Preparing Instructional Designers for Game-Based Learning: Part 2

By Atsusi Hirumi, Bob Appelman, Lloyd Rieber, Richard Van Eck

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Abstract

As noted in part I of this article (published in *TechTrends 54*(3)), advances in technology continue to outpace research on the design and effectiveness of instructional (digital video) games. In general, instructional designers know little about game development, commercial video game developers know little about training, education and instructional design, and relatively little is understood about how to apply what we know about teaching and learning to optimize game-based learning. In Part I, a panel of recognized and emerging experts in the design of instructional (digital video) games set the context for this three part series and one of four panelists discussed what he believes instructional designers should know about instructional game design (Hirumi, Appleman, Rieber, Van Eck, 2010). In Part II, two faculty members who teach courses on instructional game design presents their perspectives on preparing instructional designers for game-based learning. Part III will present a fourth perspective along with conclusion that compares the four views.

***Keywords*:** Game-Based Learning; Educational Games; Instructional Design, Instructional Game Design

We must DIE so that ID can Survive

By Robert L. Appelman

The arrangement of acronyms in the title is meant to stress the need for change and transition emphasizing The Design of Instructional Environments (DIE) that has always been a part of ID, but never a primary focus. I make the case that a focus on Designing Instructional Environments will give much needed energy and revitalization to Instructional Design.

If there were no change, then many design decisions within new media environments, such as games, simulations, augmented realities, will not be made by instructional designers, but by those most embedded within the development process. That is what is happening currently in game and simulation design where an instructional designer is nowhere to be found in the development pipeline (Bethke, 2003; Kirkley, Kirkley, Myers, Lindsey, & Singer, 2003; Rollings, 2000). This is even more amazing in a world where "Educational Games" have been on the market for a couple of decades, and when the military and medical industries are investing millions in these new media environments for training. What is particularly disturbing is that drill and practice continues to be used as

the highest level of instructional method within many of these environments which are capable of much more (Appelman, 2005b; Fromme, 2003; Gee, 2003; Salen & Zimmerman, 2004).

The forecast is even darker when the curricula of Instructional Technology is analyzed, where one finds that there is little to no inclusion of design strategies in these new media environments. For instance, there are no formal design conventions established for navigating through simulations and games as there are for web navigation. Each game a player encounters has similarities for sure, but designers of these games and simulations seem to correlate the discovery of information and access to success as subtracting from the fun of the experience. For learning environments this can be counter-productive to learning. As a field, we are not generating the personnel needed to weigh these design decisions for new wave instructional environments that are being produced today.

Why are we as a field so resistant to this need for change? To answer this, we need to step back and review the epistemological bases upon which we have focused through the years.

The process may feel as if we are moving backwards instead of progressing forward, but I would interject that we are really looking over our shoulder as we make this leap to a new level. In 1928, John Dewey cried out that the industrial age was influencing education in such a negative way that he formulated an approach to education called experiential learning (Dewey, 1938). The mechanistic society supported the efficient assembly-line style of education in our K-12 contexts and corporate training such that it became the norm even for today. The industrial model stressed standardization and placed expectations on every student to perform at the same level at the same time. Experiential education, on the other hand, was individually defined by the experiences that each child had, and acknowledged that students learned different things at different rates as they experienced their world (Reigeluth, 1999).

In the 50's and 60's instructional designers were involved with the use of motion pictures that taught and trained individuals. It was a medium that could extend a person's experience into all parts of the world and bring almost any process, culture, or lifestyle into the classroom. Other than actual field trips, the film medium offered the opportunity to bring virtual experiences into the classroom, thus giving instructors an opportunity to begin dialog with students on what they understood about what they just experienced. The cognitive and affective learning objectives being theorized as optimal goals were well defined (Anderson & Ausubel, 1966; Brunner, Olver, & Greenfield, 1967; Dale, 1946; Gerbner, 1956; Piaget, 1950), but the instructional principles for facilitating learning and prescribing specific forms of these films were not clear. To more readily define these forms, communication models were accessed and combined with taxonomies of form to create an approach called Message Design (Dale, 1946; Fleming & Levie, 1993; Gerbner, 1956). The use of Message Design then became a necessary component to successfully integrate prescribed learning objectives emerging from theory.

New Learning Environments

As we transition through the information age, where the source, quantity, quality, and authenticity of information challenge the scope and functionality for instruction, instructional designers must meet this challenge by entering into technologies that have the capacity to deliver information and experiences at the pace that our digital natives are accustomed. The tendency during this transition is to forget the past lessons and try to re-create the wheel, but I see the lessons learned, with theory driving instructional strategies and message design driving formative decisions for implementation, as still viable. Also, with the epistemology of a constructivist paradigm driving problem-based experiential learning, we are finally bringing much of what Dewey and Bruner were envisioning into the instructional mix. The taxonomies of Message Design, however, need focus and a redefinition of terms. When Fleming and Levie defined their taxonomy there were text, images, animation, pacing, and continuity of printed and linear media. Today's media onslaught finds us faced with sound, text, and image bytes that are often disconnected, hyper-linked, and often assembled into confusing forms. Expediency of creation based on style conventions increase the growing mass of "neutral information" that lacks innovation or originality. In this type of environment, interest is often fostered through the use of glitz, hype, or special effects instead of crafted messages presented in congruency with visual form and the desired learning goals.

Instructional Designers now face a myriad of options for presenting, accessing and making instruction available to individual learners. The experience each environment provides will be different with subsequent differences in learning potential for each student. We may never leave the option of traditional classroom-based instructional environment, but its role in the repertory of options, compared to distance or on-line education as well as many new forms of simulated virtual environments, must now be

weighed to determine the most effective instructional environment to achieve specified learning goals. Figure 1 defines the boundaries of these new learning environments in terms of the degree of virtuality as plotted against the degree of sensory immersion of the student.

The new Experiential Modes, shown in the diagram above, highlight the fact that older traditional teaching spends the majority of its time in the lower left portion of the figure during lecture and image display (considering that an image is the lowest level of virtuality). Some instructors engage in role-play and simulation in a face-to-face mode that can take the level of the "Real" category to the top of the engagement chart. Now there are virtual environments possible where avatars can play just as effective a role as live actors (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Sellers, 2002). For procedural learning there are virtual simulations, such as those placed on-line by the Howard Hughes Institute of online Virtual Labs (Hughes, 2007), where students can learn lab procedures entirely at the blended level of virtuality. The functionality, and resulting immersion for learning have yet to appear at the levels found in current video games, and we can only dream of an environment as potentially rich as the *Star Trek* Holodeck found aboard the fictional Enterprise (identified in the upper right portion of the Experiential Modes diagram).

With such a landscape available for today's Instructional Designer, it is a wonder why our field has not expanded to include the full breadth of Experiential Modes (Appelman, 2005a). This could be for many reasons. Perhaps it is because Message Design options are too broad. Some designers might even have problems recognizing what these modes are, let alone describing the variables necessary to choose which would provide the best learning experience for the learner. This would not be surprising given the level of micro analysis necessary to unpack the complex interactions between the learner and the virtual environment during an experiential learning session (Appelman, 2005a). Whatever the reason for this lack of development, the demand is there for the ID Field to train designers to make critical decisions about Experiential Modes, so we had better address them in our curricula, or be left behind in the stampede for their use in instruction. We now recognize that learning is not limited to the classroom and as such instructional designers must recognize learning opportunities wherever and whenever they may occur. These "opportunities" may still be in classroom contexts, but as is pointed out in Figure 1, they now may extend on-line and within very complex virtual spaces that produce a wide variety of modality within learning environments.

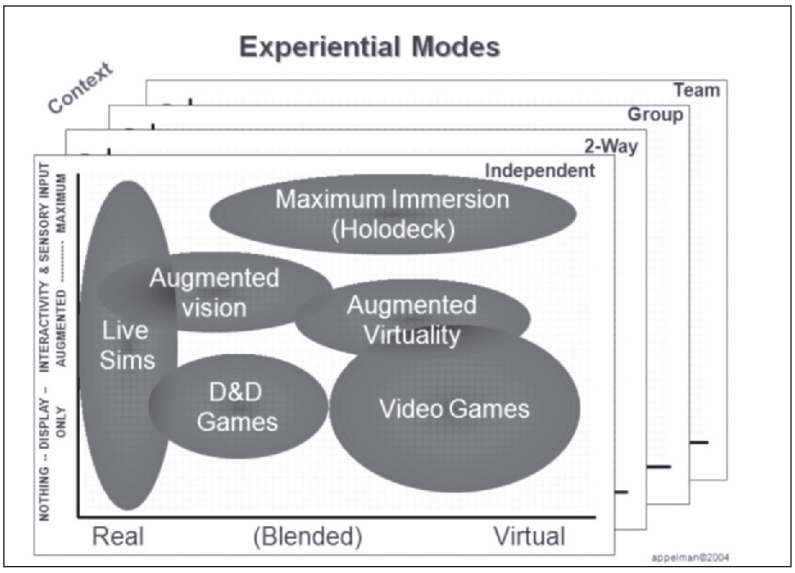

Figure 1. Range of Experiential Modes in Learning Environments

The massive information flow has created expectations among students and instructors that Instructional Designers must work hard to meet. For instance, the rising acceptance of a constructivist, problem-based, learner-centered epistemology places demand not only on information access, but also on information manipulation and understanding in a highly dynamic and interactive collaborative environment. Traditional classrooms do not have the capacity to handle such range of experiential modes, so instructional designers are now looking at the internet to create on-site field trips, or build virtual field trips in interactive video game and sophisticated simulated environments. This means instructional designers must be capable of designing for these rich immersive environments as part of their repertory. These instructional environments are not included in the common inventory of competencies for instructional designers; however, they may well determine whether or not ID will transition to Designing Instructional Experiences as a principal focus. We must be able to compare and contrast eLearning with traditional classroom teaching, compare home schooling with New Technology High Schools, and to compare the learning differences through the use of immersive game technologies (Appelman, 2006; Hannafin & Hill, 2005; Jonassen, 1999).

How to DIE

For all points along the continuum of the ID Field, there need to be opportunities for faculty and students to experience as many new environments as possible. This simple statement is in no way easy to accommodate. Some of the newer technologies require special head

displays that the user must wear, while others require complex projection technologies. Pervasive approaches require classes to move out into the world so learners can interact with real people, animals, and objects using special sensing devices that are later brought back for analysis and reflection. A short list of these new learning environments might be (in order of complexity):

1. Traditional Classroom Teaching
2. Role Play
3. On-line Instruction
4. Single and Multi-Player Games
5. Live and Virtual Simulations
6. Augmented or Mixed Reality
7. Augmented Virtuality

Each new environment has strengths and weaknesses for carrying messages and meaning to the learner. These "potentials" need to be known for selection and integration into our instructional strategies. On-line asynchronous environments, such as forums, blogs, and wikis offer the opportunity for in-depth analysis, collaboration, and reflection (Bonk, Appelman, & Hay, 1996; Barab, et. al., 2005; Sue & Anne, 2004) while game environments allow for the practice and manipulation of variables in a fail-safe environment (Appelman, 2005b; Mitchell, 1993; Shreve, 2005).

The need to design a wide variety of learning environments, such as those listed above, requires literacy in domains beyond the common language and visual literacies. Some of these new literacies are:

1. Audio (voice, music, effects, podcasting)
2. Video (interpretive, dramatic, informational, podcasting)
3. Interaction & Navigation
4. Drama and Presentation
5. Storytelling
6. 3-Dimensional
7. HCI
8. Programming
9. Pattern Analysis
10. Visual Content Analysis

These literacies will impact the perception of the cognitive processing, psychomotor functionality, and affective reaction to our instruction in significant ways. Being able to control and manipulate the new literacies to achieve the necessary intricate balances between them is the new challenge for instructional design. Additional requirements to immerse students in experiential processes draw upon new criteria defined as flow and engagement (Csikszentmihalyi, 1990). The capability of instructional designers to control content flow and density in complex game interactions and simulations will become key foci in the future, but is now a new arena of design for most. Balance is clearly the question when it comes to instructional games being fun or learning. Prensky has already thrown down the gauntlet by claiming that instructional designers will "kill the fun" for the learner or player, and this attitude may be the reason why one finds so few skillful instructional designers in the development pipeline of these virtual environments (Prensky, 2001c). Unfortunately there are already too many instances that support his challenge, and it underscores the need for instructional designers to become skilled at not only achieving an effective balance between fun and learning, but also at coupling our learning challenges with the desired play strategy the player uses to overcome them.

Combined with the skills of creating a balance of fun and content engagement is the redefinition of responsibilities of the learner to engage for the right reasons. Just as teachers expect appropriate focus and motivation for learning in a traditional classroom environment, we now have the task of informing our learners that even though the environment might look like a game designed just for fun, there are serious outcomes expected through game play, and serious content embedded within the environment they need to interact with. The use of serious games and simulations should not be conceived to be played at recess, but should instead be attended to for the specific attainment of understanding or skill acquisition, as well as heuristic and strategic problem-solving. Thus serious games and simulations impose a requirement on the context for there to be serious learners involved as well. The new arena of Serious Games for learning, which was first stated by Abt (1970), is now a reality and new goal in both real and virtual environments.

To be inclusive of all forms of learning environments and to understand what is involved in designing successful environments, we must

expand who we work with on our developmental teams and reengineer our development process. We must embrace iterative and/or spiral design models that include advocates from all aspects of the entire process. This includes not only the subject-matter experts, but also the craft persons from disciplines such as art and engineering (Gibbons, 2000). We must become managers of the process by knowing the advocacies involved and gathering their evaluations and input into each phase of the development process. This is contrary to the view of instructional designers developing instructional prescriptions that are then passed on to developers, craft persons and teachers for implementation. Instead the ID person must be an advocate for appropriate learning experiences throughout the entire process and work with those advocates involving different areas of development, such as the functionality, the delivery, and the affective components of the form itself. This places the instructional designer at the point of content selection and chunking, and also at the point of learner interaction, which in the game field is called level design.

Usability testing is already a norm we incorporate into evaluation. As we move into more complex iterations, new methods of testing will necessarily be developed. If we are to be professionals in these new arenas, we must also be able to predict the learning that will be generated by students immersed in them. Adequate testing for learning in these new media environments is not yet defined, and it will be our role to create them. In other words, we must establish appropriate game testing protocols that feed back into the iterative process to inform advocacies of the success of their design to achieve desired levels of learning and engagement.

The Road to Salvation

The demand for what is described above is here now, and if the current instructional designer is slow or resistant to picking up the new skills and approaches, they will most certainly be passed by for those who are up to the challenge. However, if a shift in focus of the Instructional Designer moves to embrace the design challenges of the new immersive instructional environments, then a rebirth of energy and enthusiasm among both students and faculty will assure that ID will not only survive, but be stronger than ever.

Game Design as a Creative Act

By Lloyd P. Rieber

There are three approaches to design: artistic, empirical, and analytical. The artistic approach likens design to a person creating a work of art. The person goes into a room and emerges hours or days later with a finished design. We do not know how they do it, but we are grateful they can. The process is mysterious and magical. The empirical approach uses trial and error by a well-meaning but untrained or inexperienced person. Based on intuition and common sense, the person quickly tries something out to see if it works. Changes are made and the person tries it out again, slowly getting closer to a successful design. The analytical approach follows a predetermined, algorithmic process. The design is a direct output of following this process. Obviously, each approach has many weaknesses when employed separately. Finding the right balance between them is the key to becoming a great designer.

Game design and instructional design are similar in that both result from a process that mixes the artistic, empirical, and analytic. The history of instructional design clearly favors the analytic approach where the empirical approach is subsumed within this process (i.e. formative evaluation). The artistic side of instructional design is usually acknowledged, but frowned upon, by instructional design scholars. Some scholars have sought to reduce or even eliminate the artistic component to achieve a science of instruction. In contrast, I have long embraced the artistic component of instructional design even though I recognize that to prepare people to become instructional designers, it is necessary for them to learn analytic methods. However, I do not believe that instructional design can ever be reduced to a set of scientific principles and procedures that will result in exemplary instruction by merely following the process. Instructional design will always be a form of a situated activity with decisions largely based on the specifics and dynamics of the design topic and the context within which it will be used (Streibel, 1991). The creative act has not been studied much or well within the instructional design community, though this is changing (Clinton, 2007). I believe that the role and value of the creative act within instructional design will grow in support among scholars in the field, thus tipping the balance back from the dominance of the analytic approach.

Although controversial among creativity researchers, there is broad agreement that everyone has the potential to be creative and that there are ways to help a person to be more creative in their professional work (Nickerson, 1999). Gardner (1993) makes the distinction between "Big C" and "little c" creativity – evidence of the former being in the works of Picasso, Mozart, and Einstein and evidence of the latter being those times when "just plain folks" go beyond the everyday or routine. Some people do seem predisposed to thinking creatively when they approach a task, but few theorists would dare suggest this is a trait that only a rare few possess (see Sternberg, 1999, for a review). Instead, it is better to view this as a temporary, contextual state, one that can be enhanced and nurtured. One of the simplest approaches is to give people opportunities and places to be creative.

"I view educational game design as largely a creative act that cannot be broken down into analytic steps. I believe the artistic approach to design prevails here."

The design of a game – educational or not – is one of the most sophisticated design problems one can attempt. The history of the young video game industry demonstrates this – the number of poorly designed games over the past 20 years has been staggering. Indeed, one of Gee's (2003) main points has been that the Darwinian nature of the video game industry has weeded out poor games. The best games, though relatively few, have succeeded in the marketplace and they have been mimicked by other designers.

A good game invokes the play phenomenon, that is, the feeling of being "at play." This is not the same as just playing a game. Play is an example of an optimal life experience where time seems to disappear and attention gives a person a temporary "escape" from their everyday world (Csikszentmihalyi, 1996). Play is also an essential characteristic of human development throughout one's life (Elkind, 2006; Sutton-Smith, 1997). A person who enjoys a game will play it repeatedly and even will go to great lengths to return to play it often. In contrast, a person who thinks a particular game is poor will not play it even a second time.

There are common elements to games, but it is very difficult to reduce these to specific design principles. Designing a good game is similar to writing a good story. While it might be useful and important to know and understand the parts of a story, writing a good story involves much more than filling in each element. If it were otherwise, we all would be budding Dickinsons, Hemingways, and Steinbecks. I believe the relationship between game design and story writing is more than metaphorical. The best games seem to have a good narrative. A good heuristic for starting the game design process is to write a short story that will situate the game's players and provide the objective of the game.

Designing an educational game requires even more skill and creativity than other forms of game design because the outcome of the game is more than diversion or enjoyment – the outcome includes learning. While some might argue that the path to becoming an able educational game designer is analytical – focusing on the parts or rules that frame a game – I believe that the huge majority of the attention should be focused on the artistic or creative side of the design task.

It would be interesting to compare how different professionals are trained, especially those at traditionally different places on the creativity continuum, such as artists, architects, engineers, game developers, and (somewhere in the list) instructional designers. Although I have not conducted a formal review, I did have the experience recently of taking a creative writing course by a very well known writer in the Athens area who had taught this particular course for years. Successful local professional writers had praised the course and many pointed to this course as contributing to their first successes in publishing. My expectation was that I was going to be "taught" explicitly how to be able to write nonfiction well. I expected principles of the craft to be given to me and that I would practice them well until I had mastered them. I expected to take notes, study them, and try to apply them in my writing assignments. Instead, the instructional approach was wholly based on critique. Each week, volunteers read up to ten minutes of something they were working on, followed by a group discussion in which the reading was critiqued. There were no explicit "anythings" on which I could latch onto. Instead, it was a slow accretion of general ideas, feelings, and situated examples. I wanted a shortcut to the essential principles I was sure all writers but I knew, but the lesson I was given was that to be a good writer, one has to write, write, and write combined with (sometimes brutal) critiques of the current draft. I am sure there are many other approaches to creative writing, but the more sophisticated the skill, the less likely there is a "best way" to teach it.

At the University of Georgia, we couch the topic of game design within the broader context of interactivity and engagement. One of the strategies we use to both inform and inspire

our student designers is participation in design seminars we call "interactive museums." The idea is similar to an artist who visits the Museum of Modern Art in New York or the Louvre in Paris and studies the great works. So too do we explore and study exemplary educational software – the word "interactive" refers to the fact that the best educational software is interactive and much of the interactive museum session is focused on how the designers engage students in their software. Interestingly, this is largely the approach Gee (2003) used in forming his opinion that the very best applications of what we know about learning and cognition can be found by examining the very best commercial video games. However, this is not the same as reverse engineering a successful game down to its component parts and their various interrelationships. Indeed, it is very difficult to translate the 36 learning principles he identified and described into design principles or a design methodology. But, we can learn a great deal about games and their relationship to learning in this way. We also require students to do desktop critiques of other students' work. Here again, interactivity is a major focus of the critique. We also require students to keep design journals to record their design struggles and their attempts to overcome them. We have also begun a non-competitive student award for creative interactions in our design studio curriculum (http://it.coe.uga.edu/studio/). The goal of this award is to raise student awareness of interaction beyond traditional strategies, such as end-of-lesson quizzes. Although the concept of creative interaction goes beyond games, good games have been some of our first winners.

I believe that macro-instructional design methods, such as needs assessment, work well in identifying the educational content to be embedded in the game. However, I do not believe that game design can or should be informed by existing micro-instructional design methods (i.e. models that are meant to guide the design of lessons). For example, I find that Gagne's events of instruction are of little use to an educational game designer. I do not say this to belittle the events of instruction in any way. I have long admired their simplicity, and brevity, for providing remarkable guidance in the design of instruction. Of course, Gagne's own evolution from behaviorist to cognitivist (or perhaps neo-behaviorist) speaks to the need for all great ideas and approaches to continue to grow and evolve. The events of instruction work remarkably well for didactic instruction, and are a useful reminder for more inductive approaches to learning, but their usefulness in explicitly designing a game leading to purposeful learning is questionable. Of course, the events themselves were Gagne's way of describing how the learning environment should be shaped to meet the conditions of learning of the individual and group for the given learning outcomes (Gagne, 1985). So, reexamining the conditions of learning in light of our current understanding of learning and cognition does seem to be good advice to any would-be educational game designer. Of course, games (at least small-scale ones) may be designed to fulfill one or more of the events of instruction, but my main point is simply that the elements of a good lesson do not translate well into the elements of a good educational game. I, like Noah (2002), do not believe there is any meaningful intersection between instructional design and educational game design at the level of game play. I view educational game design as largely a creative act that cannot be broken down into analytic steps. I believe the artistic approach to design prevails here.

"I advocate for an approach that is largely artistic but with empirical elements: design a game, play the game, and revise the game until one reaches an optimal blend of fun and learning."

It also must be recognized that designing a good computer game requires much programming skill. Indeed, a computer game is among the most sophisticated and demanding of programming tasks. However, it is important to remember the world of game design extends far beyond computers. I tell my students that the history of games goes back at least almost 3000 years, if one uses the history of the Olympics as a convenient starting place. I encourage students who are interested in game design and who do not have the programming skill to build one to consider designing a less sophisticated game using a model we have established called "Homemade PowerPoint Games" (Rieber, Barbour, Thomas, & Rauscher, 2008). In this approach, PowerPoint is used as a game development tool. The approach combines both advanced storyboarding and game play within a PowerPoint file. For example, the game itself can be played on a game board that is a print-out of one or more PowerPoint slides. However, PowerPoint can also be used in the play of other parts of the game, such as creating a set of question slides (For examples of Homemade PowerPoint games, go to the following Web site: http://it.coe.uga.edu/wwild/pptgames/). Even if a student designer has good

programming skills, designing a homemade PowerPoint game can be a useful step in understanding the structure of a game and the tenuous nature of good game play. It also allows for easy modification of the game rules and play space. After all, the only way to tell if a game is any good is to play it.

In conclusion, in my teaching at the University of Georgia, I encourage and advocate for the design of educational games. Much of my own instructional design work over the past 30 years has been in gaming or has game elements to it (For an example of my own design work, visit my design journal for "Nowhere Road – The Game": http://www.nowhereroad.com/nwr-thegame/nwr-tg.html). I believe that students are best served by providing nurturing opportunities to build educational games in a context of continual critique and reflection. Much can be learned about game design from the play of existing, high quality, games and so we use "interactive museums" for this purpose. I advocate for an approach that is largely artistic but with empirical elements: design a game, play the game, and revise the game until one reaches an optimal blend of fun and learning. I downplay analytic elements as my students explore game design. Analytic elements do exist, but analytic elements that generalize to multiple game contexts are rare, in my opinion. Again, like story writing, some analytic elements are important, but knowing them rarely leads to good stories or good games. At best, I believe there are only general heuristics that can guide educational game design, such as "begin by writing a good story" (see Rieber et al., 2008 for a description of a general implementation model we have used to introduce children to game design). I have written about others, such as the need to design an educational game with an endogenous fantasy context (Malone & Lepper, 1987) so that there is little or no distinction between playing the game and learning from the game (Rieber, 1996). Doing otherwise constitutes educational "sugar coating." I recognize that a danger of downplaying the analytic is a designer inefficiently going off on useless and unproductive design tangents. However, I also believe that most people inherently understand what a good game looks like, or least what a good game feels like and so I trust that will be brought to their design work if only in implicit ways.

Robert Appelman, Ph.D. *is a nationally recognized authority on multimedia production and technology education. Trained initially as a graphic designer, Dr. Appelman continued into motion picture and television production and produced award-winning titles in both of these mediums. Over the past 30 years he has combined his training as an instructional designer, researcher, and instructor with his creative experience in multimedia production. His current focus is on the integration of technology into teaching, along with the coordination of production management strategies necessary to create virtual learning environments such as games and simulations. As Director of the Virtual Xperience Lab (VX Lab) at IU, he has guided research in Game Play Analysis and learning evaluation in Virtual Learning Environments. Dr. Appelman also serves as the Secretary of the Board for the international Digital Games Research Association (DiGRA).*

Richard Van Eck, Ph.D. *is Associate Professor and Graduate Director of the Instructional Design & Technology program at the University of North Dakota (idt.und.edu). He has published and presented extensively in the field of game-based learning (GBL), including the featured cover story of* Educause Review, *book chapters on building intelligent learning games and on the future of GBL as a field, seven keynote presentations and eleven invited speaking engagements from 2005 to 2007. He also has dozens of publications and presentations on his research in intelligent tutoring systems, pedagogical agents, authoring tools, and gender and technology, is currently conducting research on games and training with the John D. Odegard School of Aerospace Sciences at UND and is designing a game to teach middle school students about air pollution. He has taught a digital game-based learning graduate course every year since 2001.*

Lloyd Rieber, Ph.D*. is a Professor in the Department of Educational Psychology and coordinator of the Instructional Design & Development emphasis area within the Instructional Technology program at University of Georgia. He has written extensively on microworlds, simulations, games, and play. He co-designed, co-founded and currently teaches in the EDIT Studio, an innovative sequence of courses teaching educational multimedia design and development for which Game design is a prominent feature. He designed and programmed the WWILD Team, a web site/community devoted to experiential learning using existing games and simulations as learning objects. He also directs a project called "Homemade PowerPoint Games," which promotes learning through designing games with technology already available in the schools. In 2006 he won the Outstanding Practice Award from AECT's Division of Design & Development for, "In Search of Lost Wisdom," an online game designed to help graduate students understand task analysis.*

Atsusi "2c" Hirumi, Ph.D. *is an Associate Professor and Co-Chair of the Instructional Technology program at the University of Central Florida. Over the past 12 years, Dr. Hirumi has centered his research on the design of alternative e-learning environments. As an extension of his research, Dr. Hirumi has focused on story and game-based approaches to teaching and learning over the last 4 years. He serves as the lead instructional designer or learning advisor, working directly with teams of game developers on the creation of five instructional games. He also leads teams of graduate students, faculty, instructional designers and game developers investigating various aspects of game-based learning. Based on his experience, Dr. Hirumi has designed and delivered graduate courses and several workshops on instructional game design, and has written a number of book chapters and journal articles, and has made over a dozen invited and refereed conference presentation on design of instructional games and game-based learning.*

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