Preface

OVERVIEW

This book is a collection of case studies of collaborative virtual learning environments focusing on the nature of human interactions in virtual spaces and defining the types and qualities of learning processes in these spaces. Cases in the book discuss training and education in virtual worlds using case study evaluative research methods as a comprehensive methodology for understanding the development of advanced learning processes in collaborative virtual learning environments (CVLE). Using a case study analysis as a basis for this collection provides a unifying perspective for discussing the viability of collaborative virtual spaces as training programs for insurance brokers, forums to support at-risk university students, simulations of historical places, means to aid autistic children learning social skills, repositories for digital libraries, collaborative spaces for designing new university programs and emergency response training. As a result this book provides multiple cases of collaborative virtual learning environments in varied fields as a resource for designing, implementing or evaluating these emerging learning environments.

Collaborative Virtual Learning Environments

Collaborative virtual learning environments are both two dimensional (2D) and three dimensional (3D) virtual spaces that include multiple interactive aspects including collaborative dialogic forums such as chat rooms, discussion boards, live audio, information dissemination and presentation in multiple media including sound, video and animated graphics, and hyperlinks in the environment that link the learners throughout the learning experience. An excellent list of some of the relevant characteristics of a collaborative virtual learning environment is:

- A virtual learning environment is an intended information space.
- A virtual learning environment is a social space.
- The virtual space is represented through text only to 3D immersive worlds.
- Students are active and co-construct the virtual space.
- Virtual learning environments can also enrich classroom activities.
- Virtual learning environments integrate varied technologies and pedagogical approaches.
- Most virtual environments overlap with physical environments (Dillenbourg, Schneider, Synteta, 2002, p. 3).

3D collaborative virtual learning environments can be highly engaging to learners as they respond to interactions in the virtual worlds. These immersive virtual worlds are simulated environments designed using 3D graphics where the learners can interact via virtual characters, avatars, by taking on roles and responding to simulations. Immersive virtual worlds are designed around an interactive theme. These
worlds can simulate real world events or fantasy worlds. Avatars can communicate using text, voice and gesture. Avatars can walk, fly, dance, run, gesture and change appearances. Interacting in these worlds through an avatar provides the learner with the potential to experience telepresence, a higher level of involvement in the virtual space. Instructional design theories, specifically problem-based learning (PBL) design principles, based on constructivist principles of learning can provide a basis for the design of these immersive virtual learning environments. Virtual problem-based learning environments engage learners in simulated problem spaces designed to encourage the interactions needed to develop advanced cognitive processes. Immersive virtual PBL environments designed based on constructivist theories of learning can potentially develop advanced cognitive processes as a result of the interactions in virtual worlds.

Problem-Based Learning Design

A problem-based learning environment is designed using social cognition processes including situated theories of learning (Cole & Engestrom, 1993; Lave & Wenger, 1991) and distributed cognition theories (Pea, 1993; Resnick, 1987; Salomon, 1993) where learners engage in socially mediated interactions and consider themselves active members of their community of learners within the context of solving the problem, a phenomena Lave and Wenger (1991) call legitimate peripheral participation (LPP) (Lave & Wenger, 1991). According to sociocultural learning theory students create meaning as a result of social interactions by attempting to resolve dissonance in an attempt to understand a problem (Vygotsky, 1978; Bruner, 1990). Research of collaborative online learning environments has shown that learners can develop higher levels of awareness and knowledge as a result of their dialog and interactions in online environments (Russell, 2005). When learners have the opportunity to articulate what they have learned and reflect on the knowledge they acquired in that process, they understand more and are better able to use that knowledge to solve problems (Russell, 2008).

Cognitive processes required to problem-solve include an active search for information, an immersion in task, a motivation to solve the problem, goal setting and the necessity to use divergent, analytical and evaluative thinking (Tan, O. 2003). In a problem-based learning environment the learner sees information as something functional and him or herself in control of using the information in pursuit of a particular goal (Bereiter, 2001). Problem-based learning is intentional learning where learners establish goals (Jonassen, 1999). Problem-based learning environments include authentic tasks that are intentional, active, and collaborative engaging learners in the purposeful application of knowledge and skills to solve a problem (Jonassen, Peck, & Wilson, 1999). The design of a 3D immersive virtual problem-based learning environment means considering the constraints of moving these problem-based learning processes and interactions into a virtual space. Considerations in designing an immersive virtual problem-based learning environment should include the potential to develop telepresence in these virtual worlds and the use of pedagogical agents to scaffold the development of advanced learning processes.

Telepresence

One critical aspect in a PBL environment is the high level of engagement by learners in solving problems that they perceive as meaningful (Jonassen, 2000). A design consideration then is whether learners in an immersive virtual world can feel a high enough level of engagement. The level of presence in virtual learning environments is telepresence. Telepresence is the sense that a person using certain technologies has that he or she is present in a location other than their real world location. Dr. Hayles described telepresence as "extending embodied awareness in highly specific, local and material ways that would
be impossible without electronic prosthesis” (Hayles, 1999, p. 291). McLuhan writing about the then new media of television described electric consciousness as “putting our physical bodies inside our extended nervous systems, by means of electronic media, we set up a dynamic by which all previous technologies that are extensions of our bodies will be translated into information systems” (McLuhan, 1964, p. 57). In the book Natural Born Cyborgs, Andy Clark describes the ability of the human brain to respond to immersive environments as extremely opportunistic. He further states that “we should not underestimate the capacity of human brains in general—young human brains in particular—to simultaneously alter and grow so they can better exploit the problem-solving opportunities our technologies provide” (Clark, 2003, p. 45).

In a sociological phenomenology study of online games the researchers found that the online interactions of the players were considered by them to be real engagements occurring in real forms of community (Chee, F., Vieta, M., and Smith, R. 2006). In a study of the dialogic interactions in a multi-user real-time virtual world, the virtual interactions were found to have strong emotional connotations to the participants because the dialogs are intentional and included social effect and significance similar to real world dialogs (Wolfendale, J. 2007). In an ethnomethodological study of social identity in collaborative virtual environments the researchers found that, when enough context is established to develop a minimal amount of trust, users will recognise each other in the future and progress through all the phases of identity production in social conventions including greetings, acknowledging and leaving rituals, establishing groups, social positioning and expression of intimacy and social sanctions (Kauppinen, K., Kivimaki, A., Era, T., Robinson, M., 1998). Studies have shown that high levels of telepresence are possible in immersive virtual learning environments if these virtual environments provide a presence in the environment, interactivity in the environment and social forums for collaboration (Clark, 2004).

**Pedagogical Agents**

The design of an immersive virtual problem-based learning environment should include high levels of interactivity to increase motivation, engagement and goal-setting responses in the learners. The incorporation of artificial intelligence robots, AI bots, as pedagogical agents can increase student levels of telepresence and engagement levels. When you correlate the language processing and reasoning control of AI bots with an avatar’s personification in the virtual world, a pedagogical agent becomes a powerful personification of knowledge response and representation. A study by Lester, Stone and Stelling found that pedagogical agents can be productive interactive aspects in a constructivist learning environment if the pedagogical agents are animated, include vocal behaviors and respond to a series of problem-solving tasks (Lester, J., Stone, B. Stelling, G. 1998). In a later study they found that pedagogical agents could serve multiple purposes in virtual learning environments including modeling complex tasks, tutoring learners and as an instructional guide (Johnson, L., Rickel, J., & Lester, J. 2000). These types of learner’s interactions with a pedagogical agent are similar to the development of cognitive apprenticeship as defined by Anderson (Anderson, 1998). Additionally providing ongoing mentoring capabilities in virtual worlds scaffolds learners to higher levels of mastery in their zone of proximal development (Vygotsky, 1978).

Pedagogical agents are connected to an ontological knowledge base of information in the virtual PBL environment with the resulting ability to change and update knowledge representation and their responses to the learner. The learner’s levels of engagement and motivation, both necessary to the development of advanced learning processes, can be sustained by ongoing interactions with pedagogical agents. Pedagogical agents can be guides, mentors, experts and provide assessment feedback in an immersive virtual problem-based learning environment.
Virtual Problem-Based Learning Design Template

The design of an immersive virtual problem-based learning environment should include the same design characteristics as a real-world problem-based learning environments including an interactive problem space for exploration, developmentally phased learning activities for the reinforcement of advanced cognitive processes, formative and summative assessments, and collaborative forums. Figure 1 is a virtual problem-based learning design template that can be used as a guide to design multiple virtual PBL environments. The model includes three phases that develop advanced problem-solving abilities including critical decision-making, inquiry, evaluative and collaborative processes. The template uses Bereiter’s Scheme of Knowledge to assess formative and summative learning processes and knowledge response (Bereiter, 2001). The design template includes guides for group work, development of artifacts, use of pedagogical agents, and inquiry processes. Gaia world, an immersive problem-based learning virtual world, designed based on the template is described below and an instructor’s guide for implementing Gaia world is included in Appendix A.

The virtual problem-based learning design template can be used to design virtual worlds that guide a learner through the development of problem-based learning processes in three phases. Each phase includes interactions with pedagogical agents in differing roles based on the level of user response. An example of an immersive virtual PBL environment is Gaia world. Below is the curriculum overview for Gaia world.

GAIAWORLD: IMMERSIVE VIRTUAL PBL ENVIRONMENT

World Characteristics

Gaia world is an island in the Teen Grid in Second Life. It is designed using the virtual PBL design template. It is a role-playing simulation designed to develop advanced cognitive processes and knowledge. Evaluation standards are included in the instructor’s guide as well as a rubric for assessing performance standards. It is designed for fourth grade through high school. The learning goal is to develop the students’ awareness and knowledge of global climate change by engaging them in a virtual simulation of an environment that has undergone drastic environmental damage. The students will interact with the virtual environment, each other and the inhabitants of Gaia world to develop a plan of action to save the environment. Their problem is how to restore the environmental damage caused by volcanic eruptions. The world is a jungle island. It should be built to include multiple volcanoes. One will eventually explode. It should include multiple species that are unique and endangered. The humans are hunters and gathers that have recently started farming and other diversified forms of labor. They have cut large sections of the forest causing erosion. They are living in wooden dwellings. The humans are having problems with limited access to good water and with population growth that makes feeding everyone difficult. They have a barter system of trade with other villages. The flora and fauna should include marker species such as coral that are used by scientists to study environmental damage.

Geoscientists (Students)

Students will study a world that has suffered a devastating natural disaster-a volcano explodes. As geologists, the students must go into the world before, during and after the disaster in a series of fact-finding missions. Their missions are:
Figure 1. Virtual PBL design template

<table>
<thead>
<tr>
<th>Virtual Design</th>
<th>Problem Space (Banathy, 1996; Lawson, 1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogical Agent used as Guide to aid learners as they explore the problem space. <strong>Output</strong>: Virtual artifact including a rationale for relevancy of the problem.</td>
<td>Simulation designed as an interactive virtual environment that relates to a real world problem space.</td>
</tr>
</tbody>
</table>

**Phase 1:** Why is the problem important?  
**Inquiry Processes:** Working in pairs, learners gather and analyze information in the virtual simulation to determine nature of the problem and to define the scope of the problem. (Barab & Duffy, 2000; Petroski, 1996).  
**Output used as input:** Knowledge that a diverse community needs impact the complexity of the problem. (Bereiter, 2001).

**Phase 2:** How can we use our expertise to better understand the problem and develop a feasible solution?  
**Inquiry Processes:** Working groups, learners gather and analyze information about an area of expertise (Brown, Collins & Duguid, 1989) and how that area relates to the problem, (Bruer, 1993, Shulman, 1992) learners examine areas of expertise in simulated environments, determine the interdependence of the areas of expertise.  
**Output used as input:** Knowledge that a problem can look different and be understood differently from multiple perspectives.

**Phase 3:** How can we use the knowledge and skills from Phase 1 and Phase 2 to develop a feasible solution?  
**Inquiry Processes:** Working in jigsaw groups (Aronson, Blaney, Stephan, Sikes & Snapp, 1978), learners develop a solution to the problem and assess the feasibility of that solution from the perspectives of the experts within the group and the needs of the community.  
**Outcome:** Knowledge has properties of use and value; is something that can be used and responded to.

Figure 2. Virtual Jungle Island in Second Life
1. identify major ecological factors and report on pre-eruption conditions including human conditions
2. short-term damage assessment immediately following the eruption with suggestions for minimizing damage
3. long-term damage assessment with a report on changes and suggestions for controlling further loss.

Students will gather information on the environments before and after the environmental damage through 1) tests run on the virtual environment, 2) AI guides who respond to their questions and 3) research done using kiosks in the virtual environment. They will work in groups in the virtual world. Students will use a field book for taking notes in the world. They identify the major problems of the environment by testing the environment and interacting with AI guides and each other. The guides will give them clues to finding further information.

Real World Classrooms

In the real world classroom the facilitators implement a correlating study of climate change and environmental damage that includes developing a community project on a related issue such as reducing the carbon footprint in their community, recycling, improving water quality and reducing energy consumption. Before and after their virtual experiences teachers introduce and then conclude the learning activity by focusing on using the student’s new knowledge to develop their community-based project. Some of the potential real world problems possible for anchoring this virtual PBL environment include:

- **Hydrology Problem**: The central region water reservoir is running out of water. How can the water reserve be protected from depletion?
- **Geology Problem**: Our region has a major earthquake fault. How can our community prepare for a potential earthquake?
- **Water Problem**: Our community has experienced continued growth and construction. The region has also suffered a drought over the past several years. How can the community maintain and protect their waterways from erosion and pollution caused by construction?
- **Air Problem**: The EPA has established an air pollution goal for our community. What are actions that the city can take to improve the quality of the air in our community?

Virtual Interactions

Instructors, pedagogical agents and collaborative work groups are all forms of interactions in the virtual world. Pedagogical agents will be used to interact with the students in each phase. During phase 1 the pedagogical agent will be a village elder who will be a guide AI bot. This guide’s role is to help students inquire into the problem space, learn about the environment and the expert issues that need to be understood to solve the problem. During phase 2 the pedagogical agent will be a villager. There will be multiple villagers each with a different role and perspective. They will be the experts on the sub issues in the problem such as a fisherman who understands water issues, a farmer who responds to land use issues, and a traveler bot who has seen multiple scenarios for a wider perspective on the result of the phase 2 environmental changes. During phase 3 the pedagogical agent will be a village ruler designed to receive the students’ plan of action for improving the environment and provide an assessment tool to the instructor.
Fieldbooks

Each time the student geoscientists visit the Gaiaworld they will add to their fieldbooks by taking notes and creating artifacts. All of the fieldbooks will be available through a learning management system designed for this unit. As a result of completion of activities, the students will move through levels of scholarship. In each level they will get additional capabilities in the virtual environment including the ability to design artifacts in the environment, new clothing or capabilities for their avatars and the ability to move into and present in the associated museum and scientist conference building. As a result, in further iterations they can function in the social dynamic of the humans living in Gaiaworld.

- **Phase 1 Virtual Activities:** During phase 1 students do an intensive study of the environment pre explosion. Students enter the world with a scientist’s field book. They have a set of questions to answer and observations to record. They interact with the village elder (pedagogical guide) to understand the current (pre-explosion) state of the environment. To understand the terminology of the geoscientist they use a library kiosk. When they have finished they meet with their classroom facilitator. This first assessment is a survey. If they have completed their field notes they can post it on the learning management system web site for everyone to share their ideas.

- **Phase 2 Virtual Activities:** Once the volcano has erupted the students go in to explore a second time. The devastation includes a large percentage of the forests, loss of several animals, farmland and dwellings. They talk with a village farmer, traveler or fisherman. The pedagogical agents respond to student questions and focus them on developing a plan of action to help the environment recover. What are the expert issues that need to be understood to solve the problem? Who should be involved? What should be done? How does each aspect of the human and natural environment work together to recover? Again the students go to kiosks to get information on vocabulary and background information. Also the students write up a field note report that assesses the damage by comparing it to the previous field trip. They post their finished report in the learning management system for review and comments.

- **Phase 3 Virtual Activities:** Finally the students go into the world to implement their plan of action. They are able to create objects in the environment depending upon their level of development based on the completion of previous projects in the virtual world. The final mission also includes talking to the village ruler. The village ruler is a pedagogical agent who is a form of assessment. He asks them for a report of the status of the village and how to develop a plan to aid in redevelopment and conservation. The village ruler will be a pedagogical agent who has preset questions and responses for survey assessments. The pedagogical agent also serves as a form of assessment of the student’s plan of action to save the village. The students make suggestions for ongoing recovery and long-term recovery.

They post their final report in their bulletin board for others to comment on. They also create a storyboard of all their field observations. They can create an object in the simulation, a machinama video, a Powerpoint, or a website showing their ideas and their progressions. This scenario includes another island, Geoscientist Island, for the students to meet, present and display their findings. Everyone will visit an outside auditorium on another island to see all the presentations and discuss their findings. New objects and projects will be displayed in a museum on the Geoscientist Island. All of these phases will include a formative assessment by talking with a facilitator or designer’s avatar. Each phase’s fieldbooks will be assessed using a rubric designed for the artifact. The presentations are their final assessments and will be assessed using a rubric designed for this process.
The teachers’ instructional design guide is included as an appendix A to this chapter. The instructional guide is a series of guided questions, possible activities and assessment guides for the teachers to use to develop their curriculum for this unit. The instructional guide includes a rubric based on Bereiter’s Scheme of Knowledge for the end of phase 1. The instructional guide was designed using the virtual PBL design template. This example of an immersive virtual PBL environment includes the constructivist sociocultural learning theories and models that provide the foundation for the design of a problem-based learning environment.

Using a problem-based learning model based on constructivists theories of learning as a guide, educators can design virtual worlds that engage the learners in problem-solving, decision-making and critical thinking by involving them in simulations of real world events, explorations of worlds not otherwise possible. This includes the potential to design simulations of emergency rooms in virtual hospitals to train medical students, the design of virtual classroom simulations to train future teachers, the design of simulations of training programs for emergency response personnel to develop the necessary critical decision-making and evaluative problem solving processes as well as advanced knowledge needed in these professions. Understanding the potential of collaborative virtual learning environments to be productive learning environments in the development of knowledge workers in the knowledge age is the purpose of this book.

ORGANIZATION OF THE BOOK

This book includes case studies of varied collaborative virtual learning environments with insights into design, development and implementation of these emerging learning environments. There are nineteen chapters in this collection. Each is a unique contribution to the dialog on the characteristics and implications of the varied virtual learning environments.

Chapter 1 reviews the University Life Café, a new website that promotes mental wellness among university students, faculty and staff, with a particular focus on suicide prevention. This publicly available site uses the power of social networking at its core to provide a sense of virtual community to its members. It delivers information on resiliency and protective issues against suicide through podcasts, audio files, images, text, and other types of contents. Users of the site may also access professionally created heuristics dealing with various aspects of mental health. This also strives to de-stigmatize communications about suicide, depression, and substance abuse and to encourage help-seeking behaviors. This site was co-developed with contributions from students, faculty, and staff; it involved partnerships from across campus. This site is one part of a comprehensive, campus-wide plan, which engages students and faculty/staff, while respecting the race, ethnicity, cultural background, sexual orientation, and belief system of every member of our campus community.

Chapter 2 reviews the OpenHabitat project, a study exploring the experiences of art and design students and tutors engaged in collaborative learning and teaching activities within the multi-user virtual environment (MUVE) Second Life OpenHabitat represents a 15-month JISC funded project and collaborative partnership between three UK based institutions: University of Oxford, Leeds Metropolitan University and King’s College London. The project focuses on the extraction of good practices and meaningful design approaches for collaborative and dialogic teaching activities in 3D virtual spaces.

Chapter 3 reviews the introduction of a collaborative virtual learning environment into a music program at a Midwestern comprehensive research university that can stimulate creativity and innovation in learning and extend that innovation to students at a distance. The learning environment consists of a room, technology, and an Internet assisted set of tools. This music learning environment is one of a series of learning environments created to enhance learning especially in the humanities.
Chapter 4 is a chronicle of Korean elementary students’ efforts to gain autonomous control of a foreign language, English, from the top down, that is, through use of English in communication (as opposed to mere exposure to English through study or through the passive absorption of comprehensible input). This communicative use of English is realized through materials pertinent to their overall development and not just to their language development. The materials include a surrogate self or avatar within a virtual learning environment which can, in principle, though not in this study, connect them with children all over the world.

Chapter 5 reviews the Center for the Advancement of Distance Education (CADE), a self-supporting unit within the School of Public Health at the University of Illinois at Chicago. The center’s services range from online continuing education and professional training to multimedia Web-casting and research data management, analysis and presentation. The case is a quarantine scenario designed for emergency training. “The Canyon Crossroads” was designed as a key transit point between two quarantine areas and two uninfected areas with a state border to divide the crossroads leaving quarantine zones in each jurisdiction. The local hospital was located in one of the quarantine zones and it is an official holding and treatment location for infected victims.

Chapter 6 presents a pedagogical case in science in which the learners take part in an argumentative debate mediated by a technological environment, called Digalo. The chapter focuses on a socio-cultural perspective, thus assigning a central role to social interactions, symbolic and material mediation in development and learning processes. The author describes a case in biology tested in two educational contexts, and discusses its psycho-pedagogical assumptions. From a qualitative analysis of the data, it appears that cognitive and argumentative processes are interconnected. This means that by articulating and making reference to the others’ arguments, learners also develop a new understanding of the scientific content. The challenges for educational issues and the lessons that may be drawn from an analysis of this case are then discussed.

Chapter 7 reviews the International Health Challenge in Second Life with the goal of extending the real life mission, goals and activities of the Texas Obesity Research Center (TORC) of the University of Houston (UH) into Second Life (SL). This case investigates the utility of applying the ecologic model of health to virtual environmental settings to reduce the public health burden of obesity, with the case example of the International Health Challenge.

Chapter 8 reviews the case of the design and implementation of a virtual learning environment in a biology department at a middle school in northeastern Illinois with the problem of finding an alternative means of instructional delivery that would yield substantially the same cognitive knowledge development in the students, help address the declining frog population, address the issue of science anxiety among students at the middle school level, and accommodate the learning modalities of the students.

Chapter 9 reviews the use of Second Life to develop a digital community of students from a single academic department to enhance student persistence toward graduation. Achieving student persistence and retention at the University of Houston has often been a challenge for the university. It was postulated that the development of a digital community could strengthen the social cohesion of the students and thereby promote academic persistence. Students joined Second Life voluntarily or as part of their course requirements and then were invited to participate in various social and educational activities led by their classmates.

Chapter 10 reviews the iSocial project is to support the development and practice of social competence for individuals with Autism Spectrum Disorders (ASD) through a social-skills curriculum and online social interaction delivered via a 3D virtual learning environment (3D-VLE). This chapter describes the background and rationale for developing iSocial, gives an overview of the system, and reports some of the results from a field test of a partial system implementation.
Chapter 11 reviews how to maximize collaborative learning and work in digital libraries and repositories by applying pedagogical strategies as designers of digital libraries and repositories become more focused on making such spaces usable for collaborative learning and building networks of communities. This chapter will explore how to maximize collaborative learning and work in digital libraries and repositories by applying pedagogical strategies.

Chapter 12 provides a case study of the problem solving processes of a faculty who developed a new graduate program in communication studies. Students could take all courses online, all on ground, or use a combination of the two delivery formats. For the totally online program, a key desire was to help students and faculty achieve a sense of a collaborative community. Students needed to get to know each other and feel a part of the whole program, even though course delivery for some students was totally online. Further, the faculty sought to motivate students to engage in a challenging program of research and application.

Chapter 13 is a narrative of the design, implementation, review, and redesign of an online training program for insurance brokers. The goal of the online training program is to develop advanced problem-solving knowledge and skills including communication abilities in trainees. The case is narrated from the perspective of the training manager with the reviewer’s comments included during the review cycle of implementation. The evaluative review uses cultural historical activity theory to identify contradictions in the training process.

Chapter 14 reviews the case of an instructor and students and their educational experiences in a graduate course in virtual learning and Second Life (SL) and will provide ethical and legal guidelines for teaching and learning at the university level and for others who teach in SL. As this generation grapples with the intersection of “real” reality, virtual reality, and increasingly three-dimensional technologies, little has been written about the legal and ethical issues, affecting teaching and learning in virtual worlds and no research has been done on them. This case study is of an instructor and students and their educational experiences in a graduate course in virtual learning and Second Life can provide some guidance on these issues and provide ethical and legal guidelines for teaching and learning at the university level and for others who teach in Second Life.

Chapter 15 reviews the use of online discussion to help participants reach a more critically informed understanding about the topic or topics under consideration, to enhance participants’ self-awareness and their capacity for self-critique, to foster an appreciation among participants for the diversity of opinion that invariably emerges when viewpoints are exchanged openly and honestly, and to act as a catalyst to helping people take informed action in the world.

Chapter 16 explores the question: Does online discussion produce critical thinking? It presents a selective review of the literature concerned with critical thinking and/or interaction during online discussion. It presents an experimental study of the effects of instructional media and instructional methods on critical thinking. The study tests the influence on critical thinking of online vs. face-to-face discussion, individual vs. group consensus in summarizing discussion, and discussion of examples of concepts vs. discussion of more abstract analysis. The purpose for reviewing the literature and carrying out the study is to increase awareness of variables that may influence the quality of discussion.

Chapter 17 reviews whether online edutainment gaming can enhance intelligence, student learning, or scholastic performance remains hotly debated in education research circles. In response to this academic issue, and in order to address a number of educational policy questions asked of the authors by several government organizations, the authors developed the online e@Leader edutainment gaming platform as a solution. Their e@Leader program is the first comprehensive ‘learning by gaming’ system to also be designed according to the findings of advanced machine learning and cognitive developmental neuroscience research. In 2008, the first empirical evidence was generated with its use, and together with
its built-in assessment system, integrated into the school curriculum. Beyond this existence proof of concept, and practical program application for educational use, results of beta-testing with the e@Leader system across primary schools in two countries support the claim for tutored online educational gaming in enhancing intelligence, active student learning, and scholastic performances in English and math.

Chapter 18 reviews the concept of knowledge-building as an approach that is effective in online learning, and the concept of protocological control as a means of controlling the communications networks that evolve during the learning process. Teachers using online learning environments have found that traditional classroom control techniques do not work when applied online. Instead, other approaches need to be used. This chapter introduces data from a study involving students in a gr. 5/6 hybrid (online and face-to-face) class are used to illustrate how the teacher controls the learning process when the students all work independently of each other. The use of social network analysis as a tool for visualizing the communications networks that form is demonstrated.

Chapter 19 describes the training course for school managers for the use of information and communication technology (ICT) that was developed at Sao Paulo Pontifical Catholic University, Brazil. This was a blended course, using face-to-face and online activities, providing school managers with the experience of using ICT to share experiences, and to learn about effective ways of using ICT for school management. Social and cultural practices were considered for analysis concerning the subjects that contributed to the creation of the ICT culture in the school.

CONCLUSION

This book anticipates the potentiality of collaborative virtual learning environments by addressing their inherent complexities using case analyses of varied learning environments. Consequently the book provides holistic descriptive and evaluative responses to identify the processes and interactions occurring in these environments. As a result this book provides support for designers, educators, and researchers as they respond to the potential of these learning environments. Using the integrative processes of case study analyses provides new insights into collaborative virtual learning environments and the interactive aspects that impact learning. This case study collection develops new insights and provides productive discussions on the potential of these highly engaging virtual environments.

REFERENCES


Instructional Design Template for Gaiaworld

The purpose of this instructional design template is to guide the teacher through the development of a problem-based unit based on constructivist learning principles. This unit will be supplemented by the information learned in the virtual Gaiaworld described above. The facilitator chooses a real-world problem and then uses the virtual created reports to identify areas of expertise and sources of information in the real world unit.

What is the nature of the Real World problem students will as they do the Gaiaworld unit?

- **Hydrology Problem:** The central region water reservoir is running out of water. How can the water reserve be protected from depletion?
- **Geology Problem:** Our region has a major earthquake fault. How can Our community prepare for a potential earthquake?
- **Water Problem:** Our community has a experienced continued growth and construction. The region has also suffered a drought over the past 5 years. How can the city maintain and protect their waterways from erosion and pollution caused by construction?
- **Air Problem:** The EPA has established an air pollution goal for our community. What are actions that the city can take to improve the quality of the air in our community?

Meaningfulness for Students

*Why do you think students will find the problem in this unit meaningful?*
Unit Overview (continued)

Relevant Missouri Show-Me Knowledge Standards

Although several of the Missouri Show-Me Knowledge Standards could relate to the content in this unit, which knowledge standards will you integrate into the activities and projects of this unit?

Communication Arts

4. writing formally (such as reports, narratives, essays) and informally (such as outlines, notes)

6. participating in formal and informal presentations and discussions of issues and ideas

Mathematics

3. data analysis, probability and statistics

Science

7. processes of scientific inquiry (such as formulating and testing hypotheses)

8. impact of science, technology and human activity on resources and the environment

Social Studies

6. relationships of the individual and groups to institutions and cultural traditions

7. processes of scientific inquiry (such as formulating and testing hypotheses)

Others
Unit Overview (continued)

Goals and Objectives

Based on the Missouri Show-Me Performance Standards, what are the goals of the unit and what objectives will help students meet those goals throughout the three phases of the unit?

1. Working as a researcher exploring geoscience issues in our region, the student will gather, organize, analyze, and apply information ideas:
   **Objectives:** conduct research to answer questions and evaluate information and ideas use technological tools and other resources to locate, select, and organize information organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation

2. While analyzing potential problems and solutions, the student will communicate effectively within and beyond the classroom.
   **Objectives:** plan and make written, oral and visual presentations for a variety of purposes and audiences exchange information, questions and ideas while recognizing the perspectives of others use technological tools to exchange information and ideas

3. Using the tools of inquiry to develop a plan of action, the student will recognize and solve problems.
   **Objectives:** identify problems and define their scope and elements examine problems and propose solutions from multiple perspectives assess costs, benefits and other consequences of proposed solutions

4. While considering the interdependence of human and environmental needs, the student will use critical thinking to defend decisions.
   **Objectives:** explain reasoning and identify information used to support decisions reason inductively from facts and deductively from general premises

5. As a scientist working with other scientists, the student will be a responsible group member and demonstrate positive leadership skills.
   **Objectives:** develop, monitor, and revise plans of action to meet deadlines and accomplish goals work with others to complete tasks that require a coordinated effort

Expert Contacts

What experts in fields related to this unit will contribute to the design, development, and implementation of this unit with students?

1. Geologist;
2. Civic officials
3. Economists
4. 
## Unit Overview (continued)

<table>
<thead>
<tr>
<th>Pre-Assessment</th>
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</thead>
<tbody>
<tr>
<td><em>What knowledge and skills do you think are important for students to have in order to complete the projects in this unit successfully?</em></td>
</tr>
<tr>
<td><em>How will you identify students’ prior knowledge and misconceptions about the problem?</em></td>
</tr>
</tbody>
</table>

### Phase 1.

<table>
<thead>
<tr>
<th>Critical Question</th>
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</thead>
<tbody>
<tr>
<td><em>What is the critical question that students will respond to throughout Phase 1 of the unit?</em></td>
</tr>
<tr>
<td>Why is the <strong>GAIAWORLD</strong> problem important?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considering the goals of this unit, what are the objectives for students during this phase of the unit? You might consider the performance and knowledge skills required for students to complete the project in Phase 1 with little or no teacher support.</td>
</tr>
</tbody>
</table>

1. use technological tools and other resources to locate, select, and organize information
2. make oral and visual presentations for a variety of purposes and audiences
3. identify problems and define their scope and elements
4. explain reasoning and identify information used to support decisions
5. work with others to complete tasks that require a coordinated effort

<table>
<thead>
<tr>
<th>Problem-Solving Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>What part of the model for design problem solving best illustrates the problem solving that will occur in the work groups during Phase 1?</em></td>
</tr>
</tbody>
</table>

In Phase 1, students are not only gathering information to determine the relationship between the living and non-living aspects of Gaiaworld. |

*How does the problem solving process in this phase of the unit relate to the way experts in related fields solve problems?*
## Phase 1 Project Criteria

*What project will students work collaboratively to complete during Phase 1 that relates to the critical question of this phase of the unit?*

After gathering relevant, accurate, and clear facts and statistics about the **GAIAWORLD** issue in their community, the group will determine why the **GAIAWORLD** problem is important to their community. Their knowledge and ideas for the future of **GAIAWORLD** will be shared with other groups in the class with other groups of students from our partner schools.

*What criteria will you expect students to complete when they work on the project collaboratively? Consider the objectives you identified for students’ learning during Phase 1.*

1. locate relevant, accurate, and clear facts from different sources that help your group explain why **GAIAWORLD** is important to your community
2. talk in your group about whether or not your group thinks **GAIAWORLD**, as it is today, can meet the needs of people in your community
3. talk in your group about what your group thinks **GAIAWORLD** should do to better meet the needs of people in your community
4. develop a plan for how to convince students from other communities why **GAIAWORLD** needs improvement in order to better meet the needs of people in your community
5. present the plan to other workgroups in your classroom and improve your presentation before sharing it with students from other communities

## Formative and Summative Assessment

*How will you assess students’ learning in regards to the objectives at the end of Phase 1?*

see Phase 1 Group Scoring Guide for assessment of group products based on Bereiter’s Scheme of Knowledge (levels 1-3)

## Facilitating Activities

*What activities do you think are important in Phase 1 to help your students meet the objectives of this phase of the unit and to successfully complete the project?*

1.

2.

## Initial Inquiry Questions

*What kind of questions do you anticipate students posing at the beginning of Phase 1 that will guide them in answering the critical question in this phase of the unit?*
### Important Implementation Dates

*What aspects of the activities in Phase 1 need to be scheduled or arranged ahead of time?*

1.

2.

### Resources and Tools

*What resources and/or tools within your classroom, in your building, or in your community are necessary to help students during Phase 1?*

1.

2.

### Phase 2.

### Critical Question

*What is the critical question that students will respond to throughout Phase 2 of the unit?*

How can we use our expertise in an area related to **GAIAWORLD** to better understand the problem and develop a feasible solution?

### Objectives

*Considering the goals of this unit, what are the objectives for students during this phase of the unit? You might consider the performance and knowledge skills required for students to complete the project in Phase 2 with little or no teacher support.*

1. conduct research to answer questions and evaluate information and ideas
2. exchange information, questions and ideas while recognizing the perspectives of others
3. examine problems and proposed solutions from multiple perspectives
4. reason inductively from facts and deductively from general premises
5. develop, monitor, and revise plans of action to meet deadlines and accomplish goals
Problem-Solving Model

What part of the model for design problem solving best illustrates the problem solving that will occur in the work groups during Phase 2?

In Phase 2, students will acquire expertise in an area related to GAIAWORLD, including problem solving strategies and conceptual knowledge. This will help them know where change could be effected in the system and help the revise their original vision for GAIAWORLD.

How does the problem solving process in this phase of the unit relate to the way experts in related fields solve problems?

Experts draw upon their prior experiences and knowledge and relate these to the unique characteristics of a current design problem.

Phase 2 Project Criteria

What project will students work collaboratively to complete during Phase 2 that relates to the critical question of this phase of the unit?

After gathering and analyzing relevant, accurate, and clear facts and statistics about an area related to GAIAWORLD, the group will determine how the area of expertise applies to development of a feasible solution to the GAIAWORLD problem that impacts multiple communities in Missouri.

What criteria will you expect students to complete when they work on the project collaboratively? Consider the objectives you identified for students’ learning during Phase 2.

1. locate relevant, accurate, and clear facts from different sources that help you understand your expert area related to GAIAWORLD
2. talk in your expert area group about how your expert area affects the way we will solve the GAIAWORLD problem and how it affects each of your communities
3. develop a plan for how to accurately communicate the following to students in your group: (1) the main ideas about the expert area and (2) how you think your expert area will help us solve the GAIAWORLD problem better
4. develop your plan for communicating to students in your group
5. talk in your group about how the areas of expertise are related and how the expert areas will help you solve the GAIAWORLD problem better

Formative and Summative Assessment

How will you assess students’ learning in regards to the objectives at the end of Phase 2?

see Phase 2 Group Scoring Guide for assessment of group products based on Bereiter’s Scheme of Knowledge (levels 3-5)
Facilitating Activities
*What activities do you think are important in Phase 2 to help your students meet the objectives of this phase of the unit and to successfully complete the project?*

1. case study analyses of similar projects

Areas of Expertise
*What areas of expertise are important to the GAIAWORLD problem that students will investigate in their groups?*

1. ecology
2. socioeconomics
3. design
4. public affairs
5. natural environment (e.g., wetlands, habitat, species)
6. human environment
7. human environment
8. human environment
9. human environment
10. human environment

Important Implementation Dates
*What aspects of the activities in Phase 2 need to be scheduled or arranged ahead of time?*

1.

2.

Resources and Tools
*What resources and/or tools within your classroom, in your building, or in your community are necessary to help students during Phase 2?*

1.

2.

Phase 3.

Critical Question
*What is the critical question that students will respond to throughout Phase 3 of the unit?*

How can we use the knowledge and skills from Phase 1 and Phase 2 to develop a feasible solution to the GAIAWORLD problem?
### Objectives

*Considering the goals of this unit, what are the objectives for students during this phase of the unit? You might consider the performance and knowledge skills required for students to complete the project in Phase 3 with little or no teacher support.*

1. organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation
2. use technological tools to exchange information and ideas
3. assess costs, benefits and other consequences of proposed solutions
4. explain reasoning and identify information used to support decisions
5. work with others to complete tasks that require a coordinated effort

### Problem-Solving Model

*In Phase 3, students will work in their local group to propose a solution to the GAIAWORLD problem that incorporates a plan of action for their community and multiple communities. They will apply the expert areas and assess their solution to determine feasibility.*

*How does the problem solving process in this phase of the unit relate to the way experts in related fields solve problems?*

### Phase 3 Project Criteria

*What project will students work collaboratively to complete during Phase 3 that relates to the critical question of this phase of the unit?*

After gathering relevant, accurate, and clear facts and statistics about GAIAWORLD in their community, the group will determine why the GAIAWORLD problem is important to their community. Their knowledge and ideas for the future of GAIAWORLD will be shared with other groups in the class with other groups of students from our partner schools.

*What criteria will you expect students to complete when they work on the project collaboratively? Consider the objectives you identified for students’ learning during Phase 3.*

1. write a description of the problem, including facts and statistics, of the current condition of GAIAWORLD as well as a prediction for its future
2. develop a hypothesis, or a statement describing how your group thinks the local organizations should develop GAIAWORLD to better meet the needs of people in Missouri
3. outline a procedure, or a logically-defined plan of action, about how your group’s idea would be implemented
4. talk in your group about how to “test the feasibility” of your solution and plan; determine whether your solution could feasibly be implemented locally.
5. using the results of your feasibility test, predict the success of your solution and plan and identify short-term and long-term problems that might occur because of your solution and plan of action
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<td><em>How will you assess students’ learning in regards to the objectives at the end of Phase 3?</em></td>
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<tr>
<td>see Phase 3 Group Scoring Guide for assessment of group products based on Bereiter’s Scheme of Knowledge (levels 4-6)</td>
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<td><em>What activities do you think are important in Phase 3 to help your students meet the objectives of this phase of the unit and to successfully complete the project?</em></td>
</tr>
<tr>
<td>1</td>
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<td>2</td>
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<tbody>
<tr>
<td><em>How will you motivate students to develop solutions to the GAIAWORLD problem that incorporates state and local community needs from Phase 1 and the different areas of expertise from Phase 2?</em></td>
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Phase I. Group Artifact Scoring Guide

<table>
<thead>
<tr>
<th></th>
<th>Learning</th>
<th>Accomplishing</th>
<th>Excelling</th>
<th>Exceptional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>gathering information</strong></td>
<td>Working with the teacher, the students found and used at least two resources.</td>
<td>With some teacher help, the students found and used at least two resources and identified if the information gathered was relevant.</td>
<td>The students found and used information from different types of resources, determined if the information was relevant, and explained if the information was reliable.</td>
<td>The students independently found and used information from different types of resources, judged the relevancy of information, and verified the reliability of information by cross-referencing.</td>
</tr>
<tr>
<td><strong>using facts and statistics</strong></td>
<td>The students and teacher worked together to identify and use facts and statistics to support their ideas.</td>
<td>With some teacher assistance, the students determined facts and statistics to support their ideas and could explain how some facts and statistics were connected.</td>
<td>The students could combine information, make connections between information, and identify relevant prior knowledge to support their ideas.</td>
<td>The students independently combined information, made connections between facts and statistics, recognized contradictions, and integrated prior knowledge.</td>
</tr>
<tr>
<td><strong>working on a team</strong></td>
<td>With teacher help, the students listened to one others’ ideas and shared in the responsibility for completing work.</td>
<td>With encouragement, the students listened to one others’ ideas, tried to compromise with each group members, and shared in the responsibility of completing work.</td>
<td>The students listened to one others’ ideas, encouraged all group members to compromise, and actively shared in the responsibility for completing work.</td>
<td>The student listened to others’ ideas, motivated all group members to compromise, and proposed a plan for sharing responsibility for completing work.</td>
</tr>
<tr>
<td><strong>setting up the problem</strong></td>
<td>With teacher support, the students identified and/or explained constraints in the GAIAWORLD system and stated a vision for the future of interstate.</td>
<td>As they described a vision for the future of GAIAWORLD, the students identified and explained constraints in the GAIAWORLD system including some that are related to the students’ community.</td>
<td>As they described a specific vision for the future of GAIAWORLD in their community, the students identified and explained constraints in the GAIAWORLD system that are directly related to the students’ community.</td>
<td>As they described a specific vision for the future of GAIAWORLD in their community, including constraints that are not apparent or are external to the GAIAWORLD system.</td>
</tr>
</tbody>
</table>