1. Introduction

This study exploring a one semester faculty technology mentoring experience at Iowa State University (ISU) investigates what kinds of knowledge were acquired by the faculty, what strategies were learned, and what contextual factors facilitated faculty member learning. The theoretical framework that underpins this study is cognitive apprenticeship developed by Collins, Brown, and Newman (1989). The mentor's use of cognitive apprenticeship teaching strategies during the mentoring sessions with the faculty formed a major part of this research. Knowledge transfer in the cognitive apprenticeship situations used in this study was thought to take place mostly through a cycle of modelling, coaching, and scaffolding. This cycle forms an integral part of knowledge development, communication, and social interaction that together represent a learning cycle based on mentor supported cognitive apprenticeship learning methods using an authentic design project in a real setting.

In the following part, I provide a literature review on the topics of constructivist learning, situated learning, and cognitive apprenticeship. Following the literature review, I include a detailed description of the methodology including research design, data collection and data analysis procedures and case introduction. Then, I present the findings of the study based on the cognitive apprenticeship model. I conclude the paper with some discussion of the results emerged from the study and recommendations about both designing cognitive apprenticeship learning environments and future research.
2. Literature Review

2.1 Roots of Cognitive Apprenticeship: Constructivist theory

Constructivism asserts that knowledge is constructed by the learners based on their experiences. Meaningful knowledge is the result of active reflection on the part of the learner, and is best accomplished by means of tasks relating with real-world experiences. Effective instruction, therefore, aims at asking the learner to model the world, predict outcomes, and attempt to reconcile actual outcomes with predictions based on the student's own cognitive model (Rodenburg, 1998). Piaget’s developmental theory, Vygotsky’s theory on the Zone of Proximal Development (ZPD) and Bruner’s theoretical framework, which stresses cognitive structure in the form of schema and mental models, influenced the development and implementation of constructivist learning environments (Seitz, 1999).

2.2 Situated Learning/Contextual Learning

Constructivists view cognition as situation-bound and distributed rather than decontextualized tools and product of minds (Lave, 1988). Situated learning is a general theory of knowledge acquisition (Seitz, 1999). The activity in which knowledge is developed is an integral part of what is learned. And, one of the main tenets of the situated learning is that “Learning and cognition are fundamentally situated” (Brown, Collins, & Duguid, 1989).

The key principles of situated learning are stated as follows:

1. Knowledge needs to be presented in an authentic context. Lave (1988) argues that learning is a function of the activity, context, and culture in which it occurs. It is believed that rich contexts can reflect students' interpretation of the real world and improve their knowledge being transferred in different situations. Situated learning takes place in an environment which shares as many qualities and characteristics with a real performance environment (Rodenburg, 1998; Gibbons, 1996).

2. Learning requires social interaction and collaboration. Learners become involved in a "community of practice" which embodies certain beliefs and behaviors to be acquired (Bredo, 1994). In situated approaches, students collaborate with one
another and their instructor toward some shared understanding (Oliver, 1999). Collaboration can lead to articulation of strategies and generalization of situated bounded understanding.

2.3. Cognitive Apprenticeship

Cognitive apprenticeship developed by Brown, Collins, and Newman (1989) is a model of learning based on situated learning theory. It provides practical steps for applying situated learning theory (Oliver, 1999). Therefore, it is based on the notion that all significant human activity is highly situated in real-world contexts (Hockly, 2000; Rodenburg, 1998; Brown, et. al., 1989).

Collins, et. al (1989) explained the importance of cognitive apprenticeship as follows:

"Only in the last century, and only in industrialized nations, has formal schooling emerged as a widespread method of educating the young. Before schools appeared, apprenticeship was the most common means of learning and was used to transmit the knowledge required for expert practice in fields from painting and sculpting to medicine and law. Even today, many complex and important skills, such as those required for language use and social interaction, are learned informally through apprenticeship-like methods--that is, methods not involving didactic teaching, but observation, coaching, and successive approximation" (p. 453).

Therefore, cognitive apprenticeship is viewed as an "instructional tool” that is aimed at helping students acquire cognitive skills that are concerned with the cognitive processes of analysis, interpretation and decision-making. The development of cognitive skill demands a sophisticated learning process as much of its process is not externally visible and runs inside a human mind (Patel, Kinshuk & Russell, 2002). Among the key principles of cognitive apprenticeship is to support novice learners in developing their reasoning abilities by making expert thinking in a subject area visible (Gibbons, 1996; Collins, Brown, & Holum, 1991; Collins, et. al. 1989). Collins et al. (1989) pointed out that in cognitive apprenticeship, learners can observe how experts deal with problems in an authentic context, and they learn to solve the same or similar problems by “learning through-guided-experience” in authentic activities (p. 457). Therefore, instructors should put their thoughts and reasons into words while explaining and demonstrating certain actions such as describing what they are thinking
and doing, why they are doing what they are doing, and verbalizing their self-correction processes" (Seitz, 1999). These think-alouds allow students to build a conceptual model and acquire an integrated set of cognitive and metacognitive skills through processes of observation (Collins, 1991; Collins, et. al., 1989).

Essential to the model is the context in which this apprenticeship takes place. The context for the cognitive apprenticeship has three key features:

- The work must be situated in realistic tasks that are representative of the field being pursued.
- Tasks are typically carried out within a collaborative learning community where learners work together with the educator to develop ideas, assist and critique each other’s work.
- Tasks are motivating to learners due to their real-world value (Brown, et. al., 1989).

The model that Collins et al. (1989) proposed has six major steps:

1. **Modeling**: Modeling in cognitive apprenticeship means showing how a process unfolds and giving reasons why it happens that way. The goal of this stage is to build mental models of experts' cognitive processes so that learners can eventually work on their own (Brill, Kim, & Galloway, 2001). Moreover, by seeing both process modeling and accompanying explanations, learners can develop the knowledge about when and where they should use the knowledge to solve a variety of problems (Seitz, 1999; Wilson, Jonassen, & Cole, 1993; Wilson & Cole, 1991). Modeling does not just occur at the beginning of the study. As learners experiment and create, the teacher might take a moment to model a more sophisticated technique (Darling-Hammond, Austin, Cheung, Lit, & Martin, 2006).

2. **Coaching and feedback**: Coaching within cognitive apprenticeship consists of assistance delivered either prior to, during, or after portions of a learner performance (Darling-Hammond, et. al, 2006; Gibbons, 1996). The master coaches the apprentice through a wide range of activities: choosing tasks, providing hints and scaffolding, evaluating the activities of apprentices and diagnosing the kinds of problems they are having, challenging them and offering encouragement, giving feedback, structuring the ways to do things, working on particular weaknesses. In short, coaching is the process
of overseeing the student’s learning (Collins et al., 1991). One key to effective coaching is to not interfere too much thereby, allow students to detect and use their own errors (Seitz, 1999; Wilson & Cole, 1991).

Although it is considered a separate component of cognitive apprenticeship, coaching has as much in common with the process of scaffolding. Both involve a teacher (or a more knowledgeable other) providing some type of assistance to a learner to facilitate attainment of a goal. However, coaching may be seen as a broader term than scaffolding. Because it is the process of doing whatever it takes to assist learners in their learning, from start until finish (Brill, Kim, & Galloway, 2001). Therefore, scaffolding can be considered only one form of coaching.

3. Scaffolding and fading: Scaffolding is based on Vygotsky's concept of the zone of proximal development (ZPD), which he defined as the distance between the "actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Wilson, et. al, 1993). Scaffolds can include examples of completed tasks that allow learners to see what they are working toward, a series of sequenced steps with assistance and instruction that add up to a completed product, or a variety of aids for learners, including materials, techniques, and tutoring on specific concepts or skills (Darling-Hammond, et. al, 2006; Gibbons, 1996). As novices become more skilled, scaffolding is removed (sometimes referred to as fading or descaffolding), giving the apprentice more and more responsibility (Darling-Hammond, et. al, 2006; Brill, Kim, & Galloway, 2001; Oliver, 1999)

4. Articulation: Articulation consists of expressing things at a verbal level and plays a role in forming patterns of performance and of knowledge. It is a part of learning to learn, and so must be practiced as a part of performance starting from the beginning of learning (Gibbons, 1996). Talking about one's plans and activities as they solve problems can help learners develop more appropriate mental models of expert performance (Wilson, et. al., 1993). Think-aloud protocols are one example of articulation (Wilson & Cole, 1991). Articulation can be interwoven in a learning experience through a variety of strategies including discussion, demonstration, presentation, and the exchange of written or other learner-produced artifacts (Brill, Kim, & Galloway, 2001).
5. **Reflection**: Reflection is similar to articulation, except it is pointed backwards to past tasks. Reflection can be encouraged in students in a variety of ways. For example, a mentor can pose experientially-based questions, or ask students to construct their own questions, throughout the learning experience -- questions that consider content (e.g. who or what?) while emphasizing process (e.g. how and why?) (Brill, Kim, & Galloway, 2001). The risk of ignoring reflection is that learners may not learn to discriminate in applying procedures; they may fail to recognize conditions where using their knowledge would be appropriate, and may fail to transfer knowledge to different tasks (Wilson & Cole, 1991).

6. **Exploration**: Exploration in cognitive apprenticeship is pushing students to try out their hypotheses, methods, and strategies with processes similar to those that experts use to solve problems (Collins, 1991). Exploration consists of forcing the students into problem-solving situations where the path to solution is not clearly labeled and where guidance is sparse (Gibbons, 1996). Exploration should not be included only after all the supports are removed during cognitive apprenticeships. When students are lost in the course of exploration, guiding and scaffolding should be provided. Also, students need to continue to articulate and reflect on what they have found, as experts do in real situations (Brill, et. al., 2001). Therefore, cognitive apprenticeship is not a linear process occurring once during the teaching and learning process of particular subject-area content; rather, it is a recursive process (see Figure 1).

![Figure 1: Cognitive Apprenticeship process (Brill, Kim, & Galloway, 2001).](image-url)
3. Methodology

In this part, information is provided with regard to the study carried out within the framework of the cognitive apprenticeship model. First, the research design is addressed. Subsequently, the context and the participants of the study is described, followed by a description of the data collection and data analysis procedures including an overview of the instruments, topics, and organization of the data.

3.1 Research Design

This study was designed as a case study. Yin (1994) suggests that case study research is most appropriate in situations where the phenomena and variables are impossible to separate from the context. Therefore, through data collection, researchers identify the relationships between the phenomenon, variables, and context. Cases can be an instructional program, an activity, an institution, or an individual. The case or the unit of analysis in this study was the interactions that took place in technology mentoring program practiced by a mentor and the mentee during Fall 2006 semester. Therefore, when examining the direct and indirect influences of cognitive apprenticeship strategy on mentee’s technology skills and knowledge, I focused on an individual person as one case.

3.2 Data Collection and Data Analysis

Data were collected over a four-month period using a variety of methods including reflective journals, questionnaires along with open-ended questions and informal interviews with the mentee.

Mentoring journals were the primary method of data collection for this study. I wrote the journals including both the observations and the reflections of the process in a weekly period. Furthermore, at the beginning of the process the mentee was invited to complete a questionnaire with regard to her technology use (see Appendix 1). The topics addressed by the questionnaires were as follows:

1) Duration of technology use
2) Percentages of technology use with students in the classroom and expectation of students’ technology use
3) Views about how technology should be used to improve teaching and learning (open-ended question)
4) Impact of technology on the students
5) Ways of technology use in and outside of the classroom
6) Proficiency level of mentee in technology use

The purpose of the preliminary questionnaires was to gain information about mentee’s experiences, views, and needs of technology use in order to conduct the mentoring process effectively.

At the end of the technology mentoring process, the mentee completed a questionnaire to describe her experience with the mentor and answered five open-ended questions regarding her reflections about the process. The purpose of the questionnaire and the open-ended questions was to present the research findings and to compare researcher and participant interpretations of the findings. Moreover, informal interviews between the mentor and the mentee during the meetings provided valuable information in interpreting the findings.

Furthermore, the web site that we developed during the process as a physical artifact was another source of data reflecting both the process and product of mentoring experience. Thus, triangulation of data from different sources facilitated rigour in data collection and analysis which ensured reliability of the research methods and validity of the research findings.

In analyzing data, content analysis and the particular characteristics of the steps of cognitive apprenticeship model were used. The answers given to the open-ended questions and the mentoring journals were coded line by line. After the free coding, the codes were rearranged according to the steps of the model represented a historical development of technology mentoring process. Besides, the questionnaires were analyzed according to the choice/s the mentee selected for each question item.

3.3 Case Introduction

A case study researcher identifies the characteristics of a case by exploring it over time through detailed, in-depth data collection in natural settings (Creswell, 2003). The researcher needs to provide enough information regarding the case so that the readers
are given the opportunity to experience the researcher’s experiences of the case and make any other meaningful connections of the findings with their interests. To meet this responsibility I present the following information in this section: (a) background information of the context of the study, (b) descriptions of the participants.

3.3.1 The Context

Iowa State University’s Department of Curriculum and Instruction developed a mentoring model that involved graduate students as mentors through the course “CI 610-Technology and Teacher Education.” For the field component of this course, each graduate student was paired with a faculty member. The pairs spent approximately one hour per week working on technology-related learning tasks. This model provided an individualized approach to professional development, because each faculty member chose the focus of the sessions based on their specific needs (Zachariades & Roberts, 1995). Each faculty member received one-on-one attention to facilitate the process of technology integration. The pairing, in most cases, became a true partnership and collaboration (Stewart, 1999; Thompson et al., 1996). The course instructor organized the mentoring program by scheduling weekly seminars in which student mentors exchanged experiences, solutions, and pedagogical thoughts.

3.3.2 The Participants

The participants were a faculty from Mathematics Education Department as the mentee and me-graduate student in Curriculum & Instructional Technology Department-acting as mentor.

The Mentee

Dr Corey Drake graduated from Northwestern University in 2000 with a PhD in Human Development and Social Policy. Currently, she is an assistant professor of elementary mathematics education in the Department of Curriculum and Instruction. Her research is focused on understanding how teachers, both in-service and pre-service, learn to incorporate new resources into their teaching practices. In particular, she has examined how in-service teachers learn to use new standards-based curriculum materials and how pre-service teachers learn about families and communities as
resources for mathematics instruction. Dr. Drake’s primary teaching responsibilities are in the area of elementary mathematics methods. She has recently begun a project investigating the teaching of elementary methods at universities across the United States. She has also developed a framework for helping pre-service teachers in her methods courses understand, access, and learn to use the variety of resources available for teaching elementary mathematics.

When we first met, she expressed an enthusiasm about integrating web technology into her courses. She wanted to design a web site which would facilitate class discussion and also allow students to access course information quickly and easily. Her expectations from the mentoring program included:

1. consistent help from someone who knows more about technology and design than she does and
2. someone who push her to complete her web site and also to think harder about her goals for the site both within the classroom and beyond.

The Mentor

I entered the mentoring program at Iowa State as a first semester graduate student in Curriculum and Instructional Technology. Prior to that, I was a research assistant in Computer Education and Instructional Technology Department at Hacettepe University (HU), which ranks among the best four in Turkiye with one of the best education departments. During my MS study at HU, I was involved in two research studies aiming at investigating primary school teachers’ situation in the integration of Information and Communication Technologies (ICT) into teaching-learning process. Then, in my MS thesis, in order to demonstrate the intimate mechanisms that link ICT, learning and its socio-cultural setting, I adopted Activity Theory providing a holistic framework for analyzing ICT integration efforts. All these studies helped me develop an extensive understanding about technology integration process and provided me with not only theoretical but also practical experiences.

Apart from my research experiences, I was offered to be a teaching assistant of many courses, at least one course per semester. The excitement I felt when I rigorously
prepared for classes and the joy I had when I saw the assured faces of the students at the end of each class are really hard to put into words.

Graduate school constitutes the next step of attaining my goal of becoming an academician. I believe a strong graduate education should emphasize rigorous theoretical training and provide an environment that stimulates students and helps them develop and apply their research skills with a diversified and active faculty on the forefront of current research. The two major areas of interest that I would like to focus on in my graduate studies are designing collaborative virtual learning environments to enhance the quality of teaching and learning and developing interactive multimedia. In the future, I would like to consult with planners in designing instructional systems for university education, informal education, and business/industry training and conduct research on evolving issues and trends in instructional technology. I think an Iowa State PhD will mediate between my ambitious plans and me. In exchange for the graduate years and the resources I forego, I will earn an invaluable asset and an everlasting experience.

One of the first precious experiences I had in my first semester was in CI 610 class thanks to Dr Thompson, the instructor of the course. I gained valuable perspectives regarding teachers’ technology use and had a chance to involve a technology integration process not only as a researcher but also as an active participant assisting a faculty’s technology integration efforts. In the first class meeting, I was paired with Dr Drake based on my experience in web development which was also compatible with her needs. The following sections describe how we experienced technology mentoring journey and finally how she became confident in web design and development in order to integrate this technology into her instruction.

4. Findings and Conclusions

Firstly, I describe mentee’s technology experience based on the results of the questionnaires I implemented in our first meetings. Then, I describe the technology mentoring process with following the three steps of cognitive apprenticeship model (modeling, coaching, and scaffolding) to make the connections between the theory and research. Although I state some of the particular differences between coaching and scaffolding processes, I consider them together because of the fact that coaching has as much in common with the process of scaffolding.
4.1 Mentee’s Technology Experience

Dr Drake has been using computers for personal and professional purposes more than 10 years. Although she stated that she integrated technology into her instruction, the percentage of her technology use in classroom instruction is less than 25% of total class time. Moreover, she expects her students spend less than 25% of total preparation time to use technology in and outside of the classroom. However, this amount of time spent for technology use with students seems insufficient for effective technology integration which implies regular use of technology to enhance student learning. On the other hand, she explained her views about how technology should be used to improve teaching and learning as follows:

“I think that technology can be used to help students see practices or concepts that are not as accessible in the physical environment (e.g., giving pre-service teachers access to a wide range of teaching practices or helping students visualize geometric transformations). It can also be used as a community record of practices, activities, and understandings”.

The similar results were obtained from the questions regarding her views and ways of technology use for instruction;

- she thinks that technology increases her students' motivation, her students use technology to help them construct new knowledge and to communicate knowledge and information.
- she uses technology to produce materials for use with her students applications (such as word processors and spreadsheets), to present the information (presentation software and hardware), to find materials relevant to her curriculum (www resources), to contact peers and experts both inside and outside of the district as well as with parents and students, and to maintain student records. Moreover, she believes that she is aware of the ethical uses of technology and model it with her students.

The results of questionnaire about her proficiency in technology use are as follows:

- she thinks that she needs training in creating and using lessons that integrate technology and creating and updating web pages.
• she feels herself adequate in facilitating student use of technology within the classroom or lab and establishing classroom policies and procedures that ensure the ethical use of technology.
• she finds herself fluent in searching, evaluating, and selecting Internet resources that support curriculum, using a digital camera and/or scanner to capture images for instruction or student use, using e-mail to collaborate, publish, and interact with peers, experts, and other audiences, and assigning projects to students involving higher-order thinking and collaboration that use computers to do research, create products, and to present findings.

The results of the questionnaires helped me develop an understanding of her views about technology use in teaching-learning environment, what kind of technologies she used, and the level of her technology proficiency. Therefore, I had a chance to plan the technology mentoring process based on her skills, needs, and beliefs regarding technology use.

4.2 Faculty Technology Mentoring Process Based on Cognitive Apprenticeship Model

4.2.1 Modeling:

In our first meeting, I asked what her plans were with respect to using technology in her courses to make our goals explicit and to learn what her expectations were from me and the mentoring process. She had very clear ideas in mind that helped us create the goals of the process easily. Our main goal was developing an effective and professional web site to be used in one of her undergraduate courses (CI 449). The underlying reasons of this goal stated by her were providing students with access to many resources with regard to course topics, communicate with their peers in other universities, and share their ideas with each other via discussion groups.

Because, the expert’s goal is to make thinking visible by modeling the central aspects of the activity, showing how strategies work in an authentic situation (Liu, 2005; Darling-Hammond et. al, 2006; Oliver, 1999), my work with mentee began with introducing her to typical design methods. In our first meeting, instead of working on the computer I preferred to talk about design process. I explained that developing a
web site began with intense and systematic design on paper (content design, visual design, and navigation design), and then the organized content was transferred into web environment with the help of specific software and the messages were supported with appropriate media such as sound, graphic, picture, and video. After that, we decided to begin with content design. Because she was the subject matter expert, she was responsible for providing the content. The conceptual framework she developed was very helpful in organizing the content and navigation of the web site.

Before our second meeting, I sent her a PowerPoint presentation and a word document including website design principles. I also selected some web pages to show her both the good and bad examples so that she could have a general idea regarding the principles of web design. During the second meeting, to make our thoughts and ideas clear, I offered her to draw the layouts of the pages on the paper and talked upon them. So, we created the storyboards of some web pages (see Appendix 3) and discussed the issues such as what would each page include and if the contents were ready or would be prepared. My goals were explaining her the design issues with incorporating the professional thoughts about how to think while designing, what factors to consider and when to use what based on the technological availability and the purposes of the web site. These discussions by which I reflect my professional experience were very helpful to make the tacit knowledge I owned visible to her, thus facilitated her understanding about designing a real project.

Then, to make the organization of the web site easier, I created a folder system and put all the media that I found into related folder. Next, I explained her how the folder system would provide us with convenience while developing the web site. Before creating the template of the web site, I thought that I must give a decision that whether I should show her how to create the template at the beginning or to continue to develop the site together with using the template I created. I believed that she was not supposed to learn how to write and edit many HTML codes to create a web site. Instead, we should more focus on management and design issues so that she could learn how to manage the web site and update the content regularly. Moreover, the mentoring program would be more effective for both of us when we made discussions on the ready-made template, gave design decisions, added content, made necessary changes and published the site together. Because she accepted my suggestion, I prepared the template, showed her with explaining how I created it and asked her
ideas and suggestions about the colors, texts, menu types etc. By working in this way, she could construct her knowledge about expert practices in ways modelled by the mentor. For instance, in one of our first meetings, we discussed about why too much information on the page was not recommended. After I modeling her, she learned how to separate the texts into manageable parts and distributed them to more than one page so as not to disturb the audiences with too much information on a single page.

She explained her views about the beginning of the process as follows:

“In the beginning of the process, I had an idea of what I wanted to accomplish in terms of the design and function of the my web site, but I really did not know how and/or whether those goals could be achieved using Dreamweaver, much less how to actually use Dreamweaver. The first few weeks of the process involved a series of discussions, or negotiations, in which my mentor and I tried to (and ultimately did, I think) reach mutual understanding of our goals for the web site. During the next several weeks, my mentor spent a good deal of time creating a template for the web site – including finding images to be used, working with colors and design, and, most importantly, setting up a structure within which I could begin to add the content (texts, pictures, video, etc.).”

Moreover, she discussed my modeling as follows:

“While she explained some of the process and thinking behind the creation of the template, we decided early on that our time together would be best spent with her modeling me in learning how to add and revise content within the template she created, rather than learning how to modify the template itself.”

To sum up, in the very beginning, after I showed how to perform the task, I asked her if she wanted to do herself. Although, I observed that she enjoyed doing something herself and seeing the results on the screen, she was reluctant to try herself especially if the task or procedure was new that I did not show her before. She was little or no active, made little contribution to the design decisions, almost always accepted my ideas and the strategy of asking her suggestions did not work. Therefore, I asked myself what was wrong in my approach and how can I make her more active.
4.2.2 Coaching and Scaffolding

After I modelled for the mentee, I went on to coach her as she applied those methods to authentic design project with using website development tool.

During one of the meetings, she offered that if I transported all the web files into her computer, she could do the other pages herself. I was very impressed. Because this might be a sign of her self-confidence with regard to technology use or desire to try something herself instead of watching me. So, I transported the website folder into her computer. After she opened one of the pages we saw that some of the pictures were not seen on the page. She remembered how to upload a picture and followed the procedures herself. Moreover, at first we could not see the "properties window" on the interface and actually I could not guess how we could see it. But Dr Drake tried some Dreamweaver menus and found how to make enable to see the properties window. This was also fascinating because she began to become more active and discover something herself.

I realized that my approach was more predictive in our mentoring process. When I began to encourage her sometimes after showing the steps especially if the task was complicated and sometimes without any help, I saw that she was more eager than before. For example, firstly I showed how to divide the table cells and paste different objects into each cell. Then she implemented these in other table parts, gave links to some words on the page and wrote her own paragraphs into the page. I was very satisfied because she began to be more active in the process and got used to accustomed to controlling the mouse.

Another example of her changing role in the mentoring process came from the next meeting. I offered her to do the student page herself to be more familiar to the site's structure. So, she made the organization of the page, wrote the texts, imported the pictures, gave links to the appropriate texts, and tried to solve the problems she faced while performing the tasks. I guessed all these made her both more motivated to the work and gain expertise on how to deal with the basic problems that can appear while working on the computer.

Her views regarding how we were solving the problems we faced during the activities and the importance of background in communication are as follows:
“Because we come from fairly different prior experiences, it has sometimes been difficult for my mentor and me to come to a shared understanding of the purposes of the site and therefore of the design features that would be most effective. For the most part, we have been able to work through this difficulty with a series of discussions and negotiations.”

When the time passed and she gradually got accustomed to the web environment, I gave her more responsibility. In other words, I did not help her or remind her everytime and waited for her own decisions, but when I realized that she needed to make a new action that we did not make before, I guided her verbally and sometimes showed her how to do the required action. She was more active than me and we were all thinking laudly when we made decisions about the structure of the page such as adding something new or changing the properties of the elements of the web page. This made her more sure about what we were doing for what reason and helped her give proper decisions with regard to design issues. For example, I showed her how to use javascript codes in the web page and she completed the rest of the procedures herself. It was amazing to see the enjoyment in her face when she was able to do the activity without my help.

Her reflections about the next half of the process is as follows:

“As the semester went on and I slowly developed content for the web site, my mentor began to give me more and more responsibility, and less and less scaffolding, in adding that content to that site. Ultimately, by the last week of the semester, I felt confident in being able to indepently continue the development of the web site by adding and refining my own content.”

Before the second mentor-mentee lunch, we met and controlled what we had done to show the other people. Although it was a never ending process we talked that we had a great job (see Appendix 4). Some of the web pages were ready to present but needed some organization. Dr Drake said that she could do and I became very pleased to see her convenience and motivation in being active in the process. Then, she repeated many steps that I showed her in our previous meetings in order to build the "papers and presentations" page. She performed all the tasks and I only guided her when she could not remember what she shoud do next. I also offered her if she wanted to present the structure of the web site to others and she accepted my idea. I
thought that it would be a great opportunity for me to watch her how she was reflecting her opinions about our process and talking about what she gained. After the lunch, I was very satisfied, because she clearly explained the purposes of the tasks we performed, why we made the design like that, what were my contributions, and what she learned. As I stated during the lunch, it will be really effective when this web site will be used in her course. I am looking forward to seeing this technology integration process.

5. Discussion

Emergent findings suggest that the guided discovery approach that I used assisted the mentee to deal with authentic tasks in the context and culture of everyday design practices. The cognitive apprenticeship situations developed in the authentic website design provided the transfer of responsibility to the mentee for her own learning and also provided opportunities by which she could observe, engage in, or invent expert strategies in context (Brown, et. al., 1989). The mentee then applied strategies she had learned to authentic design tasks with the aid of mentor in the work settings. In this way, she became engaged in authentic, meaningful real work design tasks.

Undertaking design projects in this way facilitated the development of the mentee’s design expertise within a cognitive apprenticeship framework, implemented using mentor-supported design activities. It also helped both her development of ways for solving design problems and acquirement of declarative and procedural knowledge of design methods.

On the other hand, we had some problems during the technology mentoring program. First, in the very beginning of the process, while I was trying to show her how the design process needed intense work and planning, she was more curious about the technical capabilities of the program and whether we could do some practices she imagined in her mind. Next, sometimes I was frustrated about the time which was not sufficient to concentrate on the details. Her workload sometimes hindered the progress of the design. Besides, although Dreamweaver is not a very difficult program to learn to develop web site, you can meet so many problems that make you bored and confused. Finally, our mentoring process was in conjunction among modeling, coaching and scaffolding processes. I assume that much more time is required in order for the
mentee to articulate and reflect what she learned, and explore new knowledge and strategies.

In addition, this was the first time that I was working with a faculty as a mentee to help her learn the whole web design process. Therefore, I had a unique opportunity to have an idea about how instructors in USA wanted or intended to use technology in their classrooms, thereby added new experince onto my technology integration knowledge. Furthermore, I understood again that design was a process that should begin with taking into consideration of many factors, asking many questions to negotiate and thinking all the possibilities of the situation.

Moreover, there was a community of learning in the context of the mentoring course in which I learned much. Because each of us had different experiences and reflections, it was valuable to share our ideas both in WebCT and the classroom. The community was not restricted to the class members. For example, while trying to find out how to integrate forum into the web site, I contacted many people both in ISU Department and out of the department to learn information in order to figure out how to solve the problem.

Regarding the deficiencies or limitation of the mentoring process the mentee explained her views as follows:

"My lack of time-this is not really a limitation of the program, but I feel that for the program to work well, it really requires a fairly intensive time commitment on the part of faculty."

She stated that her expectations from technology mentoring program were definitely met. She further explained her views as follows:

"I have been supported in creating a web site that will have many uses and I am starting to feel comfortable about my ability to modify and complete the site. While it hasn't directly impacted my classroom teaching this semester, I think it will be a useful tool next semester. Overall, this is a great experience and I highly recommend to other faculty."
The results of the questionnaire supported her views regarding her experiences with the mentor. Based on this, she was strongly agreed that the mentor possessed the knowledge and skills necessary to conduct the mentoring sessions, made herself available for questions and feedback during the mentoring process, and helped her increase her awareness of how technology can be infused into instruction. Then, she agreed that the mentor helped her learn the skills necessary to use technology in instruction and worked with her cooperatively to develop and implement a plan based on her identified needs.

She concluded her views as follows:

“Although I am still not fully comfortable with “playing around” with Dreamweaver, I feel much more comfortable just trying things and seeing what happens than I did in the beginning of the semester. In the beginning of the semester, particularly as the template for the web site was being developed, I primarily relied on my mentor to identify and solve any problems that arose. However, I now feel much more confident in both being able to identify problems and, in many cases, to try several different ideas and tools for solving the problem.”

6. Recommendations

6.1 Designing Cognitive Apprenticeship Learning Environments

Based on the instructional principles that the model of cognitive apprenticeship includes, I propose some design issues regarding the types of knowledge required, the order of learning activities and the social characteristics of learning environments in the mentoring process.

- The mentors must be expert in the discipline in which they are supposed to be act as mentors as well as having expertise in the use of the teaching strategies of a cognitive apprenticeship approach to learning. Moreover, having multiple people, each of whom bring a different perspective and expertise to the learning situation, may enhance the main purpose of mentoring program by supporting a community of learning.
The learning activities should include modelling and coaching in the use of think-aloud protocols used by the mentors when explaining the ways or strategies of performing the tasks and the discussions among the participants of the activity with regard to ideas and actions in the learning process. Besides, the learning activities should let the learners participate actively in the activities by articulation of personal ideas and problem solving methods, along with reflection of the understandings and presentation of explored decisions and methods.

The learning environment should incorporate a real life situation, one-on-one mentoring and interaction among the people having different perspectives thus, contributing the effectiveness of the program.

The learning tasks should be arranged to proceed in an order from simple to complex, with increasing diversity. In other words, teaching the underlying principle first, then providing the application of that principle to specific performance contexts may help the development of specific skills on behalf of the mentee.

6.2 Future Research

Based on the results of this study, I recommend the following aspects for future research. In the first place, considering that the only one case may affect the validity of this study’s results, more studies with larger size samples are recommended. Moreover, even if the current cognitive apprenticeship model is only applied to learning how to design a website, its characteristics seem to permit it to be used in ICT integration into teaching-learning environments that includes complex and ill-structured situations, such as management of resources and designing technology-enabled activities. Furthermore, the results of this study reveal that the interaction between the mentor and the mentee significantly affects learning and teaching. But further study is required to analyze the relationship between the types of interaction and learning results. Finally, the research results imply that faculty, graduate student, and Curriculum & Instruction community can be closely linked thanks to the technology mentoring program. Future research can investigate the possible relationships or cooperation among the three.
7. References


APPENDIX 1: Questions asked at the beginning of the technology mentoring process.

1. How long have you been using a computer to enhance your personal and/or academic productivity? (select one)

- I don't use a computer
- 6-10 years
- less than one year
- 11-15 years
- 1-5 years
- Over 15 years

2. Do you integrate technology into your instruction?

- No
- Yes

If you answered YES, continue with this section.

3. What percent of total class time did you use technology in your classroom instruction?

- None
- 51-75%
- less than 25%
- 76-100%
- 26-50%

4. What percent of total preparation time do you expect your students to use technology? Consider the time spent preparing in and outside of the classroom.

- None
- 51-75%
- less than 25%
- 76-100%
- 26-50%

5. How do you think technology should be used to improve teaching and learning?
1. How has technology impacted your **students' achievement**?

Please check all of the following statements with which you agree

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology increases my students' motivation</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to acquire basic skills</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to become more critical thinkers</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to help them construct new knowledge</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to solve relevant, real-life, problems</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to discover concepts and prove relationships</td>
<td>☐</td>
</tr>
<tr>
<td>My students use technology to communicate knowledge and information</td>
<td>☐</td>
</tr>
</tbody>
</table>

2. The following questions deal with **your own** use of technology.

Please check all of the statements with which you agree

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I use technology applications such as word processors and spreadsheets to produce materials for use with my students</td>
<td>☐</td>
</tr>
<tr>
<td>I use on-line (WWW) resources to find materials relevant to my curriculum</td>
<td>☐</td>
</tr>
<tr>
<td>I use presentation software and hardware within my classroom</td>
<td>☐</td>
</tr>
<tr>
<td>I use e-mail to contact peers and experts both inside and outside of the district</td>
<td>☐</td>
</tr>
<tr>
<td>I use e-mail to communicate with parents and students</td>
<td>☐</td>
</tr>
<tr>
<td>I use technology to maintain student records (e.g., electronic gradebook, etc.)</td>
<td>☐</td>
</tr>
<tr>
<td>I use technology to monitor student performance (e.g., electronic portfolios)</td>
<td>☐</td>
</tr>
<tr>
<td>I believe that I can recognize the ethical use of technology</td>
<td>☐</td>
</tr>
<tr>
<td>I model the ethical use of technology with my students</td>
<td>☐</td>
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</table>

**Level of proficiency in technology integration survey**

This survey will be used to assess your level of proficiency in technology integration.

Please complete the survey below by selecting one of the following choices:

1 (need training)= learners at this level are unfamiliar with or want more knowledge about the topic or skill.

2 (adequate)= learners at this level have developed the skills enabling them to use technology when prompted. (Can use technology when given directions and assistance).

3 (fluent)= learners at this level are very knowledgeable and fluent with a particular task. (Can accomplish the skill independently without directions or assistance).
1. **Create and use lessons that integrate technology**
   1. Need Training
   2. Adequate
   3. Fluent

2. **Search, evaluate, and select Internet resources that support curriculum**
   1. Need Training
   2. Adequate
   3. Fluent

3. **Use a digital camera and/or scanner to capture images for instruction or student use**
   1. Need Training
   2. Adequate
   3. Fluent

4. **Use e-mail to collaborate, publish, and interact with peers, experts, and other audiences**
   1. Need Training
   2. Adequate
   3. Fluent

5. **Assign projects to students involving higher-order thinking and collaboration that use computers to do research, create products, and to present findings**
   1. Need Training
   2. Adequate
   3. Fluent

6. **Create and update web pages**
   1. Need Training
   2. Adequate
   3. Fluent

7. **Facilitate student use of technology within the classroom or lab**
   1. Need Training
   2. Adequate
   3. Fluent

8. **Establish classroom policies and procedures that ensure the ethical use of technology**
   1. Need Training
   2. Adequate
   3. Fluent
APPENDIX 2: Questions asked at the end of the technology mentoring process.

Please use the following scale to describe your experience with your mentor:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Worked with me cooperatively to develop and implement a plan based on my identified needs.</td>
<td></td>
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<td>2. Was punctual for mentoring sessions.</td>
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<td>3. Possessed the knowledge and skills necessary to conduct the mentoring sessions.</td>
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<td>4. Was prepared to conduct the mentoring sessions.</td>
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<td>5. Made herself available for questions and feedback during the mentoring process.</td>
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<td>6. Helped me increase my awareness of how technology can be infused into instruction.</td>
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<td>7. Helped me learn the skills necessary to use technology in instruction.</td>
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<td>8. Helped me become more proficient at infusing technology into instruction.</td>
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<td>9. I would recommend this experience for others.</td>
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</table>

Mentee comments for technology mentoring process:

1. What were your expectations regarding technology mentoring program?

2. How do you describe your mentoring process in the beginning, during the process and at the end? Is there any change in terms of your and your mentor’s role? (Please also consider the following questions while giving answers)

   - Did your mentor model the tasks or procedures to you? If so, how, when, in what situations?
   - Did she explain the procedures or tasks with think-aloud processes or only showed the required actions without any explanation?
   - Did your mentor retract her guidance and let you try yourself? If so, when, in what situations?
3. Could you explain the way/s you implement when you face a problem during the process? Is there any change in these ways in the beginning, during the process and at the end?

4. What were the most valuable aspects of the mentoring program?

   (Please try to include these points: The type of support you receive, your technology needs, an example of how affects your use of technology in classroom)

5. What were the deficiencies or limitations of the process? (Please include both general issues and mentor-mentee relationship)