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ARTICLE

Solving Real World Problems With Alternate Reality Gaming: Student Experiences in the Global Village Playground Capstone Course Design

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The Global Village Playground (GVP) was a capstone learning experience designed to address institutional assessment needs while providing an integrated and authentic learning experience for students aimed at fostering complex problem solving, as well as critical and creative thinking. In the GVP, students work on simulated and real-world problems as a design team tasked with developing an alternate reality game that makes an impact on the United Nations Millennium Development Goals. Researchers employed a qualitative case study approach to evaluate what aspects of this problem-based, hybrid course design students found most and least beneficial to their learning. Findings suggest strategies for designing technology-based learning environments to support complex problem solving. Specific recommendations pertain to scaffolding team-based problem solving, particularly concept development processes, interdependence among team members, and group self-organization.

Keywords: game design, learning games, problem-based learning, complex problem solving, learning by designing, scaffolding problem-solving processes

Introduction

In the knowledge age, the need to develop in learners the higher order thinking skills that translate into real-world, complex problem-solving ability is more urgent than ever before. As early as 1991, the Secretary of Labor's Commission on Achieving Necessary Skills (1991) found that basic skills in reading, writing, and mathematics were the "irreducible minimum for anyone who wants to get even a low-skill job" but those skills were not a guarantee to either a career or access to higher education. Furthermore, data from a national survey initiated by the Association of American Colleges & Universities indicates that employers are dissatisfied with assessment test scores, grade point averages, institution ratings, and indicators of degree completion. Instead, they call for "faculty-evaluated internships and community-learning experiences" as well as "essay tests, electronic portfolios of student work, and comprehensive senior projects" which provide means for students to develop "real-world skills," as well as demonstrable products of student performance in problem-solving and readiness for the workplace (Peter D. Hart Research Associates, 2008). More specifically, the employers surveyed called for undergraduate learning experiences that foster the following:

- Engagement with big questions
- Critical and creative thinking about complex problems
- Active involvement in diverse communities and real world challenges
- Application of knowledge and skills in diverse settings and innovative ways (Peter D. Hart Research Associates, 2008)

In light of this report, the focus of instruction needs to become one that allows large-scale problem solving and compels a deliverable product that can then be evaluated by agencies outside of academia. Although employers desire these skills, learning institutions have to foster them without adding additional credit hours or courses to their programs (Safflund Institute, 2007). A means to achieving this end is through deploying instructional strategies that foster those skills in existing courses, using communications technologies, simulations, and other digital media to expand the boundaries of seat time and credit hours.

Learning Design Solution

One approach is to develop a problem-based capstone experience that allows students to apply knowledge gained across a general education curriculum as they develop solutions to

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complex problems in teams. The Global Village Playground (GVP) was such an experience, designed to address an institutional need to assess the general education program at a large, urban community college while providing an integrated, contextualized, and authentic learning experience for students. In the GVP, a six-credit capstone course, students work on simulated real-world problems as a design team tasked with developing an alternate reality game (AltRG) that makes an impact on the United Nations Millennium Development Goals (UN MDGs) (United Nations, 2005). This design project required students to engage with big questions, think critically and creatively about complex problems, and devise strategies to address them, central goals of a general education curriculum and essential skills in a global, knowledge-based economy, as well as the aims of using problem-based learning. It did so by simulating a work scenario in which students collaborate to create a deliverable product that meets the specifications of a client agency. Additionally, the scenario compelled students to grapple with real-world problems, such as eradicating extreme poverty and achieving universal primary education (United Nations, 2005), as well as develop skills in communicating effectively with members of small and large groups, managing a project timeline, and solving problems collaboratively.

Purpose and Research Questions

Although the GVP was designed to provide a means to evaluate the student learning outcomes for a general education program, assessment of student learning is not the purpose of this study. The effectiveness of many educational innovations is evaluated by student achievement of the learning outcomes targeted by the instructional design. This study does not ignore that precedent or its urgency. However, as Kirkpatrick (1994) points out, whether and what participants learned isn't the only consideration in evaluating instructional programs. Participant reactions, changes in behavior, and impact on an organization are also important. Thus, we focused first on evaluating participant experiences in the pilot implementation in order to identify design weaknesses and develop better scaffolds for complex problem solving prior to an evaluation of its impact on student achievement later (Wang & Hannafin, 2005). To accomplish this end, we designed a broader study that evaluated the effectiveness of the design of the GVP as a capstone experience, including learner reactions to the problem-based instructional methods; the knowledge, skills, and abilities they perceived to have gained in the course; and the issues that arise from implementing a large-scale, problem-based learning scenario as a capstone experience. Although students reported challenges with the design, their reactions to the course were predominantly favorable. They found the course activities (predominantly student presentations, team projects and class discussions) to be effective ways to learn, and seemed to prefer learning in these ways as compared with traditional methods of instruction (Dondlinger, 2009). Moreover, students reported learning gains in vital skills and abilities such as:

- creating new knowledge from prior knowledge and current experiences in the course,
- developing understanding of people from other cultures and a new appreciation for people within their own culture who are demographically different from themselves,
- deepening awareness of the importance of being informed, self-disciplined, honest, and reliable,
- appreciating other perspectives, new technologies, and different ways of thinking, and
- growing awareness of the relationship between self and society, need to protect the planet for future generations, and to do no harm. (Dondlinger, 2012)

Both the reactions to the course and the learning gains that students reported show promise for problem-based capstone course designs. However, implementing such designs is not without its challenges and tensions.

We focus this article on reporting which aspects of the design students found beneficial and detrimental to their learning in order to provide insight on the challenges and successes of implementing technology-based learning designs intended to provide integrated capstone learning experiences that promote the development and application of complex problem solving skills. More specifically, the research questions that we address here follow:

- What aspects of the design did students find conducive to their learning?
- What challenges or tensions arose from the design?

The research design for this study followed a qualitative case study approach to gather and analyze data collected from the students and instructors participating in the pilot implementation.

Theoretical Foundation

The use of games to promote learning is not a new instructional strategy; however, the surge of interest in digital games stems from their ability to situate learning in complex contexts that better reflect the real world and its challenges. The GVP, however, was not a game designed for learners to play; instead, designing a game became the central problem or situated task around which learning was framed. In his recent book, *A Whole New Mind*, Daniel H. Pink (2006) argues that competitive success in the conceptual age requires a new mindset, characterized by creative thinking. While the sequential, detail- and text-oriented thinking vital to the occu-

pations of the information age is still important, Pink asserts that simultaneous, big picture, context-oriented thinking is requisite to success in this new age. Thus, creating a problem-solving experience wherein students engage in the process of *designing* is a potential means to foster this way of thinking.

Problem-Based Learning and Games

Derived from constructivist learning theory, the problem-based learning (PBL) approach has provided a useful framework for understanding the value of games for learning. According to Savery (2006), "PBL is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" (p. 12). The central feature of PBL environments is an authentic, ill-structured problem, which is posed to groups of learners who develop a socially negotiated problem solution (Savery & Duffy, 1995). While much research surrounds the efficacy of PBL as it compares to traditional curricula, a recent study illuminates the design characteristics of PBL to successfully engage students and contribute to learning (Scott, 2014). Because this article centers on the design of a capstone course using PBL, Scott's (2014) study is of particular interest. She delineates four individual level characteristics and four team level characteristics. The individual characteristics include: (1) engagement in self-directed learning and reflection; (2) problem authenticity; (3) problem familiarity; and (4) learner characteristics. The team level characteristics include: (1) facilitator effectiveness; (2) team autonomy; (3) diversity; and (4) learning team collaboration. One of the implications Scott (2014) emphasized was the importance of designing with a multilevel framework in mind, including considerations at both the individual and team (including facilitator) levels. Consequently, we, too, found it imperative to design and analyze data representing multiple levels.

PBL has framed the designs and research of learning games for science inquiry in elementary and middle school settings that document learning gains over other, more traditional approaches to instruction (Barab et al., 2005; Ketelhut, Nelson, Clarke, & Dede, 2009; Nelson et al., 2005). PBL also provided the underlying theoretical framework for The Door, a problem-based, alternate reality game (AltRG) for a computer applications course in a postsecondary setting (Warren, Dondlinger, McLeod, & Bigenho, 2011). However, each of these problem-based learning games was designed for learners to play; in contrast, students in the GVP learned through designing a game rather than playing one. This approach was intended to more deeply engage learners in creative thinking and complex problem solving, and compel them to consider the experiences that others will have as a result of their design decisions. Indeed, Jonassen and Hung (2008) classify "design problems" as "usually the most complex and ill structured of all problems" (p. 19) because in addition to a moderate to high degree of relational complexity, design problems also possess "all the common attributes of ill-structured problems, such as vaguely defined goals, multiple solutions, multiple solution paths, and unstated constraints" (p. 20). Although the PBL approach has been found to create a degree of cognitive and social conflict (Albanese & Mitchell, 1993; Duffy & Cunningham, 1996; Savery & Duffy, 1995), engaging learners with big questions and fostering an open, supportive environment in which learners can practice learning with and from peers while confronting authentic challenges is thought to promote deeper understandings and more distant transfer of knowledge and skills (Bransford et al., 2003; Lave & Wenger, 1991; Vanderbilt, 1993).

Learning by Designing Digital Games

While the research on learners designing games has yet to be instituted widely, a few studies have indicated that the *process* of designing games or simulations can encourage higher order thinking and potentially complex problem-solving abilities (McLester, 2005; Robertson & Good, 2005; Robertson et al., 2004; Steiner, Kaplan, & Moulthrop, 2006). According to El-Nasr and Smith (2006), "during the design process, skills such as analysis, synthesis, evaluation, and revision must be used, providing opportunities for learning content and metacognitive skills such as planning and monitoring" (p. 2). Designing and developing video games, rather than playing them, applies a constructionist approach to learning with games (Robertson et al., 2004; Robertson & Good, 2005). El-Nasr and Smith (2006) view game "modding"—the development of new modules in an existing game using toolkits packaged with the game—as a constructionist method of learning. This approach to learning involves both "the mental construction of knowledge that occurs with world experiences" and the creation of "products that are personally meaningful" (p. 2). The theory proposes that, whatever the product, a birdhouse, computer program, or robot, the "design and implementation of products are meaningful to those creating them and that learning becomes active and self-directed through the construction of artifacts" (p. 2). Steiner, Kaplan, and Moulthrop (2006) concur with this view and contend that when "working to develop designs, test technology, and suggest revisions, children as design partners improve the technologies they consume as well as gain educational benefits from the experience" (p. 137).

Alternate Reality Games

While the research literature noted above indicates much educational merit in designing a game, developing students'

proficiency with game modding tools did not align with the goals of the course or the program it was intended to cap. However, the alternate reality game, or AltRG genre, which distributes game challenges, tasks, and rewards across a variety of media, both digital and real, provided a welcome alternative to high-tech modding tools and game engines. As described by the International Game Developers Association (Martin & Chatfield, 2006), "Alternate Reality Games take the substance of everyday life and weave it into narratives that layer additional meaning, depth, and interaction upon the real world" (p. 6). Controlled by the narrative storyline, players are given new clues and directed to increasingly complex puzzles as the game progresses. Harnessing media with intuitive usability, such as Facebook, blogs, and YouTube, an AltRG leverages tools that digital age learners use as part of their daily lives. Thus, design and development of the game could focus on application of knowledge and skills related to purpose, narrative, character development, and other conceptual considerations, rather than acquiring technical proficiency with game development tools. Game designer, researcher, and theorist, Jane McGonigal (2011), proposes that "we could leverage the power of games to reinvent everything from government, health care, and education to traditional media, marketing, and entrepreneurship—even world peace" (p. 8). The purpose of her AltRG, *World Without Oil,* was to "play our way to a set of ideas about how to manage that crisis [a dramatic decrease in oil availability]" (cited in Strickland, 2007, p. 1). McGonigal observed that players not only generated strategies for coping with a peak oil crisis, but they also changed their real-world behavior: planting trees or converting their cars to run on biodiesel (Strickland, 2007). Thus, the simulated problem yielded practical solutions and prompted real-world applications of the knowledge constructed in the AltRG play space.

Scaffolding the Problem Solving Process

Creating a problem-solving experience wherein students engage in the process of *designing* offers a potential means to foster both complex problem solving and creative thinking. Such a strategy combines problem-based and situated learning models, as well as elements of both constructionist and constructivist approaches. However, as much of the research on problem-based learning cautions, these skills and abilities don't develop automatically. Designers of problem-based learning environments must scaffold the problem-solving process in ways that make complex tasks accessible and manageable for novices (Davis & Linn, 2000; Golan, Kyza, Reiser, & Edelson, 2002; Hmelo-Silver, Duncan, & Chinn, 2007; Quintana et al., 2004; Reiser et al., 2001; Reiser, 2004; Toth, Suthers, & Lesgold, 2002). Saye and Brush (2002) distinguish hard scaffolds, defined as "static supports that can be anticipated and planned in advance based on typical student difficulties with a task" (p. 81), from soft scaffolds which are "dynamic and situational," requiring teachers "to continuously diagnose the understandings of learners and provide timely support based on student responses" (p. 82). Whether designed in advance (hard) or provided situationally (soft), scaffolds vary in purpose. Hmelo-Silver, Duncan, and Chinn (2007) group the varied purposes for cognitive scaffolds into three overarching categories: scaffolding that makes disciplinary thinking and strategies explicit, scaffolds that embed expert guidance, and scaffolds that structure complex tasks or reduce cognitive load. Nevertheless, as Belland, Kim, and Hannafin (2013) assert, cognitive scaffolds alone are not enough. Designers of problem-based learning environments must also provide motivational scaffolds beyond merely designing "authentic, problem-based experiences" with which many assume "students will automatically be engaged" (p. 243). Indeed, as noted earlier, because design problems are among the most ill-structured of problem types (Jonassen & Hung, 2008), course designers were particularly concerned with providing appropriate scaffolds for the interdisciplinary thinking this capstone experience was intended to foster, while also supporting learners beliefs that they could successfully complete their project: the design of an alternate reality game.

Design of the GVP

A primary impetus for creating this capstone course emerged from the need to provide evidence that completers of the general education or core curriculum had attained the state-recommended core perspectives. However, since these courses are not sequenced, students in their final semester might have any combination of the required courses remaining to complete. Thus, a capstone course could not summarily replace any single core course requirement. Consequently, the GVP was designed as a learning community—a team-taught course that combines two or more courses from different disciplines into one, integrated and themed learning experience. Deploying this approach gave students some enrollment options depending on what courses they had left to take, selecting two from a menu of three or four, for example. Moreover, the interdisciplinary nature of learning communities is well suited to problem-based learning. Savery (2006) delineates the essential aspects of PBL which align with this course design, including (but not limited to): (1) problems are ill structured and allow for inquiry; (2) learning is integrated and interdisciplinary; and (3) the process is collaborative.

Curriculum Alignment and Delivery Modes

Identification of courses for which students could earn credit proceeded from an analysis of the tasks that students would

perform throughout the process of designing and developing an AltRG (Kirwan & Ainsworth, 1992). Since this process involves creating a coherent game narrative, researching necessary informational and contextual content, structuring the game challenges and rewards, and developing the distributed game world, designers identified four subject areas from the program curriculum upon which the capstone could be based: composition, literature, speech communications, and humanities. Contextualizing student presentations and written compositions as the central activities of the game design process was intended to promote attainment of course-level competencies (such as writing, speaking, and listening) as well as provide more direct connections to the state core perspectives (listed below), and thereby clearer evidence of them in student work collected for program assessment purposes:

1. Establish broad and multiple perspectives on the individual in relationship to the larger society and world in which he or she lives, and to understand the responsibilities of living in a culturally and ethnically diversified world;
2. Stimulate a capacity to discuss and reflect upon individual, political, economic, and social aspects of life in order to understand ways in which to be a responsible member of society;
3. Recognize the importance of maintaining health and wellness;
4. Develop a capacity to use knowledge of how technology and science affect their lives;
5. Develop personal values for ethical behavior;
6. Develop the ability to make aesthetic judgments;
7. Use logical reasoning in problem solving; and
8. Integrate knowledge and understand the interrelationships of the scholarly disciplines (Texas Higher Education Coordinating Board, 1999)

The instructors chose a hybrid delivery format, which required students to make use of telecommunications media for collaboration outside of face-to-face meetings in class. This format allowed instructors to leverage affordances of online tools, as well as those of in-class meetings into a blend of the best of both. For example, although face-to-face discussions of key concepts and ideas have many benefits, continuing those discussions online in an asynchronous discussion forum allows every student to participate when time constraints in class can prevent some students from contributing. Moreover, students have more time to think through their ideas before posting online, while the spontaneous nature of face-to-face discussions often limit deep thinking to some extent. Posting some course content online, such as the mechanics of documenting research sources (a key outcome/objective of composition courses), allowed students who had already taken composition to simply review these conventions while those who hadn't could spend what time they needed with these resources. Class time could then be dedicated to identifying gaps in understanding and addressing them with just-in-time instruction. This structure is further supported by PBL literature, which highlights the importance of a facilitator or tutor to scaffold learning, prepare students to engage in PBL, ask questions that require deep thinking, and help students reflect on their experiences (Savery, 2006; Scott, 2014). Moreover, the hybrid approach is in keeping with current practices in a global workplace wherein problems are solved and projects are developed across expansive geographical distances via various digital media. The class met for three hours, one evening each week, accompanied by three hours of online coursework. Face-to-face class meetings were held in a LearnLab—a technology-rich classroom configured with moveable tables and chairs to support collaborative learning. Online activities included multimedia presentations of course content, asynchronous discussions among students, and peer evaluations of course assignments. The course also included "offline" homework, such as assigned readings, reflective journal assignments, as well as individual and small group assignments: preparation of speeches/presentations, research papers, and game design products.

The "Learn, Then Apply" Approach

The course was taught by an author of this article and a co-instructor who had some difficulty reconciling her instructional philosophy with the central problem-scenario. While she was able to see the connections between such collaborative projects and speech communications, as well as those between literary studies and the narrative structures that underlie AltRGs, she was uncomfortable having students explore literature and art (central components of the literature and humanities courses) entirely through the process of designing a game. Thus, the two instructors negotiated a compromise between delivering some instructional content through more traditional methods and wholly contextualizing student learning within the game design scenario. Following a "learn, then apply" approach, course activities were sequenced to allow some presentation of course content during the first four weeks of the semester, followed by three weeks of student exploration of additional course content, and finally an application of that content to development of the game during the last eight weeks. Course designers also thought that the approach would better allow them to first scaffold the disciplinary and interdisciplinary thinking (Hmelo-Silver, Duncan, & Chinn, 2007; Saye & Brush, 2002) underlying speech communications, composition, literature, and humanities, before immersing students in the highly ill-structured game design project. The primary learning activities from the first seven weeks of the course are detailed in Table 1.

Table 1. Primary learning activities from the first seven weeks of the GVP capstone course

Activity/ Assignment	Brief description	Intended Learning	Curriculum Alignment
Superhero Speech: Speech of Introduction	Students introduced themselves to the class by creating a fictional superhero persona of themselves. Assignment required that they select 3 objects representing some aspect of their persona and incorporate them into their presentation.	Elements of composition: purpose, audience, unity, and coherence.	Speech and Composition
		Interpreting meaning of images and objects	Humanities: Art and Architecture
		Creating and developing fictional characters	Literature
Campbell Presentation	Students read Joseph Campbell's *The Hero with a Thousand Faces*. Student pairs prepared an informative presentation of one section of the book, identifying key concepts and illuminating them with examples from film, art, and literature	Archetypes and cross-cultural patterns in images, stories, and structures	Humanities: Art and Architecture
		Recurring narrative plotlines, characters, and conflicts	Literature
		Providing supporting evidence for a central theme or idea	Speech and Composition
Rosencrantz and Guildenstern Are Dead and Modern & Postmodern Art and Architecture: Online and in Class Discussions	Students read and viewed clips of a film version of the Tom Stoppard play. Discussions focused on major versus minor characters, examining events from different perspectives, and questioning what is "real" or how we come to "know."	Interpreting literary and dramatic works	Literature
		Interpreting and appreciating artistic works	Humanities: Art and Architecture
		History of ideas & movements	Literature and Humanities
	Students viewed and discussed works of art and architecture from the late 19th through 20th centuries. Discussion focused on the big ideas of a given period and how they are articulated in buildings, public spaces, and a variety of artistic media.	Engaging in critical discourse and interpersonal communication	Speech and Composition
Culture Project	Student teams were assigned a region of the world and selected a culture from that region. Teams researched the culture and identified significant works of literature and art/architecture, presenting justification for their selections in a proposal and annotated bibliography. Selected literary works became assigned reading for the entire class. Teams prepared a class presentation and led a class discussion of the culture that they had researched.	Familiarity with significant works of literature, art, and architecture from various cultures	Literature and Humanities
		Finding, evaluating, and selecting information from appropriate research sources	Composition
		Articulating interpretations in oral, written, and visual formats	Speech and Composition

Table 2. Course Activities in Weeks 8 through 15

Week	In-Class Activities	Homework & Online Activities
8	Group 1 Culture Presentation	Reading and online discussion of literature and art of Group 1's selected culture
	Initial ideation/brainstorming of game concept (the overarching narrative for the game)	Students select one concept/idea generated in class to develop further and post their elaborations in the game design wiki space.
9	Group 2 Culture Presentation	Reading and online discussion of literature and art of Group 2's selected culture
	Discussion of game concepts that students developed in the wiki: identifying the 2-3 most viable for further development, forming pairs or tryads to further develop.	Pairs/tryads further develop and refine.
10	Group 2 Culture Presentation	Reading and online discussion of literature and art of Group 2's selected culture
	Discussion of developing game concepts and selection of the one to be developed by the whole class. Identification of game development tasks to be completed and assignment of tasks to class members	Individual class members complete their assigned tasks.
11-15	Students present/share their work completed outside of class and get feedback/input. Class identifies game development tasks and assigns tasks to class members to complete.	Individual class members complete their assigned tasks.

The first class meeting introduced students to the course, alternate reality games, and their first assignment: the Superhero Speech. Online discussion pointed them to a website of "Great Speeches" and prompted them to view/read three, identify qualities of a great speech, and compare/contrast those qualities with the qualities of effective writing/composition. In the second week, students gave their Superhero speeches and then began work on the Campbell presentation. Online resources and activities focused on archetypes and literary structures. Weeks 3 and 4 included student presentations of Campbell, discussion of *Rosencrantz and Guildenstern are Dead*, as well as modern art and architecture. Week 5 delved into postmodern art, and students began work on their Culture Projects. Work on these projects continued in Weeks 6 and 7. Students gave their presentations (one group per week) in Weeks 8, 9, and 10, during the first part of class. Game design started in Week 8, following the first student presentation, and continued through the end of the term. Table 2 depicts the in-class and online activities during weeks 8–15 of the course.

Scaffolds for Thinking and Problem Solving

Instructors provided a variety of scaffolds for thinking and problem solving throughout the course. Scaffolds in the first four weeks included thinking prompts in online discussions, slide shows with images coupled with guiding questions for in-class discussions, evaluation rubrics, and written assignment specifications for student presentations. These hard scaffolds were further supported with soft scaffolds modeling the kinds of thinking involved in the study of literature, humanities, and communication, both oral and written. Instructors also provided hard and soft scaffolds to guide student inquiry during their work on their Culture Projects in the fifth, sixth, and seventh weeks. These included assignment instructions for each project component: a proposal, annotated bibliography, and a class presentation with discussion. Students received feedback and coaching on the progress of their inquiry with each component, in addition to input from instructors during class time dedicated to working on the projects in their respective small groups. However, instructors practiced "guidance fading" during this phase of the course, facilitating the inquiry process, but largely transitioning from the highly structured activities in the first four weeks to a more student-directed, yet moderately structured series of tasks (Hmelo-Silver, Duncan, & Chinn, 2007).

Instructors continued guidance fading during the last phase of the class, Weeks 8 through 15. The first three weeks of this phase were more structured than the last four. In each class meeting of Weeks 8–10, student teams gave their culture presentations and led a discussion of the literature and art of their selected culture. This literature, which student teams had

selected in the proposal phase early in this project, became the assigned reading for the rest of the class each of these weeks. Discussion of the art and literature of the selected culture continued online throughout the week. Following the culture presentations in Weeks 8–10, instructors coached students in initial ideation and concept development for the game design project. The charge to students for the design of the game was simply that they were to design a game that made an impact on one or more of the UN MDG's (United Nations, 2005). This impact could range from mere increased awareness of one the issues addressed by the MDGs, such as child mortality in parts of the world; to providing player choice or collaboration on how they might impact one of the goals, such as promoting gender equality; to actually requiring players to bring cans of food to a food bank to collect their next clue in the game—an action which could more tangibly impact the goal to "eradicate extreme poverty and hunger" (United Nations, 2005). After this period of initial ideation and concept development, the remaining four weeks of class were dedicated to fleshing out the design of the game: the narrative, characters, levels, player objectives, and rewards, as well as rules and interactions. Instructors hoped that much of the game could also be developed in this timeframe, but anticipated that it might not. Ultimately, they wanted a cohesive game design, documented with enough detail that a future class could evaluate it, redesign it, or develop it further if time prohibited full development of the game. Instructors set up a class wiki for collaboration and development of the game design. Students' course grades were not dependent on a finished game product, but rather their participation in class, contributions to the wiki outside of class meetings, and game pieces (such as blog for the main character, an email exchange between one character and another, a cryptic clue embedded in an image) that the team had assigned an individual to complete. Although the game design was a whole class project, students divided up tasks and assigned them to individual members to complete each week. Instructors served to keep students on track, guiding the design process, but design decisions and assignments of tasks were made by the students.

Methods

The research design followed a qualitative case study approach, investigating "a contemporary *phenomenon* within its real-life *context* especially when the *boundaries* between the phenomenon and context are not clearly evident" (Yin, 2003, p. 13). In this case, the *phenomenon* was participant perceptions of their experiences within the *context* of the pilot implementation of the GVP. This qualitative approach to educational evaluation follows Guba and Lincoln's (1989) *Fourth Generation Evaluation*, a methodology that seeks "*full participative* involvement, in which the stakeholders and others who may be drawn into the evaluation are welcomed as equal partners" (p. 11). The claims, issues, and concerns of institutional, business, and industry, as well as state-level stakeholders, informed the design of the course and the assessments within it. However, the purpose of this evaluation was to gather and analyze the perspectives of participants concerning the effectiveness of the design as a capstone experience, and to inform refinements to it prior to full-scale implementation of it or of similar capstone course designs.

Setting

The setting for this research study was a 16-week course at a large, urban community college in the southwestern United States, enrolling over 16,000 students during the implementation semester. The student body is internationally and ethnically diverse, speaking over 90 first languages, and enrollment is approximately 42% Anglo, 21% African American, 19% Hispanic, and 15% Asian. The course was a six-credit, integrated learning community experience comprised of four general education subjects: speech, literature, humanities, or composition. The course design blended face-to-face class meetings with online learning and communication tools into a hybrid format.

Participants

Participants included all students who completed the course, and the two instructors who taught the course. Although eight students enrolled in the course, only six students completed it, which limits the generalizability of the findings. Nevertheless, the data collected and analyzed represents the entire case—the perspectives of every participant—rather than a sample. In order to protect their identities, participants have been assigned to pseudonyms in the reporting of the results. Instructors are referred to as "Instructor 1" and "Instructor 2" to distinguish their comments from those made by students. Five of the six students were male. Four of the students were Caucasian, including the female student. One student was African American; one was Hispanic. One student was over 40; one student was in his 30s; the remaining students were 18 to 21 years old. Both course instructors were female, over 40, and taught English composition as their primary discipline. One instructor also taught speech communications while the other also taught humanities.

Data Collection

The primary method of collection was semistructured interviews conducted with students and instructors near the end of implementation. Course instructors did not conduct the interviews; the interview team was comprised of instructional design doctoral students from a university near the partic-

ipant college. Interviewers asked students what they learned about each of the core perspectives (listed in **Design of the GVP** section). After stating what they learned, students were asked whether they learned those concepts in the GVP, what other classes contributed to their understanding, and what role the game design scenario played in their understanding. Researchers also collected course documents and student posts in online discussion boards, web logs, and wiki pages. These data documented students' active involvement in the learning activities of the GVP, but did not necessarily elicit their perceptions of them. As such, these data served to triangulate the interview data and further ground interpretations, but did not serve as the primary data source. Instructors were asked the following questions in their interviews:

- How is teaching in a PBL learning community qualitatively different from the existing methods according to the instructors?
- How much scaffolding was required with the PBL method vs. existing methods?
- What are your attitudes towards using technology to teach?
- What are your tacit beliefs about instruction?
- What would you like to see done differently?
- What are the management obstacles the teacher faces when trying to use this method vs. other methods?
- What system structures (period length, classroom structure) impede the method?

Data collected from instructor interviews served to further explore the challenges and successes that arise in implementing PBL capstone designs. Interviews from all participants, instructors, and students were transcribed for coding and analysis.

Data Analysis

In order to systematically analyze this data, researchers followed a constant-comparison approach involving three phases of coding: open, axial, and selective (Glaser& Strauss, 1967; Strauss & Corbin, 1998). Researchers worked concurrently to identify emergent codes and categories, and to construct a mutual understanding of the text, codes, and categories. Emergent codes were constantly compared to previously identified codes, collapsed into categories, and refined as additional codes and categories emerged. After open coding and segmenting the data into themes, researchers then axial coded each theme line by line, continuing to compare the data with the codes, generating additional codes, and refining the code and category labels. All phases of coding were completed by three researchers; disagreements in the assignment of codes were discussed until consensus was achieved among the three analysts.

This article reports the categories and codes pertaining to two research questions:

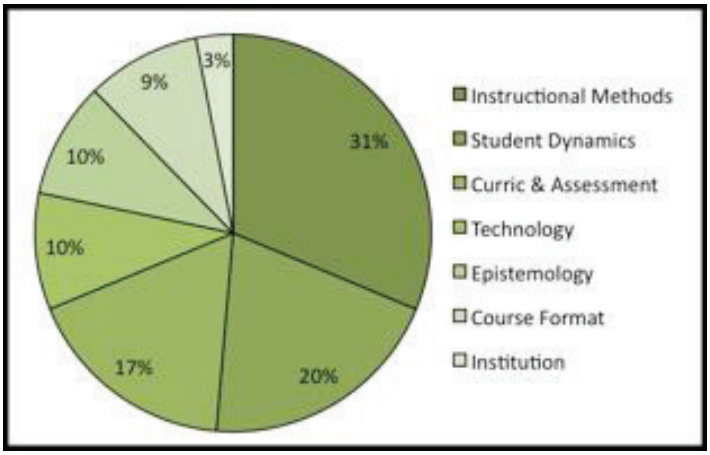
- What aspects of the design did students find conducive to their learning?
- What challenges or tensions arose from the design?

Although the research methods used in this study are qualitative, researchers computed a quantitative value for each unique code and category in order to determine the significance of each in relation to other codes and categories representing this dataset. This statistic, the passage/character mean percentage (P/C mean), allowed researchers to more objectively interpret the strength of codes and categories in relationship to each other and better ensure that interpretations of the significance of any one of them was grounded in the perceptions of participants, rather than the interests or biases of the researchers. To compute the P/C mean, both the percentage of text characters of interview transcript data and the percentage of passages ascribed to each code were calculated and averaged. The percentage of text characters gives a fair depiction of how much of the interview text each code and category represents but does not account for how often a category or code occurs. Conversely, calculating only the percentage of occurrences—or passages—does not account for how much text comprises each category and code. Some codes occur repeatedly, but responses are brief. Researchers used the P/C mean only to interpret the importance or strength of the student and instructor perceptions represented by the various codes and categories to which they were assigned. This statistic is not intended to draw conclusions or make generalizations outside of the context of this study. However, we report these statistics so that readers may make their own judgments about the relationships among the codes and categories that researchers identified from the data. So that readers might distinguish among the labels for codes and categories more easily, *codes* are italicized and **categories** are bolded.

Findings

Analysis of the interview data yielded seven categories of codes pertaining to what aspects of the course design worked well and what did not in this semester-long implementation. Figure 1 below shows the P/C Mean percentage of each of these seven categories in relation to each other. Text from both students and instructors were coded in categories; however, we present only the categories and codes most relevant to tensions and successes that students faced in a technology-rich learning environment intended to promote complex problem solving: **Instructional Methods**, **Student Dynamics**, **Curriculum & Assessment, Technology,** and **Course Format** (see Figure 1). These categories do include comments from instructors, as well as students. However, because the **Epistemology** and **Institution** categories pertain exclusively to instructor experiences, they do not provide a great deal

Figure 1. P/C mean percentage of text by category.



of insight on challenges and successes that students faced. Nevertheless, we do present all of the codes within each of the remaining categories whether they represent student or instructor perceptions, or a combination of both. We also separate the codes within each category into tensions and successes to better distinguish positive and negative experiences. In each section, we present the tensions first and the successes second. While students overall were very satisfied with the course and believed it was very successful, we did not want to imply to readers that the course design was without its challenges.

Instructional Methods

Table 3 lists the codes representing tensions in the **Instructional Methods** category, along with a description and

Table 3. Tensions Codes in Instructional Methods Category

Code (P/C Mean % of Category)	Description & Example Comments
Sequence/ Time to Design AltRG (8.95%)	Assigned to comments regarding the "learn, then apply" sequence of the course or the amount of time provided for the game design problem. Example: "Personally, I would have to say there's only one thing I would change about . . . this class, just because I'm also going into game design and I know the effort it takes to just design a game. It can take years to design games. When the game is thrown right at the end, and we also have all this other stuff that we also needed to take care of that really does kind of throw it off" (Michael).
Guided vs. Directed Instruction (8.32%)	Comments pertaining to intentionally, ill-structured aspect of the PBL phase of the course as compared to the more traditional first phase. Examples: "I require more direction than most people do," and "there were times when the sort of free form flow of the class sometimes didn't seem as organized or pointed or driven" (Nick). "I think, it was more structured in the very beginning. We kind of knew what we needed to have done. I didn't like it as much towards the end, because it was less discussion based" (Kevin).
Encouraging vs. Forcing (8.31%)	Predominantly comments from instructors regarding their role in facilitating and encouraging students rather than dictating what students should do, or punishing them for neglecting to do something. Example: "First and foremost, positive reinforcement is better than punishment, but it's gotten down almost now to that at the end of the semester, it's going to be punishment" (Instructor 1). "My role is not to harp on students or nag them with constant reminders of due dates and deadlines, but some of them really want that, and I have difficulty providing it" (Instructor 2).
Student Expectations (5.82%)	Captures the disparity between what students expected to occur in the course and what actually happened. Example: "I did like that we were going to develop this [the AltRG], but I was kind of surprised that we were actually going to develop this a little late in the semester. I was kind of hoping that we were going to do this a little earlier" (Les). "I kind of imagined taking a class that I was going to be participating in an AltRG while I was actually designing an AltRG, so that we were, you know, learning something about making an AltRG while we were playing one" (Nick).
Time Necessary for Consensus (5.09%)	Related to, but distinct from *Sequence/Time to Design AltRG*, comments in this code pertain specifically to the process of building consensus. Example: "Game development should always start with as much time as possible cause you'll work through a concept for months. It's hard to get people to agree on one thing in just a couple months and then get a final product done just from that" (Michael).
36.49%	% of Instructional Methods category represented by "Tensions" codes

Table 4. Successes Codes in Instructional Methods Category

Code (P/C Mean % of Category)	Description & Example Comments
Attainment of Core Perspectives (18.6%)	Student and Instructor comments related to the Core Perspectives, particularly "the individual in relationship to the larger society and world in which he or she lives," and "the responsibilities of living in a culturally and ethnically diversified world" (Texas Higher Education Coordinating Board, 1999) Examples: "Well, I think in just these past few weeks that we've learned more about what we are because of the AltRG, about us as a whole and how our contributions make a bigger difference" (Kevin). "I am that cog in the giant, grand scheme of things . . . that I have a certain place and purpose, but I am not the greatest thing in the world" (Michael).
Transfer/Relevance to Real World (8.73%)	Student comments on the authenticity of the game design project and its relevance to real world problems. Example: "The way that [the course project] prepares you to go into real life settings. It's basically the same thing. Same concepts" (Les).
Instructors/ Interaction w/ them (8.33%)	Student comments on their interactions with instructors and the scaffolding they provided. Example: "When Instructor 2 was first talking about AltRGs, and she was linking, so I was actually understanding the concept. So I felt like, OK, maybe I can do this" (Karen, when asked about a time she felt successful).
Open Learning Environment (7.22%)	Student comments on the openness of the course and the way instructors encouraged open inquiry, discussion, and debate. Example: "So this kind of class the way it's setup, the openness of the way it is, really is a good way to learn" (Michael).
Personal Responsibility for Learning (4.96%)	Student comments on developing more personal responsibility for their own learning. Example: "In college, you're on your own. No one is there to tell you, 'Hey, get up! You've got an assignment [to get] done. Or, 'Hey. You've got homework due tomorrow.' But, that's scholarly discipline that I started to learn more so from this class than any of the others" (Michael).
Encouraging Learning/Risk-taking (4.42%)	Comments describing the instructors' interactions and/or roles in encouraging students to take risks and learn. Example: "With a student who was very upset, I said that I'm going to keep your 'A' and I'm going to hold it in my hand so that you can feel free to go risk and do whatever you need to do to bring your considerable, creative processes to this game (because I know he's very, very good). And, I'll hold on to your 'A' and nothing will happen to your 'A' if you'll just go out and risk" (Instructor 1).
GVP vs. Traditional Instruction (3.98%)	This code captures passages in which students compare traditional learning activities, "that stagnant textbook, read Chapter 12" (Les) to what they did in the GVP. Example: "Well, other classes are kind of in the same classical setting. Where the professor talks and you just kind of do essays and such" (Les)
Building/Creating Something New (3.25%)	Comments related to taking content explored in the first part of the course and applying them to create something entirely new in the game design phase of the course. Example: "It uses that content to create something . . . you know, in the game. You kind of reinforce yourself to create something new. something that you develop, something that you come up with using your own ideas, and use them to create as your own game" (Les).
Strengthening Prior Knowledge (3.12%)	Student comments on elements of the course strengthening prior knowledge of core perspectives. Example: "as always, every class is a new experience. You just kind of develop and build upon what you've learned, outside and inside. But yeah, this class, it strengthened that" (Les).
Empowerment from Design (0.91%)	Student comments that the game design project gave them a sense of empowerment. Examples: "developing the AltRG, taking the class with the AltRG helps you find your areas where you're strong" (Adam) "It has empowered me a little bit" (Karen).
63.52%	% of Instructional Methods category represented by "Successes" codes

example comments as well as the passage/character mean percentage of the comments assigned to each code within this category. The code *Sequence/Time to Design AltRG* was the strongest tension in this category, and was exacerbated by *Time Necessary for Consensus*. Students also expressed a tension between *Guided vs. Directed Instruction*. One stu-

Table 5. Tensions Codes in Student Dynamics Category

Code (P/C Mean % of Category)	Description & Example Comments
Lack of Leadership/ Too Many Ideas (15.49%)	Student comments regarding diverse opinions and ideas without a single arbiter to lead or make a final decision. Example: "There was no leader. I think that came as a huge problem because we got so many different ideas that there was no one to say 'we're going to go with this one. And that's final.'" (Kevin)
Individual Tasks for Group Projects (14.12%)	Student comments that it was difficult to complete individual tasks for the group game design project outside of class. Example: "So we're in class and we define assignments and tasks and then sometimes I feel a little lost trying to complete or make things work together" (Karen). "I guess, one of things that was frustrating to me was that it [developing the AltRG] was a combination of individual work and group work, but they never, at least for me, they never came together" (Nick).
Communication Challenges (11.19)	Comments related to communicating, particularly outside of face-to-face class meetings. Example: "I think communication. It was really the break down that ended hurting us the most" (Kevin).
Non-participation/ Accountability (7.06%)	Comments regarding group members either not doing their share of the work or the lack of accountability to other members of the group. Example: "I had a project with another fellow in the class . . . [laughs] mainly he was absent, so I ended up doing the project primarily on my own" (Nick, on the Culture Project).
Conflict Between Students (6.39%)	Student comments relating disagreement or conflict with each other. Example: "We didn't get a grade that I was happy with . . . and I was not happy with the presentation" (Karen, on the Culture Project).
Student Self-Regulation Challenge (6.15%)	Student or Instructor comments on lack of discipline or self-regulation among students. Example: "I think it's really about a lack of discipline. That it's much more fun to email or go on Facebook when you're kind of having fun with it" (Instructor 1).
Difficulty Organizing Group/Work (3.91%)	Comments expressing the struggle with identifying tasks and determining who should complete which task. Example: "a lot of times you just have to find out what people are good at. Because sometimes they don't really know themselves until they start trying things. You have try one thing. And if they're not very good at it, push 'em to another. Eventually they'll find their niche or at least where you can put them" (Kyle).
Giving Up Control/ Taking Risks (2.23%)	Comments related to the role of taking risks in the creative process. Example: "there's a point in creativity when you have to give up control. And if you're a control freak, and several students were, then it's very intimidating. You know, if you have to keep it all tight it's no longer the creative process" (Instructor 1).
66.54%	% of Student Dynamics category represented by "Tensions" codes

dent commented that he "didn't like it as much towards the end, because it was less discussion based." While he perceived the later part of the course to be less "discussion based," the tension here is that, while highly discussion based, discussions in this phase were student led. This contrasted with the early weeks of the semester when discussions were led by the instructors. Students also expressed some disparity between what they expected to occur in the course and what actually happened, comments assigned to the *Student Expectations* code.

Nevertheless, participants described more successes with respect to **Instructional Methods** than tensions (see Table 4). The strongest successes in this category were *Attainment of Core Perspectives* and *Transfer/Relevance to Real World*. Students found that the *Instructors/Interaction with Them* and the *Open Learning Environment* that the instructors created, helped scaffold their learning and *Encouraged Risk-Taking/ Learning*. Despite the tension between *Guided and Directed instruction* that students experienced, the guidance fading that instructors enacted did yield some acknowledgement among students of their *Personal Responsibility for Learning*. Moreover, students indicated that the *GVP vs. Traditional Instruction* allowed them to *Strengthen Prior Knowledge* in *Building/ Creating Something New*, both of which tended to provide a bit of *Empowerment from Design*, or the experience of designing.

Table 6. Successes Codes in Student Dynamics Category

Code (P/C Mean % of Category)	Description & Example Comments
Learning From Peers (13.67%)	Student comments regarding the value of learning from peers, often stating it's more valuable than learning from instructors. Example: "Learning through that, learning through other people, your peers . . . has kind of showed me that there is a little bit more to the world than what I originally thought. And you don't learn so much from what just the teacher is teaching you. You learn from your fellow classmates" (Karen).
Synergy/Close Relationships (7.79%)	Passages regarding the friendships and/or synergy they developed with each other. Example: "I think probably the first success was the first presentation that we did. And Nick and I actually worked together and we were able to work from a distance. We had really stimulating conversations. And I felt like when we gave our presentation all that you could, you know, that it was synergistic. That you could tell that we had formed a team well . . . and a friendship's come out of it" (Karen).
Personal Responsibility to Group (6.41%)	Passages in which students describe a heightened sense of personal responsibility because they don't want to let down their team. Example: "Well, with the group projects, it was always important to me to, in fact it was more important to me actually, to participate or to have more participation and to put more effort into group projects than it was individual projects . . . I'm a lot more dependable if I'm afraid I'm going to disappoint somebody, in a way that I'm afraid it's going to hurt them in some way" (Nick).
Peer Teaching/ Sharing Life Experiences (3.24%)	Comments in which students describe sharing their prior knowledge or life experiences so that others can learn from them. Example: "I am the eldest person in the class, with the most life experience, aside from one of the instructors, and so . . . I've tried to help teach because some of the other classmates are so young" (Karen).
Roles/Others' Strengths as Assets (2.35%)	Passages in which students describe identifying others' strengths so that they can leverage those strengths for the benefit of the group or project. Example: "to understand what everybody, the other students, what they do better and then use those assets to give 'em a certain job. And with that you're able to better build, and to efficiently create a game" (Les).
33.47%	% of Student Dynamics category represented by "Successes" codes

Student Dynamics

Participants did express a number of tensions related to dynamics among students**.** Table 5 details the tensions codes in the **Student Dynamics** category, which seemed to outweigh the successes in terms of the percentage of passages and characters of text. Of these tensions, the *Lack of Leadership* among students was the strongest, followed by the difficulty completing *Individual Tasks for Group Projects* between class meetings and *Communication Challenges*. Considerably less significant, but still present were *Non-participation/Accountability to Group*, as well as some *Conflict Between Students*. One of the course instructors felt that much of the tension among students was due to the *Student Self-Regulation Challenge*, suggesting students would rather be on Facebook or other social media than working on coursework. While the other course instructor also observed that students had trouble "managing themselves and the tasks they had to do," she's not as certain that they were pursuing more fun. Near the end of the semester, when she noted that students were not completing game development tasks outside of class because they had gotten stuck on some detail that they weren't sure about, she asked them why they didn't call someone, or email, or post a question in the wiki or the discussion board. The response was, "Are we allowed to do that?" For some reason, it simply had not occurred to them, once they had been assigned a task by the group, that it would be appropriate to seek help. The process proceeded more smoothly after the misperception was discovered, but discovery came late in the semester.

Although the tensions among students outweighed the successes, students expressed considerable appreciation for learning with others (see Table 6). They enjoyed *Learning from Peers* and developed *Synergy/Close Personal Relationships* with each other. Despite occasional lapses in participation or accountability to the group, students did feel *Personal Responsibility to Group* and expressed benefiting from *Peer Teaching/Sharing Life Experiences*. Additionally, students were able to assign *Roles* that made use of each *Others' Strengths as Assets* in the design process.

Curriculum and Assessment

Similar to **Student Dynamics** category, researchers found considerably more tensions in the **Curriculum & Assessment**

Table 7. Tensions Codes in the Curriculum & Assessment category

Code (PC Mean % of Category)	Description & Example Comments
Contextualizing C&A w/I AltRG (21.71%)	Comments in which students or instructors describe course assignments/assessments disconnected (or decontextualized) from the ARG project. Example: "It seemed like a lot of the projects weren't tied together. I wasn't really sure how the AltRG really related to the first part of the class" (Nick).
Meeting Course-level Objectives (13.10%)	Largely instructor comments expressing concern that students may not have fully met course-level objectives, particularly for speech and English Composition. " Example: "Not all of the students were taking the course for writing credit, but I know I am very worried about students who took this for Composition II credit going on to literature class and having other professors wonder how in the heck they passed English 1302 [Comp II]" (Instructor 2).
Communicating Expectations (12.48%)	Comments from students or instructors regarding clear communication of standards/criteria for assessing students work. Example: "So that students don't feel completely groundless, it's important to be as specific as possible about what the purpose and goals of an activity are, and how the instructors will evaluate achievement of those goals. This is important in any learning environment, but perhaps more so in one like this" (Instructor 2). "I haven't always felt that you know my assignments or my grade were as well defined as I would like them. I mean, like in some of the speeches that I had given, I just get a grade. It's a subjective assessment. So like, I don't know what the difference between a 94 and a 95 is" (Nick).
Covering Material/Content (8.78%)	Largely comments from instructors regarding direct instructor covering discrete course level objectives. Example: "I'm not comfortable with what little we covered in speech. I'm not comfortable with the lack of diversity of literature that my other classes get . . . we heavily drilled them in Humanities and not enough in Literature. Literature got the short shrift this time" (Instructor 1).
Assessing Core Perspectives (5.26%)	Mostly comments from instructors pertaining to assessing students' attainment of the state "core perspectives"—the goals/outcomes of general education programs. Example: "So the overarching premise of this course was to shift state level assessment outcomes to course level and see if course level goals could be accomplished by focusing on those higher level objectives. And think that we have more than amply hit those state level objectives" (Instructor 2).
"Learn then Apply" Approach (4.02%)	Comments regarding assessments or activities early in the course as compared to those that came later in the game design phase of the course. Example: "So what happened then is that the assessments early on became a way for students to explore some content and report their findings, but they weren't connected to the game. Although we intended that those explorations of content in their culture projects and research papers could be applied to the game, what seemed to happen instead is that all the work with developing the game now is just . . . added work that isn't really a part of the course" (Instructor 2).
(65.35%)	% of Curriculum & Assessment category represented by "Tensions" codes

category than successes (see Table 7). In this category, comments assigned to the code, *Contextualizing Curriculum & Assessments within the AltRG*, represented the strongest tension, and included comments regarding the perceived lack of connection between class assignments or assessments and the process of designing an AltRG. For example, Michael recommended that "for the curriculum of this class, if there is a final project to design the game, the class should be wrapped around that instead of putting it at as the last thing we need to worry about." Nick concurred, observing that he "saw the connections" between the first part of the class and the AltRG project later, "but the connections felt superficial."

Communicating Expectations also seemed to be a challenge. While most students found the scoring rubrics, peer comments, and instructor feedback for their presentations and writing assignments to be adequate, one student struggled a bit with what he perceived to be the subjective nature of evaluating speech and writing.

Another strong tension, largely for instructors, was *Meeting Course Objectives*, a tension often experienced in interdisciplinary learning communities comprised of multiple courses, and a challenge in capstone designs aimed at fostering and *Assessing Core Perspectives* (or program level outcomes). For one instructor, this tension was connected to

Table 8. Successes Codes in the Curriculum & Assessment category

Code (PC Mean % of Category)	Description & Example Comments
Integrating Disciplines (13.68%)	Comments from students and instructors describing the rich connections made given the interdisciplinary nature of the course. Examples: "I think that's the best part of it because you have to connect a lot of different things . . . the writing and literature and then the technology aspect and integrate them . . . um . . . with different people" (Kevin). "All Learning Community courses are unique in how they blend multiple disciplines, assessments, and that's why I love and believe in these learning communities is that they get something better than . . . They see this connection, they see this whole." (Instructor 1).
Enjoyed the Course (12.93%)	Comments from students that they enjoyed the interdisciplinary and problem-based aspects of the course over more traditional/lecture courses. Example: "What worked for me most of all, I guess this is kind of a new strategy for me, I've always taken classes in sort of a haphazard way, um especially when I was younger, I was always the one who showed up for the exam but hated to go to the lecture, but actually liked to come to this class" (Nick).
Content Establishes Foundation (4.55%)	Comments suggesting that activities in the first part of the course established a foundation for the game design problem in the second part. Examples: "But I can't say that I didn't actually enjoy the stuff beforehand. That it would actually kind of set the foundation, the bricks and all that sort of stuff that lead to the game, so you're able to develop it better" (Les). "[We were] laying a good slab foundation for archetype, myths, stories, story narratives, story boarding" (Instructor 1).
Increased Substance (3.49%)	Comments from students indicating that they found the course to have more "substance" than many of the courses they've taken. Examples: "I think I've gotten more of the meat and more substance" (Karen). "A class like this is setup very nicely. You learn more of a broader base" (Michael).
(34.65%)	% of Curriculum & Assessment category represented by "Successes" codes

her philosophical need for *Covering Material*, as opposed to presenting an ill-structured problem and allowing students to discover material as they worked toward solutions to that problem. As she stated in her interview, "I'm not comfortable with what little we covered in speech. I'm not comfortable with the lack of diversity of literature that my other classes get." Further, she questioned, "How is that [the game project] reinforcing Speech? It does bring group dynamics into the equation, which is part of Speech. And we heavily drilled them in Humanities." What her statements suggest is that while students were engaged in practicing the group dynamics that they would have studied in a textbook and perhaps been "heavily drilled" on in her other speech courses, this instructor did not see the value of practice and discovery as opposed to covering that material explicitly. It was because of this epistemological frame that the course took on a "learn, then apply" sequence during the first part of the semester, so that the instructors might cover some material first. It was believed that students would then apply the covered material to the development of the game. What seemed to happen as a result, however, was that they perceived their activities with developing the game (the writing and presentations associated with game development) to be added work that was less important, "superficial" even, or "an afterthought."

Although the interdisciplinary nature of the course presented some tensions, students found that *Integrating Disciplines*, the strongest success code in this category, allowed them to make connections among disciplines that they wouldn't have otherwise made (see Table 8). Many indicated that they *Enjoyed the Course* because of the interdisciplinary connections, as well as the course activities which compelled active involvement: participating in discussions, giving presentations, and designing the AltRG. They also suggested that found *Increased Substance* in this course as compared to other courses they had taken. Although students indicated that activities in the first part of the course were somewhat disconnected to their design work later, comments assigned to the *Content Establishes Foundation* code indicate that they found value in what they learned early in the course and applied that learning in the game design project.

Table 9. Codes in Technology Category

Code (P/C Mean % of Category)	Description & Example Comments
Tech as Impediment to Learning (20.69%)	Passages indicating the numerous technologies deployed in the course impeded learning. Example: "We were being introduced to so much, so many different types of communication over the internet that it was hard for us to figure out which one everyone else was using" (Kevin).
Limitations of LearnLab (8.23%)	Passage from one student indicating that the single work station in the LearnLab was a limitation. Example: "In the LearnLabe, people had to have laptops to be working with technology. I'm used to collaboration where everyone has a computer and everyone has access to the same technology so you can work faster" (Kevin).
28.92%	% of Technology category represented by "Tensions" codes
Tech as Organizer/ Motivator/ Comm (23.73%)	Passages where students expressed a variety of benefits to using technology, particularly for organizing, engaging others, and communicating more effectively. Example: "We were able to use graphics and video and everything to make our presentation more interesting and more active other than just having a plain old text, standard, Powerpoint presentation, that you could just talk, talk, and talk for hours and get bored of it fairly easily without having some sort of image or illustration. Personally I think classes these days for the most part except for experimental ones like this are way too much in the dark ages" (Les).
LearnLab Enhancing Learning (23.58%)	Student comments regarding features of the LearnLab that enhanced their learning. Example: "The classroom we were in was nice for it's technology 'cuz there was only one station. You have much more focus. On one person. On one task. Than when you have multiple peers and people are kind off in their own world" (Kevin).
Tech as Tool to Improve Learning (11.38%)	Distinct from the *LearnLab Enhancing Learning* code, this code was assigned to comments about technology in general, rather than the technology in the LearnLab classroom. Example: "The more you use technology the more you can do because at least if it's good technology and it's working correctly it can help make the learning easier" (Adam).
Co-Learning w/ Students (7.02%)	Comments from instructors and students about acquiring technology skills from each other. Example: "it's been terrific in terms of the students have been my teachers in there. I've been a co-learner. And, in many cases, the role reversal has been really neat because they get to exhibit a confidence that I don't have. They've been great tutors and teachers" (Instructor 1).
Increased Confidence w/ Tech (5.35%)	Comments from students and instructors regarding increased confidence with technology as a result of the course. Example: [At the beginning of the class] "I was feeling a little like I didn't have much to bring to the table for the technology part."
71.08%	% of Technology category represented by "Successes" codes

Technology

Technology prompted only a couple of tensions in the course (see Table 9). One student perceived *Technology as an Impediment to Learning*, largely because of the variety of tools students were offered: blogs, online discussion forums, and the class wiki for game design, to name a few. Although students had a variety of tools for communication, they didn't self-organize around a single tool or set of tools that worked well for their unique dynamic. They also pointed out some *Limitations of the LearnLab*, namely that there's only one computer station. However, the successes with technology outweighed the tensions. Students found the technology they learned to use in the course to be useful as a means to *Organize*, *Motivate*, and *Communicate* in their everyday lives. The students who identified the single computer station in the LearnLab as a limitation also identified that as an enhancement since it focused all students on one presenter. Students also indicated that *Technology* was leveraged as a *Tool to Improve Learning*, and reported an *Increased Confidence with Technology*.

Course Format

Most of the tensions among students presented above were aggravated by the course format, the blended or *Hybrid/Half Online* format that included only *One Meeting Per Week* (see Table 10). The hybrid format might have worked better if the

Table 10. Codes in the Course Format Category

Code (P/C Mean % of Category)	Description & Example Comments
One Mtg. Per Week (20.64%)	Comments from students that they felt too much time elapsed between class meetings because it met only once a week. Example: "I think it would have done better if it met twice a week instead of the one time" (Les) "I just think the class needs to be offered more often, instead of being just once a week. I think it needs to be one of those consistent ones that at least be two a week or three times a week or something" (Les).
Hybrid/Half Online (19.62%)	Comments that 50% of the coursework being online was too large a percentage. Example: "You had a lot of 'you need to do this' and 'come back with this.' But I would rather have that as a supplement instead of half the class" (Kevin).
Reluctance to Work Online (19.57%)	Comments from instructors and students suggesting a reluctance to participate in the online components of the course. Examples: "I'm not one of those people that do very well with online classes" (Kevin). "These are people that are constantly on the internet in one form or another. We had a hard time getting ours to do those discussions except for one student. We tried to do peer review online instead of taking up valuable class time. That did not happen. That was another disappointment" (Instructor 1).
Inadequate Face Time (10.99%)	Passages regarding too little time to communicate face-to-face. Example: "It [the hybrid format] didn't give you a whole lot of time for face time so we didn't . . . we kind of missed out on a lot of time that we needed" (Karen). "I like face time with the teacher" (Kevin).
Class Size (7.41%)	Comments that the small number of students in the class had a negative impact. Example: "I think what has had something of a negative impact is just six students and believe it or not."
78.23%	% of Course Format category represented by "Tensions" codes
Working Together While Separated (13.19%)	Comments that tasks students had to complete for group projects outside of class enhanced their feelings of success or importance. Example: "What I got out of this class most is not necessarily what we talked about in class, it's what we were driven to do, you know, outside of the class. I mean, in that way, it sort of resembles an AltRG, right? You know, with your little sort of task bubbles. In order to come back next week and feel successful, you have to go off and do this mission" (Nick).
Class Size (4.67%)	Comments that the small number of students in the class had a positive impact. Example: "But this class kind of stood out in that it was such a small group rather than having 20 or 30 people, other people trying to get their ideas in" (Michael).
6-Credit Class (3.91%)	Comments on the benefits of the 6-credit learning community. Example: "It's a very good way to get your credits done from just those two subjects [English and Humanities]" (Michael).
21.78%	% of Course Format category represented by "Successes" codes

class met more frequently. However, some students simply did not like that it was *Hybrid/Half Online*. Kevin felt that "you had a lot of 'you need to do this' and 'come back with this'," suggesting that he felt that class time could have been devoted to preparing or completing what was "homework" online. Students exhibited a degree of *Reluctance to Work Online*, but only Kevin expressed that he was "not one of those people that do very well with online classes." On the other hand, more of them commented that the course left *Inadequate Face Time*, particularly for developing the game. Although they struggled a great deal with working together at a distance, once students discovered that they should be communicating with each other outside of class, they expressed feeling successful at *Working Together while Separated*. They had mixed perceptions about the *Class Size*, finding it both a tension and a success. However, they liked that it was a *6-Credit Class*, which was seen as "a very good way to get your credits done."

Discussion

Although analysis of participant interviews yielded significant successes with the course design, several challenges or

tensions also emerged. Here we synthesize key findings from the participant interviews based on analysis of these tensions and successes.

Time Necessary for Concept Development

One of the strongest tensions was the amount of time necessary to develop the game. On one hand, part of this tension was the reduced face time resulting from the hybrid design, as indicated by student comments coded as *Inadequate Face Time* and *One Meeting per Week* in the **Course Format** category. However, much of that was alleviated once students realized that they could and should be communicating with each other at a distance, as noted in the findings related to **Student Dynamics**, particularly comments coded as *Individual Tasks for Group Projects, Difficulty Organizing Group/ Work,* and *Communication Challenges*. Students thought they were to work in isolation on their individual tasks for the game without assistance from peers; thus, when they were uncertain about how to proceed, they stopped working until the next class meeting. It didn't occur to them to simply call someone, post a question in the discussion board, or send an email. On the other hand, face-to-face time is necessary to build consensus. Getting everyone on the same page, establishing a common vision or concept is critical to this effort, and that process takes time (Barron, 2000; Hmelo-Silver, 2004; Savery, 2006). The "learn, then apply" approach was effective in providing a foundation for game concept development (see comments coded as *Content Establishes Foundation* in **Curriculum & Assessment**); however, it considerably shortened the span of time available for game concept development. Since the game was not completed, clearly more development time was needed. Whether this was due to the course sequence or the hybrid nature of the course is less certain.

Problem-Based Learning and Instruction

The tension between guided versus directed instruction was also strong. Comments in the **Instructional Methods** category coded as *Attainment of Core Perspectives* and *Transfer/ Relevance to Real World* indicate that students learned much from developing the game—a project that was much less instructor-directed—but preferred learning with more direction. This finding is not unusual among students accustomed to the directed instruction typified in an education system focused on preparing students for standardized tests (Kelly, 2005; Ladd, 2008; Wasley, 2008). This preference for more direction may have been aggravated by the hybrid delivery mode, as online learning typically requires more self-direction (Cunningham, 2010). Although students enjoyed the creativity, the application of knowledge, discovery of new ideas, and the relevance to their emerging and future values (see comments coded as *Building/ Creating Something New, Strengthening Prior Knowledge, Transfer/ Relevance to Real World*, and *Empowerment from Design* in **Instructional Methods**), the ill structured nature of the game development project itself also perturbed them, prompting the cognitive conflict that Savery and Duffy (1995) find to be critical to PBL environments. Learning to adapt to challenging situations and to become self-directed are vital skills—ones that cannot be fostered through continuous intervention by instructors (Grabinger, 1996; Jonassen, 1999). Finding the appropriate balance between directing students and allowing them to develop these skills themselves can be difficult, as indicated by instructor comments coded as *Encouraging vs. Forcing* in **Instructional Methods**. Nevertheless, students recognized the need to become more self-directed and take personal responsibility for their learning from the game design scenario (see comments coded as *Personal Responsibility for Learning*). Indeed, one student indicated that this recognition came "*more so from this class than any of the others.*" Personal responsibility for learning and self-direction are critical skills called for in the AAC&U poll, which informed the design (Peter D. Hart Research Associates, 2008). Equally important were the interdisciplinary connections that students made in the course (see comments coded as *Integrating Disciplines* and *Increased Substance* in **Curriculum & Assessment**). Although instructors were concerned with how well students may (or may not) have met course level objectives (see *Meeting Course Objectives*, *Covering Material*, and *Assessing Core Perspectives* in **Curriculum & Assessment**), the AAC&U poll also calls for engagement with big questions, critical and creative thinking about complex problems, and application of knowledge and skills in diverse settings and innovative ways (Peter D. Hart Research Associates, 2008). The interdisciplinary and problem-based aspects of the course gave them much more than the fine-grained objectives in oral and written communication courses.

Project Leadership

Another tension among students was the lack of leadership, which further illuminates the tension between directed and guided instruction (see comments coded as *Lack of Leadership/Too Many Ideas* in **Student Dynamics**). At one point in the game development phase, students discussed their need for a leader, a designated person who would serve as final arbiter to keep things going. However, they appointed one of the instructors rather than a peer. None of them wanted the responsibility, and they all wanted more direction. The struggle to coordinate group processes and tasks is a common challenge in collaborative problem-solving environments (Barron, 2000; Kim & Hannafin, 2011). Students' uneasiness with the lack of direction was compounded by the

dwindling time and impending end of the semester; being told what to do speeds things up. Other tensions among students related to self-regulation, participation, and individual accountability, as noted in comments coded as *Non-participation/ Accountability* and *Student Self-Regulation Challenge* in **Student Dynamics.** These tensions are not uncommon in collaborative or cooperative learning designs, including PBL environments (Barron, 2000; Hmelo-Silver, Duncan, & Chinn, 2007; Johnson & Johnson, 1994; Kim & Hannafin, 2011). Despite these challenges, this group of students learned from each other and preferred that mode to learning from the teacher, as noted in comments coded as *Learning from Peers*, *Synergy/Close Relationships*, *Personal Responsibility to Group*, and *Peer Teaching/Sharing Life Experiences*. These findings are consistent with the goals and outcomes for collaborative and problem-based learning environments (Hmelo-Silver, Duncan, & Chinn, 2007; Savery, 2006). Indeed, they are also goals (if not discrete performance objectives) in the study of speech and interpersonal communications, despite one instructor's concern about how little they were "covered" (see comments coded as *Covering Material* in **Curriculum & Assessment**).

Format of Course Delivery

Clearly the hybrid delivery mode had an impact on the time necessary to build consensus and to develop the game, as suggested by comments coded as *Hybrid/Half Online* in **Course Format**. However, this may have been an issue with the sequence of the course and the fact that activities in the first part of the course weren't connected directly to game development, as indicated in comments assigned to the *Sequence/ Time to Design AltRG* code in **Instructional Methods** as well as *Contextualizing Curriculum & Assessments within the AltRG* in **Curriculum & Assessment**. Another interpretation might be that student dependence on directed instruction made them dislike the hybrid format rather than the hybrid detracted from the meeting time necessary to develop the game. As discussed previously, self-direction seemed to play a role in the tension with the hybrid format. However, it does not appear to be an aversion to technology that kept students from engaging with each other online (see comments in **Technology** category). Perhaps a greater contributor to this tension was that the course only met once a week (see comments coded as *One Mtg per Week* in **Course Format**). It's quite possible that if the class met more frequently, rather than for more hours (twice a week for an hour and a half, for example) student perceptions might have been quite different. More frequent class meetings could make course tasks more routine and increase student accountability to each other. It's also possible that had game development occurred throughout the semester, students might have been more engaged in online communication from the start and throughout the semester (Belland, Kim, & Hannafin, 2013; Savery, 2006).

Implications

The findings from this study bear implications for implementing problem- and technology-based learning designs intended to promote the development of complex problem solving skills and creative thinking. Although these implications, to a great extent, are specific to this instructional design scenario, we also suggest ways that they might apply to scaffolding complex problem solving in other team-based learning environments. Of these implications, one pertains specifically to cognitive scaffolding for problem-solving, while the other two might be better described as scaffolds for the social negotiation requisite to solving problems in teams.

Begin Concept Development Early

Although much of the learning that the course was designed to foster can be attributed to both parts of the course (the "learn" phase early in the term and the "apply" phase later), in problem-based learning environments designed around a central problem scenario for an entire course, it's critical to allow students to begin concept development from the onset of the course, whether the concept they are developing is a game narrative or the solution to some other sort of complex problem. The "learn, then apply" approach was effective in scaffolding students' disciplinary thinking, and course designers still believe that game development can begin after some initial work with course content. However, beginning to discuss the overarching game *concept* can and should begin fairly early. Grappling with conceptual understanding and building a shared understanding with others in a team takes time (Barron, 2000; Belland, Kim, & Hannafin, 2013; Jonassen & Hung, 2008). Moreover, content devoid of the context of the problem-based scenarios results in sterile, inert knowledge that is not easily transferred to the problem scenario. Such context allows discussion and consensus building to focus on how the content applies to the concept they are currently building, how it might apply to other contexts, and ultimately a deeper understanding of the content, context, and other applications beyond either. In short, it would facilitate the "questioning," "argumentation," "modeling," and to a certain extent, "analogical encoding" that Jonassen (2011) describes as cognitive scaffolds for problem-solving. Beginning concept development in the early weeks need not detract from other course activities. Indeed, it could enhance them by providing a situated context for them. In fact, the Preparation for Future Learning (PFL) approach advocates for situating students within a problem context before they have any foundation for their work (Swan et al.,

2013). Through this early work, students "internalize key dimensions of these problems" (p. 92) which can then prepare them for more formalized learning (Swan et al., 2013). For example, if students had already begun to establish an overarching game concept when they gave their culture presentations, the discussion that followed each presentation could have been an evaluation of what parts of the literary and artistic production of the culture presented applied to the game concept. As it were, students were beginning development of the game concept at that time. Had they completed even initial ideation before beginning their culture projects, the proposals and research bibliographies that were components of this project could have been situated to a more relevant context than the class itself (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Students perceived these assignments as busywork, rather than an integral part of the game development process, which they could and should have been (Belland, Kim, & Hannafin, 2013; Hickey et al., 2006; Savery, 2006). Moreover, students likely would have been more engaged during the culture presentations—reflecting on which artifacts, archetypes, images, and ideas applied to the game concept they had identified. They sat through these presentations and gave feedback to each other, but little of what they heard, read, and discussed informed the development of the game, beyond that each level of the game "took place" in one of the regions of the world explored in these culture projects.

Foster Interdependence Among Students

One of the course successes was the self-direction it obliged students to develop. While the hybrid format did decrease the amount of face-to-face contact, whether or not students would have developed this self-direction if the class met six hours a week instead of three is not as clear. Regardless, students should not feel hindered by the delivery mode of a course. Clearly the class needed to meet more frequently, and instructors needed to more clearly communicate that they expected students to work together while apart. Using technology with which students routinely communicate might also promote greater interdependence (Bonk & Zhang, 2008). While half of the students routinely logged into the course management system because they were using it for other courses, the other half did not do so habitually. Moreover, email reminders were not particularly effective with students who rely more heavily on their cell phones and instant messengers. Web tools such as Twitter or Remind 101 could be leveraged to reach students on their mobile devices and keep them more instantly in touch. The caution in using such tools, however, is to employ them in a way that enables students to support one another rather than increase their reliance on the instructor (Johnson & Johnson, 1994). Engaging students' personal interests and prior experiences by beginning game concept development earlier, so that they're not directed to communicate with each other, but are eager to do so, might also encourage more interdependence (Belland, Kim, & Hannafin, 2013).

Enable Group Self-Organization

Engaging students in the problem scenario and fostering interdependence early on could also allow students to better self-organize (Barron, 2000). As students indicated, identifying each other's strengths takes time. Getting students into small and large groups earlier could better allow these strengths to emerge, so that students can assign and shift roles with greater facility (Brush & Saye, 2001). In this pilot course, student leaders emerged in the small group projects early on, but the class had more difficulty appointing those roles during the game development project because their concept for the game and their familiarity with each other's skills and abilities relative to the entire group were still emerging. Scott (2014) delineates this dynamic in the team level characteristic she named Learning Team collaboration. This characteristic includes three elements: (1) sharing responsibility for learning and action; (2) questioning and challenging ideas; and (3) climate of openness, trust, and encouragement. In this study, students seemed to have enough prior experience with "typical" school projects that they were able to self-organize effectively when working on presentations, research papers, and proposals. However, the team dynamics of PBL and game development were very different for them, and they were less able to effectively transition their self-organization. This is certainly a challenging skill, one that is much needed in the real world with team members of varying experience (Savery, 2006).

Limitations and Future Directions

Characteristics of this study do pose limitations to conclusions that may be drawn from it and applied to the body of knowledge regarding game- and problem-based instructional designs. First, one of the authors and researchers for this study was also the primary designer of the GVP, as well as one of the two instructors who taught the course. These multiple roles provide additional insight into the research questions, but they also compromise claims to objective distance from the case under study. The number of participants in the study also limits the assertions that can be made from it. Moreover, the course was designed as a capstone for the academic transfer program at the college of implementation. However, three of the six student participants were technical program students in the college's Interactive Simulation and Game Technology program. Consequently, those participants had not been exposed to the full range of general

education courses that other participants had experienced, but did have experience with game design and development which influenced their perceptions of that aspect of the course design. Finally, because this research design does not compare the GVP with other capstone course designs, the results cannot support claims that this design scenario is better than others. Conclusions should be limited to assertions regarding the relative success or failure of problem or project-based methods as the foundation for meaningful capstone experiences, rather than the game design scenario itself.

Although this pilot implementation of the GVP met with some success, a direction for future research is to compare these results with those from an implementation in which course assignments are contextualized within the game concept development process, which takes place throughout the whole semester. Another area for future exploration is the course format. Comparing the use of the distance learning components to the frequency and duration of class meetings is an area ripe for further research. Examining them both when game concept development begins earlier and course assignments are fully contextualized in the problem scenario will enable us to make better assertions about the role of distance communication tools and student self-direction. Examining how to better scaffold team organization, consensus-building, and project leadership is another area for further research. Finally, a comparison of the GVP to other capstone course designs is another area for future research. At least one other capstone learning community, which employed more traditional methods of instruction, had been developed and implemented at the college where this study was set. Comparing outcomes between these two capstone experiences may illuminate the efficacy of problem- or project-based methods in fostering attainment of the overarching objectives of the academic transfer program.

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