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Perspective Making

Constructivism as a Meaning-Making Structure for Simulation Gaming

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Constructivism has recently gained popularity, although it is not a completely new learning paradigm. Much of the work within e-learning, for example, uses constructivism as a reference “discipline” (explicitly or implicitly). However, some of the work done within the simulation gaming (SG) community discusses what the basic assumptions and implications of constructivism for SG are. Constructivism provides one theoretical approach to the use of computer-based systems and, as such, deserves careful consideration. The author’s view is that SG researchers—as SG is a transdisciplinary field—should seek to do research that is acceptable in terms of other disciplines and need to go back to the original texts in the reference discipline to gain genuine appreciation of the arguments being proposed. This is an aim of this article. Another aim of this article is to provide theoretical tools with which to enhance SG argumentation development and debriefing.

Keywords: *computer-based systems; constructivism; debriefing; designing simulation games; experiential learning; learning theories; research; research methods*

My research question is, Is the constructivist learning paradigm able to increase our understanding about the learning processes that take place in simulation gaming (SG) training? As a research method, I have applied the literature survey.

The idea for this article arose from the observation that in the field of educational technology and educational sciences, there is a view of learning that is increasingly also cited within other disciplines. Jonassen and Land (2002) note that during the 1990s a convergence of learning theories never before encountered was witnessed. These contemporary learning theories are based on substantially different ontologies and epistemologies than were traditional objectivist foundations for instructional design. Here, I will introduce a view of learning—constructivism—arising from the field of educational sciences. I am interested in constructivism because it seems to give much advice on how to construct computer-based learning environments, but

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also on how to facilitate learning in general. In this respect, constructivism is relevant for the SG community.

The practice of instructional design should be based on some conception of how people learn and what it means to learn. (Duffy & Jonassen, 1992b). Bednar, Cunningham, Duffy, and Perry (1992) argue that in the field of instructional systems technology it has been appropriate to select principles and techniques from the many theoretical perspectives, choosing those we like best and ending up with a design technology, based on no single theoretical base. Thus, concepts and strategies are abstracted out of their theoretical framework, placed within a practitioner's framework, and grouped based on their relevance to a particular instructional design task. Bednar et al. propose that "instructional design and development must be based upon some theory of learning and/or cognition; effective design is possible only if the developer has developed reflexive awareness of the theoretical basis underlying the design" (p. 19). In other words, effective instructional design emerges from the deliberate application of some particular theory of learning. SG as a discipline organically linked with learning should actively follow the development within its reference discipline.

It is difficult to give an unambiguous definition of constructivism. Hakkarainen, Palonen, Paavola, and Lehtinen (2004) note that there are so many versions and interpretations of the term *constructivism* that the term has become rather uninformative without further qualification. Duffy and Cunningham (1996) note that the term *constructivism* has come to serve as an umbrella term for a wide diversity of views. However, they find two similarities among them: (a) Learning is an active process of constructing rather than acquiring knowledge, and (b) instruction is a process of supporting that construction rather than communicating knowledge. Although the definition of constructivism is difficult to give, it is possible to describe the central assumptions and claims of the learning paradigm. This is also a central aim of this article.

There seems to be much in common between the constructivist principles and how the SG community argues for their gaming artifacts. Actually, it is striking to study constructivism because many—if not a majority—of its ideas of an effective learning environment exist in SG environments. Furthermore, studying interactive learning through gaming simulation is productive only if a suitable epistemology is available to connect learning through a specific game with learning through gaming (Klabbers, 2003). But, "A comprehensive theory about learning and knowing through gaming and simulation is not yet available due to competing epistemologies" (Klabbers, 2003, p. 260). Furthermore, the community of gamers seems to be more interested in the instrumentality of games (methods and techniques of game design and use; Klabbers, 2003). It is only with a clear hypothesis about the process of learning that one is able to choose an adequate research design to properly evaluate learning effectiveness and to draw meaningful conclusions (Herz & Merz, 1998).

What Klabbers (2003) notes above gets affirmation when one takes a look at the articles published in the journal *Simulation & Gaming*. I have checked through the references of research articles, editorials, and reviews of *Simulation & Gaming*, from Volume 30, Number 1 (March 1999) to Volume 35, Number 3 (September 2004), altogether 142 articles. The field seems to accept several views of learning as a starting point when giving reasons for the use of SG tools. But what is even more evident is that it is possible to do SG research without references to any learning theories or a clear definition of the applied learning paradigm. The most popular learning “theory” reference was Kolb, who was cited in 11 articles (7.7%). Argyris and/or Schön were cited in 7 articles (4.9%). Authors who are influential in both the experiential learning and the constructivism fields were cited as follows: Piaget was referred to in 6 articles (4.2%), Vygotsky in 3 articles (2.1%), Dewey in 2 articles (1.4%), and Lewin in 1 article (0.7%). Some central (according to our interpretation) constructivism authors were referred to: Wenger in 5 articles (3.5%; 2 of those by one author in 2 different articles), Lave in 1 (0.7%), and Jonassen in 1 (0.7%). Besides this, there were some references to other authors who can be placed in the constructivist field, but these were rare. Only 2 of the articles (Alessi, 2000; Spector, 2000) included a broader collection of constructivist references.

The very short analysis above brings to mind two speculative conclusions. First, as Klabbers (2003) notes, clearly a comprehensive theory about learning and knowing through gaming and simulation is missing. Second, it seems that to do SG research does not necessarily require from the authors any familiarity with learning theories. Both of these conclusions should deserve more research in the SG field.

If the constructivist principles describe learning in a valid manner, we have an excellent tool with which to

- Argue more sharply why simulation games are excellent learning environments.
- Concentrate on the critical learning characteristics of our tools when we build them.
- Understand the learning taking place during the gaming process, thus getting more out of the debriefing.

The Central but Problematic Experiential Learning

SG has traditionally been argued by the experiential learning theory. Experiential learning and constructivism build on the thoughts of the very same authors (Dewey, Lewin, and Piaget; see Kolb, 1984; Mirvis, 1996) when developing their views of learning, thus making these views on learning look quite similar in many respects. Although the experiential learning theory seems to satisfy the majority of the SG community, it makes sense to view other views on learning. As Boland and Tenkasi (1995) note, as a scientific community progresses, it carries out perspective making. Perspective making is the process whereby a community of knowing develops and

strengthens its own knowledge domain. As a perspective strengthens, it complexifies and becomes better able to do knowledge work (in SG, to understand the learning process and to exercise better debriefing). This is a process of developing more coherent meaning structures.

Educational games and simulations are experiential exercises (Gredler, 1996). Experiential learning theory is one of the most influential theories of management learning. Still, in professional education literature, virtually nothing has been said about experiential learning theory, which prevails in industrial settings (Ekpenyong, 1999). Ekpenyong (1999) finds two reasons for the neglect of experiential learning in professional education literature: (a) the lack of a formal theory of experiential learning and (b) the dominance of experiential learning in industrial and nonschool settings.

Experiential learning theory points to the significance of learning through direct experience as opposed to learning through "instruction." According to Kolb (1984), the most powerful learning comes from direct experience—through action taking and seeing the consequences of that action. Learning is said to occur through the resolution of conflicts over different ways of dealing with the world. It suggests a holistic integrative perspective on learning that combines experience, perception, cognition, and behavior (Kolb, 1984). There are several different models of experiential learning that all have in common the belief in experience and reflection on it. Thus, there is not a single theory of experiential learning but a range of related concepts and models of learning (Cheetham & Chivers, 2001). The most influential of the models has been the one from Kolb.

Kolb's model has been the target of much criticism because of its potential theoretical limitations. According to this criticism, Kolb's model provides only a limited account of the many factors that influence learning, for example, that individual experience comes at the expense of its social and institutional aspects (Kayes, 2002). On the other hand, Kayes (2002) criticizes the critique by stating that the critiques of experiential learning often distill the model into a simple formula, risking replacing the broad and diverse tradition of management learning with alternatives that are "intoxically" simple. Cheetham and Chivers (2001) note that the proposition that learning through experience takes the form of a neat cycle may also be open to challenge. Learning seems likely to be a more complicated and multifaceted process. Thus, learning is more fragmented, and often more chaotic, than the cycles suggest.

Critiques of experiential learning fail to preserve its two fundamental assumptions (Kayes, 2002): (a) the inherent potential of human beings to learn and (b) the belief that learning lies in problem solving. The critique amounts to privileging one aspect of learning over another and thus selectively devaluing the holistic nature of learning. Kayes (2002) suggests that an alternative approach should preserve the dialectic nature of experience and account for its social aspect more fully. Kolb's model also looks at learning primarily from the individual's point of view, which is not sufficient to explain learning within the organizational context. However, although the formulaic way in which Kolb has been interpreted may not represent reality accurately, his

theory provides those who wish to be more learner centered with a starting point for thinking about their practice (Marsick & Watkins, 1990). Having noted the above, the following is an introduction to the theoretical background for constructivism.

The Educational Field

Today's ways of understanding learning can be appreciated only against the historical background of thoughts on human learning and in relation to one another. All the theories still remain a vital part of the way we think. Learning theories are not generally replaced by superior ones but rather are incorporated into subsequent theories. The field seems also to have continuous debates about the right teaching procedures, and often it is quite difficult for an outsider to understand why all this disputation. Following are some classifications to give the reader an example of how these views can be seen from different perspectives. The first introduction of learning theories is based on Lehtinen and Kuusinen (2001).

The most influential author in *behaviorism* has been B. F. Skinner. He put together a theoretical model of behaviorism, which was based on the central experimental research of behaviorist tradition. Behaviorism was based on human stimulus response. Whatever had to be learned could be reduced to a linear series of steps: immediate reinforcement by rewards, mastery of simple behaviors leading to mastery of complex behaviors. Learning could only be detected if the external behavior of the learner changed. Only observations that could be detected by sense perception could be a source of knowledge. Thus, behaviorism presents a tightly positivistic ideal of science. Behaviorism and its linear programming of instruction led to the first mechanical teaching machines and to the model of programmed learning.

In educational psychology (*cognitive psychology*), crude stimulus-response behaviorism eventually gave way to more sophisticated views on human individual information processing. Research and theories are based on the individual's information gathering, storage, and usage, which all belong to an area (individual's internal cognitive processes) that could not be studied according to the behaviorist view of learning. Thus, when studying human consciousness, we have to study indirect findings.

From the view of *constructivism*, the basic forms of interpreting human thinking are shaped in the work of Piaget. According to Piaget, the forms of human thinking and knowledge are built through the activities and interplay by which the individual adapts to his or her environment. Each individual develops those inevitable basic forms of thinking that make him or her possible to survive in the world. One of the principles in Piaget's thinking was that cognitive constructions develop through action. Processes of the mind develop from action that is originally concrete, but they can also later develop through internal mental processes without direct connection to the external action. So, for Piaget, the shaping of cognitive constructions is not passive information adaptation through senses (empiricism-behaviorism) or information

selection to channels of limited capacity (information processing) but active functioning in the real world and coordination of these actions as consistent constructions.

Other influential scientists for the formation of constructivism have been Dewey, Mead, and Vygotsky. They all searched for explanations for the dynamic interrelationship between the individual and the environment. An important ingredient of Vygotsky's work is that he started studying human learning from the point of view of how cultural habits, social relationships, and language as a tool of thinking facilitate the condition for learning. The central message in Vygotsky's work is that an essential condition for understanding the psychological development of an individual is to understand the system of social relations within which the individual lives. In other words, an individual continuously carries with him or her the culture and its meaning in his or her knowledge, skills, and whole personality.

Another way of looking at different views on learning is described by Duffy and Jonassen (1992a). The *objectivist tradition* acknowledges that people have different understandings based on differing experiences. However, the impact of prior experience and human interpretation is seen as leading to partial understandings and biased understandings. The goal is to strive for the complete and correct understanding. Knowledge is believed to exist independently of instruction, and there is no need to look at the instructional activities to see what is learned. Rather, a test that stands separate from the instruction is produced, and it is designed to probe the knowledge acquired in an objective way. The objectivist epistemology underlies behaviorism and much of cognitive psychology. Also, *constructivism* holds that there is a real world that we experience. However, there are many ways to structure the world, and there are many meanings or perspectives for any event or concept. Thus, there is not a correct meaning for which we are striving.

The Formation of Constructivism

Jonassen (1992) notes that objectivism and constructivism are often described as polar extremes of a continuum to contrast their assumptions. Jonassen, however, states that most theorists assume positions that fall somewhere between the extremes. From this point forward, I discuss constructivism and try to represent how it differs from the objectivistic view of learning.

One of the central texts in the constructivist "movement" has been Brown, Collins, and Duguid (1989). They propose that learning is a process of enculturating that is supported through social interaction and the circulation of narrative. Here, groups of practitioners are particularly important because it is only within groups that social interaction and conversation can take place. Features of group learning include collective problem solving, displaying multiple roles, confronting ineffective strategies and misconceptions, and providing collaborative work skills. One of their arguments is that students who are taught individually rather than collaboratively can fail to develop

skills needed for collaborative work. And in the collaborative conditions of the workplace, knowing how to learn and work collaboratively is increasingly important.

Also, Lave and Wenger (1991) do not directly discuss constructivism, but their text is one that is often referred to in constructivist literature. They emphasize that learning as internalization is too easily construed as an unproblematic process of absorbing the given, as a matter of transmission and assimilation. Lave and Wenger's work concerns the concept of *apprenticeship* and the theory of *situated learning*. In their perspective, there is no activity that is not also situated. They emphasize the comprehensive understanding involving the whole person rather than receiving a body of factual knowledge about the world; activity in and with the world; and the view that agent, activity, and the whole mutually constitute each other. They state that even so-called general knowledge has power only in specific circumstances because abstract representations (generality) are meaningless unless they can be made specific to the situation at hand. On the other hand, the world carries its own structure so that specificity always implies generality. "This is why stories can be so powerful in conveying ideas, often more than an articulation of the idea itself" (p. 34). Furthermore, the generality of any form of knowledge always lies in the power to renegotiate the meaning of the past and future in constructing the meaning of present circumstances.

The second shift in perspective Lave and Wenger (1991) have is to explore learning as *legitimate peripheral participation*. This is proposed as a descriptor of engagement in social practice that entails learning as an integral constituent. Peripheral participation means that a learner is always located in the social world, and changing locations and perspectives are part of actors' learning trajectories, developing identities, and forms of membership. Here, peripherality is a positive term, suggesting an opening, a way of gaining access to sources for understanding through growing involvement.

Lave and Wenger (1991) note that legitimate peripheral participation is not an educational form but an analytical viewpoint on learning, a way of understanding learning. In their concept of learning, the learner is a newcomer who changes knowledge, skill, and discourse and becomes an old-timer. This is a process of developing identity, and the learner transforms into a member of a community of practice. This process is motivated by the growing use value of participation and by newcomers' desires to become full practitioners. Knowing is inherent in the growth and transformation of identities, and it is located in relations among practitioners, their practice, the artifacts of that practice, and the social organization of communities of practice. For newcomers, their shifting location through a complex form of practice creates possibilities for understanding the world as experienced. This raises the question about the process of transparency for newcomers. Duffy and Cunningham (1996) interpret the work of Lave and Wenger by noting that an individual is legitimately a participant but is only playing a partial role in the context. There is no master who assigns tasks or who monitors the apprentice's behavior. The apprentice begins to assume responsibilities,

testing his or her abilities to assume roles and responsibilities in that environment. Apprenticeship is not necessarily the best learning environment, but it is a prevalent learning environment. In most new contexts, we first observe and then begin to take on some responsibilities in a group of which we wish to become an integral part.

Duffy and Cunningham (1996) state that from the perspective of apprenticeship, learning environments must provide the learner with access to the community of practice and provide the tools that will support the learner in assuming his or her role in that practice.

Duffy and Jonassen (1992a) argue that instruction should not focus on transmitting plans to the learner but rather on developing the skills of the learner to construct (and reconstruct) plans in response to situational demands and opportunities. Thus, instruction should provide contexts and assistance that will aid the individual in making sense of the environment as it is encountered. Plans must be constructed, tested, and revised as a function of the particular encounters in the environment. On the other hand, Duffy and Jonassen give clear reasons why learning environments based on objectivist view of learning are problematic:

Computer models of mind rely on a formalization of knowledge. Experiences must be represented in some propositional form. However, any propositionalization is simply one representation of that prior experience. The individual, but not the computer or the computer model of mind, can reconceptualize, reconstruct, and repositionize that experience in many different ways. It is the storage of experiences (unformalized background) that the computer systems and models cannot achieve. (p. 5)

In constructivism, learning is a constructive process in which the learner is building an internal representation of knowledge, a personal interpretation of experience (Bednar et al., 1992). This representation is constantly open to change. Learning is an active process in which meaning is developed on the basis of experience. Learning must be situated in a rich context, reflective of real-world contexts for this constructive process to occur and transfer to environments beyond the school. The learner should be moved into thinking in the knowledge domain as an expert user of that domain might think. As we often cannot start the student with an authentic task, we must simplify the task while still maintaining its essence. Most importantly, the goal is to portray tasks, not to define the structure of learning required to achieve that task. Thus, we must leave the identification of relevant information and correct solutions open in the instructional situation. Furthermore, the focus will be on the skills of reflectivity of the learner, not on remembering. Constructivism focuses on the process of knowledge construction and the development of reflexive awareness of that process.

Spiro, Feltovich, Jacobson, and Coulson's (1991) interpretation of constructivism is complex. They start by taking an accepted cognitive principle that understanding involves going beyond the presented information. Comprehension involves the construction of meaning: The information contained in the text must be combined with information outside of the text—including the prior knowledge of the learner—to

form a complete representation of the text's meaning. Second, emphasis must be shifted from the retrieval of intact knowledge structures to support the construction of new understandings. Learners should be able—instead of retrieving from memory a previously packaged prescription for how to think and act—to bring together from various knowledge sources an appropriate ensemble of information suited to the particular problem-solving needs of the situation at hand. Thus, constructive processing is added to those elements already in general acceptance. This kind of constructivism is doubly constructive: (a) Understandings are constructed by using prior knowledge to go beyond the information given, and (b) the prior knowledge that is brought to bear is itself constructed, rather than retrieved intact from memory, on a case-by-case basis. What the above implies is that technologies are more effectively used as tools to construct knowledge with—not from, like in programmed instruction or computer-assisted instruction frames.

Jonassen and Land (2002) list several conceptions of learning that share many beliefs and assumptions. These views are based on belief that learning is neither a transmissive nor a submissive process but rather a willful, intentional, active, conscious, constructive practice that includes reciprocal intention-action-reflection activities. The views mentioned are socially shared cognition, situated learning, everyday cognition and everyday reasoning, activity theory, ecological psychology, distributed cognitions, and case-based reasoning. They are based on a similar ontology, epistemology, and phenomenology.

Besides the process, the different views have in common the assumption that we are obligated to consider not only the performances of the learners but also the socio-cultural and sociohistorical setting (customs, rules, laws, roles) in which the performance occurs and tools and mediation systems that learners use to make meaning.

Implications for Designing Learning Environments

Traditional computer-aided instruction has emphasized a systematic approach to the design of learning environments. This approach is called instructional systems design (ISD). Boyle (1997) notes that ISD has developed a clear method for developing learning environments:

The aim of the need analysis stage is to precisely analyse the nature of the task. This analysis is meant to identify every sub-task the student must do and every piece of knowledge the student must acquire. The underlying assumption is that the systematic analysis of task requirements will map onto the steps the learner will have to go through to acquire the knowledge. This analysis will normally yield a hierarchical classification where goals are broken down into sub-goals, and the content required to achieve the lowest sub-goals is specified. (p. 68)

Constructivism challenges the approach of traditional instructional design.

Bednar et al. (1992) have a quite extreme view of how constructivism differs from the old design principles of traditional behavior theory (the sequence of instruction is specified based on logical dependencies in the knowledge domain and the hierarchy of learning objectives). Bednar et al. argue that the learning environments should encourage construction of understanding from multiple perspectives. Effective sequencing or rigorous external control of instructional events simply precludes constructive activity and the possibility of developing alternative perspectives. The aim should be to facilitate situating cognition in *real-world contexts*, teaching through cognitive apprenticeship, and construction of multiple perspectives.

By real-world contexts Bednar et al. (1992) mean,

- The task is not isolated but rather is a part of a larger context. We should create projects or environments that capture a larger context in which the problems are relevant.
- The reason for solving the problems must be authentic to the context in which the learning is to be applied.
- The environmental context is critical. Learning always takes place in a context, and the context forms an inexorable link with the knowledge embedded within it. Thus, an abstract, simplified environment is not just quantitatively different from the real-world environment but is also *qualitatively different*. Authentic learning environments may be expected to vary in complexity with the expertise of the learner. Hence, when Bednar et al. propose an authentic environment and a complex environment, they are referring to authenticity and complexity within a proximal range of the learner's knowledge and prior experience.

The last point made by Bednar et al. receives support from the cognitive flexibility theory. Spiro et al. (1991), who summarize their own research, note that a common thread running through the deficiencies in learning is oversimplification. As an example, they state that compartmentalization of knowledge components works as an effective strategy in well-structured domains but blocks effective learning in more intertwined, ill-structured domains (where each example of knowledge application typically involves the simultaneous interactive involvement of multiple, wide-application conceptual structures), which require high degrees of knowledge interconnectedness. Well-structured domains can be integrated within a single unifying representational basis, but ill-structured domains require multiple representations for full coverage. Spiro et al. have found that a single analogy may help at early stages of learning, but it actually interferes with more advanced treatments of the same concept later on, when the knowledge domain is more intertwined and ill structured, requiring high degrees of knowledge interconnectedness. Spiro et al. summarize that the very things that produce initial success for the more modest goals of introductory learning may later impede the attainment of more ambitious learning objectives.

In traditional instructional design, there is a tendency to separate the content from the use of the content (what is learned can be used later). In constructivism, the learning of the content must be embedded in the use of that content (Bednar et al., 1992).

Spiro et al. (1991)—when discussing the implications of cognitive flexibility theory—argue that *revisiting the same material*, at different times, in rearranged contexts, for different purposes, and from *different conceptual perspectives*, is essential for attaining the goals of advanced knowledge acquisition. Content must be covered more than once for full understanding because of psychological demands resulting from the complexity of case and concept entities in ill-structured domains. This should be combined with the importance of contextually induced variability and the need for multiple knowledge representations and interconnectedness of knowledge components. Revisiting material in an ill-structured domain is not a simple repetitive process useful only for forming more durable memories for what one already knows: Reexamining a case in the context of comparison with a case different from the comparison context will lead to new insights. This should happen because partially nonoverlapping aspects of the case are highlighted in the two different contexts. Spiro et al. argue that the common denominator in the majority of advanced learning failures is oversimplification, and one serious kind of oversimplification is looking at a concept or phenomenon from just one perspective. This may even be misleading with regard to some of the fuller aspects of understanding. Spiro et al. suggest a nonlinear and multidimensional traversal of complex subject matter, returning to the same place in the conceptual landscape on different occasions, coming from different directions.

Also, the concept of generative learning environments has been suggested to emphasize the importance of anchoring instruction in meaningful, problem-solving contexts that allow simulation of the advantages of apprenticeship learning:

A major goal of this approach is to create shared environments that permit sustained exploration by students and teachers and enable them to understand the kinds of problems and opportunities that experts in various areas encounter and the knowledge that these experts use as tools. (Cognition and Technology Group at Vanderbilt University, 1992, p. 78)

The research group of Vanderbilt suggests the following design principles for learning environments:

1. *The problem situation information is displayed in the form of dynamic images.* The problems to be communicated can be much more complex and interconnected than in written format, and the students can more easily form rich mental models. There is also a possibility of noticing scenes and events that lead to the construction of additional, interesting problems in other context areas.
2. *Narrative format to represent information.* The purpose of this is to create a meaningful context for problem solving.
3. *Generative learning format.* Learners are to determine themselves what the outcome of the exercise will be because this will enhance the motivation of the learners. In this way, learners are also allowed to actively participate in the learning process.

4. *Embedded data design.* All the data needed to solve the problems are to be embedded within the narrative. The problems are not explicitly formulated in the environment but are incidentally presented in the story. An analogy to mystery stories provided: "At the end of a good mystery, one can see that all the clues were provided, but they had to be noticed as being relevant and put together in just the right way" (p. 81).
5. *Problem complexity.* This is based on a simple premise: Students cannot be expected to learn to deal with complexity unless they have an opportunity to do so.
6. *Pairs of related adventures.* This principle stems from the cognitive science literature. Concepts that are acquired in only one context tend to be welded to that context and hence are not likely to be spontaneously accessed and used in new settings. This is the same principle Spiro et al. (1991) introduce (discussed above): revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives.
7. *Links across the curriculum.* The narrative should be able to provide many opportunities to introduce topics from other subject matters.

The Vanderbilt research group summarizes that these principles have been created to recreate some of the advantages of apprenticeship training and to support the kinds of teaching activities that invite thinking. Merrill (1992), although criticizing several of the assumptions of constructivism, agrees with constructivism in insisting that the learner must be active. An instructional transaction should be defined as a mutual, dynamic, real-time give-and-take between an instructional system and a student in which there is an exchange of information.

Jonassen (1992) has described three stages of knowledge acquisition: introductory (learners have very little directly transferable prior knowledge), advanced (needed to solve complex and domain- or context-dependent problems), and expert (experts have more internally coherent yet more richly interconnected knowledge structures). He argues that constructivistic learning environments are most effective for the stage of advanced knowledge acquisition. He also first states that introductory knowledge acquisition is best supported by more objectivistic approaches, but after some thinking about the Piagetian and Vygotskian heritage, he notes that younger, novice learners are probably the most constructivistic learners. As the learners acquire more knowledge, a transition to constructivistic approaches is needed to represent complexity and ill structuredness as learners acquire more knowledge. Experts need very little instructional support and will likely be surfeited by the rich level of instructional support by most constructivistic environments. Thus, it is important to consider the context in which the learning is occurring.

Duffy and Cunningham (1996) present and justify their version of constructivism in an article often referred to in the field of education:

1. *All knowledge is constructed.* All learning is a process of construction. Learning is a matter of changes in one's relation to the culture to which one is connected.
2. *Many worldviews can be constructed; hence, there will be multiple perspectives.* The engagement with others creates the awareness of multiple perspectives.

3. *Knowledge is context dependent, so learning should occur in contexts to which it is relevant.* However, the physical character of the environment is relevant only to the extent that it affects the character of the “thinking” and skill requirements.
4. *Learning is mediated by tools and signs.* All distinctly human instances of learning are constructions situated within a context that employs some form of mediational means, tools, and/or signs.
5. *Learning is an inherently social-dialogical activity.* Knowledge, and thereby learning, is a social, communicative, and discursive process, inexorably grounded in talk. The way in which an individual (a student) comes to manifest the effective behavior of a community is to speak with the voice of that community.
6. *Learners are distributed, multidimensional participants in a sociocultural process.* A distributed concept of self shifts the activity of learning to the connections one has with communities, to the patterns of participation, and away from efficient internalization of knowledge. Here, Duffy and Cunningham (1996) refer to Lave and Wenger (1991) and state that learning is not the lonely act of an individual but a matter of being initiated into the practices of a community, moving from legitimate peripheral participation to centripetal participation in the actions of a learning community.
7. *Knowing how we know is the ultimate human accomplishment.* We are generally unaware of the beliefs we have adopted or created to live and teach by, but raising them to awareness can have salutary effects.

Computers can be as tools to off-load the basic cognitive task (amplifying the teaching task we have always been doing). But computers can also offer genuinely new representations or views of phenomena that would not otherwise be possible and hence provide *new understandings*. Duffy and Cunningham (1996) suggest that the technology should be seen as an integral component of the cognitive activity. The focus is not on the individual but on the activity in the environment. The task of the learner is no longer seen as static—the computer as applied to the task—but rather it is dynamic. The computer opens new opportunities and makes available new learning activities:

Success [of learning] will increasingly depend on exploring interrelationships in an information-rich environment rather than on accepting the point of view of one author who pursued one set of relationships and presents conclusions reflecting his or her implicit biases. (p. 188)

Duffy and Cunningham (1996) go still further and describe problem-based learning (PBL), which they feel exemplifies the constructivist theory. They identify five different strategies for using problems, all reflecting different assumptions about either what is to be learned or how learning occurs. The strategy Duffy and Cunningham are calling for is called “the problem as a stimulus for authentic activity.” The focus should be on developing the skills related to solving the problem and other problems like it. Skills are developed through working on the problem (i.e., through authentic activity). It is impossible to describe what is learned in terms of the activity alone or in terms of the content alone:

Rather, it is the activity in relation to the content that defines learning: the ability to think critically in that content domain, to collaborate with peers and use them to test ideas about issues, and the ability to locate information related to the issues and bring it to bear on the diagnosis. (p. 190)

The teacher does not teach students what they should do or know and when they should do or know it. Rather, the teacher supports the students in developing their critical thinking skills, self-directed learning skills, and content knowledge in relation to the problem. The key issues that one should go through in designing PBL instruction are the following:

1. *Task analysis.* What must be learned? Combine identification of the key concepts, procedures, and so on, with an analysis of the professional use of those concepts. But this does not involve the analysis of that key information into underlying learning requirements. What must be learned includes not only the information in the content domain but also metacognitive, collaborative, and other skills necessary for participating in authentic activity.
2. *Problem generation.* This determines what the students must learn. The two principles to follow are the following: (a) The problem must raise the concepts and principles relevant to the content domain. (b) The problem must be "real." Real problems tend to engage learners more; there is a larger context of familiarity with the problem.
3. *The learning sequence.* The learning cycles go through two types of learning activities: collaborative problem analysis and self-directed learning. For example, the whole class might first work to identify learning issues in the content area, and then small groups assume responsibility for particular issues. They develop expertise on those issues and then share that expertise in large-group problem solving. This is considerably different from learning activities in traditional instruction, where the reading is assigned by the instructor and the task is to learn what is in the text. Throughout the sessions, the facilitator models high-order thinking by asking questions that probe knowledge. Duffy and Cunningham (1996) suggest that in PBL the learning tasks should be both self-assessed and peer-assessed.

Today, the basic principles of constructivism seem to be more or less established: Technologies can support learning if they are used as tools that help learners to think. For example, the basic principles of constructivism (11 principles) listed by Jonassen, Peck, and Wilson (1999) do not add much to the lists described earlier. Some of those 11 principles are, however, quite sharply defined by Jonassen et al.:

1. *A knowledge construction process is produced by a dissonance between what is known and what is observed (i.e., there is a problem).* We can memorize ideas, but to actively seek to make meaning involves the desire to make sense of things. This is the learner's problem, not the teacher's. Resolving dissonance ensures ownership of the ideas. What is learned becomes more relevant, important, and meaningful.
2. *Knowledge building requires articulation of what is learned.* For usable knowledge to be constructed, learners need to think about what they did and articulate what it meant (verbal, visual, auditory).

3. *Meaning making can also result from conversation.* Social constructivism believes that meaning making is a process of negotiation among the parties through dialogues. This dialogue occurs most effectively within communities where people share their interests and experiences.
4. *Meaning making and thinking are distributed throughout our tools, culture, and community.* Distributed memory—what the group as a whole knows—is clearly more capacious than individual memories. Sharing those memories makes the community more dynamic.
5. *Not all meaning is created equally.* If individual ideas are discrepant from community standards, they are not regarded as viable.

Constructivism presents some challenges for the creation of learning situations. If learning is an active, constructive, intentional, authentic, and cooperative process, so should be the ways in which we assess the learners and the criteria that we use to evaluate them. Constructivism suggests that we need to assess the meaning that learners have co-constructed from their interactions with the world. So how can we know when students have learned? Probably by assessing learning while it is occurring (Jonassen et al., 1999). This assessment is process oriented. When assessing learning, the questions we are interested in are, Does it make sense? Is it well founded, well presented? Can it be applied? Is it consistent with the standards?

How Does Constructivism Link to SG?

I am not trying to say that constructivism should replace the experiential learning theory in the SG field. But we see that constructivism includes explanation power that should help simulation gamers to better argue their exercises and to further understand the power of experiential and PBL.

On the basis of the findings in the previous sections of this article, we find several links between constructivism and SG exercises. For example, Jonassen and Land (2002; introduced earlier) describe a learning process (intention–action–reflection) that is similar to the experiential learning cycle.

In SG, the learner is a newcomer (Lave & Wenger, 1991) who changes knowledge, skill, and discourse and becomes an “old-timer.” This has much to do with developing identity, where the learner transforms into a member of a community of practice. As Lave and Wenger (1991) note, knowing is inherent in the growth and transformation of identities, and it is located in relations among practitioners, their practice, the artifacts of that practice, and the social organization of communities of practice. This is similar—if not equal—to an SG learning experience. According to the ideas of constructivism, understanding the world as experienced is important (Lave & Wenger, 1991): For newcomers, their shifting location through a complex form of practice creates possibilities for understanding the world as experienced. Duffy and Cunningham (1996) note that there is no master who assigns tasks or who monitors the learner’s (apprentice’s) behavior. The apprentice begins to assume responsibilities, testing his or her abilities to assume roles and responsibilities in that environment. Is not the

process of gaming about first observing and then beginning to take on some responsibilities in a group of which we wish to become an integral part?

Much like Duffy and Cunningham (1996) describe, SG environments provide the learner access to the community of practice and provide the tools that will support the learner in assuming his or her role in that practice. Moreover, SG focuses on developing the skills of the learner to construct (and reconstruct) plans in response to situational demands and opportunities (as Duffy & Jonassen, 1992a, propose). Thus, SG instruction provides contexts and assistance that will aid the individual in making sense of the environment as it is encountered. SG plans are constructed, tested, and revised as a function of the particular encounters in the environment. Furthermore, authenticity and realism has a role both in SG and constructivism. Our tools are *simulation games*. What is simulated in SG is some of the critical features of the reality (Saunders, 1995). Keys and Wolfe (1990) define a management SG as a simplified simulated experiential environment that contains enough verisimilitude, or illusion of reality, to include real world-like responses by those participating in the exercise.

Gaming produces a narrative where the participants enculturate through social interaction. Constructivism emphasizes the group environment, and what Brown et al. (1989) describe as group learning is much like the description of SG: collective problem solving, displaying multiple roles, confronting ineffective strategies, and providing collaborative work skills. Compare this to the descriptions of SG from, for example, Klabbers. Games are social systems, and they include actors (players), rules, and resources, which are the basic building blocks of social systems (Klabbers, 1999, 2001). In each game, the players (actors) interact with one another while applying different rules and utilizing different resources (Klabbers, 2003).

In SG, the learner is building an internal representation of knowledge, a personal interpretation of experience (as Bednar et al., 1992, suggest). This representation is constantly open to change. Learning in SG is an active process in which meaning is developed on the basis of experience. Learning in SG environments is situated in a rich context, reflective of real-world contexts, making it possible for this constructive process to occur and transfer to environments beyond the learning situation. The learner should be moved into thinking in the knowledge domain as an expert user of that domain might think. And as noted earlier about the constructivist principles, the goal is to portray tasks, not to define the structure of learning required to achieve that task. As in constructivism, also in SG we must leave the identification of relevant information and correct solutions open in the instructional situation. Again, similarly, the focus will be on the skills of reflectivity of the learner, not on remembering.

Also, Spiro et al.'s (1991) requirement suits SG exercises: Emphasis must be shifted from the retrieval of intact knowledge structures to support the construction of new understandings. Learners should be able to bring together from various knowledge sources an appropriate ensemble of information suited to the particular problem-solving needs of the situation at hand. What this implies most of all is that SG environments are most of all tools to construct knowledge with—not from, like conventional programmed instruction.

Considering a branch of SG, business gaming, we can note the following. Business gaming forms an intention–action–reflection learning process typical for different kinds of games. In a business game, the player is always a newcomer, as the game setting and environment probably describe an environment different from the participant's real-world environment. Even if the game were tailored for a specific industry, the game environment still would be a new experience for the player. During the game, the participants discuss the characteristics and logics of the environment, negotiate together, change knowledge, learn from each other, and make decisions. Thus, they develop identity as managers of the firm they are running. At the end of the game, the participants should be experts who are on top of the events taking place in the game. All the participants in the game session (from different companies) form a community of practice, which has understood the simulation world as experienced. If the game session works as intended, the learners begin to assume responsibilities and test their abilities to assume roles and responsibilities in the game environment.

In business gaming, the gaming process definitely includes constructing and reconstructing plans in response to situational demands and opportunities. The game environment provides contexts and assistance that will aid the players in making sense of the events and business logic embedded in the game environment: Plans are constructed, tested, and revised as a function of the particular encounters in the environment. Business games have also been argued to be authentic and realistic learning environments as mentioned above, although this argument is under serious doubt (e.g., Gosenpud, 1990; Paul, Macredie, & Thomas, 1996).

Business games definitely create a narrative of an industry and companies acting within the industry. The gaming manuals usually give a background story about the nature of the industry and how the customer market is going to develop. The players are able to enculturate in this narrative through social interaction. The group environment with collective problem solving is an essential part of the game, and the players may be told to take different management roles.

In every business game session, every player builds personal interpretations of experience. As Gosenpud (1990) notes about business gaming, the learner often learns things not intended by the designer, and often this unintended learning is more valuable because it is relevant to the learner. The business gaming learning context is without doubt rich: It includes social interaction and decisions, which cover a multidisciplinary field and where the environment is in change. The players are given an expert role of a manager, and they are supposed to think in the knowledge domain as an expert. The whole idea is to give the participants knowledge that can be transferred to environments beyond the learning situation. The goal is to portray tasks, not to define the structure of learning required to achieve that task. The identification of relevant information and correct solutions is left open in the situation.

But when considering the constructivist principles further, we can also note that business gaming could better answer to them. Present business games are not very dynamic. They form a budget-making process (the black-box model), which is in general very static, as the game participants mainly get reports from the end of the

period and then need to form new decisions. This kind of decision-making environment lacks dynamicity and interactivity. In other words, the black-box model of business games lacks the lapse of time as a continuous flow of events.

Furthermore, in traditional business gaming, the role of the game operator may be very central and influential. The game environment should let the participants determine themselves what the outcomes of their decisions are and what the causes for these outcomes were. In business games, the operator often has to explain, for example, why the customers reacted in a certain way or why R&D investments lead to certain results. The game environment should be transparent (see Alessi, 2000). This has much to do with the fact that present business games do not allow the participants to see the game processes at all, as they are executed in the black-box simulation model.

Implied above is that following the constructivist principles tells us to seriously consider the structure of present business games. To also give the participants the possibility to experience the game environment with its processes would imply that the black-box model should be opened. This would create an authentic way of presenting game internal processes. This would provide better contexts and assistance to aid the individual in making sense of the environment as it is encountered.

Conclusions

The aim of this article has been to clarify the concepts, beliefs, and understandings related to constructivism. Our research question was, Is the constructivist learning paradigm able to increase our understanding about the learning processes that take place in SG training? At this point, I do not want to give a finite answer. However, the findings have strengthened my belief that constructivism is very relevant for SG research, design, and understanding about game participants as meaning makers and knowledge constructors.

I also wanted to make the learning view more understandable for the SG community. Constructivism is not a coherent learning theory; it is more a set of principles that can be applied especially when designing computer-based instructions. Not all the advocates of constructivism share the same view of these principles, and the degree of how strictly these principles are applied varies.

Merrill (1992) states that as compelling as the arguments of the constructivists may be, there is no empirical evidence in support of their assumptions. Also, Hakkarainen et al. (2004) note that constructivist learning perspectives do not appear to address the processes of deliberately creating and advancing knowledge that are essential for the modern society. As constructivists focus on adaptation to existing cultural practices, they do not pay any special attention to creative changes in these practices. Thus, constructivism is not enough because it has been elaborated as a way of investigating stable cultures rather than cultural transformations.

On one hand, the above should not prevent the SG community from carrying out perspective making (Boland & Tenkasi, 1995), the process whereby a community of

knowing develops and strengthens its own knowledge domain. On the other hand, most important in constructivism for the SG community is that if the constructivist assumptions on learning are valid, then the future of SG seems ever prosperous. SG exercises seem to support and fulfill most of the constructivist requirements for effective learning environments. Furthermore, SG has traditionally functioned as a change agent, through the use of which organizations are seeking for more efficient work practices or enhanced perception of organizational functioning. The discipline of SG has always aimed at individual, cultural, or organizational transformation. In that sense, SG offers a very potential discipline within which to study processes of deliberate transformation of knowledge where new ideas, tools, and practices are created.

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