Instructional Design Factors as they Relate to the Creation of a Virtual Learning Environment

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ABSTRACT - This study builds on two parallel paths of application and development: the Instructional Systems Design (ISD) process in the design, development, and implementation of instructional materials, and the evolution of the virtual learning environment from a distance learning vehicle to an approach for synthetic, distributed, and interactive learning (Boehle, 2006; Christie & Ferdos, 2004; Osman, 2005). Instructional Systems Design (ISD) was initially developed to support the creation of learning materials that are more linear in nature, from correspondence, to audio and video, and some versions of computer-based training (Reigeluth, 1999). Virtual learning environments (VLEs), however, are multidimensional and flexible, often providing multiple pathways to learning, a representation of multiple perspectives, and a range of methods for evaluating learning outcomes (Carnevale, 2000; Ferguson & Wilson, 2001).

This study compared the processes followed by developers of virtual learning environments in commercial, academic, and government settings, and examined the role of learning elements and approaches identified in the literature for distance learning in supporting the learning success within a VLE. This study indicates that all but one of the seventeen participants uses ISD or similar process, and all but one focus intensively on phases that pertain to audience analysis and usability testing. This research suggests that for the creation of VLEs, ISD or a similar process should be adapted to integrate the phased processes for software production, as well as structured strategies for preparing intended users to participate in the virtual environment. Finally, this research suggests that for virtual environments designed for specific learning outcomes, summative evaluation needs to be reconceptualized to adapt to the elements unique to the virtual learning experience.

Introduction

The purpose of this study was to explore the use of Instructional Systems Design (ISD) in the creation of virtual learning environments (VLEs). For over 50 years, instructional developers have relied on ISD as a systematic process predicated on history and research to provide a framework for making informed decisions about the design of face-to-face, print, video, and computer-based instruction in government, corporate, commercial, and academic settings. More specifically, the goal of this framework is to guide an instructional developer or team of developers in clarifying learning goals and addressing the issues surrounding the learner and learning environment to determine the approach and direction of a successful design and delivery of instruction with measurable learning outcomes.

However, the ISD process may not fully address the issues characteristic of the VLE. A VLE is an online instructional system designed for active learning, communication, and collaboration, which is facilitated through supporting tools for materials management, and discussions (Yang & Lui, 2004). A VLE is technically and pedagogically multidimensional in comparison to other delivery systems, providing content organization that is often less than linear and considerably more vested in learner or user motivation and participation (Ibid).

The creation and implementation of a VLE requires considerable investment in money, time, personnel, programming, and a supporting infrastructure. It also involves a learning curve for those who participate in it as students or instructors. An initial implementation that fails the participants in terms of stability, support, and effectiveness could lead to a lack of trust in and an inoculation effect towards future related solutions. Consequently, it is worth examining and possibly reconceptualizing the best instructional design approach for creating a VLE to meet specific instructional goals.

In addition, while the advent of the VLE may call for at least an adaptation of the processes used to create learning materials and successfully meet learning goals, perhaps within the context of VLEs, the ISD process itself should be revisited as well, to compare, as Rossett (1999) describes in her literature on the ISD analysis phase, desired performance with actual performance. The gap that lies between the two may clarify which ISD elements are

relevant to the design of VLEs, or clarify which elements within the ISD process may need modification. To define this gap, this research involved interviewing the designers, developers, and producers of VLEs in the academic, government, and commercial sectors and observing their processes for developing VLEs. Data was used to identify similarities and differences between the theory of ISD and professional practice, or more specifically, the real life feasibility and application of ISD to the creation of VLEs, and opportunities for adaptation to a more plastic delivery system. By considering our history, we may have a clearer sense on how to move forward with the creation and implementation of VLEs.

Review of the Literature

This research objective is informed by three key bodies of literature, consisting of a review of the current research on

- Instructional Systems Design (ISD)
- The instructional design of Virtual Learning Environments (VLE's)
- Learning and learning factors within a distance learning environment.

Prior to review of the literature is an explanation of current VLE approaches within academic, corporate, government, entertainment, and commercial sectors.

The Virtual Learning Environment

A Virtual Learning Environment (VLE) is an online space designed to create a specific learning experience. VLEs were initially created to support distance learning. Distance learning is described as learning in which the instructor and learner are in different locations (Fox, 2000). With the proliferation of the internet into the personal, professional, and commercial landscape, its use in academia and professional development was inevitable (Bates, 1994). As an instructional delivery system, a VLE can provide a solution to a range of instructional issues, from mediating geographic dispersion among course participants, to providing flexibility and convenience in learning, to satisfying an interest in a unique experience. However, because a VLE can also provide specific types of learning experiences as well as convenience, flexibility, and portability, it has been quickly adapted by academic institutions to address instructional approaches and learner needs rather than geographic dispersion (Boehle, 2006; Christie & Ferdos, 2004; Osman, 2005). A VLE can involve online learning, distance learning, game-based learning, and even immersive simulations. A VLE can also involve activities as simple and fundamental as a discussion board or as complex as an avatar-driven multiplayer collaboration. The instructional value of a VLE is in facilitating knowledge building through collaboration, synthesis, and the experience of participation (Carnevale, 2000; Ferguson & Wilson, 2001). Learning in a VLE may be characterized by an understanding that grows out of the learner's participation with other learners and the learner's interaction with and adaptation of content, culminating in a personalized expression of meaning. These terms for successful learning in a VLE may indicate the need for the reconceptualization or adaptation of elements of the ISD process (Ilrbeck, Kays, Jones, and Sims, 2006).

This new direction in information synthesis may indicate an opportunity for those involved in instructional message design to reassess methods and processes for addressing and meeting learning needs.

Figure 1. An example of a virtual learning environment created in the immersive learning simulation (ILS) There.com.

VLE TOOLS

In a VLE, the computer serves as a tool *with which* one learns rather than a tool *from which* one learns. This new dynamic requires new strategies for mediating knowledge that were otherwise supported solely by the instructor, and self-regulation by the learner in meeting learning goals (Brown & Voltz, 2005). As a result, learning is more and more emerging as a product of collaboration, social presence, and communities of practice (Rheingold, 1993; NMC, 2005; Tuomi, 2000; Fulford & Zhang, 1993; Short,Williams, & Christi, 1976).

VLEs currently can be classified into one of two categories:

- Learning Management System (LMS)
- Immersive Learning Simulation (ILS)

A learning management system (LMS) is a software tool that manages content and learning for an online learning environment. Its framework is created by either commercial or open source developers, who then provide it for use in university or corporate settings. Commercial LMS software requires buying a license or subscription, which also includes at least a measure of guaranteed technical support. An open source LMS typically allows for more user customization, but it also leave resolutions surrounding technical support to the group that is using it (Bellefeuille & Buck, 2005).

The LMS is designed for academic use, and provides a more formalized instructional approach that includes course management tools to support the instructor and institution with tools for grading, enrollment and student tracking, and assignment and course material management. The VLE created by an LMS is built on communication and information exchange (Ibid).

The ILS differs from an LMS in that an ILS is typically designed for recreational use, with tools and features that support more socially-oriented functions (Livingston & Kemp, 2006). An immersive learning simulation (ILS) is a software tool that provides the framework for a 3-D environment, and is available through membership or subscription. This environment can be created using a tool designed for enabling user interaction, be it a Massive Multiplayer Role-playing Game (MMOPRG), or an application designed specifically for academic or social environments. An ILS is defined by virtual places, virtual people, and activities, most of which are created by others who subscribe to the simulation (Ibid).

Figure 2. An example of a virtual learning environment created with the massive multiplayer role-playing game (MMOPRG) World of Warcraft.

Instructional Systems Design

Instructional Systems Development (ISD) includes four interrelated facets:

- Instructional design theory
- Instructional technology
- Instructional design
- Instructional Systems Development (ISD) Models

Instructional design theory offers explicit direction on how to foster cognitive learning. Instructional design theory is not learning theory. Unlike a description oriented theory that focuses on the results of given events, instructional design theory focuses on the means to successfully meet a given goal rather than the goal itself (Perkins, 1992). Instructional design theory identifies methods of instruction and the situations in which such methods should be applied. These methods of instruction, which can be broken down into more detailed components are probabilistic, designed to increase the chance of attaining the stated learning goals (Reigeluth, 1999). Gagné and Dick (1983) describe instructional design theories as a way to apply our current understanding of learning theories to

- Identify conditions of instruction which will optimize learning, retention, and learning transfer
- Identify specified events of instruction
- Relate the events of instruction to specific learning processes and learning outcomes
- Provide a description of causal relationships between instructional approaches used and their learning outcomes

Instructional technology is the systematic application of strategies and techniques derived from behavioral, cognitive, and constructivist learning theories to mediate an instructional problem. This application includes the selection of a delivery system and other learning materials that are aligned with the learning theories being used to meet the intended learning outcomes (Winn, 1997). Clark (2002) concurs, explaining that while instructional technology pertains to the design of instruction, it needs to address and support cognitive processes in order to be successful.

Instructional design is the practice of applying instructional learning theory, developing instructional specifications, and customizing or designing media for use within an instructional context to facilitate the effective transfer of knowledge (Smith & Ragan, 1990). The outcome of an instructional design may be directly observable and measurable, or assumed (Ibid).

ISD models are graphic representations of the activities that make up a systematic approach to instructional design. The ADDIE model is the most commonly used instructional design model and because it is so basic, is often adapted. Its name is an acronym that stands for the five phases it includes for instructional development (Dick & Carey, 2001):

- Analyze – to analyze the intended learner and learning environment
- Design – to develop learning objectives, and choose an instructional approach
- Develop – to create instructional or training materials
- Implementation – to deliver the instruction
- Evaluate – to ensure that the instruction meets the intended learning goals

These five phases are inherent to most ISD models, which elaborate with sub-processes and feedback loops and run parallel to the software development process, which involves the following phases in various versions of models that serve the same purpose (Rehman & Paul, 2003):

- Requirements Analysis – to determine in detail what the software should do

- Specifications – to describe in detail how the software will be created
- Design – to define in conceptual terms how the software will run
- Implementation – to translate the design to code that runs the design
- Testing – to verify the quality of the software
- Documentation – to address maintenance and future enhancements

These software development phases focus on creating software that meets performance requirements for the user, while the ISD model phases focus on creating instruction that supports the user in meeting performance or learning requirements.

In real world application, some ISD phases may be abbreviated or ignored completely due to a lack of access to resources, or to meet time and budget requirements, or to appease upper level decision-makers who may not have an appreciation or understanding of the value offered by each phase (Rossett, 1987). Despite that each phase may not be fully applied, if at all, in an instructional design, instructional developers have managed to create instructional experiences with measurable, intended learning outcomes.

Instructional Design in an Online or Virtual Learning Environment

With the escalation of changes in technology and access, instructional design, like many other disciplines, finds itself at a juncture with past methodology and a call for adaptation to align with changes in distance education, user expectations, and the potential of further technological and social innovation (Arbaugh (2007). Others, such as Ilrbeck et al (2006) maintain that the challenge for those involved in instructional development is to be able to recognize what will continue to be pertinent in terms of what we know about distance education (Ibid) and to identify opportunities for pedagogical and systems-based adaptation – or perhaps even complete reinvention (Ibid).

In face of the perceived inadequacy of the current ISD process, coupled with the challenges of designing instruction for VLEs, Ilrbeck, Kays, Jones, and Sims (2006) developed an Emergence Theory of Instructional Design. Ilrbeck et al. point out that the current instructional design models are two-dimensional, adequate for print and video, for instance, but fall short for the more holistic and three-dimensional VLEs. They contend that current instructional design models provide a foundation for creating instruction, particularly for emerging delivery systems, but are not relevant to the complexity and dynamics of online learning (Ibid).

Ilrbeck et al. suggest that a continuous instructional design and development for a VLE should be maintained by the participants within the learning environment on an iterative and collaborative basis. Within this Emergence Theory, the role of the instructional designer is to frame the instruction in a way that allows for spontaneous responses and unexpected outcomes, and hopefully, higher learning. As a result, every design would become unique and discrete, the result of ongoing participant interaction.

Within this framework the role of the instructor moves from providing content to

- Providing feedback;
- Building rapport;
- Influencing the culmination of activities that appear more successful in moving toward the intended course outcomes; and
- Amplifying or extinguishing student behaviors.

The instructional design process for Emergence Theory is based on a Three-Phase design (3PD) Model, which would involve setting learner baselines, rapid prototyping and adaptation, and ongoing maintenance. Within these three phases, one might see the importance for activities in the current ISD model, particularly the needs assessment to set learner baselines, before moving into a process that seems to fold design, development, implementation, and evaluation into one ongoing phase. However, the only data to support their theory is based on research using their own course in computer programming, which may have involved content and learning goals inherently suited for an ILS. Ideally, this approach needs to be validated through application to other content domains. Similarly, it would appear the ISD process could use similar validation through research on its application in the creation of VLEs.

To address the decision-making that informs instructional design choices, Clark (2005) offers a new model for creating effective online instruction. Her DVEP model includes the following sequential phases:

- Define – clarifying business goals and the knowledge skills needed to achieve them
- Visualize - choosing the instructional methods appropriate to achieve the stated learning objectives
- Engage – selecting the delivery methods to mediate the instructional methods identified
- Package – manage the preceding elements and those that follow in the virtual classroom event, support participants with technical issues, state course objectives and assignments, and establish social presence in the early stages of the virtual environment.

These phases resonate with the ISD model in terms of Analysis, Design, Development, and Implementation, as well as the earlier discussed virtual learning elements of community and social presence. Interestingly, Clark's focus is on "Package," which is closely related to the ADDIE Implementation phase, characterized by an oscillating communication interaction between the instructor/developer and the learner, but it does not include a formative evaluation or summative evaluation to measure learning outcomes.

It is worth comparing the research in the instructional design of VLEs with the processes advocated by those involved in virtual game design. Virtual game designs

already have proven successful and widely received by their intended audience as reflected by sales and proliferation of user communities that develop around them. During a threaded mailing list discussion on the design of a game-based learning simulation, Clark Aldrich, an established game designer and author, posted the following description of what he considers critical steps (Aldrich, 2007):

I have two:

Audience Technology Survey: The step of identifying, of the target audience, the most powerful common technology platform and distribution process to which at least 80% have (or can easily get) access.

Piloting: The step before a major roll-out of taking either 10% or 30 sample and representative participant members (whichever is smaller), and running the program exactly as you intend the full program, but with a greater rigor in measuring the results at the end of the program. The results of a pilot can be used either to support a "go"/"no go" decision if an organization is evaluating a sim, or to calibrate the sim before the full roll out. If calibrating the sim, and significant changes are made, another pilot deployment is suggested before a major roll-out. When piloting a sim, it is critical not to tell the audience "we are piloting this program, what do you think?" Instead, it should be positioned similarly to the major roll-out, such as "this is a required program. Do your best."

Aldrich's steps may not reflect instructional design, but they do speak to similar audience considerations addressed in the ADDIE Analysis phase, and usability testing that would fall within the Evaluation phase – processes that Aldrich's model does not incorporate.

Each of the models discussed endeavors to address the technical dimensions of the creation and operation of a VLE, as well as the role of the user or participants in providing feedback to improve the performance of the environment technically and instructionally. Some models, including those of Ilbeck, and Brown and Voltz, are more organic and flexible in allowing users to set the boundaries and terms of the learning. Others, such as Aldrich, rely on establishing terms of engagement in a VLE through stated learning goals that drive the direction of the learning experience, outcomes, and meaning-making.

Elements of Instruction in Distance Learning and Virtual Learning Environments

As a term, *distance learning* is used to describe distance education, distributed learning, open learning, flexible learning, networked learning, online instruction, or connected learning spaces. However, distance learning not only addresses geographic dispersion, but how and when learning takes place (Holmberg, 1989), especially in that through the use of an LMS or ILS, a VLE has become more distinctly a learning space distinguished by deliberate establishment of a place and community to meet instructional purposes (Livingston & Kemp, 2006). Consequently, although online learning was initially developed as a distance learning solution, given the convenience and flexibility an online learning environment offers its participants, and the rich opportunities it supports for collaborative learning and knowledge building, the virtual online learning environment has become more of an instructional solution rather than a distance mediator. For these reasons, VLEs are considered tools for distance learning.

What follows is an examination of how elements of distance learning characterize the learning and synthesis that take place in VLEs. These same elements will inform the instructional design of a VLE.

Initial research in distance education and learning focused on media comparison studies, and as was discussed earlier, attrition rates, which have tended to be high for distance education courses, and the cost effectiveness and appropriateness of specific technologies for delivery of instruction (Yang & Lui, 2004).

Comparisons studies on the effectiveness of different media did not identify significant differences in learning (Beta-Jones & Avery, 2004; Boswell, Mocker, & Hamlin, 1968; Chen & Jones, 2005; Chu & Schramm, 1967; Hoyt & Frye, 1972; Kruh, 1983). In fact, these comparative media studies for distance learning continue to support Schramm's view that "learning seems to be affected more by what is delivered than by the delivery medium" (Yang & Lui, 2004), and Clark's analogy of how media does not have an effect on learning "any more than the truck that delivers groceries influences the nutrition of a community" (1984). However, as technologies have become more complex, interactive, and requiring extensive upfront financial and training investment, research continues to focus on delivery system selection, as well as the process for doing so (Wagner, 1990).

Current research in distance learning identified in this study focused on the following:

- Learner Factors, including
- Transactional distance
- Community and the socio-cultural context of knowledge
- Social presence
- Learning Factors, which include
- Feedback
- Interactivity
- Human Computer Interface (HCI) design and cognitive load

Transactional Distance

Transactional distance is not a geographical measure, but rather a pedagogical phenomenon. It describes the amount of dialog that occurs between the learner and instructor, and the amount of structure within the design of the course (Moore & Kearsley, 1996). More structure in the course design will lead to less student-teacher dialogue (Moore, 1991). With less course structure and more

participation in dialog, the learner functions with more autonomy and increased motivation (Saba & Shearer, 1994).

In addition, Moore maintains that more course structure and active dialog can reduce the learner's perceived sense of transactional distance (Ilrbeck, Kays, Jones, and Sims, 2006). Recent studies, however, have suggested that dialog may be more important than structure in positively affecting the learner's sense of transactional distance in the learning environment (DeTure, 2004). This may be due in part to increasing levels of access to technology and comfort with using computers, and also ever-improving digital literacy.

Community Building and the Socio-cultural Context of Knowledge

The work of Lave and Wenger (1991) on communities of practice deals with learning transactions as well, but focuses on the culmination of a group, identity, and terms of engagement. Wenger maintains that a learner's identity within a group or community is contended through negotiated experience with others in the group (Ibid). As one begins to identify with a learning community, for instance, their membership is predicated upon perceived competence in the group's mutually agreed upon endeavors and values. This concept of community of practice concurs with the earlier discussion on the importance of self-efficacy in learner motivation, and addresses the collaborative, interactive, and social elements that contribute to learning in a VLE.

The ability to define community in a learning environment is often a predictor of whether or not a learner will identify with being a part of it (Brown, 2001). The interaction between the instructor and students that takes place in many forms of computer-mediated distance learning creates a "virtual community," a term that is often used interchangeably with "online community." A virtual community does not indicate a necessarily strong bond among its members, but rather is the product of discussions that continue long enough and with "sufficient human feeling, to form webs of personal relationships" (Rheingold 1993; Tuomi, 2000). The social networks and knowledge webs that form within a virtual community offer a means for facilitating teamwork and constructing knowledge (NMC, 2005). If done successfully, the underlying technologies used to facilitate connecting and creating meaning within the virtual environment become seamless to the collaboration and communication that take place (Ibid).

However, simply using technology to build or facilitate a virtual community for learning purposes does not necessarily make it a learning community (Schwier, 2002). To become a learning community, the participants must be in agreement with and committed to the process of building knowledge (Nishinde, Shima, Araie, & Ueshima, 2007). This involves not only personal contribution but responsiveness to others' contributions as well (Rovai, 2002). In addition, community members need to be able to trust other community members to provide credible and genuine contributions and exchanges. This study endeavored to determine how an instructional design can support and facilitate the successful development of a learning community as well as other elements that distinguish successful learning in a VLE.

Social Presence

Social presence in an online learning environment describes the extent to which its learners are able to establish identities with social and emotional dimensions through communication with other participants in that environment (Gunawardena & Zittle, 1997; Short, Williams, & Christi, 1976).

A study conducted by Lofstrom and Nevgi (2007) examined perspectives of instructors, students, administrators, and institutional leaders involved in an online learning environment. Students, on the other hand, ranked isolation and loneliness as their primary obstacle to learning in the VLE. Consequently, social presence appears to be a more reliable predictor of student satisfaction in a distance learning environment than the extent to which the learner actually interacts with the environment (Fulford & Zhang, 1993; Wang, 2000), although it is safe to say that interactivity can be an important part of cultivating social presence.

Learning Factors

Feedback

For purposes of this discussion, feedback describes the response of the instructor to the student's performance and learning (Nishinde, Shima, Araie, & Ueshima, 2007). Its purpose is to amplify learning, and increase skill and knowledge (Ibid). In a face-to-face learning environment, feedback is immediate, and in addition to the content of the instructor response, includes cues in tone of voice and body language (Pritchard, 1998). In an e-learning environment, however, a student gets feedback most likely through text, which can be provided through the immediacy of synchronous communication tools, or asynchronously. In either case, feedback for students represents a connection with the instructor and an indication that their presence in the course matters (Nishinde, Shima, Araie, & Ueshima, 2007). This need for immediacy resonates with the earlier discussion on social presence and creating a context for membership (Williams, 2006). Furthermore, students in an online learning environment are more likely to become engaged if the instructor is responsive to the students' interactions (Pritchard, 1998).

Interactivity

Regardless of the delivery system and instructional approach, learner interactivity is both necessary for learning to take place and central to the process of teaching and learning (Saba, 2000). Interactivity establishes the extent to which the learner derives a sense of control in his learning environment by the degree to which he is

allowed to make choices (Ibid). Interactivity is directly affected by the learner's entry level skills and abilities, motivation for learning, and the support that is available (or embedded) as needed to facilitate the learner in negotiating the learning environment (Garrison, 1990; Baynton, 1992). Chepya (2005) refers to this latter aspect as the "teaching presence" to describe the sense of learner support and efficacy in a VLE. Roberts (2006) concurs, indicating that how and the extent to which an instructor or facilitator participated with students and in activities in a VLE had a direct and significant impact on student participation and their contact time in the VLE.

Human Computer Interface Design and Cognitive Load

The transactional distance mediated through student-to-content interaction in a VLE describes the relationship of the student-to-the technology and the tools which are used to facilitate the formation of the learning environment. This includes the student's interaction with the computer interface that conveys and sets the stage for the learning environment, as well as the specific tools it includes for collaborative activities like discussion boards, for instance, or for creating digital content.

Computer interaction involves a few basic elements: a computer user, a computer, an interface, and a means for the user to input or respond to the computer interface, usually via a mouse or keyboard. Key to this dynamic is the computer interface and how it can be best designed to convey information and respond to user interaction. Cognitive Load Theory (CLT) provides a framework for human computer interaction (HCI) factors in terms of the design and comprehensiveness of the information provided (Templeman-Kluit, 2006).

Cognitive Load Theory describes how meaningful learning occurs when a learner makes connections between information in the visual and the verbal processing channels of their working memory (Ibid).

Ultimately, as interface design sets the stage for student-content interaction, its success appears to rely on the following learner-driven factors, and which would be considered in the instructional design of a VLE (Ibid; Morrison & Anglin, 2005):

- Chunking information into segment lengths that are not too long as to disengage or tire the learner
- Providing contiguity only when needed
- Providing accessible tools to facilitate participants in interacting with each other
- Ensuring that learning formats are appealing and those preferred by the intended learning audience
- Meeting the ability of participants to quickly adapt to or conform to the design for communicating and information processing

Summary

The design and success of a virtual learning environment as a platform for learning are predicated on distance learning elements that are characteristically synthetic: social interaction, collaboration, and knowledge building. Transactional distance, group identification, social presence, and interface design considerations, particularly cognitive load, facilitate these elements.

Given the importance indicated here and in later discussion about the role of communities of practice, transactional distance, and social presence in distance learning, it would seem that these elements would need to be addressed somewhere within an instructional design process. However, while current research indicates the importance of these elements, it does not appear to address how they are identified as integral to an instructional design, or how they would be contextualized and measured for meeting learning goals.

Methodology

Methods

This exploratory study used qualitative methodology to improve our understanding of the extent to which the instructional systems development (ISD) process applies to the creation and implementation of a virtual learning space, and the instructional design requirements that may be unique to creating and maintaining a VLE. A framework for this study was predicated on literature in distance learning, instructional design, and learning theory as suggested by the literature.

This study involved the analysis of multiple case studies representing key functional areas, which were built on the interviews with experts involved in the design, development, and implementation of VLEs and review of their related documentation and media. The case study approach allowed the researcher to penetrate and analyze each situation in real context in an effort to identify cause and effect relationships, particularly as they relate to decision-making, team dynamics, and processes (Cohen, Manion, & Morrison, 2000). Multiple case studies served to address a range of aspects and issues surrounding the instructional design of VLEs, and hopefully provide insight through data that is convergent and even disconfirming at times.

Data Sources

Data for this study were gathered from three sources:

1. *Semi-structured interviews with stakeholders* and experts involved in the design, development, and implementation of VLEs in academic, corporate, government, and commercial settings.
2. *Review of relevant documentation and media* related to the VLEs in which the participants are involved. This documentation can include pre and post test examples, and production documentation.
3. *Observations* of the actual learning environment when possible, to explore the space, its organization, and usability.

Data Collection

Data collection involved in-depth interviews with stake-

holders involved in the design and implementation of VLEs. These in-depth, partially-structured interviews with participants explored and compared the participants' understanding and application of elements of ISD with the grounding provided by the literature review. These interviews also examined barriers from using the ISD process. When possible, document reviews further clarified the extent to which these developers applied process, set learning goals, and measured intended learning outcomes. When necessary, the researcher pursued email-based follow-up interviews with participants to clarify their comments or to request elaboration.

Data collection also involved reviewing documentation and media pertinent to the learning environments in which these stakeholders are involved. Each case study was made up of at least three participants representing a sector. These sectors include government and corporate professional development consultants, commercial and online game developers, and those involved in academia, from K-12 to university.

Participants were identified through purposive interviewing or theoretical sampling (Krathwohl, 1998) in an effort to ensure that research questions were comprehensively addressed, and specific topical alternative perspectives were explored. This study involved seventeen participants who represent sectors that are involved in creating and implementing VLEs. Their positions will include roles as:

- Administrators
- Instructors
- Game Designers
- Media Consultants
- Instructional Designers

Specifically, this study included three to four participants representing technical and content designers in the following sectors:

- Three government and corporate professional development consultants;
- Four academic instructional developers for college and other adult learning venues who create VLEs using blended technologies – an LMS and webconferencing tools;
- Four academic instructional developers for college and other adult learning venues who create VLEs using ILS's;
- Three game and edutainment designers; and
- Three consultants who create virtual worlds for commercial or advertising purposes.

For this study, the Academic functional area was broken into two subgroups, those who use Learning Management Systems (LMS's) and those who use Immersive Learning Simulations (ILSs) to create VLEs. Each functional area and the two subgroups serve as a case, and each case is comprised of interviews with at least three participants, each involved in the creation of VLEs within that functional area. Note that while only two groups represent academia, each functional area uses virtual spaces to change a behavior, understanding, or attitude, or to generate a learning outcome. Useful information was found in the similarities and differences among each of these functional areas in their respective processes and approaches to the design, development, and implementation of these virtual environments.

Data Analysis

Data from the interviews and observation were analyzed qualitatively and codified to identify common threads for analysis, and compared within cases to establish patterns, themes, and priorities (Ryan & Bernard, 2003). The same data were compared between cases as well as individual interviews within cases to determine patterns and relationships (Strauss & Corbin, 1990) and possibly draw convergence on current professional practice and feasibility in the instructional design of VLEs.

Findings

Participants from each sector are grouped together as a case. What follows is a description of the findings within each sector, followed by a cross-case comparison.

Case 1: Government and Corporate Professional Development Consultants

The first case in this study is bounded by virtual learning spaces designed for government or corporate interests for professional development purposes. These virtual learning spaces are developed to create virtual training and performance and knowledge information management, which can include online learning, distance learning, and online simulations. The instruction is designed for adults who work for a corporation or government organization such as an association or armed services.

All three participants in this case face the task of providing an online learning solution to hundreds of adult learners who are often geographically and culturally dispersed. Budgets range from a few to several hundred-thousand dollars and possibly more, depending on the scope of the project.

Case 2: Instructional Developers of Academic Virtual Learning Environments Using Blended Technologies – LMS and Webconferencing Tools

The second case in this study is bounded by virtual learning spaces designed for college and other adult learning venues using a blended approach: an LMS for synchronous instruction and webinar tools for synchronous learning. These virtual learning spaces are developed to facilitate course and content management, content delivery, and student records. The instruction is designed for instructors who work at a private or public university and their students.

Four participants were interviewed for this case study. Three of those interviewed for this case are employed by academic institutions that range from a state community

college consortium to a private university. One participant is employed by a state-funded organization that supports math and science educators.

Case 3: Instructional Developers of Academic Virtual Learning Environments Using ILS (Immersive Learning Simulations)

The third case in this study is bounded by virtual learning spaces designed for college and other adult learning venues using an immersive learning simulation. These virtual learning spaces are developed to provide real-time instruction, and often require the users, both instructors and teachers, to represent themselves in the space digitally as self-constructed avatars. The instruction for three of these learning spaces is intended for instructors and students in a private or public university, another is to complement a middle school math face-to-face classroom.

All four participants are pioneers in their exploration of the use of immersive simulations for creating VLEs. Three of the participants are not required to create VLEs, but have done so on their own initiative and out of interest in doing so. The fourth participant is responsible for managing the design of virtual learning spaces. Each of the participants uses immersive learning simulations to create an experiential learning environment for their learners.

Case 4: Developers of Virtual Environments for Entertainment Purposes

The fourth case in this study is bounded by virtual spaces and computer games designed for entertainment purposes. The goal of these entertainment game developers is to create products that make a considerable profit, cultivate a customer or user following, and provide a means for displaying their competencies in creativity, artistry, and programming. While many of these games may not be intended for learning, developers of VLEs often borrow from or imitate these entertainment-oriented, game-based virtual spaces in an effort to make learning attractive, fun, and engaging. This study includes an examination of the processes that go into the design, development, and implementation of these game-based virtual spaces for entertainment to compare and contrast their engagement and design strategies and production procedures, all of which are driven by money and market share with virtual spaces that are developed to meet specified learning outcomes. Three participants were interviewed for this case study. Two participants are CEO's of game development companies; one focuses on developing games and simulations expressly for education. The third participant is a game designer who has worked for several game development companies in the United States and the United Kingdom.

The intended audience for these game titles is people who buy and play computer-based games, and people who buy educational games for intended learners. The goal for each participant and their organization is to provide a gaming environment that engages users and attracts buyers.

Case 5: Developers Commercial Virtual Environments

The fifth case in this study is bounded by virtual spaces designed for commercial or promotional use. The goal of these developers is to create market share of users, subscribers, or participants in their virtual environments designed for their organization or for an organization that hires them. While these environments are not specifically educational, particularly the one in this case for which the virtual environment's primary function is to provide a site and community surrounding an internet service provider, their purpose is to change and sustain a new attitude, understanding, or perception of an organization or product. This study includes an examination of the processes that go into the design, development, and implementation of these virtual spaces in part because their competition for market share pushes them to use processes that contribute to "the bottom line" and in part because the same market competition pushes these developers and decision-makers to tread into less proven, "cutting edge" territory that others involved in education usually cannot afford to explore immediately.

Two participants in this case create virtual spaces "for Fortune 500 clients" using Second Life, Area A, and Metaverse, as well as "serious multiplayer games." One participant explains that the goal of his clients in creating a virtual space is to "Get a message out there and set up a presence," which he feels is "a lot like educating." Another participant within this case takes a different approach: This is a strategy focusing on partnering with people rather than trying to get them to come to a place. People try to piece the story together with each other.

Cross-Case Analysis

What follows is an analysis between and across cases. The purpose of this analysis is to identify similarities that cases share and the differences between them in terms of processes, design factors, and approaches in creating VLEs.

ISD or a Related Process

All five cases in this study use virtual environments to connect a defined group of people with information and meaning-making activities. The results indicate that developers of VLEs with specific intended learning outcomes, even those involved in non-learning sectors such as entertainment or advertising, rely on a development process that if is not ISD, is very similar.

Many developers are spending time prior to design and development in cultivating buy-in from potential participants, be they clients, teachers, students, or customers (Nishinde, Shima, Araie, & Ueshima, 2007). For academic developers, this buy-in includes training in how to use the tools, and reconceptualizing teaching, learning, and com-

munication in a way that will transfer successfully over to a VLE. As a participant in the government and corporate sector explains:

The biggest problem with all the virtual learning stuff is that people don't understand that it's still software development, which is a process not different from ISD. Software design is systematic. You've got to have analysis, design, development, deployment. So any type of e-learning is software development. You can't just do something. It's about testing, it's about quality assurance, it's about storyboarding. Everything is a process.

This study also indicates that based on three participants' experience, intended users are "ahead of the curve" and are more receptive to participating in the design and content creation within a virtual environment.

The Needs Assessment

This study indicates that 80% of the developers interviewed across all five cases use a needs assessment or related process to clarify their intended user, learner, or audience in terms of preferences, expectations, and information needs. The participants in this study who did not do this either created virtual environments that were quickly shut down or required immediate modification.

This study indicates that 80% of the developers of VLEs interviewed use a needs assessment or related process to identify the baseline skills and technology platforms to which intended users have access. Based on the developers' understanding of their intended users' baseline skills, all of the Academic LMS developers and 25% of the Academic ILS developers include user training in the early part of the implementation phase of their VLEs. This training focuses on providing technical skills, an understanding of the social and communication dynamics involved in participating in the VLE, and setting user expectations, which includes "buy-in" – the latter two cited specifically by more than half of the participants in this study representing academia.

Feedback

This study suggests that feedback is important not only to the learner but to the instructor in establishing a sense of connection between participants within a VLE. Feedback provides an opportunity for instructors to interact with students and to guide instructional outcomes. For students, feedback from instructors serves as an acknowledgment of their participation in the virtual environment. In addition, user or learner feedback pertinent to their experience in the virtual environment is used by all but one participant in the formative evaluation of the usability of the learning space.

Transactional Distance

Based on the interviews in this study, the game and commercial developers address the transactional distance of user-to-user (or student-to-student) and user-to-content interaction, while the academic developers focus on shortening the perceived learner-to-instructor transactional distance. As a result, commercial developers in this study address issues of social presence and learning community more comprehensively than developers in other sectors who were interviewed for this study. In particular, developers in academia appear to rely on mediating the transactional distance between the student and instructor in order to ensure specific learning outcomes.

Interactivity, HCI, and Cognitive Load

This study suggests that interactivity between the user and the virtual environment is dependent on the competency of the user's platform to support the interface elements, be it basic text communication or audio conferencing and animation, which are more demanding on a system. Three participants, one from the Academic LMS case, one from the Academic ILS case, and one from the Game Design/Entertainment case, cite audio quality in particular as integral to the successful implementation of a VLE, one explaining specifically that "the quality of audio conferencing is essential for conducting a live classroom."

Community Building

In this study, 65% of the participants across cases encourage the development of user or learner community within their respective VLEs. The academic developers typically rely on the discussion board and chat tools to create knowledge and social synthesis among the learners. Commercial and entertainment developers, however, rely on a more extensive user-based community not only to expand their sales volume, but to provide user-driven advertising. One commercial developer in particular takes this a step further, building community by encouraging users to build the environment rather than to simply interact with and experience it. Those developers in this study who do not incorporate specific community-building activities into their virtual environments, represented in the corporate/government, game, and academic ILS cases, appear not to see the value in doing so.

Summary of the Results

What follows is a table that summarizes these processes for each case. For cases in which participants may have differences in process, credit for a phase was provided if at least 75% of the participants did adhere to that phase.

In addition, based on this research, a new process has been added to the Analysis phase, which could easily be included in the Design and Development phase as well: User Preparation and Buy-in. This was done in response to the government/corporate and academic cases, which provide instructor preparation in particular and set expectations to get buy-in to the delivery method. The two commercially oriented cases address preparation through splash screens and contextualized help.

The academic ILS case is noted for having less process, in part because all but one of the participants is using them on an exploratory basis.

Table 1. Modifications within ADDIE Phases by Sector

	I Government and Corporate	II Academic LMS, Blended	III Academic ILS	IV Entertainment/ Games	V Commercial
Analysis					
Audience	?	?		?	?
Technical	?	?		?	?
User Preparation	?	?	?	? Splash screen/Help	? Embedded Help
Design, Development, and Implementation					
Feedback	?	?	?		?
Community	?			?	?
Transactional Distance	Student-to Teacher	Student-to-Content	Student-to-Content	User-to-Content	User-to-Content User-to-User
Role of the Student/ User	Student/ Participant	Student/ Participant	Student/ Collaborator	User/Advocate/ Consumer	User/Advocate/ Collaborator
Role of the Instructor	Facilitator	Facilitator	Facilitator	NA	Respond to User Expectations
Evaluation					
Formative/ Usability	?	?	?	?	?
Summative	?	?		?	?

Discussion

The purpose of this study was to explore if developers of VLEs are using ISD or a related process to develop VLEs, to see if the process is perceived as relevant to the development of VLEs, and to examine if ISD or a related process has been adapted to meet characteristics unique to this delivery method.

Overarching Themes

This study involved interviews with seventeen participants who represented four different sectors, two of them specifically academic. These participants each were grouped into cases bounded by their sector and their approach to creating a VLE. The goals of these environments ranged from generating specific, measurable learning outcomes, to providing an alternative experience to learning, to offering a portal into a specific experience defined by sensation, participation, and connection with the hype surrounding it. While the purpose of this study was to explore the role of ISD in the creation of these virtual environments, participants included a self-described "ADDIE freak," a rule-breaking "rogue," and those driven strictly by strategic business goals. From this range of backgrounds, values, and approaches, several overarching themes emerged. Among all of them is a need for a process vested in an extensive initial analysis phase that provides a framework for the purpose of the virtual environment in terms of intended experience and learning outcomes. Most participants in this study used a needs assessment, front end analysis, or initial research to clarify the intended audience and their learning and communication needs and habits, define the experience that the virtual environment will provide that intended audience, and ensure that the virtual environment is accessible and operable. Virtual environments developed without this step were short-lived.

This research suggests that those who use ISD are ardent advocates of the process, based on their previous successes in using it. It appears that ISD serves these developers to meet and manage both instructional and production goals. Others who do not use ISD use a remarkably similar process with an intensive Analysis phase in order to meet sales goals and to showcase their competence, and establish or foster their reputation in the industry.

Of the 20% who specifically avoid using ISD or any process appear to do so to avoid constraints in their quest for creating a novel approach and learning experience. This study suggests that others who specifically avoid using ISD, or any process for that matter, do so out of a lack of knowledge about the process, a lack of experience in designing instruction or software, or a lack of managerial and production experience, or a lack of the need to provide measurable learning outcomes.

In summation, barriers to using ISD are due to the following:

- A lack of knowledge about its value
- People using it or a similar process without knowing it
- A lack of time and resources to pay attention to phases as needed
- Promoting a creative idea taking priority over effective instruction
- A lack of need for measurable outcomes

The Application of ISD

Based on the cases in this study, 40% of those interviewed are developers specifically using ISD, 20% are

specifically avoiding it, citing deadlines and resource requirements, and the remaining 40% who most likely do not know about ISD are using a range of processes that are similar to those that define ISD. The results suggest that developers of VLEs with specific intended learning outcomes rely on a development process that if is not ISD, is very similar to it in terms of phases: analysis, design, development, implementation, and evaluation (Dick & Carey, 2001).

The developers in this study who do not use a process, specifically those who are creating immersive learning simulations for academia and one of the educational game designers, appear to focus more on the use of the VLE as a delivery method, or the novelty thereof, rather than the intended learning outcomes. As one game designer participant states, "games are sexy." These same developers are involved in projects that are not accountable to a "bottom line."

Learning Theory

This study suggests that the intended learning and learning experience for which VLEs are designed is supported by learning theories that fall under the realm of constructivism; however, in this study, constructivist approaches and learning goals are reflected more strongly in non-academic virtual environments. As a participant within the games and entertainment sector explains, "The virtual space must be cool, must excite the user's fantasies and imagination, and give him a place to want to be and to be doing things." Another game designer, who creates specifically educational games, provides a similar perspective, explaining, "The advantage of technology is that it's harmless to try things out, you don't break anything, you can explore, and a game allows you to simulate the things that you wouldn't do before." He explains that a learning game should provide "honest results and a lot of freedom to explore." The game designer's vision is supported by research. As educational game theorist Squire (2002) explains, in an educational game's learning space, "Resources become tools that players mobilize in their pursuit of goals." Claiming not to know anything about learning theory and describing himself as a "storyteller," one of the participants within the commercial sector, who scaffolds user-driven virtual spaces vibrating with user ownership, fully embraces constructivism by encouraging collaboration between users, and users and the content. The use of constructivist learning in virtual and related learning environments that are similarly collaborative in nature is supported by previous research (Duffy & Jonassen, 1992; Harasim, 1990; Lave & Wenger, 1991; Seaton, 1993; Dede, 1995). It would appear that as decision-makers and instructors become more comfortable with using technology-enabled virtual environments and more data reflects their utility, the pedagogical approach in more formal settings, such as academia, will become more flexible and adaptable to a more constructivist nature. At the same time, interviews from this research indicate the successful use of virtual environments for both objectivist and constructivist learning. In that most developers of virtual environments are using ISD or a related process, it would appear that their processes support the creation, as proven, of objectivist learning, but constructivist learning experiences as well.

Instructional Technology

Instructional Technology is the systematic application of strategies and techniques derived from learning theories to mediate learning. This includes the selection of a delivery system and other learning materials that are aligned with the learning theories to meet specific and intended learning outcomes (Winn, 1997). In this study, all but two of the seventeen developers interviewed applied instructional technology practices to the development of their VLEs. For the majority of those in this study, the delivery system drove the instructional or informational approach, supported by strategies suggested by learning theories, constructivism in particular.

For nine of the participants, including the corporate/government and academic LMS cases, the decision to use a VLE as a delivery system was made by a client or organization rather than those directly involved in creating learning. The tools used to support the VLE were determined on an organizational level or by programmers involved in the development and support of the VLE. As a participant within the government and corporate sector indicates, the tools used to create his organization's virtual environments are chosen by the programming team "based on their current skills and understanding of the need." This trend is supported by research, which indicates that the role of instructional technology as a component of instructional design may depend on a given organization's priorities and available resources (Wagner, 1990).

For commercial developers, the platform is determined by funding sources – specifically, the publishers and distributors of the game. Interestingly, a participant who works for a community college consortium explains that she considers any software her department implements as being part of a two-year plan, understanding that with functionality expanding and reorienting the role of the user in relationship to content, she can't be clear on what the next tool will be. She notes, "It's change management. It's the largest stalling block that people have. We have things constantly changing; it's a way of life in this [virtual] environment; and people aren't okay with this."

It is also worth noting that participants in the academic LMS case, all of whom use ISD, focus less on the delivery system and more on creating a learning or user experience to which the delivery method is transparent. Within this case, one participant cites "ensuring that content is relevant and presented in a way that looks easy and exciting" as a factor for the success of his learning environment. Comparative media studies for distance learning support this view, indicating that "learning seems to be affected more by what is delivered than by the delivery medium" (Schramm, 1977; Yang & Lui, 2004).

In summation, in terms of instructional technologies, participants in this study indicate that with or without the specific application of ISD or a related process, the determination of the delivery system and platform is often made to meet higher level organizational needs and expectations. This leaves the developers not only to mediate intended learning goals with the learning audience, but to mediate a delivery system to the audience and the intended learning. Seasoned participants in this study also note that platforms themselves that are used to support virtual environments are short-lived, due in part to changes in technology competency and what the market offers. This may explain why less attention is paid to identifying an optimal platform solution.

Instructional Design

Instructional Design involves the systematic process of applying instructional learning theory toward meeting specific learning goals. This includes developing specifications for learning activities to address specific learning outcomes, and customizing or designing media to mediate the learning (Smith & Ragan, 1990). The learning outcomes of an instructional design may be directly observable and measurable, or assumed (Ibid).

Siemens (2002, ¶ 1) believes that Instructional Design as a process for supporting the development of virtual learning spaces is adequate, but its role is misunderstood:

Unfortunately, the role of instructional design (ID) in e-learning is often misunderstood - due to the perceived complexity of the process and to poor understanding of the pedagogical requirements of e-learning. To a large degree, ID is the process whereby learning, not technology, is kept at the center of e-learning development.

This view is supported by a participant within the government and corporate sector, who expresses frustration that his organization focuses on the delivery method rather than the learning effectiveness of their VLEs. Others, such as Irlbeck et al (2006) maintain that the challenge for those involved in instructional development is to be able to recognize what will continue to be pertinent in terms of what we know about distance education (Ilrbeck, Kays, Jones, & Sims, 2006) and to identify opportunities for pedagogical and systems-based adaptation – or perhaps even complete reinvention. The two participants in this study who avoid instructional design or other design processes do so in an attempt to promote their ideas rather than mediating an articulated learning goal. However, the participant from the commercial sector, who creates virtual environments that people are drawn to participate in for extended periods of time, warns that the biggest design flaw the participant endeavors to avoid "would be that people start with the creative idea instead of the audience."

This study indicates that among those interviewed, 80% of developers of virtual environments use the ADDIE process or a process with similar phases, although they may not be specifically broken down and identified by task, role, or purpose. This research also suggests that those who use ISD are fervent advocates or "ADDIE freak[s]," as one participant from the government and corporate sector put it, of the process, based on previous success. It appears that ISD serves these developers to meet and manage both instructional and production goals.

Of the 20% of those interviewed who specifically avoid using ISD or any process appear to do so to avoid constraints in their quest for creating a novel approach and learning experience. These same participants were not able to produce measurable results of learning outcomes. This study suggests that others who specifically avoid using ISD or any process for that matter do so out of a lack of knowledge about the process, or a lack of experience in designing instruction or software, or a lack of managerial and production experience, or have more interest in creative expression and exploration than in creating effective learning. Some within this group focus instead on production target dates and budgets, and creating a visible product that mediates content rather than meeting specific learning goals. The remaining of those in this study who do not use ISD *do* use a process that is similar in order to meet sales goals and to showcase their competence, and establish or foster their reputation in the industry. While participants from the commercial and entertainment sectors – game designers in particular – would bristle at the suggestion of using the ISD process, they are using a model with similar phases to generate similar outcomes. Based on this misunderstanding of the ISD process and reasons others avoid it, perhaps prior to analysis, developers need to pursue a "buy-in" of ISD or a related process with stakeholders before embarking on an initial phase of Analysis.

Research in this study suggests that developers who create successful virtual environments, "successful" defined as the extent to which it is usable and accessible by the intended users, did use a process that was intensive in the initial Analysis phase. In addition, several developers cited the need for educating users on virtual environments and in some cases, the processes necessary for creating them, all prior to an Analysis phase. Processes also included in the Implementation or similar phases indicate the need for setting user expectations and cultivating user buy-in. This was especially noted in the government/corporate, and academic sectors, while entertainment and commercial sectors simply need users to "buy." The processes participants in this study follow, if not specifically ISD, are similar, and appear to have adapted elements found in processes involved in software development. In that a virtual environment does involve software development as well, this blending of processes is not surprising. In the future, processes may change further to address the more organic nature of virtual environments, which these sectors, with the exception of the more commercial ones, are not yet prepared to take the risk to address. Participants who took a more artistic approach to creating virtual environments also began with an idea,

although one commercial participant, who appears especially talented at creating successful, innovative virtual environments, warns that one should never start with an idea, but rather let it emerge from interaction with the intended users. This would be especially difficult territory to consider for those involved in performance-based instruction, which requires measurable learning outcomes.

While almost all of the participants in this study who use a process are heavily invested in what one participant describes as a "solid analysis," the outcomes of the Analysis phase are rarely used to determine an appropriate delivery system, as indicated by discussion on instructional Technologies. As was discussed earlier, most projects start with a delivery system that is often already identified on an organizational level, or by technical professionals, or a funding source. Hence, the analysis is irrelevant for most developers in identifying the appropriate delivery system – but it is useful for determining the skills intended users need to operate the delivery system indicated. In effect, instead of helping to identify a delivery system, the Analysis needs to help clarify how to mediate between the user, the learning, and their access to the delivery system.

In addition, the Analysis phase may be more relevant to the development of virtual environments if a prior process is built in for "selling" the advantages of using ISD or a related process to decision-making stakeholders and funders, as well as in some cases, the advantages of using a virtual environment as a delivery system. Additional "selling" seems to be required in the Development and Implementation phases, in which participants indicated the need for setting user expectations in participating in a virtual environment. Essentially, this is a process of what a participant within the academic sector describes as "change management," during which she needs to help participants adapt to participating pedagogically and technically in a virtual environment.

Finally, Evaluation for the participants in the study focused on usability but not on the learning. By the same token, participants within the commercial sector explain that corporations and businesses who hire out to develop virtual environments do not expect a return on investment, which is typically used to measure the success of a program. It would seem that at this point, we are not clear on what to evaluate summatively in a virtual environment. Most likely and as indicated by this research, summative evaluation of a virtual environment will involve a combination of performance, response to user interaction, and learning outcomes.

The table that follows outlines the activities by phase that participants in this study added to the ISD or a similar process.

Table 2. Summation of Phase Modifications

Analysis	Design	Development	Implementation	Evaluation
• An idea • Pre-sales • Technical Audit • Audience Acceptability Audit	• Design document on the space and user preparation • Client sign-off • A technical framework • A narrative framework • A metaphor Learning Elements • Interactivity • HCI • Audio • Transactional Distance • Community	• Creating content • Creating preparation / help materials for the user • A prototype or proof-of-concept • Usability testing • Feedback	• Setting user expectations • User training • Buy-in • Usability testing • Feedback • Content modification as needed • Community building • Marketing	• Formative • Summative • Exams outside of the environment • Sales • Change in perception or attitude • Participation and contribution • Sense of user ownership

Limitations

The results of this study are limited by a number of factors that affect the generalizability of its findings. These factors include a limited data set, the time and place of the study, and interpretive validity.

Limited Data Set

This research focused on four sectors that are using virtual environments. One sector, academia, was broken into two sub-groups, and was also represented into the sector for games and entertainment. For a more comprehensive study, academic sectors in particular could be broken down further into learning domains, such as medical education, engineering, and humanities, each of which may involve different processes and priorities in the development of related learning environments.

In addition, this study involves seventeen participants. These participants represent a population to which the researcher has access. All participants live in North America and represent a western cultural orientation. Virtual environments developed in other countries may include other processes and priorities not examined in this study. A larger sample would be necessary to support and confirm the findings of this study and suggest generalizability.

The Time and Place of the Study

This research is limited by when it was conducted. New technology-based tools are released to the public every day, and by the next day, innovators come up with new ways to apply and adapt the technology for learning and other uses. This study represents a moment among days in terms of the technology people are using and how they are adapting it for learning and VLEs. As a result, the value of this research depreciates as quickly as a new car drives off the sales lot.

Implications

Every five years or so, educational games explode into the learning landscape as an exciting arena for personal creativity, exploration, and application. As a participant who is an educational game designer in this study points out, "Learning games are sexy." Eventually, in the wake of hemorrhaging budgets, unmet expectations, and a lack of a viable market, interest in educational games recedes, carrying with it a gaggle of recent game design enthusiasts, licking their wounds and waiting until time erases the sting of poor judgment and the value of lessons learned. In time, the hype moves forth again, reconceptualized as MMPORGS, online persistent worlds, or device-driven role-playing games. Educational game designer Marc Prensky (Wagner, 2005) regularly maintains that instructional design "sucks the fun" out of educational game design. However, perhaps it is the educational game designers who, armed with an idea and visions of the masses celebrating their creative vision, destroy the viability of learning games by rejecting process, and ultimately purpose, in their approach. As media and game critic Mia Consalvo (2007) pointed out in a conversation with the researcher:

> People in game design have been worried that early educational games were about content veiled in a basic framework to convey it… so [the learning experience] was more like chocolate-covered broccoli. It's still about learning first. Now there's a bit more of an understanding that game based learning needs to be about the processes you are trying to convey, and less about transferring content.

Game design and VLEs have much in common in terms of novelty of approach and the experience of the user, which as Consalvo indicates, is defined by an experience of "process" rather than "about transferring content." As virtual environments, be they game-based, commercial-based, or instructional in role or approach, very quickly integrate into our communication landscape, it appears that instead of repeating the cyclical mistakes of instructional game design, we are in need of a reassessment of our processes. This study endeavored to explore what systematic and procedural factors are addressed in the creation of VLEs, comparing theory to professional practice.

A VLE requires not only a considerable investment in technical, financial, and human resources, but as this research indicates, buy-in by those for whom it is intended, as well as the stakeholders in its success. A better understanding of the processes that facilitate or hinder the creation of a VLE may lead to better choices, better planning, and more appropriate expectations that serve learners, educators, and their common organization or institution. This same understanding may lead to a more effective planning and allocation of the resources needed for the development of a VLE, and support its success in meeting intended learning needs.

What follows are some implications this study suggests:

1. Possible Modifications and Enhancements to a Process

This research suggests the consideration of a modification of ISD and similar processes to include, as many participants in this study have done already, a parallel design and implementation phase to address preparing intended users. This preparation includes learning the technical and communication skills needed to participate in a virtual environment, and "buy-in," or setting user expectations. One developer describes this process as "change management," adding, "I don't want them [users] to learn a software application. I want them to learn how to learn and use what you know to move to the next thing because of the changing."

2. A Need for a Plan

Based on interviews with those in the commercial sec-

tor in this study, the creation of a virtual environment may need to include a process or task within the Design phase that addresses making a plan that sets the lifespan or time parameters for the virtual space. This includes establishing a known beginning and end or closure point, and constructs for establishing these points.

In terms of timeframes for the lifespan of a virtual environment, a participant from the commercial sector explains that he likes to "build a story that lasts no more than three months in order not to go stale with the intended audience." By comparison, a participant from the academic sector draws from her experience in developing VLEs to estimate the lifespan of a virtual environment, explaining:

We consider software our department uses as being part of a two-year plan, understanding that with functionality expanding and reorienting the role of the user in relationship to content, we can't be clear on what the next tool will be.

Another participant who is a game designer describes a similar timeframe for his target platform, explaining, "The minimum spec that we get from the publisher is the top end of what the market is now, and it will be at the bottom three years from now."

3. A Summative Evaluation Strategy that Satisfies Stakeholders

As was discussed earlier, participants in this study who are conducting summative evaluation of the learning outcomes from their virtual environments are relying on sales, "traffic," notoriety, and in only one situation, a Kirkpatrick Level 4 Evaluation, which the participant finds unreliable because of confounding factors. It would seem that we are in need of a construct to clarify what constitutes a successful outcome of a VLE.

4. Watch the Commercial Sector

In this study, a participant from the commercial sector seems to have an instinct for the engagement preferences of intended users in a virtual environment. He responds to this instinct, although he will not call it that, with the creative courage or audacity to provide only a framework for his virtual environments. With a calculated strategy outlined, he beckons intended users with the promise of resources and the opportunity to create a virtual space for which they ultimately have a sense of ownership and control. The participant explains that the biggest design flaw he endeavors to avoid with his mutinous design strategy is to "start with the creative idea instead of the audience."

While the ISD process involves the creation of instruction that is based on the design and direction of content and learning experts, this participant suggests a design based on deliberate scaffolding towards an experience that is neither measurable nor replicable. An adaptation of this dynamic into the Design and Implementation phases of the ISD processes might include an outline of a strategy for incorporating and managing user-generated content – or in the Implementation phase, a sub-process for managing content creation in response to user interactivity.

Suggestions for Further Study

Suggestions for further study include replicating the research with data collection using a geographically distributed set of researchers for a broader view. This would address some of the limitations of the research identified in the previous section on limitations of the study, and mediate the external and internal threats to validity that characterize this research. Furthermore, studies of virtual environments in different cultures may reveal additional needs and considerations to incorporate into the creation of VLEs for more global applications. In addition, studies that examine and compare processes in the development of VLEs within and across content areas may better inform our knowledge base.

Adequacy of Process

On a very basic level, this study suggests that to truly assert the value of a process in the creation of a VLE, further study should compare the learning outcomes of VLEs designed with and without a plan. This same study would possibly clarify what types of learning are best supported by using a process, be it performance or objective-based learning, or within the domains of knowledge, skills, or attitudes. This study may then provide insight into identifying the earlier-discussed constructs that would help shape the terms of the summative evaluation of a virtual environment.

Additional suggestions for further research would include studies that measure and compare learning outcomes between learning environments for the same learning goal and audience, using virtual environments developed using either the current ISD process or the ISD process with the earlier suggested modifications. Similarly, in addition to examining the value of process modifications, this or a similar study could examine not only learning outcomes, but compare the types of learning that occur when the user is more in control of the character of the learning environment – and the marginal utility of the user's experience in the environment as it relates to user preparation; the extent to which users are allocated control over the content creation; and the lifespan of the learning environment.

Addressing the User Experience

In that user-generated content seems to be a growing trend, as evidenced not only by two of the case studies in this research, but the phenomenon of podcasts, video mashing, and digital content modding, this study suggests further research into two aspects of this phenomenon and its role in virtual learning. One question this study elicits pertains to the factors that support and compel the phenomenon of user-generated content. Kollock (1999) outlines three motivational factors in community of practice

participation, which warrant confirmation within this context:

- Anticipated reciprocity, the expectation that one's contribution to the group will lead to useful help and information in return
- Increased recognition for contributions
- Sense of efficacy, that one will have an effect on the environment and support his own self-image as an efficacious person

A study into the intrinsic and extrinsic motivational factors surrounding user-generated digital content would inform learning incentive and engagement factors to address and integrate into the design of a virtual environment. Similarly, this study suggests exploring the learning value of user generated content. Further study would be useful into the relationship between the extent to which a user generates content within a VLE, and measurable learning outcomes.

Summary

This study provides a snapshot of insight into the processes and design considerations creators of virtual environments address to meet their intended learning goals. This study compared the processes followed by creators from a range of backgrounds, and examined the role of learning elements and approaches identified in the literature for distance learning in supporting the learning success within a VLE. This study indicates that all but one of the seventeen participants uses ISD or a similar process, and focus intensively on phases that pertain to audience analysis and usability testing.

This study also suggests that our understanding of student-to-content interaction in computer-mediated instruction may evolve in the coming years into a more personalized, expressive dynamic, as evidenced by the VLEs created for advertising and commercial purposes. This new dynamic is supported by widespread evidence on the internet of users creating digital content on their own, motivated by creating a connection with other users and the culture surrounding the context of the content, and possibly additionally motivated by a need for a sense of ownership of and contribution to the fabric of the virtual environment.

In terms of enhancements, adaptation, or modification of the ISD process, this study suggests that for the creation of VLEs, ISD phases may need to integrate, within design, development, and implementation phases, considerations similar to those in processes for software production, as well as strategies for preparing intended users to participate in the virtual environment. Additional considerations within ISD phases might include establishing an effective, recognizable timeline for the lifespan of the environment, and strategies for scaffolding user-generated content for learning purposes. Finally, this research suggests that for virtual environments designed for specific learning, summative evaluation needs to be reconceptualized to adapt to the elements unique to the virtual learning experience.

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