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Designing Experiential Modes: A Key Focus for Immersive Learning Environments

By Robert Appelman

A student sitting in a class and listening to an instructor talk is experiencing a particular mode of instruction sensed through visual and audio channels. She is aware that she is in the center of a classroom and also in close proximity to other students. Occasionally they gesture to the instructor at the front of the room, who stops talking when they speak. She is somewhat familiar with the content being discussed, would like to know more and is interested in the comments from the other students. Her experience is similar to most of the other students in the class.

What is described above is called an *Experiential Mode*. An *Experiential Mode* in learning consists of both observable *attributes* (the physical surroundings, sentient beings, objects, systems and events that occur) and the non-observable *perceptions* of the learners (the engagement, cognition and affective responses). *Experiential Modes (EMs)* may also be considered the smallest component of a *Learning Environment (LE)*, and in most cases any *LE* will consist of a mix of different *EMs*.

The purpose of dealing with *Experiential Modes* at such a micro level is to allow designers to focus on the key variables involved in true learner-centered design for any *LE*. Creating *LEs* is what educators do, but the new immersive virtual learning environments are challenging instructional designers today because of their increased experiential attributes. The traditional development models, such as *Analyze Design Develop Implement Evaluate* (ADDIE), do not have adequate granularity nor the iterative capability to define or assist in management of these new media solutions, and this leaves the designer with inadequate tools to define and specify effective experiences for their learners. Examine the following *EM* as a comparison to the opening *EM* description.

An Air Force sergeant language trainee is exploring the virtual space of a computer program designed to look like a village in the middle-east. He is aware of virtual cars and people passing in close proximity to where he and his companions are walking, but he is not aware of the course instructor that just walked past his computer in reality. In the virtual program he notices people sitting at tables in the café across the street, and after a car passes, he manipulates the mouse and hot-keys so that they move his avatar over next to the first person at the table. The virtual man at the table stands and faces him as he gets closer, and the sergeant leans over and speaks into the microphone next to his computer screen and says "hello" in Arabic, while clicking on the appropriate gesture icon in the upper left portion of the screen. After a few seconds, the virtual man responds with a similar greeting. The sergeant feels as if he is making decisions, and also behaving appropriately, just as if he were on at a real street café in the middle-east.

The *EM* scenario described above is that of an actual 3D simulation being designed by The Center for Advanced Research in Technology for Education (CARTE) at the University of Southern California's Institute for Creative Technologies (http://www.ict.usc.edu/disp.php?bd=proj_mre). In this EM the designer must consider the design of the buildings and the access to and around them in virtual space.Then the designer must script all the branching conversations and potential reactions of not only the participant players, but also all of the non-player characters (NPCs) in the virtual space.

The video game industry is leading the way in the development of rich virtual environments, but instructional designers are not prepared to design rich *Learning Environments* that incorporate such EMs, , nor do they have any systemic models to guide them. The *Experiential Mode* framework delineated here is designed to fill this design gap, and provide a methodology to describe and design immersive experiential modes that make up rich, dynamic learning environments.

LEs may incorporate sophisticated technology systems, or they may use few to none. They may involve high degrees of interaction among learners, or may allow none. The EMs included in an LE affect the learning that may take place in that environment, but the process of design does not often include detailed consideration of the EMs that must be provided in order for learning to occur. Defining an *LE* in terms of the *EMs* required for a certain type of learning experience highlights the broadest set of needs of the learner and incorporates many layers of decision making early in the design process where the ties to learning goals are strongest.

Learning Environment design

An *LE* is rooted in the epistemology that drives the instructional design, and there are natural targets for learner experiences that resonate with each epistemology. For instance, with a positivist approach one might find students experiencing *cognitive change* in the form of factual learning, high *apperception of content* as they confront volumes of information, yet low *access to information* since they are only allowed to use sources provided by the instructor. A relativist approach might find students experiencing high *affective change* accompanied by more engagement with the content, low *apperception of the content* as they encounter smaller chunks of information and high *access to information* since they have access to a wide variety of sources (Savery and Duffy 1995; Hannafin and Hill 2005).

These descriptions describe some learner perceptions and some attributes of the *LE*, but they do not describe any specific *EM*. *EMs* are instances within a specific *LE*. The design of a given *LE* must progress from broad macro descriptions of *attributes* and *perceptions* derived from epistemological viewpoints and instructional design strategies to the particular *EM* components that ultimately make up that *LE*. Thus, a *Learning Environment* design is the description of a specific set of one or more *Experiential Modes* the learner may pass through on the way to achieving the desired learning outcomes.

Differentiating Learning Environments and Experiential Modes

Learning Environments seem to reenter the discussion of instructional design whenever a new technology or pedagogy comes into widespread use. John Dewey described learning environments when he introduced Experiential Learning (Dewey 1938), and myriad media studies described *LEs* when film and video became options in teaching (Bransford 1999). Hypertext, and eventually the world wide web, were described as *LEs* when they became a concentrated focus for learning (Nielsen 1995). And now that technology offers affordances through immersive environments like those found when 3D virtual realities and augmented reality are used ,we find that these too are being described as *LEs* (Faryniarz and Lockwood 1992; Petranek 1994; Savery and Duffy 1995; Kirkley, 2003, Gee 2003).

However, in light of this discussion, these are not *LEs* but are actually instances of *EMs that use these particular technologies.* . The important distinction here is that *EMs* in and of themselves have no epistemological or instructional design linkage; they only offer affordances that may or may not foster a desired experience for the learner. *LEs* on the other hand are created to satisfy specific epistemological and instructional design goals, and the selection of an *EM* as part of an *LE* is made only on the basis of the affordances that it offers.

EMs also do not specify any particular technology or methodology. However, they do describe specific attributes and affordances that need to be present to foster particular perceptions in the learners. Designers are accustomed to describing products and specific technologies as their solution to meeting certain learning goals. In fact, it is not the technology but the affordances that the technology offers that supports the learning. Another technology that offers the same affordance could be substituted in its place and the experiential mode would be defined as being the same. However, it is also the case that if *any* affordances differ, even if the majority are the same, then the experiential mode must be described as being different. For example, to achieve an *EM* that affords a high degree of interactivity among students, an instructor might break the class into small groups; likewise a distance delivery instructor who desires the same affordance might open a chat session for a subset of students. These two instances are very similar modes in terms of one *attribute* -- interactivity among students -- but are considered different *EMs* because of some *attributes* and student *perceptions* that differ considerably.. The definition of appropriate *EMs*, the selection of their tangible forms and the resulting perceptions of the learners using them are key to effective *LE* design (see http://www.indiana.edu/~simms for *LE* examples with *EM* definitions).

Experiential Mode design

The fact that there are so many *EMs* -- ranging from those found in formal classrooms to distance education classes to group activities, and with affordances being met through a multitude of technology options, from powerpoint presentations to print-based correspondence and from on-line simulations, to augmented reality -- makes it difficult to know what the salient differences may be between them such that appropriate selections can be made. Designers need clearly defined categories of *EM* attributes so that affordances can be coupled to each attribute. They also need categories of learner perceptions that occur in *EMs* so that correlations of these perceptions can be made with specific sets of affordances to define the *EM*. Once the *EM* is fully defined with both desired perceptions and affordances, then appropriate technologies, methodologies and physical environments can be selected for the targeted *EM*. The matrix below (Figure 1) shows the critical categories I am using as of now to define an *Experiential Mode* on the basis of these two primary criteria – the attributes of the environment, and the learner's perceptions while operating within that environment.

Learning Environment Attributes: …		**Learner Perceptions within the Environment:**	
1. virtuality	The degree of representation of persons, places, or things	***1. sensory immersion***	Engagement through visual, auditory, haptic, kinesthetic, & olfactory senses
2. infra- & super-structures *(simple to complex)*	*Infra:* hidden affordances or capabilities *Super:* real or virtual definitions of space	***2. Interaction***	Communication or contact with a person or thing
3. spatial boundaries	Real or virtual limitations of access or motion	***3. mobility***	Freedom of motion to another place
4. time boundaries	Limits of time imposed on activities	***4. sense of time***	Apperception of the flow of time
5. persons, objects, & matter	Available persons, places, or things to interact with	***5. access to information***	Available options for gathering information
6. technological affordances	Tools & processes available for use	***6. user control/ manipulation***	Options and functionality with technologies
7. content density	Scope of content relative to entry level of learner	***7. apperception of content***	Awareness of content scope
8. concreteness	Lack of abstraction of concepts	***8. cognitive change***	New understandings or perceptions of procedures, concepts, or principles
9. authenticity	Levels of congruency to real persons, places, things, or processes	***9. affective change***	New attitudes or values toward content, persons, places, or things.

While this definition links the *EM* attributes to learner perceptions in a strong relationship, that relationship should not to be mistaken as a causal one. Just as in the old adage about “leading a horse to water,” providing affordances for learning will not *guarantee* a particular perception on the part of the learner; however, there should be a high degree of probability that certain anticipated perceptions will occur. By assembling these *EMs* into particular *LEs*, designers can observe the actions of the learners and assess their perceptions and learning.

The role of the instructional designer then becomes something like that of a conductor who orchestrates a particular mix of *EMs* to make up an *LE* for learners to encounter. Assessment of the cognitive and affective changes in the learner can point to specific *EMs* that are either working or not. Too often designers load an *LE* with *EMs* incorporating technologies that do not offer appropriate affordances for the learner. Too often as well, failure in meeting learning goals is placed on the learner rather than on a poorly conceived *LE* (Cuban 2001).

Using the matrix in Table 1, an *Experiential Mode* is defined through listing the degree and/or level of any environmental *attribute* or learner *perception* within an *LE*. The myriad combinations of degrees and levels of each attribute and the several learner perceptions create an equal number of possible *EMs*. Because of the mind-boggling number of permutations, many designers have assumed that some attributes of common *LEs* (such as the physical dimensions and light level of a classroom) remain at a constant level and are therefore not usually considered a variable of design. It is also no wonder that resistance is encountered when new variables are introduced into an *LE*, since this creates the need to challenge those traditional constants (Cuban 2001). However, the premise here is that all categories should be considered for every design. The following discussion is intended to clarify how the attributes and perceptions are related for the purposes of design.

In order to understand better the individual elements within the matrix in Table 1, a few summary statements should help:

- All attributes in the first column are under the designer's control as elements that can vary in an *EM*
- All perceptions in the third column are beyond the control of the designer, but are assessable elements in that a designer may measure to determine the *EM's* success.
- Items 1, 2 and 3 of the attributes deal with the physical environment
- Items 4, 5 and 6 deal with technologies and methodologies involved in the delivery and implementation
- Items 7, 8 and 9 deal with the content being taught

To use this framework effectively and efficiently, the designer must first work at a macro mode at the *LE* level to determine what global attributes and perceptions will exist in all *EMs* within that *LE*. Decisions at this stage may divide or combine different *LEs* across hours, days, and even months. The design process can then focus on the micro decisions related to each *EM* within each *LE*, while remembering to question whether the global attributes and perceptions assigned during *LE* design are still appropriate. Since individual *EMs* are targeted for specific perceptions of the learner, the design focus will naturally be on specific affordances in the primary categories that are most likely to affect those perceptions. At the same time, the designer assumes that the affordances and perceptions in the other categories will follow the global designations of the *LE*.

The *physical structures* and *background* of an *EM* provide learners with a sense of "place" and where they perceive themselves mentally to be. Walls, doors and windows -- all are part of the *superstructure* description. Here is where the physical differences between formal classroom contexts and home schooling may be described. These attributes describe differences between an outdoor hands-on project and individualized learning in a library. Examples of the *infrastructure* are the unseen electrical wiring and the wireless networks, often coupled with the background ambiance of smells, sounds and general lighting conditions. *EMs* that require large visual and audio displays for a collaborative group my require specialized *infrastructures* for network connectivity, as well as *background* controls to allow for video projection, audio amplification and specialized lighting for computer displays.

The *virtuality* of an *EM* describes the degree to which any part of it is a representation of reality instead of "the real thing." Technically, a picture of an apple is a virtual representation of a real apple, just as a 3D computer image of a rotating apple is a virtual representation (although possibly of higher fidelity). As more and more elements are added in a 3D virtual space and the virtual apple now ends up sitting on a table in a virtual room with walls, doors and windows, and the learner can move around in the room and even pick-up the apple, the *physical structures* and *background* change to be *virtual* ones instead real ones. The learners actually perceive themselves to be in that virtual space since that is where the action and the content reside (Crawford 1984; Prensky 2001, Bethke 2003). The learner can have extremely facile mobility, with the capability not only to move around in a virtual room but even to virtually walk outside, hop into a car and speed off.

It is important to consider the contrast that can exist between the extensive *interactions*, *sensory immersion* and *mobility* perceived by learners in some *virtual EMs*, compared to the limited *sensory* stimulation, *interaction* with others, and *spatial boundaries* they experience in the actual real environment. This contrast not only explains the attraction of video games for some students, but also suggests that more *LEs* may need to incorporate immersive virtual *EMs*.

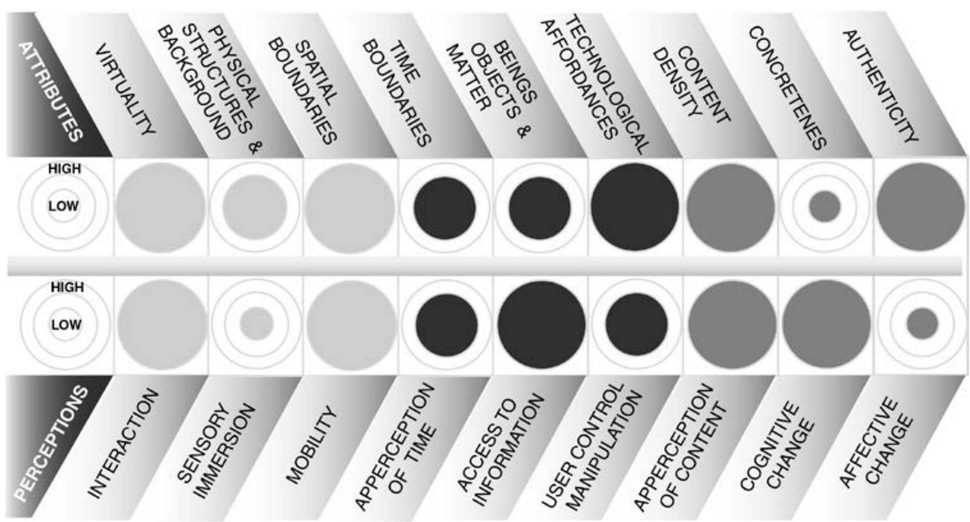
Traditional *EMs* are populated with people and objects. In some science labs, students interact with chemicals and gasses, while in earth science they dissect worms and frogs and many forms of plants. Many educators are seeking *EMs* that provide easier access to greater numbers of examples in a shorter period of time. Designers are creating virtual animals and plants where the *technology affordances* allow for quick display and offer layered parts for students to dissect -- and without the olfactory *sensory immersion* of formaldehyde found in the *background* of traditional labs. *Time boundaries* of a class period often limit traditional lab modes, while *virtual* independent modes have few *time boundaries* since they can last as long as the student needs to complete them.

The presentation of content and corresponding *cognitive change* on the part of the learner has long been at the heart of education. The majority of *EMs* focus on facilitating this acquisition of knowledge and developing a positive *affective change* toward it, and a *concreteness* to abstract continuum has been used to characterize content since the early 1950's (Lester, Towns et al.; Dale 1946; Reigeluth and Schwartz 1989). Studies of media and eLearning have spawned an additional new focus for content, *content density*, to discuss the amount of information streaming from video and internet sources (Phung, Venkatesh et al. 2002). Unlike Zettl's description of "the degree of detail occurring within a period of time",(Zettl 1999) for an *EM, content density* is relative to the entry level knowledge of the learner, and not something that can be measured outside of the context of its use (Piaget 1950). For instance, if a novice runner encounters pain in her foot and begins to explore the anatomy of the foot by browsing through some web pages, the *content density* will be *high*, due to the use of many new medical terms. This same information browsed by a registered nurse would be considered *low content density* due to previous frequent exposure.

Authenticity of content describes how congruent the content is with reality. This concept of authenticity, for both written content as well as visual content, has been at the heart of the ethos in the journalism field since the early 1950s. Any reporter or photojournalist is expected to portray *exactly what happened* in any event to the readership, thus conveying a sense of authenticity. Authenticity has come into focus as a variable for instructional experiences with the advent of realistic virtual simulations for both the airline industry and the medical field, where *authenticity* combines with another attribute -- *concreteness* -- to take on an additional component of realism (Gerbner, 1956; Gokhale, 1991; Kommers, 2003; David, 2004). For the sake of an *EM*, the need for authentic content will vary depending upon the goals of the *LE*. For instance, if an LE were being designed for a physical education class, and the only goal were to demonstrate the rules and the sequence of game play for soccer, then a *virtual EM* that allows for quick navigation through different patterns of play would be the focus; the actual physics of how the ball moves and drops when kicked could exhibit a relatively low level of *concreteness* since it would be discussed in the abstract. However, if the goal were to teach the actual skill of play, then the *EM* would most likely need to be outside (no *physical structures*), add other team members (*beings*) and engage in a simulation of soccer play that would be as nearly authentic and concrete as possible.

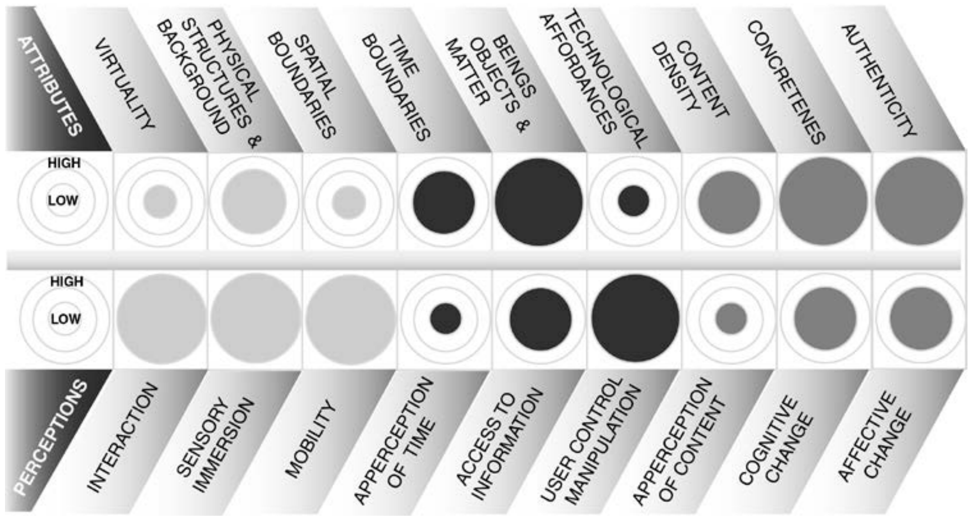
Experiential Modes should become more familiar through implementation, making it easier over time for designers to select ones that have proven themselves in application. In addition, greater understanding on the part of designers of the attributes and perceptions associated with EMs should allow patterns to emerge that facilitate integrating them into different *Learning Environments.* For instance, using the soccer example given above, the first virtual *EM* mentioned for learning patterns of play could be illustrated as in Figure 1.

Figure 1



In this graphic representation of the *EM* there is a high degree of *virtuality* since it is a computer program, and there are limits in the diagrams and soccer field representations that provide high *spatial boundaries*. Correspondingly, one would predict a perception of high *interactivity* with the *virtual objects*, but low *sensory immersion* and no sense of *mobility*. There are high technological affordances through the multiple views of fields and play patterns that might be combined with animated illustrations as well. The content *authenticity* is high since this is based on official rules of the sport. The learner is predicted to have a high sense of the amount of content (*apperception of content*) as well as web links that provide *access to information* at an even higher degree, thus supporting a high degree of potential *cognitive change* for the learner.

Figure 2



In the soccer practice example (Figure 2) there are fewer *spatial boundaries* outside and *mobility* is high. There is a perception of high *interaction* with teammates and all senses are active producing a greater *sensory immersion*. There are more *people and objects* to interact with, and the concentration on manipulation of the skills to move the soccer ball down the field provides a high sense of *user control and manipulation*. The content is very *concrete* for this procedural and psychomotor learning, and the *authenticity* is equally high which fosters a strong sense of realism and immersion. Upon completion of the practice session it would also be hoped that the learner’s confidence level and attitude toward soccer would be reinforced positively , thus raising the level of *affective change*.

Immersive *LEs*

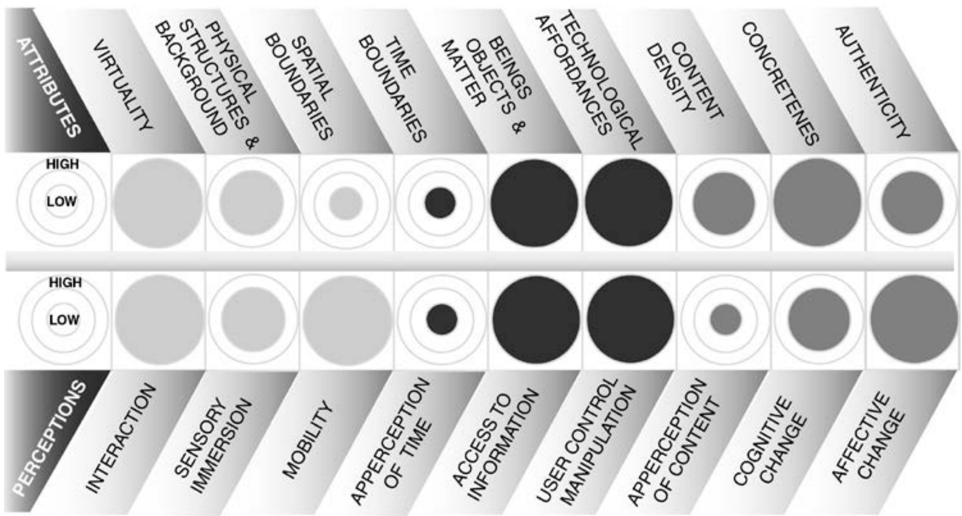
As the Information Age permeates our everyday lives, the contrast between the relatively slow content dissemination of traditional *Experiential Modes (EMs)* for learning and how we access and acquire information today becomes sharper and sharper. This contrast is most evident when observing the *EMs* of video game play engaged in by the current generation of students (Petranek 1994; Thiagarajan 1994; Gee 2003; Squire 2003).

In these experiences, traditional physical structures are replaced by virtual superstructures beyond anything previously conceived, let alone constructed. The player of games can have extremely facile mobility, with the ability not only to "leap tall buildings at a single bound," but even to walk through the walls of the buildings themselves. The information flow to be processed requires a level of multi-tasking that would challenge even an airline pilot. Because more of our learners are experiencing – and enjoying -- modes like these, there is an increasing demand to include highly immersive *EMs* in our *LEs*. And because of the learners' familiarity with multiple *sensory immersion* in *virtual environments* we can use these *EMs* for instruction whereas previously they were not an option because learners could not be presumed to be able to handle such complexity. The challenge now is on the shoulders of instructional designers to discover ways in which these *EMs* can be orchestrated within an *LE* in order for learning to be maximized (Appelman and Goldsworthy 1999; Rollings 2000; Gee 2003).

Computing power, creation tools and display technologies have improved to the degree that designers can now envision virtual environments with attributes similar to those of the real world (increased *authenticity*). Of course we are not at the *Star Trek* holodeck level yet (full *virtual sensory immersion* and complete *user control and manipulation*), but enough critical elements and functionality of a real environment can be made available to a learner in a virtual one that adequate experiential levels can be reached. So, if a particular type of learning is to be embedded within a particular *LE*, there are now available virtual *EMs* that might be able to support it.

Mixing different *Experiential Modes* to achieve a desired *Learning Environment* offers us the option to blend traditional classroom modes with virtual modes. Sasha Barab and his team of instructional designers and in-service teachers are implementing a virtual environment on-line called *Quest Atlantis* (http://www.questatlantis.com). Students blend traditional classroom work with a virtual LE that contains affordances in the form of 3D worlds in cities, underwater, and in caves for many *EMs,* plus web pages that allow for high *content density* and student input for writing and collaboration with other students around the world (Barab 2000). Another instance of an *EM* being "dropped" into a traditional classroom is Kurt Squire's use of *Civilization III* as a tool to engage learners on the topic of world history. In this project, a portion of class time was devoted to students achieving certain goals in the game. Students who were not motivated previously even to discuss history, were now excitedly dealing with the strategies used by colonial dictators and the issues raised by negotiating territorial boundaries (Squire 2003; Shreve 2005). The EM pattern for this virtual simulation is depicted in Figure 4.

Figure 4



LE, EM and Instructional Design (ID)

So where does Learning Environment Design happen in the ID process? Who does it, when does it happen and what is different about this approach from any other? Even though *Learning Environments* (*LEs)* have been discussed from the time of John Dewey, little if any discussion has been held about integrating them into a development process. The suggestion that *LEs* are made up of components called *Experiential Modes* (*EMs*) implies that the ID process must be revised as well.

Hannafin and Hill (2005) point out that “different epistemologies have different psychological frameworks, which in turn have different implications for instructional design,” and the same implications result from an *LE* design that best meets the requirements of any particular epistemological approach. For instance, a positivist epistemology might foster more teacher presence in the *LE* with more “selected” resources and less collaboration, while a relativist epistemology might foster more student collaboration and a broader range of information sources, plus a greater reliance on student presentation and sharing. Already, at the earliest stages of instructional design, the *LE* can begin to take shape through envisioning the type of experiences the learners will encounter. This is quite different from other models where any description of the learning environment is not considered until the development and implementation stages of the process. It is also different from models in which the development stage focuses only on a technological product that will somehow be incorporated into the overall instructional system, with little indication of how the learners will perceive that product when exposed to it. This approach is the definite opposite of any strategy that begins with the *EM* first; for example, one in which designers say “let’s build a 3D virtual environment”, and then attempt to build an instructional strategy or epistemology around the technology.

The key strategy for designing an *LE* is to gather visions of the emerging *LE* as one moves through the analysis and design phases of the ID process. As any instructional design decision is made, the implications for specific *EMs* should also be noted and their resonance with the overall goals identified. For instance, as an instructional designer wrestles with the body of content to be covered, the relationship between the *content density* (the combination of amount of content detail and the entry level knowledge of the learner) and the *apperception of content* (the degree to which the learner is cognizant of the scope of the information available to process) anticipated of the student should be balanced. As a specific example, if the average entry level of the learner were found to be high toward the content (the learner was already experienced with the content at the application level), ,one might envision an *EM* that would allow *high access* to relatively *dense content* through key word searching so that this learner could seek strategies for a new application of this content. The searching strategy is possible because of the high entry level, and this would result in a *low apperception of content* since the total resource would not be visible at any one time since only portions of it are accessible through keyword searches. This description could then be logged as one possible *EM* to include in the *LE*.

For all types of learning there are appropriate *EMs* that could facilitate learning concepts, learning processes, and conducting higher order inquiry. Since the designer would be gathering a repertoire of *EMs* during analysis and instructional strategy design, the task during development is assembly and elaboration, mixed with input from other design specialists who specify and build the interface and technology architecture, manage continuity and pacing, create message design strategies, and specify media and iterative levels of evaluation. The number of design specialists needed will be determined by the scope of the *LE* and its complexity, so that number can be large or small. The assembly and elaboration design process is envisioned as being very much like building a concept map, while the detailed specifications and building of each *EM* would be most analogous to negotiating with individual contractors establishing their own design centers of development. This type of development model is non-linear; it is dynamic and continually evolving, and resonates with a spiral software development model (Gibbons, Fairweather et al. 1997; Toth 1997; Bethke 2003)

Summary

*Learning Environments (LEs)*are a ways of applying epistemology, pedagogy, methodology and instructional strategy at a macro level that lead naturally to their own development (Hannafin and Hill 2005). *Experiential Modes (EMs)*are components of a learning environment that focus on the learner's perception while experiencing any experiential mode, and through a micro analysis, bridges the gap between instructional development and learner cognition.

Although Instructional Design has already turned toward a more learner-centered approach, the entire development process must also embrace the learner's experience as it focuses on providing rich *EMs* that are created through an emergent and dynamic development process.

The design strategy of focusing on *EMs* for development resonates with new virtual technologies since their experiential components are so high. The engaging video game industry has captured the imagination and social focus of young adults and children around the world, and this has impacted their expectations and also the learning potential for simulations and games with more serious purposes than entertainment. Using learner experience as the touch-stone for design is the common ground for both traditional educators and those designers attempting to incorporate complex gaming and simulation environments into educational contexts (.Crawford 1984, Prensky 2001, Gee 2003, Salen and Zimmerman 2004)

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