Electronic Collaborators

Learner-Centered Technologies for Literacy, Apprenticeship, and Discourse

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Edited by

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This book is dedicated to our parents and in memory of the late Jerome A. Bonk

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Foreword: Conceptual Order and Collaborative Tools—Creating Intellectual Identity

Margaret Riel
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"I think, therefore I am." This observation about intellectual identity comes to us from Descartes across many centuries by way of communication technology. Thinking may give us our identity, but sharing our ideas offers the possibility of intellectual immortality across time and space. What role does thinking and the sharing of ideas play in our schools? How is learning related to reflection, problem-solving, and writing?

We know from psychology that students learn best when—motivated by interest and empowered by knowledge—they take on a conceptual challenge to solve a problem or accomplish a task that is just out of their reach. Equipped with metacognitive skills, they set goals and work with human and informational resources to assess their progress towards the completion of the task. Once completed, the learner is eager to share this new knowledge with others.

How do we help students develop their interests? How do we give them the power of knowledge? How can we structure these conceptual challenges? Furthermore, what role do schools play in helping students learn to learn and to share what they have learned with others?

In the group settings of schools, it has been difficult to facilitate engaged learning. Instead, most time in school is spent preparing students to learn—empowering them with knowledge. This is done by packaging information into small conceptual units and delivering them to students in an ordered sequence. Students are then re-

sponsible for developing a filing system to organize these units so they will be easy to retrieve when they are intellectually challenged. Not surprisingly, most of our current assessment techniques simply check the status of the most recent deliveries. Did the student get the information packet that was sent?

It is difficult to know how students are organizing their minds. Just what happens to these packets of information? Are they empowering students to solve problems or create new knowledge? We cannot see how students arrange mental objects, but we can make inferences from their skills with physical objects—toys, clothes, books, pens, models, and games. Why do adults work so hard to keep the physical world of children ordered? The value of physical objects diminishes if they are all thrown into a disorganized heap. Categorizing toys invites new forms of play, new connections, and generative activities. And so it is with mental objects; organizing one's ideas has the same generative properties. When we order our thoughts, we make them readily available for the creation of entirely new concepts. The effort to order ideas ultimately makes them more powerful.

Well organized play spaces are most often the interactive accomplishment of adults working with children. Children need help understanding the reasons for organization and developing the discipline to accomplish this process. Teachers and parents need to help students understand that keeping materials organized increases their value. It is not something that is done once, but is repeated again and again, with one often finding new ways to organize things as past uses give rise to new ones.

A mind that is filled with experiences, feelings, and information needs order and organization. How do children learn to organize conceptual spaces, mental objects, and these packets of information that are routinely delivered in schools? Does it make sense to expect children to have more skill with mental objects and conceptual information than they exhibit with physical objects? If we could see the internal organization of their minds, we might not be surprised at the difficulty they have at finding what they need, when they need it.

So, what strategies and tools do we have for helping create intellectual order? How can we help students learn what it means to use information in generative ways? Also, perhaps most importantly, what role can teachers play in facilitating the design of these mental systems?

The learner-centered technologies for literacy, apprenticeship, and discourse described in this book are the tools of intellectual identity. They help shape the mind of a student, his or her ability to reflect on what he or she knows, and his or her ability to use what he or she knows to create new knowledge. When used in thoughtful ways by teachers, these tools ask students to take out the packages of information, examine them, and begin to think about how to organize them to create new understandings—knowledge products. It is not enough to just make the deliveries. The organization of information into knowledge is too difficult to leave for students to work out alone. Without help, much of what students need for leaning is hopelessly buried under masses of unexamined information delivered by well-intentioned

teachers. Collaborative technologies make it easier to facilitate collective sense-making, an activity that can take place in schools. By making explicit the process of using information to develop new understandings, teachers can help students create intellectual order and generate new mental pathways that define the way they think and learn, thereby authoring their own intellectual identities.

The authors in this book anchor their work in the writings of Piaget, Bruner, and especially the sociocultural work of Vygotsky. Vygotsky describes a developmental sequence in which social exchanges between a child and more competent others in a social and historical environment form the basis of individual thought. Children learn more than language as they repeat what they hear. Gradually these voices of self and other become inner dialogs and are eventually internalized, forming individual thought. The work reported in this book extends this argument. The tools that help build knowledge systems in social settings between students and more knowledgeable adults represent a way to organize information into powerful thinking tools. These intellectual dialogues are internalized as conceptual schemes and models that eventually help students to organize information into conceptual knowledge. The process of collaborative thinking and writing help students to:

- examine their ideas in a social context of different perspectives and develop collective ways to understand issues
- challenge the ideas of others through critical thinking.

Collaborative critical inquiry, such as the research reported in this book, provides students with the tools for self-reflection and knowledge construction. This process creates mental pathways and links between ideas and flexible filing systems, making it possible to use information in new and different organizations.

The contributors to *Electronic Collaborators* describe a range of tools that are available to facilitate collaborative writing, from simple e-mail and writing applications, to more complex environments that combine asynchronous and synchronous communication with interactive use of multimedia applications and databases. Each of the authors in this volume use learner-centered, constructivist, and sociocultural theories to inform the design and research on new technologies. The goal of the authors is to increase our understanding of the effects of different electronic collaboration tools on student learning. As we increase the collaborative learning tools that we have available, we can be more selective in matching such tools to learning outcomes.

This book itself is a reflection of the power of collaborative writing within a community of learners. All of the authors have been a part of research efforts in the School of Education at Indiana University. They are themselves making sense of, and experimenting with, communication technology in both research and instructional contexts. Although most universities extend the reach of face-to-face courses with online replications, few institutions have created the innovative uses of the technology to design new forms of learning that are taking place at Indiana Univer-

sity. The strong coherence across and within the chapters presented in this volume make it closer to a book with multiple authors then an edited anthology. This collective dialog about collaborative work, as well as the work that has been accomplished, helps us understand both the evolving tools and how they can help shape new patterns of education in the future.

The work tools of our society are increasingly mental and our need to use such tools for life-long learning is the path to the future. Those who learn how to create and use mental tools in a space that is ordered and organized will be better prepared to generate the knowledge products that will be the trade of tomorrow. They will also have strong intellectual identities and their ideas will continue to inspire those who follow in the years to come.

Preface

It was a hot August night in 1992 when I arrived at Indiana University (IU) in a rusted-out Honda Civic loaded down with books and journals from my previous post at West Virginia University. Stepping out of my tired car, I gazed up at a magnificent new structure known as the School of Education at IU, a federally supported project intended to promote the use of technology in teaching and learning. This limestone castle seemed to be beckoning all those approaching it to unlock the countless secrets of its technology treasures. Looking back, I was awestruck. Sure, I had read all the hype about the new facility in various journals and press releases and had seen the place when it was in an earlier phase of construction. However, this was a very different feeling, a humbling but exhilarating one, too seldom experienced in life. It was an awareness that I had arrived at the right place.

So, with beads of sweat fogging my glasses and an unwieldy stack of books teetering my balance, I maneuvered through the heavy doors of this technology fortress and tried to find my designated place in one of its towers. Of course, I had little knowledge that the research that would be sparked here during the next 5 years would serve as a basis for a book on electronic collaboration. The research described herein provides a glimpse into the innovations and experimentations that have transpired as a result of this wondrous learning and technology resource. Although some of these projects took place at locations outside the School of Education, all of the chapters in this book were written by individuals who worked in that grand building during those initial years.

Not long after my arrival at Indiana, a cadre of researchers investigating various electronic collaboration and communication tools began to meet informally to discuss their electronic learning ideas, models, and findings. This soon evolved into the loosely connected Computer Conferencing and Collaborative Writing (CCCW) Group at Indiana University which included professors, graduate students, instructional designers, and directors of technology projects. The idea for this book on electronic collaboration emerged when the CCCW group discovered the commonalities of our interests and findings. We recognized the need for a book that detailed

the tools for computer conferencing and collaboration, the learning theories grounding their use, and the preliminary results of this merging of theory building with technology tool implementation.

It is our hope that this text will help provide collaborative learning tools and ideas that powerfully transform education with innovative ideas for electronic social interaction and new learning communities in both public school and higher education settings. Consequently, this book provides separate illustrations of electronic collaboration in asynchronous and synchronous environments as well as a several examples wherein both forms of collaboration are employed. In addition, we attempt to document collaborative learning tool use from constructivist, learner-centered, and sociocultural perspectives. This documentation of the diverse environments for computer conferencing and collaborative writing should appeal to a wide range of potential readers.

ADDITIONAL BACKGROUND AND SETTING

Indiana University (IU) was recently ranked as the top public university in the country for its technological support and was in the top 10 overall. Given this access to technology, many faculty across disciplines at IU have become increasingly unsatisfied with teaching in the familiar and routine manner in which they themselves were taught. Fortunately, during the past decade, IU has been at the forefront of innovative teaching and learning by supporting various resources on collaborative learning. During this time, the university has sponsored several major conferences, a listserv, and a sourcebook related to collaborative learning in higher education. In October 1995, in fact, IU hosted the Seventh Annual Hypermedia Conference as well as the first International Conference on Computer Supported Collaborative Learning (CSCL) wherein some of the projects in this book were originally presented.

Like the rest of the university, the School of Education at IU also is a leader in the field of educational technologies (see Fig. P1). It is here that every contributor to this book worked or learned at some point during the past 5 years. In a walk through the W. W. Wright Education Building, one would find extremely talented graduate students from the top-ranked Instructional Systems Technology program in the country, cutting-edge distance-education technologies and classroom suites, extensive educational technology support services, and the Center for Excellence in Education (CEE). The CEE, a national educational technology demonstration and training site, offers valuable support and direction to K–12 schools from across the nation in the use of educational technologies. The Arctic adventure project described in chapters 6 and 14 of this book, in fact, was originally organized by the World School for Adventure Learning division of the CEE. A short walk down the hall from the CEE is the Center for Research on Learning and Technology, whose mission is to support the School of Education's program of research on the linkage between learning theory, pedagogy, and technology.

AUDIENCE

Electronic Collaborators is reflective of the editors' and authors' belief that as new tools for collaboration and conferencing are developed, it is essential that we disseminate research findings that document the powerful theoretical foundations and instructional approaches of these educational technologies. As schools and universities are providing increased technological support and infrastructure for distance learning and collaboration, most of us still need practical examples of effective technology for electronic collaboration.

At present, there is surprisingly minimal information on the effects of computer conferencing and collaborative writing tools in either K–12 or collegiate settings. This book, therefore, is intended for use in graduate courses in such areas as educational technology, instructional design, educational psychology, social psychology, curriculum and instruction, language education, and telecommunications. We hope that this text strikes a chord with those interested in such fields as sociocultural theory, process approaches to writing, collaborative writing, cooperative learning, adventure learning, learner-centered instruction, constructivism, distance education, peer conferencing and tutoring, electronic mentoring and collaboration, problem- and project-based learning, and educational reform. In effect, this text should be a useful reference tool on electronic collaboration for a wide range of audiences.

This book is meant to inform teachers, researchers, designers, graduate students, policymakers, and administrators of the importance of the collaborative educational learning tools and techniques for promoting student–student and student–teacher electronic interaction. Teachers will gain insights into unique venues for learning collaboration, opportunities for extending classroom boundaries, and varied experimentations and struggles to embed learning tools in one's instruction. The work in the book should also help other researchers think about useful ways to implement and assess collaborative learning tools. Instructional designers, on the other hand, should find inspiration in the range of collaborative tools employed here and the ways in which they were incorporated to enhance learning. Graduate students should gain some insight into both research and theory related to electronic collaboration as well as the types of electronic learning formats that require additional testing and where they can play a role in furthering this research. Educational policymakers will hopefully be better informed about the theoretical justification for the purchase of collaborative learning tools as well as some of the more promising areas of use. Finally, practitioners and administrators should benefit from windows into the teaching–learning process and from the implications of the electronic collaboration research emanating from the educational technology palace where I work.

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—Curtis Jay Bonk

Introduction to Electronic Collaborators

Curtis Jay Bonk
Kira S. King
Indiana University

PERSPECTIVE

Various technological, instructional, and pedagogical developments have recently converged to dramatically alter conceptions of the teaching and learning process. As innovations in computer technology, instructional design, and learning pedagogy intersect, powerful new collaborative learning tools are beginning to emerge and play a pivotal role in the educational process. Clearly, technology tools for learning are becoming increasingly interactive, distributed, and collaborative. For instance, computer-networking software is supporting our schools with unparalleled access to information resources and instruction. Through the use of the Internet and the World Wide Web (WWW), we now have easy access to highly interactive learning environments that include a wide variety of learning media (text, sound, video, and three-dimensional imaging). Virtual reality appears to be the next phase of these developments.

Not only do such technological breakthroughs offer us opportunities for accessing an overwhelming array of data and resources, but they are also generating new collaborative technologies that alter the way we learn, research, work, and socialize. Additionally, parallel advances in learning theory and in instructional design are helping educational stakeholders transform traditional notions of schooling, while challenging us to redefine the roles of teacher and student. For example, there is increasing pressure to replace the teacher-centered instruction of the Industrial and Information

Ages with learner-centered ideas of the Communication Age (e.g., collaborative learning, knowledge as design, and building communities of learners).

During the 1990s, collaborative technologies, both real-time and delayed formats, have begun to augment and redefine most academic learning environments. But as these technologies emerge to facilitate human–human interactions across classrooms, universities, and worldwide learning communities, various instructional design and implementation problems arise. Instructors simply need more guidelines from educational researchers about integrating electronic collaboration and communication tools into their classrooms.

PURPOSE

The goal of the book, therefore, is to display a range of collaborative technology tools, while documenting several representative ways of using them for enhancing human learning and development. All the projects presented in this volume are closely linked to theories of learning that emphasize social interaction and student active knowledge construction. Hence, the sociocultural work of Vygotsky, Wertsch, Cole, and Rogoff inform and underpin many of the works mentioned here (see chap. 2 for key references). The grounding of this work in sociocultural, constructivist, and learner-centered theory, is meant to afford this text a longer shelf life than typical books related to educational technology. This may, in fact, be the first book on electronic conferencing or "online education" directly addressing such perspectives.

We feel that now is the time to combine the technological and pedagogical advancements of the past decade with a text that details unique electronic learning communities now found in both K–12 and collegiate settings. In order to make decisions that productively transform learning environments, however, documentation is needed regarding how schools and teachers are discovering and incorporating new electronic collaboration and communication tools. As such tools have surfaced in schools, the contributors to this book have focused on understanding the effects of various conferencing and collaborative composing formats on social interaction and resulting student learning. Five of the key objectives of this book, therefore, are to:

- Document some of the collaborative learning tools and formats currently employed by teachers in schools and universities.
- Situate these emerging tools within various electronic interaction levels and formats (e.g., synchronous and asynchronous).
- Explore how various learning theories—learner-centered, constructivist, and sociocultural—can be used to structure, analyze, and assess electronic learning environments and social dialogue.
- Examine collaborative dialogue transcripts collected at numerous collaborative tool sites that provide rich documentation of instances wherein collaborative technologies were successfully as well as unsuccessfully used.

- Start a dialogue about the importance of student electronic social interaction and dialogue.

CONTENT OVERVIEW

This volume is divided into five distinct sections. The chapters in each respective section are chronologically sequenced according to the grade level under investigation or intended audience. Part I outlines the foundational theories, concepts, and tools for the remaining portions of this book. Parts II, III, and IV detail research on the social interaction and discourse within electronic conferencing. The second section relates to studies of collaboration in stand-alone computing environments. The more technologically sophisticated third section concerns research on asynchronous collaboration tools. Even more electronically rich is the fourth section, which features a few studies involving both synchronous and asynchronous communication. Although this sequencing of chapters is intended to represent a hierarchy of collaborative tool use, from lower level to more elegant learning tools, the stand-alone and asynchronous ideas of Parts II and III are currently more common and cost effective than the synchronous electronic discussions and multiconferencing work found in the latter chapters of this book. Finally, Part V offers both a retrospective review of these electronic conferencing studies as well as an appeal to future digital environments and networks for social interaction.

PART I: THEORETICAL AND TECHNICAL FOUNDATIONS

The first part of this book establishes key theoretical underpinnings for the use of electronic learning tools. In addition, a number of conferencing and collaboration tools are discussed.

In chapter 1, Bonk and King detail a taxonomy for thinking about computer conferencing and collaborative writing tools. Using this framework, we provide insights into how the various work in this book was initially conceptualized from a collaborative writing perspective. This chapter also surveys the sociocultural variables and instructional methods related to electronic collaboration. Central to this chapter, we describe how various electronic learning tools and approaches can be used for different levels of electronic interaction and collaboration. Tools for collaborative writing, for instance, are categorized into five levels of interaction including: (a) electronic messaging devices, (b) delayed collaboration tools, (c) real-time brainstorming and conversational tools, (d) synchronous text collaborative writing tools, and (e) collaborative multimedia and hypermedia tools. After detailing the taxonomy, electronic dialogue in both academic and informal settings is sampled and discussed. In effect, this chapter is intended to begin a dialogue about student dialogue.

Chapter 2 by Bonk and Cunningham offers three theoretical viewpoints for the work on collaborative tools. This chapter explicates learner-centered, constructivist, and sociocultural beliefs, principles, and approaches that inform the use of electronic conferencing and collaboration media. As such, this chapter builds on the previous one by pointing out that as educators have responded to passive, compartmentalized learning of the past century, new ways for thinking about teaching and learning have emerged. Most important, chapter 2 explains and defines key sociocultural terminology and principles while outlining much of the rationale for the research and ideas presented in the remaining sections of this book.

Whereas chapter 2 surveys learning theories applicable to collaborative tools, chapter 3, by Duffy, Dueber, and Hawley, details how pedagogy merges with computer-based conferencing systems to support critical thinking and learner collaboration. In particular, this group focuses on how their new web-based collaboration tool, Asynchronous Collaboration Tool (i.e., ACT), can be used to support issue-based discussion. The primary focus of this chapter, therefore, is to promote student critical thinking through electronic means. Duffy et al.'s explicit hope is that better understanding of the critical-thinking features and opportunities within computer conferencing and collaboration tools will lead to improved design of these devices and ultimately to better instruction.

PART II: STAND-ALONE SYSTEM COLLABORATION

The tools and methods of electronic interaction presented in Part II involve the most common but least elegant form of computer-supported collaboration: pairs or teams of students working together at a single workstation or sharing a common computer disk of one's work. In this section, one can read about pairs or teams of students working on papers, ideas, and reports in a computer lab or on a single computer workstation.

Chapter 4, by Angeli and Cunningham, for instance, discusses a tool for literacy development, *Bubble Dialogue*, which was tested for a period of 7 months with elementary students to enhance their reading and writing. As a tool to promote literacy among pairs of students, Bubble Dialogue supported student dialogue and role play by engaging them in meaningful, goal-oriented activity wherein word meanings were socially constructed. The authors detail how speech bubbles were used to foster intermental, social behavior, whereas thought bubbles were incorporated to foster intramental, individual behavior. In this particular study, student dialogue transcripts revealed that Bubble Dialogue has great potential as a literacy tool in promoting the articulation and development of young learners' thought processes, the development of word meaning, and the acquisition of sentence structure awareness. Using the learner-centered psychological principles as a guiding framework, the authors develop and evaluate an instructional model based on the design characteristics of this collaborative tool.

In chapter 5, Savery documents how students in an undergraduate business communications course work in five-person collaborative teams to produce written responses to problem situations presented by their teachers. Within the context of an elaborate business simulation, the students planned, drafted, revised, and edited numerous letters and memos. Notice that the teachers here coached, rather than lectured, as student teams worked in a computer lab on their writing assignments. Savery qualitatively examined teams from four classrooms for an entire semester with a focus on: (a) student self-regulation of their learning, (b) the instructional scaffolding and coaching provided by the teachers, (c) the patterns of collaboration in the writing process; (d) the use of computers in the collaborative composing process, (e) the design principles of this learning simulation and other more authentic learning environments, and (f) the intersubjectivity developed within the teams over the semester. Perhaps, most important to the purposes of this text, the development of student ownership within this learner-centered environment was documented and a model of student ownership within such settings was devised. From this study, it can be concluded that even simple word-processing tools offer rich avenues for learning collaboration and self-regulated learning.

PART III: ASYNCHRONOUS ELECTRONIC PROCESSING

The next set of five chapters explores the world of asynchronous conferencing and electronic mail systems (E-mail). Whereas Part II of this text involves the most prevalent form of collaboration, Part III extends this text into the area that most readers would immediately associate with electronic collaboration. Many of us, in fact, could not survive professionally and personally without the E-mail or other asynchronous conferencing tools described in this section.

Chapter 6, by Sugar and Bonk, focuses on middle and high school student use of the Internet to build online "telecommunities." Here, adventure-learning ideas were used to create a novel cognitive apprenticeship that connected students to Internet "pen pals" in an asynchronous telecommunications project of the World School for Adventure Learning known as the World Forum. In this particular World Forum activity, students explored critical environmental issues within a real-life Arctic expedition through discussions, questions, and debates with Arctic explorers, researchers, World Forum mentors, and peers. During the project, students responded to environmental alerts, flash points, and daily explorer journals sent from the Arctic and, in turn, were encouraged to ask questions of the explorers. Sugar and Bonk employ several different measures to understand the frequency of participation, level of questioning, depth of discussion, degree of perspective taking, and forms of mentoring and learning assistance in this unique environment. The results indicate that this form of computer-mediated communication does enhance student learning when supported by peers, mentors, teachers, and experts.

The application of delayed computer conferencing is also a significant innovation in higher education, especially when compared to conventional classroom settings. As electronic conferencing proliferates in education, studies related to its use as a supplementary tool to traditional higher education experiences seems vital. However, employing computer conferencing as a collaborative learning device in conventional settings is still in the developmental stages.

In chapter 7, Chong examines how computer conferencing may facilitate collaborative learning and enhance social interactions in large-section college classes. She tracks the support provided to a number of instructors at Indiana University as they incorporated asynchronous computer conferencing technology for student collaboration and topical discussion. Her longitudinal work includes a description of how these instructors differentially adopted a university-licensed conferencing tool in undergraduate and graduate college courses in computer science, sociology, recreation and parks administration, education, and library science. To her credit, she selected courses whose high enrollment normally allowed little interaction with the instructor and among students. In qualitatively evaluating this approach, Chong uses interviews, surveys, observations, and journals to determine how computer conferencing supplemented classroom instruction and assignments, while enhancing student discussion and social interaction. Within four basic delayed-collaboration models that Chong discovered, instructors used this electronic classroom to discuss weekly topics, analyze case studies, solve sample exams, and foster collaborative learning communities. Chong's results also indicate that delayed computer conferencing can contribute to building a student-centered learning climate if properly integrated into a course. However, student expectations and previous competitive experiences, software inadequacies, system availability, and conventional pedagogy all interfere with effective use of the medium's interactive potential. As Chong aptly notes, there is an assortment of issues that currently limit asynchronous computer conferencing and collaboration in higher education.

Instead of a longitudinal study of one particular technology, chapter 8 by Althauser and Matuga recounts the variety of electronic tools and activities used by one professor over a span of 5 years in his undergraduate courses. This chapter highlights the pedagogical possibilities facing a professor when he or she becomes interested in how cooperative grouping and computer conferencing can support "active learning." This particular professor's journey included student electronic collaboration on previewed exam questions as well as electronic discussion questions that encouraged students to integrate course content. Within each of these modes, the learning environment is described in terms of student engagement in the learning process as well as pivotal changes in the professor's instructional tactics. The reader should note the unique ideas are discussed for fostering weekly participation, interaction, metacognitive reflection, and group commentary within small, cooperative groups. Pedagogical limits and guidelines also are outlined. Additionally, near the end of the chapter, the authors compare

the instructional scaffolding found in electronic conferencing to that modeled in the traditional, lecture-based classroom. As WWW courses and fully asynchronous instruction become more common, this journey raises larger questions about the viability and advisability of electronic instruction absent from the social fabric created by at least some real-time, face-to-face social interaction.

In chapter 9, Kirkley, Savery, and Grabner-Hagen explore the use of E-mail distribution lists for extending classroom discussion in three different graduate courses. In the first instance, the instructors of a team-taught media production course use E-mail to model the feedback of a contemporary business-training setting. By focusing on the means of assistance the instructors provided, a range of pedagogical strategies was discovered.

In contrast to this production course, E-mail dialogue in two doctoral seminars was also analyzed to determine how it extended classroom discussion and coordinated course logistics. In addition to the forms of learning assistance previously studied, other factors investigated here included the content of discussions, the timing of interactions, and the frequency of participation. Interestingly, this later study found that electronic interaction maintained the common gender, status, and ethnicity differences found in the regular classroom. Despite these results, E-mail appears to be an effective resource for helping build cognitive apprenticeships and mentoring graduate students in higher education settings. In the end, the authors caution readers that the overall impact of E-mail on classroom learning environments remains unanswered.

The purpose of chapter 10, by Zhu, was to document patterns of student–teacher and student–student electronic discussions and meaning negotiations in a distance-learning class. This chapter examines: (a) the use of technology in facilitating teaching and learning, (b) the role of instructors in electronic discussions, and (c) weekly changes in student electronic social interaction and discourse. Data collected here revolves around a 15-week graduate seminar on interactive learning technologies that was taught using Picture-tel and CU-SeeMe videoconferencing technologies. Electronic social interaction data were derived from weekly asynchronous computer conferences on the assigned course readings. Electronic transcripts were analyzed in terms of note categories (e.g., comments, questions, scaffolding, and reflections), types of interaction (e.g., horizontal or vertical), and participant roles (e.g., contributor, wanderer, seeker, and mentor). Once these categories were established, the patterns of electronic discussion and meaning negotiation were examined. Zhu's analyses revealed relationships in the nature of student and instructor interaction in delayed conferencing that shed light on how electronic conferences can be efficiently organized to facilitate learning; in particular, how to help students construct new knowledge electronically. Also central to this particular study, a model for understanding the pattern of knowledge construction and zones of engagement in electronic discussion was developed.

PART IV: MULTICONFERENCING: ASYNCHRONOUS AND SYNCHRONOUS CLASSROOMS

Multiple modes of conferencing is the focus of Part IV of this text. These three chapters push this text into the synchronous or real-time conferencing arena. With the exponential growth of electronic computer-conferencing technologies, synchronous communication, such as computer conferencing chat, is emerging as an important tool within collaborative learning environments. In the late 1990s, real-time conferencing and chat tools are becoming increasingly popular on the Internet.

The first study of this section by Cooney (i.e., chap. 11) describes a 10th-grade English teacher who effectively uses *Aspects*, a prominent synchronous conferencing tool, to engage her class in discussing characters and themes, summarize and represent knowledge, and debate "aspects" of the popular but complex American play, T*he Crucible*. The teacher selected this real-time collaboration tool in an attempt to spur classroom discourse and collaboration on common text and graphics products and information. In contrast to the tools mentioned in other chapters of this book, students in this study used multiple tools, including: (a) the free-for-all text mode for writing and reporting, (b) the chat box for brainstorming and discussion, and (c) the draw and paint tools for representing knowledge (e.g., knowledge webs and concept maps). As Cooney points out, on-task behaviors were extremely high when using this tool, while student discussion was raised to new levels of discourse. Additional analyses of communication patterns indicate that social interaction patterns change when students move from a traditional classroom to an electronic setting. Although the relative participation rate was raised significantly for all students during electronic conferencing, some of the traditionally "low contributors" became high contributors when communicating online, whereas a few others remained low contributors. Transcripts, field observations, and teacher interviews all indicate that synchronous communication fostered more depth of thought, peer interaction, and learning ownership than previous semesters. In addition, new connections and skill appeared to transfer, at least in part, to the regular classroom setting.

In contrast to the use of various synchronous communication options by Cooney, chapter 12 by Bonk, Hansen, Grabner-Hagen, Lazar, and Mirabelli evaluates both synchronous and asynchronous collaboration. More specifically, this study investigates how preservice teachers resolved electronically presented case vignettes when working in subject matter-specific teams. In the first classroom studied here, students interacted about brief, one-paragraph cases during class time using real-time brainstorming features of *Connect*, whereas, in a later class, students solved two-page dilemmas at their leisure using a delayed-collaboration tool called *VAX Notes*. Although the differences in case formats and time allotment prohibit direct comparisons between these synchronous or asynchronous options, both qualitative and quantitative analyses indicated that the delayed communication af-

forded serious and elaborate discussions, whereas the real-time mode encouraged a content focus and brief but frequent student responding.

This chapter also illuminates how cases might be used to support sociocultural ideas about scaffolded learning, zones of proximal development, intersubjectivity, and intermental processing. Electronic transcripts, for instance, reveal that students—within both real-time and delayed formats—quickly took ownership over this communication medium and carefully crafted their words for others to read. Some students, in trying to impress peers with their ideas, were unknowingly operating at the edges of peer zones of proximal development, thereby significantly extending case discussions and debates. Also highlighted in this chapter are issues of group size, participant roles, task requirements, and case length. Equally important, a coding scheme for analyzing student–student interactions in collaborative environments is proposed.

Instead of comparing the results of real-time and delayed conferencing modes, chapter 12 by Kang combines both modes in one graduate classroom in Seoul, Korea. Here, a week of traditional, live classroom instruction was alternated with two weeks of nontraditional, electronic conferencing. The structure of computer-mediated communication activities in this classroom included bulletin boards for posted assignments, faculty and student lounges, asynchronous conferencing, synchronous chatting, question-and-answer forums, assorted learning resources, E-mail, and self-introduction lists. Although most course work and discussions were asynchronously posted, student teams had to meet synchronously at least once per week. In qualitatively exploring the results of these conferencing tools, Kang found various instances of impersonal, interpersonal, and "hyperpersonal" communication. In the end, she concludes that these tools can be used for focused decision making, democratic participation, and task orientation, as well as for fostering self-reflection, mentoring, and team-building consensus. Kang also notes that any affective influence of collaborative technologies is dependent on task assignment, grouping structures, and, most important, the longevity of the experience. As would be expected, semester-long electronic partnerships appear to foster greater shared understandings and concerns than briefer experiences.

PART V: LOOKING BACK AND GLANCING AHEAD

The final section of this text reflects on the work presented here and predicts several possible paths for this research on the horizon. In gleaning information and lessons from previous research projects, these authors suggest a few practical guidelines for educators and developers on how technology can support collaborative learning and the development of electronic learning communities. These chapters push us toward a framework for building integrated learning environments with access to resources, tools, and online learning communities such as the WWW.

Chapter 14, by Siegel and Kirkley, describes projects conducted within the Center for Excellence in Education (CEE) at Indiana University. Since 1991, the CEE has

been involved in a series of projects organized around the concept of "adventure learning." The core idea here is to bring the excitement and adventure of the world into the classroom while simultaneously transporting the classroom into that world. Those curious about adventure learning will find program overviews, implementation guidelines, and sample electronic interactions at the beginning of this chapter. In addition, one can also read about delightful electronic field trips offered via *Turner Adventure Learning* to more than 100,000 students across the country. An integral portion of these virtual field trip adventures is the online chat forums and electronic bulletin boards of students, teachers, and experts over America Online. Collaborations from over 10 trips, including one visit to Gettysburg, were used to illustrate how temporary communities can be formed to discuss educationally significant issues and foster ingenious electronic collaborations. Third, Siegel and Kirkley describe the *Wetlands Explorations ThinkShop,* which is a project jointly developed by the CEE and the Wonderlab (a science, technology, and health museum) that extends adventure learning into informal learning settings. The *Wonderlab Community* offers teachers, students, parents, and experts an opportunity to use a variety of electronic tools: electronic discussion forums, interactive exhibits, electronic publications and other online information resources, private forums and chats, Internet audio- and videoconferencing, and expert mentoring. These three projects are part of the CEE's "Digital Learning Environment" vision of developing cutting-edge technology tools and resources that facilitate student and teacher activity in a student-centered, problem-based learning environment.

Chapter 15, by King, is an invitation to participate in the Communication Age with many of the technologies and instructional practices documented in this text. After discussing the new job roles and educational systems required by this new age, King connects systemic educational reform to the emergence of sociocultural learning theory and the parallel rise of collaborative tools and virtual classrooms. Research in this volume informs her discussion of where collaborative media breakthroughs are structuring new social spaces for teaching and learning as well as unique knowledge-building communities. As a precautionary step, however, King compares advances in collaborative technologies to other historical developments in technology that were also predicted to drastically change teaching. Appropriately, King poses critical questions related to possible electronic course formats, learning activities, teacher roles, and assessment techniques. Finally, while recapping the qualitative and quantitative research approaches and schemes discussed in various chapters of this book, King proposes several key ingredients in effective collaborative tool research.

CONCLUSIONS

The purpose of this text is to increase the knowledge base on the benefits and drawbacks of various electronic collaboration formats, in part, by investigating the student dialogue evident in various electronic learning settings. In contrast to

researcher-imposed ideas, many of the studies presented here typically did not dictate the use of a particular collaborative tool or task, but, instead, simply observed and recorded existing electronic collaboration practices. These studies focus on how peer interaction and discourse influences group processing, intersubjectivity, and resulting cognitive change. Coding schemes of these diverse activity settings were fine-tuned to better account for the transactions occurring in these interactive environments. Across these studies, it is clear that collaborative technologies can be significant new learning tools. Equally important, questions about the benefits of social interaction and dialogue are beginning to be addressed and answered. As questions about interaction patterns, forms of learning assistance,and electronic settings are confronted and responded to, we see the benefits of recording how schools, teachers, and students are employing and exploiting numerous new electronic learning tasks and tools.

This book serves many purposes. For instance, the works in this book are organized to help: (a) teachers involved in computer conferencing and collaborative writing decisions, (b) schools debating how electronic collaboration can enhance learning, and (c) administrators and policymakers supplying discretional funding for electronic resources and training. Even though many of these audiences are currently captivated by the Internet and other tools for electronic collaboration, this enthusiasm could wane without sufficient theoretical rationale and positive social and cognitive results. We hope that the research and theory presented in this book will serve as a catalyst for future exploration of electronic collaboration related to student learning and educational reform. If this occurs, perhaps teachers will begin to grasp how to marry learning pedagogy with collaborative learning tools to create socially and intellectually rich learning environments.

To assist in this progress, the authors of this book have begun to focus on how different electronic tools and learning formats impact social interaction and student learning. The findings and conclusions across the work featured here point to some commonalities in effective instructional use of these technologies as well as a myriad of procedures for analyzing student discourse processes and meaning making. Before computer-conferencing and electronic collaboration tools can significantly impact educational reform, new approaches are needed to observe and measure the impact of these tools on both social and cognitive functioning. When a few of these windows are opened, the race for more effective learner-centered technologies and environments can be pursued more diligently.