SME. Each facilitator felt it was important to “stay in the background” and only intervene when necessary, which was often an intuitive decision and, for one facilitator, also a scheduled activity. They all agreed that their job was to keep the teams “on

track” and supported with information as requested or intuited (Harris & Anderson, 1991; Riel & Levin, 1991). Each facilitator had considered what it means to be a successful team and they were able to recognize those characteristics in message texts. The facilitators were all enthusiastic about the projects and all reflected on what they would do if they were to facilitate again. This may support research findings which indicate that the highest level of enthusiasm for using technology comes from those who act as a facilitator for teacher use of technology (US Congress, Office of Technology Assessment, 1995). The facilitators seemed to act as a safety net for the teams: always present and yet to some extent invisible and taken for granted. The facilitators did not draw attention to themselves. In this way, they allowed the teachers and SMEs to better address the true focus of the project: the students.

*“The Kids Were the Ones”*

The students kept the teachers, SMEs and facilitators motivated. Although students were not interviewed for this study, the teachers perceived their benefit and for some, in-classroom learning assessment documented this. The SMEs felt less sure of the students’ learning and the facilitators had little to say about whether students learned. Depending on the logistics of each project and its goals, students experienced different types and degrees of enriching experiences. The Gene team students learned how to use telecommunications technology and, according to the teacher, learned to adapt quickly to the medium of e-mail. The Sea Critter students learned more from their off-line experiences, traveling to a local creek bed to catch their aquarium animals. Their teacher remarked, “they became *really* good observers of what was there.”

The students who directly interacted with their SME got to know him or her more personally, which is reflected in the perceived intimacy of their messages. For

example, the Gene teacher said her students became very close to their SME. They even sent her flowers when she officially graduated from her doctoral program. The Ecology students had three SMEs with which they were able to chose as e-mail partners. The students selected a SME based on their personal interests, which provided a basis for rapport. The Ecology teacher mentioned that one student knew that the SME “had an interest on rock climbing” which was a “topic that appealed to her personally.” This helped the student “follow” the on-line communication. The manner in which the students came to know the SMEs may reflect the telementoring functions performed by the SME. While the Gene and Sea Critter teams looked to the SME to direct and clarify their knowledge construction, the Energy students appeared to look to the SME for friendship, reflecting the mentoring function of acceptance and confirmation (Kram, 1985).

In two of the teams, students were touched by the interaction in a lasting way. In the Gene team, one student who was struggling academically and who rarely spoke in class increased her grade average and delved into information that the teacher earlier thought was out of her reach intellectually. The teacher said, “I mean we were talking about enzymes . . . and she was learning so much on her own that I could see where sitting in class was holding her back!” In the Ecology team, Nicholas, a student who had struggled with many personal tragedies throughout the year found that the SME “related to him and . . . he felt very comforted by them.”

The children were most motivated by learning about something in which they were already interested. The Electricity teacher explained this. “If kids are interested in learning something then they are going to put more energy into it than if they are being spoon fed. . . [This was] totally kid-driven, so that’s why we started things with

questions they had.’ The Ecology and Sea Critter teachers supported this view of the students, both having built on prior instruction of local recycling and ecology. The Gene teacher let the students draw upon their own research, asking the SME questions to which *they* wanted to know the answers. This element of self-determination (Fosnot, 1996; Deci, Valleran, Pelletier & Ryan, 1991; Lefrançois, 1991) seemed to motivate the students in all of the groups.

The students in the Ecology team enjoyed the anticipation of receiving messages and, in the words of the teacher, were especially struck by:

feeling connected to these people far away, or their feeling listened to by adults. They did not mention much about science content. They seemed pleased with the novelty of the connection as well as the meaningfulness.

The students in these projects were the ones who, in a sense, kept everyone else going, a phenomenon reflected in research showing that student enthusiasm motivates teachers to use telecommunications (US Congress, Office of Technology Assessment, 1995). The students’ pleasure in being acknowledged by adults they did not really know and their content learning, technology use, and interpersonal skills brought the adult members together and reflected the teachers’ abilities.

### ***Expertise and Learning***

The teachers all expressed some degree of professional learning as they reflected upon their Emissary experiences. Two of the teachers also referred to their previous Emissary projects and compared them to what they had experienced during the most recent one. What they learned varied from project to project, which may have been

related to their levels of expertise in using the medium of e-mail for curriculum-based teaching and learning. They all experienced development as teachers in different ways.

Three of the teachers adapted their ideas for the projects as they progressed and the teachers encountered problems or new ways of looking at things. For the Gene team teacher, organization became a critical focus as she quickly realized that the SME could not thoroughly and easily respond to 30 student e-mail messages at once.

Without discussing this on-line, she organized the students into cooperative groups and subsequent messages were fewer in number. The SME was relieved, although this was never mentioned in the e-mail messages.

The Sea Critter teacher, who had been working with a curriculum focusing on oceans, had not considered switching to a freshwater aquarium until the SME suggested it. At first it seemed to deviate from her instructional goals but the change made sense, since a local freshwater creek was close by. The teacher also revised ways of working with her students. "I was really skeptical about taking . . . 31 children down to the stream." But she found this to be manageable and a rich learning experience for the students.

The Gene teacher also organized her class differently as a result of her telementoring experience. She had been using more constructivist approaches to teaching during the past few years, but found in this project that she truly became a facilitator of learning. She provided resources for her students to use for their inquiries, which were triggered by their discussions with the SME. She supplemented the on-line activities with relevant class activities. Once the students had sent their messages to the SME and the responses had been received, the teacher made two copies, keeping one and giving the second to the students. Because the students came up with their own

topics for inquiry and by the teacher's assessment were self-motivated to learn, they were very much engaged in their research and conversations with the SME. Even though the project was very demanding of her time, the teacher felt that the careful organization of resources and activities allowed her to use the SME effectively.

For the Gene teacher, the open-ended approach to instruction possible in the Emissary project was new, and altered how she perceived teaching and learning. Although she had used cooperative learning strategies before, this project changed her perspective. "I had to change my way of thinking and just say, you know, learning doesn't have to be the same way every year. I *know* that but . . . this had a whole different drum to it." The experience of collaboration may have done more than trigger -- perhaps it forced her to rethink her traditional approaches to learning.

The Gene teacher also became aware of the need for her to play a role in organizing students so they could be prepared to interact with the SME. She saw herself as moving from a teacher-centered approach to a student-centered approach to teaching. "I've been teaching for quite a while and it's been a pretty teacher-centered classroom. Actually, I've been changing . . . once I found out how it's good to switch it to a child-centered classroom . . ." The teacher appears to be taking a constructivist approach as she allowed the students to pose questions, inquire with a variety of resources for answers and analyze information in the process of constructing knowledge while she serves as facilitator (Fosnot, 1996).

The Sea Critter teacher, having already completed previous Emissary projects, was already using this constructivist approach. The Ecology and Electricity teachers learned that they had to play critical roles in mediating between the SME-provided information and the students (Goldstein, 1994). They both learned that their students

really could not apply the content of the on-line interaction to the class discussions directly or come up with meaningful questions for the SMEs. The Electricity teacher often had to “translate the SME’s message” for the students, facilitating the students’ analyses of information.

The Gene teacher learned the value of student journaling, a task that was added to the class activities, which helped connect the students’ classwork with the on-line dialogue. Students created journals that documented their on-line conversations in terms of their content-related learning. This turned out to be a primary source for assessment of student learning for this team.

The Gene teacher learned about her students, as did the Ecology teacher. The Gene teacher was surprised that her students responded to the project so well, since it was very demanding on their time. In fact, a class of hers that did not participate was jealous of the students who did. The Ecology teacher learned that her students got a lot out of the project but she realized this only after discussing the project with them. She was even more surprised that the students who were not directly involved in the dialoguing reaped benefits from it. “They just got hooked into the energy of it . . . and went around and around with ways it had affected them and it turned out to be much more three-D.” Since the project had not met her expectations she believed that it had not really benefited the students. For the Ecology teacher this was a shift in perspective and in new ways of thinking about what she knew. She realized that perhaps she had been “wearing filters” and determining the success of projects based more upon her expectations rather than what was working in the students’ eyes. She said, “I had higher expectations of myself and my performance.”

The teachers also learned about how to work with a SME. The Sea Critter

teacher often made instructional decisions or took instructional actions that were based on re-evaluations triggered by the SME, such as taking the SME's suggestion to make a freshwater aquarium. The SME also suggested buying the fish rather than catching them, which had not occurred to the teacher.

The Electricity teacher readily stated that part of her motivation to use a SME was to support her own content-related learning. She posed a few questions to the SME herself and found an experiment suggested by the SME -- the "Jumping Wire Experiment [was really] intriguing and mind stretching" for her as well as the students.

The expertise of the teachers was enhanced by their learning acquired throughout the project. They all learned to be more flexible and adaptable in their pedagogical methods, which for some seemed to transfer to their face-to-face interactions with their students, a phenomenon supported by research (Becker, 1992; Sheingold & Hadley, 1990). Two of the teachers experienced content learning and all added to their on-line communication skills. Their organizational skills, either in managing student behaviors or class activities, were also challenged and enhanced. Of all the professional learning, the role as mediator seemed to stand out as a natural extension of the electronic interaction. Considering that the teachers did not enter into the project intending to develop skills, this unintentional professional development proved to be a significant and thought-provoking supplement to the goal of student learning.

### **Discussion**

A common thread runs through all but one of the themes described here. The professional development of the teachers is evident in interactions with the SMEs and facilitators, the teachers' own role perceptions, the process of building sense with other

adult team members and in the teachers' recognition of the students' learning.

Learning, for teachers, comes from practice. Professional problem-solving often reveals new learning needs. Teachers are often unaware of what they need to know until confronted with an instructional or curricular dilemma (Steeple, 1993). Each of the teachers described, self-motivated and empowered, have analyzed their teaching context and pursued means to fill in the gaps of their individual professional beliefs and practices, which may have involved searching for new content information or instructional strategies. As they constructed knowledge they provided a way of "interweaving of learning and practice that allows not only the accepted skills and practices to diffuse through the community but also provides the opportunity for new innovative ways of working . . ." (Steeple, 1993, pp. 199-200). There is evidence that using e-mail allows teachers to communicate more openly than in face-to-face situations (Rowe, 1993). Electronic exchanges may give teachers a freedom that is based not just upon accessibility but reflective of the relative anonymity of the medium that does not include temporal and visual information (Smilowitz, Compton & Flint, 1988).

The teachers all perceived the social presence of the SMEs (Short, Williams & Christie, 1976), as the SMEs did of the teacher and yet none of the teachers relinquished control of their students to the SME. Each participant -- teacher, SME and facilitator -- only thought they were helping the project, not directing or determining what did or did not happen. Even though all of the players admitted to not having all of the information they would have liked or could have had, they all performed their roles adequately. Through this guided and collaborative experience, learning, for the teachers, occurred as a result of the group process (Kaye, 1992).

The nature of dialogue and conscious post-program evaluation provided the

teachers an opportunity to reflect upon their work and to create change. Smyth (1989) identifies four ways teachers reflect about their practices: *describing* what is happening during instruction; *informing* others about their analysis of their pedagogical actions; *confronting* why and how these decisions came to be made and enacted; and, *reconstructing* how future experiences might be different. The Emissary teachers in this study have engaged in all of these activities, except formally confronting decisions, either during the project or in the post-project summary required of all participants. The SMEs all pointed out that the teachers provided only minimal information describing instruction and there were no confrontations about the teachers' rationale for making instructional decisions. Perhaps, as suggested by the SMEs, both in these Emissary documents and in other papers (Michalove, 1996), a more prolonged rapport-building and planning period with the teacher and SME might result in increased teacher reflection and professional growth.

For the teachers in this study the most telling shared attribute in their professional growth was that it was unintentional. There was no school or administrator mandate that initiated their involvement. In fact there was no motive to do anything more than to enhance student learning. They all expressed a conscious connection between student comprehension and their instructional goals or perceptions of content. This was evidenced by their shift in method, re-sequencing of instructional events and revised approaches to teaching. Yet all of the teachers benefited without a structured or pre-determined program of learning as is traditionally associated with the acquisition of "job-related knowledge, skills or attitudes" (Loucks-Horsley & Sparks, 1989, p. 41). It appears that the Emissary provides teachers with opportunities to reflect on their practices and support in the form of feedback, critical factors in professional

development (Sparks & Loucks-Horsley, 1990). An action-based study with teachers and university instructors (Clark, Moss, Goering, Herter, Lamar, Leonard, Robbins, Russell, Templin, & Wascha, 1996) revealed that collaboration that is based on co-learning “has the advantage of allowing everyone to bring their own agenda and focus to the work in a way that a more structured, less open approach might not invite” (p. 226). In these Emissary teams the teachers and students learned simultaneously but they learned different things.

There is some evidence that telecommunications used for professional development can facilitate reflective practice, through which teachers and others can learn from each other (US Congress, Office of Technology Assessment, 1995). This is evident for the teachers in this study and suggests that educators might be provided more opportunities to seek and develop on-line relationships.

The teachers, however, did more than collaborate on-line; they tapped into an autonomously initiated, yet cooperatively created resource. This phenomenon may be a means of building extended communities.

Responsibilities in an information age require a higher and deeper awareness of associated living. Autonomy, so much a cherished attribute of enterprise culture, is founded on dependence (Davis, 1994, p. 64).

Lieberman (1995) suggests that educators rethink the nature of teacher growth traditionally viewed as a result of staff development, in which learning occurs outside of the school in discrete and packaged segments. Lieberman claims that teacher learning should be a combination of experience and content, which draws upon what the teacher knows and experiences on a daily basis. Teachers learn by taking on new roles, creating

new work structures with others, taking on new reflective tasks and seeking out opportunities for their own professional growth. All of these appeared to occur for the Emissary teachers, although unintentionally. Can schools rely on teachers to learn without intending to do so? What implications does this have for those who evaluate and train teachers?

Perhaps the most critical point to be kept in mind is that imposed training or opportunities for growth may not result in professional development (Miller, 1995; McLaughlin, 1991; Sparks & Loucks-Horsley, 1989). Time for teachers to interact and cooperate with peers and experts must be considered if self-generated learning can occur. The teachers in this study used their own time, outside of school, to maintain the dialogues without external recognition or even self-acknowledged admission that it was a burden. Just as we have seen with children's learning so must we accept with adult learners that flexible time and active involvement in problem solving is crucial to development (Lieberman, 1995; Watts & Castle, 1993). Learning is embedded in the context in which it occurs, hence time for development should occur during the workday (Sparks, 1994). If unintentional teacher learning can occur as an outcome of on-line collaboration with goals for student learning then resources and time might be provided to nurture this type of learning.

The conclusions drawn from this study trigger other questions for research. What qualities must a teacher have to pursue and persist in telementoring (Stuhlman, 1994)? Are there teachers who do not experience incidental learning during on-line student-centered projects? If so, what conditions prevent this? The future of telecommunications in the classroom cannot just focus on the student as learner. Ways to motivate, educate, and encourage teachers to seek out collaboration is critical to the

adoption and integration of telecomputing into the curriculum and into professional practice.

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## Appendix A

### Teacher E-mail Survey

Have you participated in Electronic Emissary projects before?

If yes, how many?

If yes, during which of the following semesters?

Please place an asterisk next to the appropriate semesters.

Spring 1994

Fall 1994

Spring 1995

Fall 1995

Spring 1996

What was/were the topic(s) and goal(s) of the Spring 1996 project?

What were your expectations as you began the project?

Did you experience any learning in any of the following areas during the project?

Content area?

If yes, to what do you attribute this?

Teaching practices?

If yes, to what do you attribute this?

Attitudes about content are, teaching practices and/or students?

If so, to what do you attribute this?

Did you experience any other learning during the project?

If so, what was this? To what do you attribute this?

#### Personal Information

Highest degree earned:

Specialization:

Years teaching/grade level/discipline:

School size:

Years on-line:

## Appendix B

### SME E-mail Survey

Have you participated in Electronic Emissary projects before?

If yes, how many?

If yes, during which of the following semesters?

Please place an asterisk next to the appropriate semesters.

Spring 1994

Fall 1994

Spring 1995

Fall 1995

Spring 1996

What was/were the topic(s) and goal(s) of the Spring 1996 project?

What were your expectations as you began the project?

Did you contribute to the planning of the project? If so, what was your contribution?

What was your role in your interactions with the teacher? The students?

How would you describe your relationship with the teacher?

Did you perceive any changes in the teacher?

If so, what was their nature and what seemed to be their cause(s)?

Content knowledge:

Teaching practices:

Attitudes:

Frequency of messages:

What, if anything, might have contributed to a more meaningful experience for the teacher?

#### Personal Information

Highest degree earned:

Specialization:

Years teaching/student level/discipline:

Years on-line:

## Appendix C

### Facilitator E-mail Survey

Have you participated in Electronic Emissary projects before?

If yes, how many?

If yes, during which of the following semesters?

Please place an asterisk next to the appropriate semesters.

Spring 1994

Fall 1994

Spring 1995

Fall 1995

Spring 1996

What role(s) did you play in each of the following teams: (names of teams listed here)

Were you aware of conversations in any of these teams concerning: content knowledge, teaching practices, attitudes (content, teaching practices, students), use of e-mail, or other areas outside the students' experiences?

If so, what was their nature and to what do you attribute their emergence?

Content knowledge:

Teaching practices:

Attitudes:

Use of e-mail

Other areas outside of students' experiences:

Did you perceive any benefits to the teacher, either acknowledged or not?

If so, what were they, for whom were they realized and in what ways were they acknowledged?

#### Personal Information

Highest degree earned:

Specialization:

Years teaching/student level/discipline: