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Learning as *becoming* through performance, play, and dialogue: A model of game-based learning with the game *Legends of Alkhimia*

Yam San Chee

Abstract

*Thomas and Brown (2007) suggest that games and virtual worlds allow play and learning to merge, enabling “learning to be” rather than “learning about”. In this context, I address the challenge of designing game-based learning to enact a pedagogy of ‘learning as becoming’ in classroom contexts. I argue that the theory of human information processing fails to provide a tenable account of human learning. I propose a pragmatist notion of education that foregrounds experience and inquiry to provide an alternative foundation for envisioning education today. I then draw on social theory to provide a theoretical framing for game-based learning design. I instantiate this framing via the Performance–Play–Dialog (PPD) Model and argue in favour of a shift to performance as a key construct for framing human learning. I illustrate the PPD Model using the game *Legends of Alkhimia*, a multiplayer game addressing the chemistry curriculum in lower secondary school.*

Keywords: learning, becoming, performance, play, dialog, identity, role-taking, habitus, pragmatism, PPD model

Introduction

There is widespread general interest in the use of games for learning (for example, Ellis et al., 2006; Sandford & Williamson, 2005) and the relation between game attributes and learning outcomes (Wilson et al., 2009). In the journal *Games and Culture*, Thomas and Brown (2007) explicitly suggest that massively multiplayer online games provide a fundamentally different way of thinking about learning—characterized as “learning to be”—compared to traditional modes of instruction that address “learning about”. There appears to be an implicit plea for a shift in pedagogical practice to one that would better leverage the unique affordances of such online gaming environments that might better serve the needs of students today. In the field of science education, in particular, Roth and Tobin have been particularly vocal, cogent, and urgent in their articulation of the vital need to include considerations of being and identity in students’ learning of science (see, for example, Roth, 2006; Roth & Tobin, 2007).

There appears to be little response so far to Thomas and Brown’s plea. While recent work by Kafai and colleagues (Kafai, 2010; Kafai, Quintero, & Feldon, 2010) makes interesting connections that explore student identity related issues in tween virtual life, the orientation toward learning remains one of “learning about”. This orientation is evident in the descriptions that Kafai (2010, p. 11) gives of several single player science games in the *Whyville* (Numedeon, 1999) online environment. *Spin Lab* is described as being for a player to “learn about momentum, rotational velocity, and inertia”. *GeoDig* is a game where “players can learn about different rock origins”. *Rocket Design* is a game where “players learn about velocity, acceleration, and graphing”. Even the collaborative science game, *Solstice Safari*, is described as one that “teaches [students] about the Earth’s position in relation to the Sun, notions of time (days, years) and seasons, temperature,

and geography (latitude and longitude)". This emphasis on "learning about" subject content may well arise from the requirements of school curricula and the demands of standardized testing. However, the emphasis on "learning about" merely manifests the legacy of a Kantian and Cartesian heritage that detaches knowing from the material world, including the body, and considers knowledge structures to be abstractions from experience, including the emotions (Roth, 2006). Such a perspective fails to acknowledge and account for the reasons humans have for the actions they take and the personal agency that drives human investment in the learning process. Freed from the constraints of "learning about," however, how might we design for effective game-based learning that is more deeply educative in nature?

In this paper, I respond to Thomas and Brown's interest in "learning to be." I seek to address what it would mean to design an immersive, interactive, multiplayer game to support a pedagogy based on *learning as becoming* (Chee, Loke, & Tan, 2009). My work takes place in the context of funded research directed toward the development and evaluation of innovative technology-enhanced pedagogies that incorporate new media literacies in classroom learning. I approach this task by adopting Dewey's approach of fostering learning *as* inquiry (Biesta & Burbules, 2003; Dewey, 1938/1991). The position that I take is inherently values based. This value system is rooted in American pragmatism, which traces its roots to Peirce, James, Dewey, and Mead.

The remaining sections of the paper proceed as follows. In the next section, I critique the cognitivist mode of understanding human cognition that has led to viewing how people learn predominantly in terms of content acquisition and attempts at re-presentation of content. Having identified the flaws of the cognitivist paradigm, I draw upon the philosophy of pragmatism to establish an alternative foundation for conceiving of learning in the context of education in the age of new literacies. Next, I draw inspiration from the ideas of Dewey, Mead, and Bourdieu to provide a dialectical account of learning rooted in the interdependency between the individual—self—and the social—society.¹ Building on the ideas of Dewey, Mead, and Bourdieu allows me to reframe learning not as "learning about" but as a process of becoming: a perspective on learning that finds resonance with approaches such as situated learning (Lave & Wenger, 1991), communities of practice (Wenger, 1998), and discourse as constitutive of becoming (Roth, 2010). This reconstruction then allows me to ground game-based learning on the central construct of *performance*, as explicated by the Performance–Play–Dialog Model. I concretize this model with a case example based on *Legends of Alkheimia*, a multiplayer game for lower secondary school chemistry, before concluding the paper.

How People Learn: Is Human Information Processing the Answer?

There is widespread acceptance that thinking, reasoning, and problem solving arise from human information processing (Bransford, Brown, & Cocking, 2000). This belief is grounded in *cognitivism* (Still & Costall, 1991), the term used to refer to the computational paradigm of cognitive psychology and its associated computational theory of mind that arose in the mid-20th century. Based on the metaphor of the computer processor, human cognition is conceived of as following an input–process–output model. This model presupposes that cognitive processes are based on receiving information inputs (which may include sensory inputs), processing those inputs, and outputting information that results from processing back into the environment. On this view, cognitive processing usually entails mental processes of recognition and recall from memory, where memory is construed as a form of information storage.

Arising from the work of Newell and Simon (Newell, 1980; Newell & Simon, 1976; Newell & Simon, 1972), the mind is hypothesized as a physical symbol system that has

all the necessary and sufficient means for general intelligent action. On this account, human mental function is a process of computation. As with the execution of software programs, the mind has a “cognitive architecture” (Anderson, 1983) that establishes the structures for “mental programs” to run. These programs run by executing “rules,” such as statements of If–Then conditions, upon “representations of knowledge,” such as semantic nets, schemata, and mental models (Johnson-Laird, 1983). In this manner, the study of cognition adopted a computational turn (Pylyshyn, 1984), and computer models of mind came into vogue (Boden, 1988). A corollary of the commitment to computation is that thinking is understood as the deliberate manipulation of mental representations, and thinking-as-computation focuses primarily on the truth value of symbolically expressed propositions (Holder, 1995).

The understanding of human cognition sketched above provides the foundation for cognitive science today. That understanding, however, raises many questions to which credible answers remain lacking. For example, how does sense data, entailing physical impulses of energy, become transformed into “information”? How does thinking relate to action? What is the relation between mental and physical phenomena? What is the role of emotions and values in thinking and how are they related? What is the role of experience in thinking? How is creative thinking possible? Is thinking a product of “mind”? If so, what is mind, and of what is it constituted?

Probing the intellectual climate that gave rise to the above ideas, we find that the seeds of a mechanistic understanding of cognition can be traced to two significant historical developments. First, the growth of the physical sciences from the seventeenth century onwards, together with the success of these disciplines, that led to the dawn of the Enlightenment, opening up the era of modernity and producing a slew of impressive technological successes. This period gave rise to a quest to pursue disciplines in such a manner that they would be able to withstand the new norms of scientific scrutiny. These norms were framed in terms of empirically grounded inquiry and causal explanations rooted in material bases; that is, materiality. Second, the field of epistemology was established based on the belief that it must be a foundational enterprise; that is, a rigorous discipline *prior* to any science so that epistemology could be used to check the truth claims of any alleged science. Epistemology would make clear “just what made knowledge claims valid, and what ultimate degree of validity they could lay claim to” (Taylor, 1995a, p. 2). In this way, epistemology would ensure the integrity of any scientific domain.²

The above thinking, however, is itself rooted in two fundamental (mis)assumptions. First, it assumes the existence of an “inner” mental world and a separate “outer” physical reality. Second, it assumes that “true knowledge” is the correct representation of that independent “outer” reality. Both assumptions are flawed.

The first assumption of an “inner” mental world and an “outer” physical reality gives rise to ontological dualism and the classical mind-body problem. It reflects a “reflexive turn,” attributable to Descartes, where the seeker after science is directed “within,” to the “contents” of his own mind (Taylor, 1995a). This inward turn raises the question of what the “inner” world of mind is made of and how it works. There have been many attempts to provide a compelling answer, but as the argument between Pinker (1997) and Fodor (2000) demonstrates, there is no agreement to be found. While Pinker advocates a computational theory of mind “enhanced” by the theory of natural selection, Fodor argues that this “new synthesis” remains wanting because it fails to account for humans’ capacity for “higher mental processes” such as making a purchase decision. Philosophers have attempted to address the mind-body problem for decades, but they have not met with success (P. Churchland, 1988; Searle, 1984). No compelling and credible explanation has been proposed that can account for how human beings,

constituted by material bodies, can come to possess the ability to think and to experience consciousness when all other known material substances show no like capacity for thinking and consciousness.³

The putative construction of “mind” arising from the ontological move above raises a concomitant question about the material basis of mind. Neuroscientists and neurophilosophers make the convenient assumption that mind is reducible to brain, but they have not been able to specify how this might be achieved. P. S. Churchland (1986), for example, argues that the inter-theoretic reduction she seeks is a relation between theories such that explanatory unification is achieved. Unable to provide an account of how cognitive and social psychology (as known and based inherently on “folk psychology”) might be reduced to brain states, she suggests that folk psychology may ultimately need to be overhauled: “If we see that folk psychology has no right to epistemological privilege, and no immunity to revision and correction, then we can begin to see that its generalizations and categories can be corrected and improved upon” (P. S. Churchland, 1986, p. 311). To strengthen the assumed reducibility of mind to brain, the hyphenated term “mind-brain” or a variant using a slash notation, “mind/brain”, has become popular. This attempt to force-fit a “science of mind” into the requirements of a materialist creed so as to banish “ghosts” and other homunculi (Edelman, 1992) from a respectable theory of mind has only served to expose the flaws embedded in dualist assumptions. In an incisive critique of cognitive science in general and neurophilosophy in particular, Coulter and Sharrock (2007) assert that both materialism and ontological dualism must be rejected. They show, through cogent argument, that adherence to materialist and dualist assumptions in respect of mind and brain arises from errors of *conceptualization* deeply intertwined with how everyday language is used. They argue that the claim that things are identical with what they are made of—the materialist assumption—is not a result of science but rather an idea inherited from the substance metaphysics of Aristotle. They further argue that it is not the part of neurophysiology, in particular, brain states, to inform us about peoples’ intentions, motives, conventional ways of doing things, the grammar of their languages, and their attitudes to things because such phenomena arise out of *social* forms of life and discourse—discursive practices—that bear *no necessary relation* to neurophysiology (Coulter, 2008). Consequently, looking solely to the brain for an explanation of the mind is erroneous and misguided. To understand intelligent adaptive human behaviour in situated contexts, it is necessary to appeal to alternative onto-epistemological foundations upon which to construct our explanations (Barad, 2003).

Returning to cognitivism and the computational theory of mind, the second assumption that “true knowledge” represents the assumed, independent “outer” reality is an epistemological claim. It presumes that mind is a mirror of nature (Gergen, 1999; Rorty, 1979). On this account, there is a one-to-one correspondence between the “in here” world of subjectivity and the “out there” world of objects. The words and language that we use to describe the world and events therein are assumed to have a direct correspondence with what takes place in the world. This latter stance, also known as the “correspondence theory of language” (Gergen, 1999), implicitly assumes that a human knower can stand outside of and apart from the world and account for what takes place in the world completely objectively. However, this is not possible. Classical epistemology approaches the problem in terms of the (independent) knower and the (objective) known. As Dewey and Bentley (1949) have shown, however, epistemology can only be approached in terms of *knowing*, an in-the-world process, and the known. As human observers, we are unable to detach ourselves from the world to view it from an objective third person standpoint. Rather, we are born *into* the world, and our observations of the world are always and unavoidably rooted in our learned experiences

in the world. In short, we are always *part of* the world. Hence, there is no possibility of observing the world “objectively”.

Based on the above arguments, we claim that people do *not* learn by human information processing, in the sense advocated by the computational theory of mind. In taking ‘information’ as the elemental unit of processing, the cognitivist paradigm side-steps the difficult issue of *meaning* associated with information because information is *assumed* to be inherently meaningful. Drawing in part on computing terminology related to “electronic data processing” and then “information processing,” the metaphoric understanding of cognition as information processing connotes the idea that the “data” in electronic data processing are “raw” and not very meaningful until they are processed, manipulated, and aggregated into a higher level form: meaningful information. Given that symbols processed by a computer have no inherent meaning in and of themselves and that the correspondence theory of language is not tenable, it follows that the human information processing paradigm of cognitive science is an inherently “meaning-less” theory of cognition; that is, it is meaning-free. Hence, the human information processing paradigm fails to explain human cognition in a way that addresses meaning and human meaning making. Instead, it avoids the issue. A theory that avoids dealing with meaning and with meaning construction cannot be a viable theory of human cognition. It is not tenable on both ontological and epistemological grounds.

Pragmatism as an Approach to Education

The philosophy of pragmatism originated in the United States around 1870. Peirce, James, and Dewey are typically regarded as the founders of this philosophy. The pragmatist stance may be exemplified by means of Peirce’s maxim: “Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then our conception of these effects is the whole of the object” (Peirce, 1878/1992, p. 132). Significantly, pragmatism may be understood as emerging out of a theory of *meaning* because there is no difference of meaning so fine that it cannot be detected in terms of a difference in terms of possible consequences. If the consequences of two conceptions are identical to an individual, then their meaning must be identical (Garrison & Neiman, 2003).

Given the orientation toward consequences, a central aim of education based on pragmatism is to develop students’ capacity for effective action. For James, as well as Dewey, human needs, interests, and purposes are pre-eminent in thought and action. James insists: “My thinking is first and last and always for the sake of my doing” (James, 1890/2007a, p. 333). The etymology of pragmatism flows from the Greek word *pragma*, meaning act, deed, or affair, and pragmatists are most interested in action that can be socially regarded as intelligent.

Arising from a desire for organic unity and a grounding in the biological conception of psyche, the crucial idea connecting biological functioning with mental functioning for James is that of *habit* (Garrison & Neiman, 2003). James argues that “[t]he great thing, then, in all education, is to *make our nervous system our ally instead of our enemy . . . For this we must make automatic and habitual, as early as possible, as many useful actions as we can . . .* The more of the details of our daily life we can hand over to the effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work” (James, 1890/2007b, p. 122). Similarly for Dewey, fundamental dispositions are an important category of habits.

For both James and Dewey, thinking is a process that emerges from and is continuously controlled by *non-cognitive* levels of experience.⁴ These levels include emotion, habit, and imagination (Holder, 1995). James and Dewey reject cognitivist

models of thinking because such models over-strongly foreground “mental structures” at the expense of non-cognitive aspects of experience such as habits, values, and beliefs. For Peirce, a belief is an *embodied* habit of action evincing emotion. Peirce states that “[o]ur beliefs guide our desires and shape our actions . . . The feeling of believing is a more or less sure indication of there being established in our nature some habit which will determine our actions” (Peirce, 1887/1992, p. 114).

Reconstructing cognition from the perspective of pragmatism, thinking is viewed as a process situated inextricably in experience. Dewey argues that experience has as its basic pattern a two-way *transaction* of an organism and its environment. He was dissatisfied that modern theories of experience fail to carry the sense of doing (*poiein* or *praxis*) and being done to (*pathos*) that the concept had borne from the time of the ancient Greeks, and that it had become exclusively identified with what is intellectual and cognitive (Garrison, 1998). Transactions occur on a variety of interdependent levels, including social and physical levels. According to Dewey, experience involves embeddedness in a situational context that has structural complexity, and structural complexity invokes the qualitatively immediate features of experience such as emotions, feelings, and attitudes. Dewey distinguished between the “foreground” and the “background” in experience. The foreground in experience is that which holds our attention. The background is that part of the experiential situation that does not fall within the focus of attention, but it nevertheless provides a qualitative immediacy which is presupposed and unquestioned when we are thinking. There is no foreground without a background. Hence, there is always some presupposed implicit context in every act of thinking (Holder, 1995). Within the unity of the transactional act, meanings emerge through reflection on precognitive activities and feelings (Garrison, 1998).

Dewey argues that the origin of thinking arises in a feeling of perplexity or doubt in the non-cognitive background of embodied experience (Johnson, 1987, 2007). In the activation of thinking, the qualitative immediacy of experience is transformed from the level of feeling to a level where possibilities and connections are recognized. Such possibilities and connections are exploited at the cognitive level for use as ideas and plans of action. Even as cognitive events transpire, substantial portions of the non-cognitive dimensions of experience are retained, and they serve to regulate the thinking experience. The non-cognitive background provides the standards of *valuation* that are the habitual norms by which humans make judgments. Furthermore, every experience, cognitive or otherwise, is qualitatively pervaded with *emotion*, the basis of attitudes towards things. From the perspective of pragmatism, emotion provides a primary interpretative scheme by which not only the meaning of a situation as a whole is apprehended, but it also “colors” the meanings of the particular constituents of the situation. Unlike a cognitivist interpretation, emotion is not perceived as an inhibiting factor or a source of bias; rather, it plays a constructive role in the thinking process. Dewey’s analysis of thinking demonstrates that cognitivism, on which the information processing account of thinking is based, is epistemologically deficient because thinking cannot be reduced to and equated with the logical or computational manipulation of mental representations, information, or ideas. Based on Dewey’s account, the emergence of thinking does not entail a radical break in the continuity of experience. Rather, it represents the emergence of a new organization of experience (Holder, 1995).

For Dewey, inquiry, or deep thinking, begins in doubt and concludes when the stimulus of doubt is removed.⁵ He argues that educational aims must be capable of translation into teaching methods that fit the activities of those receiving instruction, and education administrators must foster the kind of environments required to liberate and to organize the capacities of students. He further insists that students must be treated as participants in life, not just as spectators of life. Unlike passive spectators,

participants have direct care and concern for their own future. They are inclined to act so as to assure the best possible consequences. This participatory orientation can be productively leveraged for personally meaningful curriculum design and student learning. From Dewey's perspective, education should be approached as a process of forming fundamental dispositions, intellectual and emotional, toward nature and toward fellow-beings (Dewey, 1916/1980). It should free intelligence in ways that reconstruct physical and social environments, including selves. Intelligence is as much about creative imagination and passion as it is about cognition. The education of *eros*, a passionate desire for what is valuable, and the development of a creative imagination capable of envisioning future possibilities are every bit as important as acquiring a mastery of facts and the principles of logic. This cannot be achieved in the absence of a thorough critique of existing social customs and forms of thinking, an endeavour in which Dewey duly engaged (Garrison, 1998). In contemplating the design of game-based learning, pragmatism offers a powerful alternative to cognitivism, and it is upon this foundation that I have chosen to proceed.

Social Theory for Game-based Learning

In the preceding discussion, I argued for shifting our understanding of thinking and cognition away from the metaphor of information processing to a more naturalistic understanding grounded in notions of embodiment, transactions, and experience *in* and *with* the world (including humans in the world). This repositioning marks a first step toward aligning a general theory of learning with how people learn when playing digital games.⁶

A second, important manoeuvre is now required. This second step addresses the problem of "meaning-less cognition" surfaced above by re-contextualizing how people learn in terms of the construction of personal identity through the process of *becoming*. In this section, I make the connection between learning and social theory in order to build on the pragmatist approach to education and to further construct a theoretical conception of game-based learning in terms of learning to become some kind of person in society: for example, a chemist, as in the curriculum discussed in this paper, or an active citizen. From this perspective, learning is no longer restrictively conceived of in rationalistic, mind-centric terms. Instead, it is reframed as a person-centric, developmental, and interactional process. Jarvis (2009) conveys this idea elegantly: "Learning to be a person in society: Learning to be me".

As Dewey (1925/1988, p. 226) argues, "[m]eanings do not come into being without language, and language implies two selves involved in a conjoint or shared undertaking". Meanings emerge when, through the reciprocal coordination of behaviour, we render something common between two or more centres of action (Garrison, 1998). A focus on the development of understanding between two or more selves places us firmly within the domain of social and cultural theory. Dressman (2008) suggests that social theory can offer educators and educational researchers insight into social and educational problems that extend beyond a critical historical account of modernity that is rooted in rationalism. In this section, I draw upon the social theories of Mead and Bourdieu to ground my theoretical approach to designing for and effecting game-based learning.

Mead's theory of mind, self, and society

Since the 1980s, educational phenomena have increasingly been viewed as the product of historical and sociocultural forces that produce behaviours too subtle and complex in their dynamics to be quantified and experimentally manipulated (Dressman, 2008).

Moving beyond experimental approaches, Mead (1934) focused on conceptualizing a social account of the “self” in a manner faithful to what is known from biology and sociology. His theory of the self is completely social in orientation. It views social interaction as the chief organizing principle underlying human behaviour. For Mead, mind is not conceived as something that resides in the physical brain or in the nervous system. Rather, the (social) mind is constituted in *behaviour*, and it is manifested through internalized communication that is always social in nature. A corollary of Mead’s theory is that we are not *born* human; rather, we *become* human. Becoming human in this manner implies that each person is a historically and socially situated self (Allan, 2005).

According to Mead, the self is a social object whose meaning emerges through successive role-taking experiences in interaction. It is not a structure or core attribute of an individual. Instead, its meaning will tend to change as the person’s interactions change. Self is thus a social entity and an ongoing production that arises in social interaction. The self is a pivot point for the formation of society as well as for individual thinking. Society and thinking are made possible reciprocally via the existence of self. The self, on one hand, and society and thinking, on the other, thus stand in dialectical relation with one another. Furthermore, what society is and the influence it has on people’s meaning making arise through their face-to-face interactions that involve the use of symbolic and natural language. Language as used thus serves as a repository of *social* experiences. It expresses and preserves social and cultural events, experiences, and pragmatic meanings. It is therefore a social entity that exists “outside of” individuals. Consequently, when we use language to understand our *own* experiences, those experiences become social as well.⁷

Based on Mead’s theory, the self is a constructed *perspective* divorced from the constraints of time and place. It is a symbolic platform on which to stand and from which we come to view our own behaviours as if someone else were performing them. *Role-taking* is the process through which we learn to place our self in the position of another in order to see our own self. This process requires the individual to adopt a separate perspective, and it necessarily entails the activation of personal meaning making processes.

The genesis of self occurs through three stages of role-taking: play, game, and the generalized other (Mead, 1982). Mead articulates these stages in the context of a child being enculturated into society. During the play stage, the child takes the role, or assumes the perspective, of a certain significant other. Mead calls this stage the play stage because children must literally play at being some significant other, such as the child’s mother, in order to see themselves. This act represents the genesis of an *objective stance* that allows a child to get outside of herself in order to watch the self, as if on stage. During the game stage, the child begins to take the perspective of several others and learns to take into account the rules, or sets of responses that different attitudes bring out, of society. During this stage, role-taking is still not very abstract: the child can take on the role of several individuals, but they all remain as separate individuals. As the child progresses in ability to use abstract language and concepts, he or she becomes able to think in terms of more general or abstract others such that there are no longer any specific other people involved. Rather, the child is able to see herself through the eyes of some generalized other. This generalized other refers to sets of attitudes that an individual can take toward oneself. It is the general attitude or perspective of a community. Through the generalized other, the community begins to exercise control over the conduct of individual members.

The construction of self as a generalized other realizes, for Mead, the notion of the (social) mind as an internalized conversation between two people, the actor and the observer, referred to as the “I” and the “Me.” The “I” is the seat of impulse; it is that

part of the self that is unsocialized and spontaneous in behaviour. The “Me” is the perspective that is assumed when, as individuals, we view and analyse our *own* behaviours. Having a sense of selfhood, then, entails a reflexive, internal dialog between the two parts. The “I” is the subject, and the “Me” is the object. What “I” do, I do to the “Me” (Allan, 2005).

For Mead, the self is not an individual, nor is it a psychological construct. Rather, it is constructed through language acquisition and role-taking in social interactions. The “Me” presents to the individual the perspectives of society at large—the meanings and likely repercussions of our actions—while the “I” presents our impulses and drives to act. These two elements of the self converse until a course of action is decided upon. The individual cannot know the action of the “I” until it is executed and then experienced. Hence, it is possible for the “I” to take an action that the “Me,” from its social standpoint, would not consider acceptable. These two elements of the self are reflexively and mutually aware, and they continually converse back and forth. Self is thus constituted by this social, reflexive, dialogic, and ongoing internal communication process, as part of an unfolding trajectory of *becoming* a person.

Immersive digital games have the unique affordance of allowing players to learn in the *first person*. Role-playing games, for example, allow students to enact role-taking in the sense set forth by Mead, and to construct themselves via the I–Me dialectic. These environments thus provide an ideal context within which to enact learning in terms of becoming. This orientation toward becoming, however, begets the necessary question: becoming what? That is, what kind of identity development does game playing activity concern itself with?

In his seminal book *The Aims of Education*, Whitehead (1929) argues against the teaching of facts and information. He says: “Culture is activity of thought, and receptiveness to beauty and human feeling. Scraps of information have nothing to do with it. A merely well-informed man is the most useless bore on God’s earth. What we should aim at producing is men who possess both culture and expert knowledge in some special direction” (Whitehead, 1929, p. 1). From the perspective of designing games for learning, it is therefore essential to identify the “special direction” that marks the learning designer’s intentions addressing what students should learn through a game-based learning curriculum. Whitehead (1929, p. 6) further argues: “There is only one subject-matter for education, and that is Life in all its manifestations”. It is sensible, therefore, for a game’s contextual setting to instantiate an authentic context that allows students to develop valuable expertise in relation to becoming a person with some type of specific expertise and professional identity. To better understand this, we turn to Bourdieu.

Bourdieu’s theory of practical knowledge and habitus

Professional identity develops in the context of engagement in professional practice. Bourdieu (1991) objected to what he saw as the many false dichotomies prevalent in Western thinking, especially the dichotomy between theory and practice. According to Calhoun (2003), Western thinking, derived from predominantly Kantian and Cartesian foundations, tends to neglect and undervalue the kind of non-theoretical knowledge that is implicit in practical skills. Furthermore, the theory–practice dichotomy encourages the view that practice arises from the application of theory, based on a form of rule following. These entailments are seriously problematic, and they hinder the development of a deep understanding of practice.

Bourdieu sought to confront the widely presumed difference between practical and theoretical knowledge. He drew upon the metaphor of sports games to convey his sense of what is entailed in practical, social life. For Bourdieu, games are “a central part of the

activity by which forms of life are constituted and transformed” (Calhoun, 2003, p. 275). No game can be understood simply by grasping the theoretical rules that define it. To play a game effectively, it is necessary not just to follow rules, but to also have a “sense” of the game and a sense of how to play it. Actions in gameplay do not consist of simple, conscious decisions that are quickly executed. A player’s actual shots, as in basketball, are real time improvisations irreducible to theoretical rules. *Habitus* is the capacity of each player to improvise the next shot, the next move, and the next play. We are not born with a habitus. It is something that we acquire through repetition, like a habit, and it is something we know in our bodies, not just our minds. In practice, human activity involves a combination of discursive awareness and unconscious skill. The rules of each game are constraints on both players and the ways in which players get things done. Players are usually obliged to treat rules as fixed and unchanging, but in fact they are historically produced and subject to continual change.

Bourdieu’s thinking was influenced by both Mead (1934) and Goffman (1959) who, first, stressed the ways in which *interaction* shapes who actors are and what strategies they pursue and, second, also paid attention to the ways in which social action shapes social structures (Calhoun, 2003). While Mead drew upon the game as a metaphor for his theorization, Goffman drew instead upon drama. Notwithstanding, both Mead and Goffman shared the sense of participation in social life as a *performance*.

Bourdieu (1977, p. 78) refers to habitus as “the durably installed generative principle of regulated improvisations” that produces practices. The habitus appears as each individual’s characteristic set of *dispositions* for action. It is the meeting point between institutions and bodies and is the way in which each person, as a biological being, connects with the sociocultural order such that the various games of life retain their meaning and keep being played. Habitus is thus not only a personal achievement but also a social and collective achievement that develops, in individuals, habitual orientations to action.⁸

Viewed from the perspective of *learning as becoming*, the educator’s goal is to help students develop enactive expertise that is deeply embodied, highly adaptive, and closely aligned to professional practice. Such expertise is grounded in values, dispositions, and habits of action that arise through the influences exerted by students’ cultural trajectories. The rules and structures of perception related to a particular habitus are inscribed on, and in, individuals as if they are ‘human nature’ or ‘civilized behaviour’ (Webb, Schirato, & Danaher, 2002). However, the rules are not self-interpreting. As Taylor (1995b) argues, without a sense of what they are about and an affinity to their spirit, they remain dead letters or become a travesty in practice. Rules exist in our lives as “values made flesh” (Taylor, 1995b, p. 179). They operate in our lives as *patterns* of reasons for action; they do not constitute causal regularities. Rules lie essentially *in* practice. They animate the practice at any given time and are not some formulation behind it, inscribed in our thoughts, our brains, or our genes. Practice involves a continual interpretation and reinterpretation of what the rules might mean. Rules can only function in our lives along with an inarticulate sense “encoded” in the body. It is this habitus that ‘activates’ the rules (Taylor, 1995b) and brings professional practice to life. Learning conceived as a trajectory of becoming oriented toward professional participation necessarily entails the development of habitus. Habitus is therefore something that I attempt to help students develop via my design for game-based learning.

Learning Design: The Performance–Play–Dialog Model

My research efforts focus on how to design and enact game-based learning curricula in the context of Singapore classrooms. The foregoing sections of the paper have sought to establish vital components of a theory of becoming rooted in human action, social development of the individual, and participation in professional practice. In this section, I articulate the conceptual framework that I have developed to guide the research process. This articulation will focus on one of the games, *Legends of Alkhimia*, developed at our research centre. *Legends of Alkhimia*, a multiplayer game addressing the chemistry curriculum in lower secondary school. The research process includes (1) the design and development of the game, (2) conceptualizing how student learning should be enacted within the broader learning environment of a socialized, teacher-facilitated classroom, and (3) enaction of the game-based learning curriculum in the classroom.

Central to my conception of the learning design (Gagnon & Collay, 2006; Kalantzis & Cope, 2005) of the game-based learning curriculum is the Performance–Play–Dialog (PPD) Model shown in Figure 1. I shall next consider the three constructs—performance, play, and dialog—and their role in the said model.

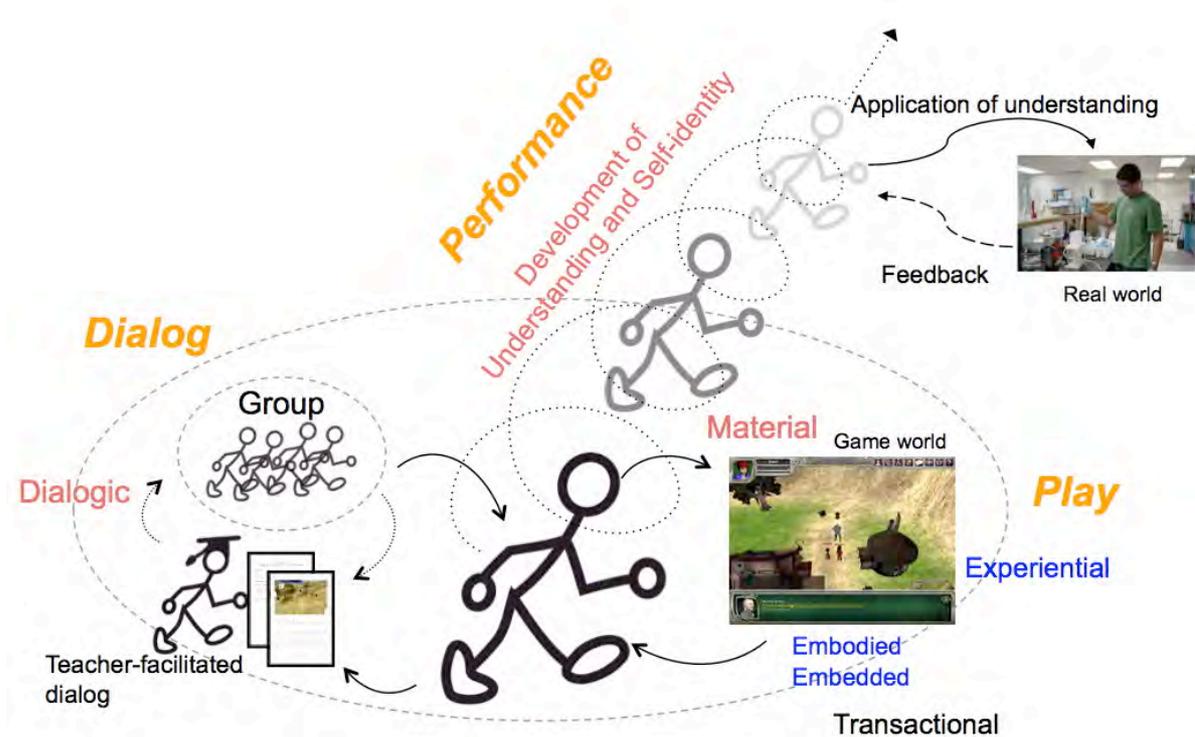


Figure 1. The Performance–Play–Dialog model of game-based learning.

Performance

In order to establish learning in terms of a theory of becoming, I have chosen to draw upon the construct of *performance* as the foundational basis upon which intelligent human enactive capacities are developed. In so doing, I wish to position performance as the scientific study of the means by which human action, meaning making, and communication practices are advanced (see also Burke, 1968; Coulter, 1989; Wertsch, 1998).

The construct of performance arises from the related domains of performance theory and performance studies (Bell, 2008; Carlson, 2004; Schechner, 2006). According to Bell (2008), performance has three key characteristics. First, it is *constitutive*; that is, it is established, created, and given form through enactment. Performance is constitutive of identity because implicit and explicit claims about that which is valued by human actors as well as how these actors, as members of a group, ought to act are made manifest through performance. Through performance, individuals are inscribed and authored. Second, performance is *epistemic*: that is, performance is a way through which human actors come to know themselves, know others, and know the world. Consistent with the kind of knowing articulated by Bourdieu's notion of habitus, performative knowing encompasses "body knowledge" or "somatic thinking": a way of knowing the world through all our senses, emphasizing immediacy and direct involvement. Third, performance is *critical* in that it provides a means for staking claims about knowledge and the creation of knowledge. All performance can be approached in terms of faking, making, breaking, and staking. Performance holds possibilities to imitate a life world, to create a life world, to transform a life world, and to stake claims about that life world.

From the perspective of the individual performer, performance is deeply *reflexive*. It implies not just doing or even re-doing, but a *self-consciousness* about doing and re-doing on the part of the performer. According to Carlson (2004, p. 4), the difference between doing and performing lies "not in the frame of theatre versus real life but in an attitude—we may do actions unthinkingly, but when we think about them, this brings in a consciousness that gives them the quality of performance". Thus, as Baumann (1989) asserts, all performance involves a consciousness of *doubleness*, according to which the actual execution of an action is placed in mental comparison with a potential, or ideal, or a remembered original model of that action. Performance is always performance *for* someone, some audience that recognizes and validates it as performance even when, as is occasionally the case, that audience is the self. Performance thus involves a kind of inner dialog with the performer herself, a framing that is consistent with Mead's dialogic "I"—"Me" interaction.

Aligned with Dewey's pragmatic stance, performance entails living, experiencing, and acting in the here-and-now. Through performance, performers wrestle with human experience as a lived and always dynamic process, and they develop participatory and embodied ways of knowing and being. Experience is made available for contemplation, thereby providing opportunities to *think* and to think *differently*.

In sum, performance may be understood as (1) both a process, by virtue of being enactive, communicative, and transactional, as well as a product, by virtue of yielding observable events, (2) productive and purposeful, subsuming intellectual inquiry, cultural memory, participatory ritual, and social commentary, and (3) traditional and transformative, by virtue of always making reference to former ways of doing, acting, seeing, and believing, and thus providing the potential for critiquing the status quo. Through performance, human actors develop new ways of seeing and understanding the world and understanding themselves in relation to that world. In short, they develop a part of their self-identity. The construction of an expansive yet coherent worldview, coupled with the agency to act, is central to learning that is empowering, and this is what we seek to achieve through our learning design. Figure 1 represents this future-oriented pathway of a learner as a trajectory of becoming whereby the learner develops understanding in and practice of a professional domain and, at the same time, constructs her self-identity through performance. Performance itself is realized through the sub-constructs of play and dialog, both of which are performative processes in their own right.

Play

The formal study of play can be traced back to early writings by Huizinga (1938/1955) and Caillois (1958/2001). More recent notable play theorists include Sutton-Smith (1997) and Henricks (2006). Huizinga, a Dutch cultural historian, identified the characteristics of play as (1) voluntary, (2) stepping out of ordinary life into a temporary sphere of activity that absorbs the player intensely and utterly, (3) creating its own limits of time and place, (4) producing no material gains, (5) creating its own fixed rules, and (6) promoting secrecy and social groups (Bell, 2008). Caillois (1958/2001) proposed a taxonomy of games in terms of the labels *agon* (competitive games), *alea* (games of chance), *mimicry* (simulation games), and *ilinx* (games that create vertigo). He also defined the nature of play as (1) free, (2) separate, (3) uncertain, (4) unproductive, (5) regulated, and (6) fictive, with the last two characteristics tending to exclude one another.

Common to both characterizations above is the idea that play involves stepping into a “magic circle” (Klabbers, 2006) where disbelief is suspended and a new form of reality applies, even if temporarily.⁹ Stepping into the “magic circle” entails taking on a new role, as expressed by Mead, and this role-taking is often realized in digital games such as the *Baldur’s Gate*, *Final Fantasy*, and *Diablo* series, by role-playing. According to Turner (1982), Sutton-Smith suggests that play spaces can be productive for learning because they are places of ‘anti-structure’, a term introduced by Turner (1969) himself, that afford the exploration and construction of *new* forms of culture. Sutton-Smith (1972, p. 18–19) writes: “The normative structure represents the working equilibrium, the ‘anti-structure’ represents the latent system of potential alternatives from which novelty will arise when contingencies in the normative system require it. We might more correctly call this second system the *protocultural* system because it is the precursor of innovative normative forms. It is the source of new culture.” From this perspective, sites of play may be designed and constructed as performance borders and margins that instigate learner transformation by provoking re-evaluation and reconstruction of understanding and identity: that is, by breaking, re-making, and staking afresh. Such experiences are akin to rites of passage that entail separation, transition, and re-incorporation, usually to a new community and its associated practices (Van Gennep, 1960).

Rites of passage are said to be *liminal*. They represent a transitional process that is ‘betwixt-and-between’ two worlds, and they are characterized by heightened emotions, the suspension of rules of normal life and time, and centralization of that which is usually marginal. Liminal activities are inherently anti-structure, and liminal situations provide a space removed from normal daily activity for members of a culture to “think about how they think in propositions that are not *in* cultural codes but *about* them” (Turner, 1969, p. 22). This context establishes the potential for deeply personal and transformative learning to occur, and it establishes the basis for the design of game-based learning described in this paper. The realm of play thus serves as the crucible in which ‘responsible’ action for the ‘real’ world is seeded, nurtured, and developed into significant new forms. Play, as a rite of passage, fulfils the crucial task of “inculcating a society’s rules and values to those who are to become its full-fledged members,” and the crux of learning and transformation is the performance (Bell, 2008, pp. 123–124).

Figure 1 depicts how a student learns by engaging in play via a material, digital game world. This space of play is experiential, and learning actions are transactional (Dewey, 1925/1988; Elkjaer, 2009). The player’s experience is embodied, by virtue of being represented in the game world by his avatar, and the player is embedded, or immersed, in the virtual space of the game world (Chee, 2007). In the design of our learning curriculum, students play multiple levels of the game *Legends of Alkhimia* as part of their learning trajectory. Game levels build incrementally on one another to help students

develop the habitus related to professional practice. When students complete the last level of the game at the close of the curricula program, the liminal process terminates.

Dialog

The notions of dialog and dialogism are central to the writings of Bakhtin (1981, 1986). Emerson and Holquist, in the Glossary to Bakhtin's *The Dialogic Imagination*, describe dialogism as the characteristic epistemological mode of a world that is dominated by heteroglossia. In such a world, everything means only as part of a greater whole. There is constant interaction between meanings, and all meanings have the potential of conditioning yet other meanings.

For Bakhtin, dialog is not constituted merely by words or in talking. Dialog is also ontological: it is a way of life. Dialog expresses a fundamental orientation to an *other* and a desire to understand and be understood in relation to this *other*. It is fundamental to a way of life that is changeable rather than fixed and that is open and tentative rather than authoritative (Shields, 2007). Dialog has little in common with *discussion*, a word whose root is more closely related to the idea of conducting a judicial examination (Senge, 1990). Entering into dialog entails taking a stance. It is the means through which we develop openness to others different from ourselves and relate to people and ideas that remain separate and distinct from our own. Dialog is the means through which new ideas are born.

Although Bakhtin uses the word *truth* frequently, he does so with a special meaning. For Bakhtin, our reality and other equally valid and distinct realities of others comprise a more complete 'truth' than can otherwise be known. All ideas and positions should be put on the table in order for deep dialog and understanding to occur and for 'truth' to be determined (not *the* truth, but a more complete one). Thus, Bakhtin is not talking about fixed, irrevocable, and universal Truth with a capital 'T'. Instead, he is pursuing the testing of an idea, *a* truth, to elicit something of value as one interacts dialogically with it. Truth, as understood by Bakhtin, is collective. It can never reside in the heart or mind of a single person but only in a community's temporary understanding of some phenomenon (Shields, 2007).

In the context of the classroom, dialog is intended to help students achieve comprehension rather than to provide an explanation. As Bakhtin (1986, p. 111) asserts: "With *explanation* there is only one consciousness, one subject; with *comprehension* there are two consciousnesses and two subjects. There can be no dialogic relationship with an object, and therefore explanation has no dialogic aspects . . . Understanding is always dialogic to some degree".

The notions of utterance and addressivity are central to Bakhtin's construction of dialog. Bakhtin (1986, p. 67) regards the utterance as "a real unit of speech communication". An essential marker of the utterance is its quality of being directed at someone: that is, its addressivity. An utterance has both an author and an addressee who may be a co-present interlocutor in dialog or an indefinite unconcretized *other*. The composition and style of an utterance depend on those to whom the utterance is addressed, how the speaker senses and imagines his addressees, and the force of their effect on the utterance. In addition, the speaker always tries to anticipate the addressee's response in the very act of constructing his utterance, thus giving rise to an ongoing utterance chain (Baxter & Montgomery, 1996).

Utterances as speech acts are always performative in nature (Austin, 1975; Searle, 1970). They involve a complex layering of the previous usages of words that are applied within the current context, resulting in a plurality of 'voices'. From Bakhtin's perspective, a voice refers to a speaking personality, a speaking consciousness. It always has a will or desire behind it, its own timbre and overtones. Indeed, "[t]he word in

language is half someone else's. It becomes 'one's own' only when the speaker populates it with his own intention, his own accent, when he appropriates the word, adapting it to his own semantic and expressive intention" (Bakhtin, 1981, p. 293). Producing utterances inherently entails a process of appropriating the words of others and making them, at least in part, one's own (Wertsch, 1998).

A dialogic classroom, as indicated in Figure 1, is characterized by the inter-animation of student voices (Wertsch, 1991). Dialogism generates internally persuasive discourse that is *open*, allowing students to construct new ways to mean. When student thinking begins to work in an independent, experimenting, and discriminating way, internally persuasive discourse begins to separate from authoritarian enforced discourse, a form of discourse that can only be transmitted, not negotiated, because it imposes fixed meanings. Fostering dialog in the classroom thus creates a more open yet more critical disposition toward discourse and the knowledge construction process. As ideas collide and become interrogated, students learn that the practice of science is itself a sense making, and hence dialogically constituted, activity. Consistent with Deweyan pragmatism, they learn that scientific 'facts' are warranted assertions and hence tentative rather than eternally 'proven' claims. Dialogism thus sustains inquiry as an open process and allows students to participate in the social construction of reality (Berger & Luckmann, 1966).

Case Example: The *Legends of Alkhimia* curriculum

In this section of the paper, I provide a glimpse of what the chemistry game *Legends of Alkhimia* is like to illustrate how it fits in as *one* component of the overall PPD Model of game-based learning: that of Play. Due to space constraints, it is not my purpose to provide a full-fledged description of the game but merely to allow readers to get a 'flavour' of what playing the game might be like. In accordance with the PPD Model, each level of gameplay is accompanied by a dialogic segment of the classroom learning process where students engage in dialogic activity driven by online curricula materials that promote inquiry and meaning making, reflection on gameplay, and performance reflexivity. This portion is elaborated on after the game level description.

The game and gameplay

By way of preamble, *Legends of Alkhimia* comprises eight levels of gameplay. It is a multi-player game that supports up to four students in each game session. The game begins in Level 1 with a scenario where the four players crash-land in the environs of the ancient town of Alkhimia. They have with them certain weapons, a form of gun, that shoot ammunition drawn from cartridges attached to the weapons. On exiting their aircraft and surveying the surroundings, several monsters, emerging from a narrow mountain passageway, suddenly attack them. The players use their weapons against the monsters, but find that their weapons are ineffective against them. This situation establishes the context for the players to inquire into what kinds of substances their ammunition is made of and to synthesize more effective ammunition that will be able to destroy the monsters. The players soon learn of the strange incidents that have been occurring of late in the once sleepy town of Alkhimia from the villagers they meet: the legends of Alkhimia. The villagers seek the help of the players to solve the mystery of the marauding monsters. The players promise to help, with a view toward putting their understanding of chemistry to good use by helping the villagers to deal with their problem.

In this paper, I draw from Level 3 of *Legends of Alkhimia* to provide my more detailed illustration of the game. In this level, the villagers send the players an emergency request

for help because some slimy looking monsters are attacking their cabbage patches. Some of their crops have gone up in flames because of the fireballs that the monsters wantonly hurl around. The players come to the rescue of the villagers. They battle the monsters using substances that they previously separated in the chemistry lab as well as other substances they find in the lab. After an intense battle, the players manage to kill one monster, while the other monsters take flight (see Figure 2). Unfortunately, as the dead monster's body lies in the open field and decays, its decomposing body matter liquefies and begins to contaminate the villagers' cabbages, turning some cabbage patches from a plot of normal-looking green cabbages to bright red cabbages. The players are given the challenge of trying to establish what kind of substance the dead monster is made of so that they can find some other suitable substance with which to reverse the unwanted chemical reaction that has taken place in the contaminated cabbage patches.



Figure 2. Screen snapshot of gameplay in Level 3 of *Legends of Alkemia*.

Unknown to the students at this time, the cabbage leaves actually serve as a surrogate for litmus paper in a conventional chemistry lab, and the red cabbage leaves indicate that the monster is acidic. With a sample of the monster residue in hand, players proceed to the chemistry lab where they experiment individually with different substances to try and devise a solution for getting the cabbages to revert to their original color. In the course of the lab work in Level 3, students experiment with and make sense of chemical reactions that entail the generation of acids, bases, and salts. By way of fictive imagination, the cabbage leaves are made to play the role of litmus paper. Figure 3 illustrates the situation where a student has added a soluble base (which is alkaline) into the conical flask containing the monster waste, thereby getting the cabbage leaf first to transform into a green colour. However, due to the inability to pour in the exact amount of alkali that is needed to neutralize the amount of acid contained in the

conical flask (and no more), the colour of the cabbage leaf proceeds to transform into a purple-blue (indicating that the cabbage leaf has become alkaline instead). As students continue to run experiments in the virtual lab, they may, through trial and error, systematic investigation, and careful thinking finally find that their problem is solved by adding an appropriate insoluble base into the conical flask containing the monster waste. This action transforms the cabbage leaf into green. With the appropriate substance in hand, the player then returns to the contaminated field and disperses the insoluble base over the contaminated cabbages to make them return to normal cabbages and to obtain the thanks and approval of the villagers.



Figure 3. Screen snapshot of a student testing different substances to reverse the effect of cabbage patch contamination by the monster's body waste.

It should be noted that not all students necessarily find a solution to the foregoing problem on their own. This outcome is not necessarily problematic as learning is designed to be collaborative, with students helping each other. What is vital is for students to engage in deep sense making to *understand* the underlying chemistry phenomena. There is, of course, no guarantee that students will always invest the intellectual energy required for this kind of reflective, inquiry-oriented thinking. It is up to the teachers to foster the disposition that values the intrinsic satisfaction that can be derived from deep understanding by developing an appropriate classroom culture of learning.¹⁰

In the curriculum based on *Legends of Alkhimia*, the fostering of practice-based professional identity (as a chemist) is of special importance. Prior to entering the game world, students are positioned by the game as aspiring chemists who learn their craft under the tutelage of their boss, Master Aurus. In the game lobby, they choose their in-game name. They also select their personal look in the player customization screen, in a manner that reflects their sense of personal identity at the commencement of the game.

As gameplay proceeds, the game narrative as well as the game interface provide opportunities for players to modify their avatar's look and feel so as to foreground the values they adhere to via their self-presentation. For example, in a later game level, players have to choose a piece of armour for themselves. The armour choices are designed to represent different kinds of symbols such as those representing notations related to chemistry or signs that depict an accomplished warrior. By observing the symbols or signs that students choose, we are able to infer the kind of chemist any individual student aspires to become; that is, we can track the student's learning in terms of becoming a (type of) chemist. It should be noted that the game itself promotes certain values. The portion of the game narrative that casts students in the role of using their understanding of chemical reactions to help the villagers is intended to suggest that science should be used for human good. This theme contrasts with students discovering toward the end of the game that it is their erstwhile master, Aurus, who has been behind the unseemly happenings in *Alkhimia*: all for personal power and gain.

As students continue playing *Legends of Alkhimia*, the chemistry involved becomes increasingly complex. Like the apprentice chemists that the game positions them to be, they are *required* to develop their own classifications of the substances that they encounter in the game world. They do not experience the world as a pre-labelled and a pre-configured place. This pedagogical design inducts students into an authentic practice of science making by requiring them to *construct* functional and concise representations and organizations of knowledge as part of the process of inquiry.

In the classroom

Recall that Play constitutes but one component of the Play–Dialog dialectic. In order to foster and support a gameplay sense making process in the classroom, students are asked to complete a reflection activity that runs parallel to gameplay and scaffolds their thinking process so as to reduce the likelihood that gameplay success results purely from trial and error efforts while playing the game. This design works well where students are organized in pairs during gameplay, with two students assigned to the use of one computer: an arrangement that we have often used. Under this arrangement, one student controls the computer mouse while the other works on completing the reflection sheet. This role is swapped about mid-way through the gameplay segment of the class. Our experience shows that organizing students in dyads realizes a context that is conducive for them to *think through* their common play experience collaboratively. Students find it natural to talk to each other about what they are thinking. In this manner, they verbalize and thereby externalize their thinking for the benefit of their peers (as well as for our benefit, as researchers).

During the dialogic phase of the class, teachers are positioned as professional chemists. (We often have two teachers involved in the curricular program and hence in the classroom as well.) They trigger and scaffold the conversations between students positioned as apprentice chemists. The teacher facilitating the dialog at any particular time attempts to elicit from students their specific hypotheses concerning the nature of the different substances encountered in each level of gameplay. Drawing upon differences between ideas that arise from heterogeneous trajectories of gameplay, teachers help students to identify contradictions between the ideas contributed. They then facilitate deeper interrogation of those ideas, querying students on their thinking related to the underlying chemical properties of the gameplay substances as well as their chemical reactions. In this way, teachers seek to develop a dialogic culture of learning in the classroom, one where different hypotheses are forwarded, critiqued, and rebutted as necessary. The dialogic learning environment constitutes a performance space in which students not only (verbally) articulate and negotiate their understandings but also enact

those understandings through the manifestation of their attitudes, values, beliefs, and “ways of becoming” chemists in the classroom. It is the dialectic between Play and Dialog that allows this performance space to be realized. The manner in which students conduct themselves and behave as junior chemists constitutes the metagame of “becoming chemists,” where the metagame is played out in the classroom. As a performance space, all that students do and say constitutes a public presentation of themselves: a presentation that is subject to interpretation, analysis, and critique. As a performance, and from the perspective of each individual student, it is also intended that the experience be one that is reflective as well as reflexive as the student performs himself or herself before others.

In the *Legends of Alkhimia* curriculum, teachers, positioned as professional chemists, are expected to model that role before students, both in word, deed, and the dispositions that they manifest as part of playing their part in the classroom metagame. In this manner, it is intended that students develop as the generalized (chemist) other and begin to appreciate, amongst other things, that the construction of scientific knowledge is a practice-based social enterprise founded on a set of human values that esteem simple, parsimonious, and generalizable explanations of natural phenomena. It is hoped that students also learn to imbibe the values, dispositions, and beliefs that undergird the practice of science *making* and to demonstrate the capacities for practical action and reason inherent in science making: in short, the habitus of Bourdieu. We anticipate, by design, that learning chemistry in this manner will yield rather different outcomes compared to traditional emphases on content mastery. Students will come to *know chemistry performatively* rather than merely end up *knowing about* chemistry.

Conclusion

In this paper, I articulated a set of theoretical ideas that provide a foundation for designing game-based learning based on a pedagogy of *learning as becoming*. Taking up Thomas and Brown’s conception of “learning to be” rather than “learning about”, I argued that the paradigm of human information processing that leads to a focus on “learning about” is an inherently flawed model of human cognition. In its place, I have proposed a model of education based on the philosophy of pragmatism that foregrounds experience and inquiry as core learning processes. Building on the ideas of Mead and Bourdieu, I have sought to reframe learning not as an intra-individual cognitivist enterprise, but as one that is inherently social. Mead’s theory of mind, self, and society provides an account of how the self is socially constructed by means of role taking, passing through the three stages of play, game, and the generalized other. Bourdieu’s theory of practical knowledge and habitus extends the development of the social self into the realms of professional practice, subsuming the critical development of dispositions and habits of mind that are central to the pragmatism of James and Dewey. Based on the foregoing ideas, I proposed the Performance–Play–Dialog Model for designing game-based learning in the context of addressing school-based curricula. Central to this model is the construct of *performance*, which provides a theoretical lens through which learning can be viewed, and studied, in terms of human action, meaning making, and communication. Play and dialog were explained as sub-constructs of the performance model, emphasizing the performative nature of these sub-constructs in their own right. A partial description of the multiplayer chemistry game, *Legends of Alkhimia*, was provided to help readers appreciate how the digital game constitutes one component of the PPD Model that attempts to realize the theoretical ideas based on pragmatism as well as those drawn from social theory. I also outlined how the game-based curriculum is enacted by teachers in the classroom.

To conclude, the account of learning proposed here is dialectical, involving the mutual interdependence between self and society, developing in a cultural context. Such an account admits of multiple levels of empirical analysis when the curriculum innovation is operationalized in the classroom. These levels comprise a focus on the subjective, focusing on beliefs, attitudes, and values held by individual students, to the structural, focusing on patterns and rules that hold the enacted classroom culture together, to the dramaturgical, focusing on the expressive and communicative properties of students' identity construction in the new classroom culture, and finally the institutional, focusing on how and to what extent school culture is impacted and changes as a result of the curriculum innovation. We expect that these multiple perspectives and levels of analysis will provide the basis for a multi-faceted and nuanced understanding of the impact of curricular innovation with game-based learning to emerge.

Notes

¹ Some critics have argued that there is an inherent tension between Bourdieu's more "closed" model of reproduction of self-in-practice and Dewey and Mead's more "open" model of self-society dialectics. While this may appear to be the case if a static comparison is made, a different picture emerges if we adopt a more longitudinal perspective. In the domain of apprenticeship learning, one usually first accepts "subjection" into a practice. However, as one becomes more of an expert and develops to the level of a master, one begins to engage in "breaking the rules" in order to advance the practice in question. In this way, pathways to "openness" are preserved, and fresh constructions of practice-in-the-making avert stagnation. The implicit tension can thus be made productive.

² The claim made here, based on Taylor (1995a), focuses on how a trustworthy body of knowledge is traditionally positioned as being constructed. It does not detract from recognizing the distinction between "knowing that" and "knowing how" made by Ryle (1949/2009), between "knowledge by description" and "knowledge by acquaintance" made by Russell (1912/2010), or even acknowledging Polanyi's notion of "tacit knowledge" (Polanyi, 1958/1962; 1966/1983). Rather, the goal is to acknowledge that human knowing is inherently embodied (Varela, Thompson, & Rosch, 1991) and relational (Gergen, 2009), and not merely about justified true belief.

³ As suggested by one anonymous reviewer, the lack of success in constructing a solution may well be a function of the way the problem has been framed in the first instance. Indeed, I believe this to be the case and suggest that it is for this reason, precisely, that the present critique is warranted. I further suggest that the reframing proposed by Barad (2007) offers one potentially fruitful approach to reconstituting the problem. A detailed discussion of this approach is, however, outside the scope of this paper.

⁴ When Holder and others write about non-cognitive levels of experience, they refer to aspects of human thinking that are *not* customarily associated with the rules and representations basis of the computational theory of mind that gives rise to symbolic processing.

⁵ For Mead, thinking arises when old ways of adjusting, customs, and habituated ways of acting do not meet the needs of a new situation at hand. An act is triggered as a process of adjustment (Mead, 1938; Miller, 1973).

⁶ There is no presumption here that what follows is *the* only way of learning with computer and video games or that there is *only one* way of learning with digital games.

Much depends on what the learner's goals and motivations for engaging with the digital game are.

⁷ To the extent that we use language, therefore, it might be said that “languages uses us”. This aporia is explicated by Roth (2010) and is also a constant theme of Bakhtin (1981).

⁸ Some readers may be surprised by the seemingly de-politicized account of Bourdieu that is provided here. While this may indeed be so, it is not inconsistent with the argument advanced by Deleuze and Guattari (1994) that to engage in philosophy is to engage in a creative mode of thinking that can lead to the construction of new and productive ideas. “Correctness,” as such, is not the primary goal here.

⁹ More recent scholarship on game studies argues that “there is no magic circle” on the grounds that gaming practices are so deeply intertwined with real world practices that the distinction between the two is in a fundamental sense artificial (Consalvo, 2009; Malaby, 2007). While this argument has validity, it might also be argued that traditional schooling practices are so bounded from the real world that, in school settings, the construct of the “magic circle” might well still apply. (I thank an anonymous reviewer for this insight).

¹⁰ Research papers that document empirical findings and challenges that we have faced in enacting the kind of curriculum outlined here are outside the scope of this paper and can be found elsewhere. (See <http://gli.lsl.nie.edu.sg/> for one source of papers).

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