Intentional learning with educational games: A Deweyan reconstruction

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Abstract

Intentional learning has customarily been construed from a perspective that foregrounds cognitive engagement and mental life in meaning making. In this paper, I interrogate the said perspective. I argue that a theoretical positioning based on the dominant paradigm of human information processing psychology leads to incoherence because this paradigm results in "meaning-less cognition." To get out of this conundrum, I offer a reconstruction of intentional learning from the perspective of Deweyan inquiry and the philosophy of pragmatism. I situate this reconstruction in the context of game-based learning.

Keywords: Dewey, educational games, inquiry, intentionality, pragmatism

Introduction

Intentional learning has customarily been understood from a perspective that foregrounds cognitive engagement and mental life in meaning making. Bereiter and Scardamalia (1989) proposed this construct when they lamented the degeneration of learning into routine unthinking schoolwork. They also decried students' impoverished learning as comprising only "knowing that" and "knowing how": the customary declarative–procedural distinction associated with the terms "knowledge" and "skills" prevalent in discourses of schooling. Responding to the unsatisfactory state of affairs, Bereiter and Scardamalia insist: "*In order to learn what is ostensibly being taught in school, students need to direct mental effort to goals over and above those implicit in the school activities*" (p. 385). Hence, they propose that learning must be intentional. They argue that students' cognitive processes must target learning as the explicit goal rather than let it be an incidental outcome. Given that children have little conception of learning as a goal-directed process, they only assign themselves a kind of school-like work when they try to direct their own learning. Thus, educators are faced with a challenge.

In this conceptual paper, I identify and evaluate the theoretical underpinnings of the said challenge. I locate my analysis in the context of digital games given its pervasive reach and appropriation by today's schoolchildren. I ask whether intentional learning, as conventionally understood, provides an apt theoretical frame for understanding game-based learning in the context of 21st century education.

In the next section of this paper, I trace the development of intentional learning as a theoretical construct. Following this, I interrogate the claims underlying intentional learning. Next, I proceed to offer a Deweyan reconstruction of intentional learning. I then outline and contrast the kinds of educational games implied by conventional and reconstructed notions of intentional learning. I discuss Bereiter and Scardamalia's (1989) criticism of Dewey and consider the implications of their criticism before concluding the paper.

The development of intentional learning

Kirkhart (2001) suggests that intentional efforts to learn or remember information involve different processes compared to unintentional efforts. Learning is explicit if the learner possesses the intention to acquire a specific set of target knowledge and this knowledge is assessed directly. Explicit learning may occur when a learner is instructed to acquire some target knowledge, as often happens in schools, and is then asked to explicitly state or apply the knowledge in a subsequent testing phase. Kirkhart is taken up with the acquisition of declarative knowledge because of disagreements in the psychological research literature concerning the role that declarative knowledge plays in implicit vis-à-vis explicit learning. The pursuit of declarative knowledge for its own sake is passé today because of the deluge of information brought upon us by the Internet. What Kirkhart's research establishes is a theoretical association between intentional learning and declarative knowledge acquisition.

Given widespread use of mind maps and semantic nets for representing declarative knowledge, Sinatra and Pintrich (2003) argue for the importance of intentions in conceptual change research. They advance the idea of intentional conceptual change on the premise that traditional models of conceptual change, drawn from science education research and cognitive developmental research, do not fully account for learners' intentions in the change process. Cognition researchers, they argue, provide a good description of the various "internal" cognitive processes that mediate conceptual change, but neglect the "external factors" such as social and situational variables that might facilitate conceptual change. On the other hand, science educators focus on external factors such as the teacher, the format and content of instruction, or the structure of activities students engage in. Both, however, underemphasize the degree to which motivation, affective resistance, and learners' beliefs may be controlling factors in the change process. Sinatra and Pintrich therefore suggest that the "value added" of intentional learning as a general mediating process between external factors and internal psychological processes is that the impetus for change is placed within the learner's control. By this argument, metacognitive processes entailing motivation and affect become subsumed into theoretical accounts of conceptual change.

Sinatra and Pintrich (2003) further argue that intentional cognition needs to be distinguished from unconscious or automatic thoughts and behaviors. They do so on the assumption that cognition is organized in a manner that allows information to be processed and represented in qualitatively different ways. When the mind acts on information, "it" often does so without intent. The learner does not necessarily plan to modify information in a specific way; rather, such constructions can and often do occur without the learner's awareness. Such knowledge construction is deemed to occur at the algorithmic level of cognition and is characterized as incidental or implicit. Intentional level processing, by contrast, is goal-directed and under the learner's control.

Rooted in the tenets of human information processing, Schnotz and Kürschner (2007) also argue that, according to cognitive load theory, "understanding" occurs when all relevant elements of information are processed simultaneously in working memory. Material is too hard to understand if it consists of too many interacting elements that cannot be held simultaneously in working memory. Frensch (1998) further suggests that implicit learning be regarded as the non-intentional, automatic acquisition of knowledge about structural relations between objects and events. He boldly assumes a relation between "concepts" and "meanings" as follows: "It is a truism that scientific concepts do not have absolute, god-given meanings, but only those that science creates for them" (p. 47). Consequently, he argues that as interest in a given concept increases within a research community, the number of meanings attached to the concept increases as well. This speculative move creates a dichotomy between "concept" and "meaning" by suggesting that different meanings can be attached to a given concept.

From the foregoing, we see how the construct of intentional learning became associated with implicit vs. explicit learning of declarative knowledge, with internal cognitive processes and executive control based on the model of human information processing, and, finally, through a leap of imagination, to human understanding expressed as the relation between "concept" and "meaning". In this manner, "internal cognitive processes" that the human mind putatively executes get imputed with semantics, and "meaning" and "understanding" somehow become legitimate theoretical terms of a computational theory of human cognition.

Interrogating the claims underlying intentional learning

The construct of intentional learning is well motivated. However, its theoretical basis is flawed. Elsewhere, I have argued that the human information processing paradigm in psychology fails to provide a credible account of how people learn (Chee, 2011). As a representationalist and mechanistic construction of human cognition, information processing psychology has the benefit of allowing cognitive psychologists to test their theories through writing computer programs. This much-vaunted "breakthrough" was significant in the historical context of behaviorism, which held the study of cognition captive in an impenetrable "black box." But cracking open the box has revealed a Pandora's box.

The execution of a computer program is based on a structural organization that distinguishes between executable program code and the data that the program uses as input. This organization exemplifies the input–process–output formalism underlying computation. The input is *represented* in a form that the program can utilize. Execution of the program produces the computed output. An electronic calculator is an example of a simple computer. One can input an operation such as 3 x 5 by pressing the calculator's buttons "3", "x", and "5" in sequence and initiate the calculator's digital processing by hitting the "=" button. The output "15" is displayed. Has the calculator performed arithmetic? Does the calculator understand the meaning of the arithmetic operation 3 x 5? Emphatically no. The inputs are merely *representations* of number; that is, they are numerals. Numeric representations can take on different forms; for example, the Arabic form "15" and the Roman form "XV". Both forms represent the same number, 15. An electronic calculator is useful because purely syntactic manipulations of digital representations of number yield valid semantic arithmetic outcomes. However, not all subject domains can be framed in such terms and problems solved computationally because the domains may not be formalizable as closed, rule-based systems. Consequently, computation, the underlying mechanism of human information processing, yields a kind of meaning-less cognition; that is, it is semantics free.

In view of the above, it is remarkable that many psychologists, cognitive scientists, and educators subscribe to information processing psychology and yet take the unwarranted liberty of subsuming the terms "meaning" and "understanding" into their professional discourse. Words and multi-word terms, such as "implicit learning", are somehow assumed to possess inherent meanings. Consequently, teachers often speak of students "having" either the "right meaning" or the "wrong meaning". This conception of meaning likely arises from experience with the ubiquitous dictionary that, according to popular belief, "contains the meanings of words." Such a belief is misplaced. A printed dictionary contains only carbon on paper. An electronic dictionary (viewed on a display screen) is (typically) composed of black pixels set against a background of white pixels. This material reality is inescapable. We do not find meanings in dictionaries but rather construct personal meanings from the representations we find in dictionaries. Meaning construction is inherently an interpretive act that involves a search for plausible interpretations of viewed representations. Consequently, it is entirely possible to "find a meaning" in a dictionary that remains entirely incomprehensible, as is often the case with specialist dictionaries on aeronautics, medicine, etc. Frensch (1998) rightly claims that a scientific concept, represented by words, does not have absolute, god-given meanings and may furthermore be associated with multiple meanings. Notwithstanding, his conception of meaning is severely constrained because it is tied to, and limited by, representation.

In practice, meaning making arises through the sociocultural performance of everyday life; it is not solely a cognitive production. Gergen (1999) provides a helpful illustration. Recounting his experience as a summer assistant to a wall plasterer in his youth, he narrates how he was required to serve up mixtures of water and plastering compound requested by the plasterer. At times the mixture had to be moist so it could be gently reworked. At other times, it had to be dry so it would rapidly seal the contours in plastering work. When in need of the former, the plasterer shouted "skosh," and, when in need of the latter, he yelled "dry-un." Naturally, these words meant nothing to Gergen at the commencement of his summer job. In a few days, however, he became proficient at producing the required mixtures. He reports: "In effect, 'skosh' and 'dry-un' became part of a *form of life* in which we were engaged" (p. 36, italics added). This example illustrates how a real world context of action is vital for meaning *making*. Without context, words are merely representations that hover meaning-free. Thus, meaningful learning takes place through situated action. Learning requires both doing and speaking (in the context of that doing) in practice and culture bound ways. For this reason, Dewey (1922/2008) insists that knowledge lives in the muscles and not in consciousness.

Brizendine (2010), a noted clinical psychiatrist, informs us that when a boy watches a video character in a videogame and is thrilled, neuronal signals related to being thrilled are sent from his brain to the muscles in his body, even if he does not move. Likewise, when a boy first learns to read the word *run*, his brain fires messages to his leg muscles and makes them twitch. The boy is effectively rehearsing the action of running in order to learn the word. In this manner, humans develop a form of cognition that is enactive, allowing them to behave, act, and perform. Unlike desktop computer expert systems of the 1970s that are "knowledge-based" (strictly knowledge representation based) but with no capacity to understand or act, humans develop understanding via conjoint action in the world. Real world understanding is not held back by limited working memory capacity as made out by Schnotz and Kürschner. Such postulations make sense only in the context of cognitivism's framing of students acquiring inert, declarative "facts". As argued by Dewey, however, knowledge is related to action and only in a derived way to explicit theoretical articulation of something. It is not the existence of something "mental" as such that enables the adult, unlike the child, to perceive the meanings of the world. Instead, it is the developed habitual comportment of the adult that enables her to perceive a rich, meaningful world (Brinkmann, 2011).

In Scardamalia and Bereiter's (2006) later work arguing the importance of knowledge building discourses and communities, they argue that at the level of the neural substrate, self-organization is pervasive and characterizes learning of all kinds. Conceptual development entails self-organization at the level of ideas. What is needed is an explanation of how more complex ideas can emerge from interactions of simpler ideas and percepts. Appealing to research on connectionist modeling, they presume that a more complex cognitive structure capable of supporting concepts might somehow emerge from the interactions between meaning-free percepts. Thus, they urge instructional designers to think more seriously about ideas as "real things" that can interact with one another to produce new and more complex ideas. Unfortunately, the foregoing statements are problematic for two reasons. First, the appeal to the neural substrate, self-organization, and emergence as enablers for ideas to emerge and knowledge building to then be possible is misplaced. Munz (1999) argues that conscious states of mind can be construed as a composite phenomenon comprising three layers: neuronal events, somatic markers, and explicit consciousness. Neuronal events refer to how neurons function from a biochemical and electrical point of view, and somatic markers refer to the non-linguistic feelings that we experience from time to time. Bringing somatic markers to explicit consciousness, however, requires expressing the feelings in linguistic terms. However, the relationship between a marker and its linguistic expression is one-to-many, and it is not unique. The expression constitutes an *interpretation* of the marker that makes the feeling available to other people by virtue of being couched in a public language. While physics and chemistry have successfully described the causal relation between the first two layers, the additional step required to articulate consciousness is interpretive and based on the preponderant role of natural language. It does not and cannot arise causally. No scientific account is possible because neuronal processes are inherently non-semantic. Second, Scardamalia and Bereiter construe ideas as “real things” that can interact with one another. But ideas are not real things in the sense that physical chairs we sit on are real and material. They are ideational and brought forth by language. Without language as a tool to think with, ideas cannot crystallize. Furthermore, ideas cannot interact with one another. It is people who interact with one another in order to share their ideas.

Therefore, representationalist accounts of cognition, including that of intentional learning, commit the error of focusing almost exclusively on (language based) thinking at the expense of situated acting and speaking. Building on Descartes’ error that assumes the primacy of rationalistic thought over a person’s very being (*Cogito ergo sum*) and Plato’s bias in favor of earth-bound forms as impure representations of pristine entities in heaven, such theoretical accounts effectively place the cart before the horse. From a developmental point of view, bodily somatic learning has primacy because it begins first. As Edelman

(1992) points out, the capacity for language and language-based thinking arises only later. Unlike cognitive science theories that posit semantics as arising from syntax, Edelman emphasizes that, with a young child, semantics arises first through naming behaviors. Syntax, manifested in the regularization of speech patterns into grammatical forms, arises later, after semantics.

What then should we make of cognitive science's claim to being a "science of the mind"? What is mind? Does mind exist? Unlike brains that are material and, in that sense, real, minds are ideational and constructed through language. In this sense, they are not real. Consequently, Descartes' postulation of mind as constituted by *res cogitans*, some mystical mental stuff, is without merit. To think otherwise would amount to committing the error of hypostatization: the construal of purely conceptual entities as having real existence. Ryle (1949/2009) illustrates this error using the example of a visitor to a British university, who is shown the colleges, libraries, academic departments, and administrative offices. Having seen all this, he then asks "But where is the university?" The visitor, Ryle points out, has committed a category mistake in thinking that the university is an entity over and beyond what he has seen. The concept of "mind" like that of "university" is ideational through and through. The error of cognitive science is to treat "mind" as real. This misguided thinking has led to the computational construction of "mind," founded on representationalism and mechanism, and the perpetuation of mind-body dualism: a serious ontological error.

To their credit, Scardamalia and Bereiter (2006) argue in favor of students developing knowledge *of* in contrast to knowledge *about*. They argue that knowledge *about* constitutes the stuff of textbooks, subject-matter tests, school projects, and "research" papers that dominate traditional educational practice. For them, knowledge *about* is approximately equivalent to declarative knowledge, but knowledge *of* is "a much richer concept than procedural knowledge" (p. 101) and it gets activated when a need for it is encountered in action. Unfortunately, knowledge *of* remains objectified as a "thing" that gets activated rather than being construed as a human capacity for action. Although Scardamalia and Bereiter advance the pedagogy of knowledge building to address the failures of traditional schooling, its continued representational bias—as evident in their technological tool, *Knowledge Forum*—makes unclear how knowledge building can materially change schooling.

Intentional learning: A Deweyan reconstruction

Given that Bereiter and Scardamalia's (1989) construct of intentional learning has value, we wish to retain it. But how might we salvage it? A way forward is to reconstruct the idea by grounding it on credible philosophical underpinnings. To this end, I offer a reconstruction rooted in the philosophy of pragmatism (Elkjaer, 2009) and Dewey's transactional onto-epistemology (Dewey, 1925/1988; Garrison, 2001).

Charles Peirce, William James, and John Dewey are commonly regarded as originators of the philosophy of pragmatism. The pragmatist stance is exemplified by 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). Similarly, James insists: "My thinking is first and last always for the sake of my doing" (James, 1890/2007, p. 333). Through these statements, we note how pragmatists, unlike cognitivists, give primacy not to internal representation and mechanism but to consequential situated action in the world. Pragmatism may be viewed as emerging from a theory of meaning because there is no difference of meaning so fine that we cannot detect it in terms of possible consequences. If the consequences of two conceptions are identical, their meaning is identical (Garrison & Neiman, 2003). Elkjaer (2009) refers to pragmatism as a "learning theory for the future" because it concerns itself primarily with the future consequences of present actions. These actions are based on anticipatory imagination ("what-if" thinking) and not linear causal thinking rooted in *a priori* propositions ("if-then" thinking).

Garrison (2001) points out that the problems of classical epistemology arise from dualistic thinking that separates the knower from the known, minds from matter (including one's own body), and internal from external. However, as Dewey and Bentley (1949/1991) argue, when we come to the consideration of the knowing–knowns as behaviors, we find Self-action as the stage of inquiry which establishes a knower "in person," residing in, at, or near the organism to do the knowing. Given such a "knower," he must have something to know; but he is cut off from it by being made to appear as a superior power, and it is cut off from him by being made to appear just as real as he is, but of another realm. The assumption of Self-action leads one down the slippery slope of knower–known dualism: a separation of the knower from what he knows. To counter this false dichotomy, Dewey and Bentley (1949/1991) thus propose a trans-actional construction where systems of description and naming are employed to deal with aspects and phases of action, without attribution to "elements" or other presumptively detachable or independent "entities," "essences," or "realities," and without isolation of presumptively detachable "relations" from such detachable elements. By this means, the unity of an agent's action is preserved. All organisms are always already active. Stimuli arise and are experienced in the course of action. A stimulus changes the direction of action that is already ongoing. A response to a stimulus is thus not the beginning of activity; it is a shift of activity in response to the change in conditions indicated by a stimulus. The stimulus does not evoke a response. Rather, stimulus–response is a unitary couple. By this reframing, Dewey (1932/2008) preserves the holistic unity of the existential "trans-action."

According to Dewey (1949/1991), knowing is established only through inquiry. Any instance of knowing as inquiry is constituted by (i) the occurrence of an event in the ongoing course of life-activity which interferes in one way or another with the ongoing course of the behavior that has been proceeding smoothly and which in consequence (ii) deflects it in the case of human knowings into what may properly be termed a reflective channel, provided reflective be taken literally as standing for deliberate going-over of the conditions of direct straightaway behavior that is (iii) preparatory to its resumption. Consequently, situated action is always the ground and perquisite of human knowing. Knowing is always behavioral and deeply contextual.

To resume disrupted behavior, humans engage in inquiry. The subject matter of inquiry is to find out *how to* arrive at the destination initially settled upon. Inquiry is an intermediate and mediating form of transactional behavior because it serves an end-in-view, or purpose, for which it is entertained. It implies a need for the corrective action to be tested by its meeting or failing to fulfill the end to which behavior was originally directed (Dewey, 1949/1991). Knowing is thus empirically grounded. It establishes demonstrated means to an intended consequence.

Given the foregoing Deweyan reconstruction, knowing, engaged in transactionally, is always intentional and deliberate because it requires conscious reflection by the learner. Knowing involves relating the identification of potential means to intended consequences to the demonstrated consequences of means successfully used. Understanding arises from grasping a unity of pattern relating functional means to an end. Dewey (1949/1991) explains that *de facto* processes become intentional proceedings as *de facto* successions and subsequents are held in view. Because of foresight and intention, human beings anticipate what is to come; the subsequent then becomes a consequence to be achieved, reached, and as such is an end-in-view. In this manner, regularity of patterned human behavior arises as subsequents are habitually directed to be consequents. Knowing, thus derived, is always significance laden and hence meaningful to the knower because inquiring always requires intentional and deliberate goal-directed activity.

The above reconstruction of intentionality offers a credible account of learning as intentional human activity without falling prey to the error of dualism and the critique of meaning-less cognition. Eschewing idealism and materialism in favor of naturalism, Dewey provides a "third way" beyond entrenched dualisms of classical Western philosophy by turning to process-based metaphysics (Mesle, 2008; Rescher, 1996; Whitehead, 1978) to understand human agency and action in the world.

Educational games and intentional learning

In this section of the paper, I describe two very different educational games to contrast how their design is grounded in the conventional and reconstructed notions of intentional learning discussed above.

Intentional learning, from the perspective of representational theory, is underpinned by an emphasis on knowledge representation as an enabler of information processing. The ensuing outcomes entail learning *that*, knowledge *of*, and knowing *about*. The form of these outcomes is expressed in terms of language, signs, symbols, and images; that is, it is representational. Intentional learning, conceived thus, is well aligned with Prensky's (2001) definition of digital game-based learning as "any marriage of educational content and computer games" founded on the premise that "it is possible to combine computer video games with a wide variety of *educational content*, achieving as good or better results as through traditional learning methods in the process" (pp. 145–146; italics added). Prensky's populist writings have energized the serious games movement and led to widespread creation of what I call "games-to-teach".

A simple example will concretize the idea of a "game-to-teach". A fee collecting web portal offers students various kinds of serious games. One particular chemistry game deals with learning the periodic table. The interface shows the periodic table and gives this instruction: "Click on the element with the atomic mass of 58.693." If a student selects the incorrect element in the periodic table, the system responds: "Oops, that is incorrect. Please try again." A second incorrect attempt results in the system flashing the correct element that needs to be selected. Selecting the flashing element leads to the feedback "Correct!!!" accompanied by the presentation of extensive information about that element. The odds of a student obtaining the correct answer on the first attempt, or even the second attempt, is approximately zero given that there are 106 different elements to choose from. Playing this serious game quickly reduces to an exercise in the delayed presentation of the following "educational content": "Nickel is the element with an atomic mass of 58.693." No typical student will find knowing *that* this is true of the element nickel worth remembering. Learning *about* nickel in such a decontextualized way has little relevance to a student's life-world. Insisting that a student should exercise metacognitive effort to learn such content intentionally makes little sense. The situation is further aggravated by the fact that human information processing theory is semantics free. Consequently, what is learned, adhering to the theory, would be meaning-less. It turns out that students usually feel such learning *is* meaningless. Because of this, they quickly forget such declarative "knowledge". It matters little if a collection of such statements is linked into a "semantic" net and students discuss *about* nickel, because the representation remains semantics free. In sum, a game whose design does not allow students to *work* with (simulated) nickel in an authentic, situated, and goal-directed way will not trigger processes of interpretive sense making and the development of knowing as a human cognitive capacity.

Orienting away from “knowledge” and its derivatives, a process worldview constructs learning as knowing through inquiry. A process perspective subsumes (third-person decontextualized) “knowledge” into individuated (first-person contextualized) capacities to act and speak that is indicated by “the known.” Barring any linguistic deficits, a student who knows through doing will also be able to articulate her understanding in more abstract, linguistic terms. As argued by Dewey (1949/1991), however, an instructional approach that focuses only on students learning what is deemed by the teacher to be “right” and “true” knowledge runs completely counter to inquiry because “[t]o be *bound* to a given conclusion [by virtue of authority] is the exact opposite of being *required* to inquire” (p. 325).

Gee (2012) argues that authentic games constitute a model of 21st century learning. Although games have content, they are not about their content. Rather, they concern doing, making decisions, solving problems, and interacting: with other players as well as with objects in the immersive game world. Content, including the storyline, in a game facilitates and serves acting, deciding, problem solving, and interaction. It is subject to game mechanics: all that players must do and decide in order to succeed in game play. Good educational games are thus situated action environments that allow students to engage in meaning making through inquiry learning. They are not environments for learning subject matter *qua* content.

The *Statecraft X* game together with its associated inquiry curriculum (Chee, 2013; Chee, Gwee, & Tan, 2011; Chee, Mehrotra, & Liu, 2012) exemplifies a “game-to-learn” and is the antithesis of a “game-to-teach” (content). *Statecraft X* is a multiplayer, client-server game that supports 20 concurrent players. Students play the game using Apple iPhones. The Statecraft X curriculum was designed for 15-year-olds to understand governance in relation to citizenship in the context of Social Studies education. Students learn governance by governing towns in the medieval fantasy kingdom of Velar. As argued by Thomas and Brown

(2007), immersive multiplayer games allow players to "learn to be" (governors in the present instance) and not merely to "learn about." As an immersive game, students engage in game play (and learning) in the first person. Their overall objective is to ensure the long-term survival of the newly founded kingdom of Velar, which has seceded from neighboring Salfreda after a long and bloody rebellion. To do so, they must provide for the basic needs of citizens, develop the kingdom's economic wealth, and keep all citizens happy. However, many challenges arise. Students must solve problems in their towns thoughtfully and with foresight. Placed in the role of town governors, students must deal with epidemics that sweep through the land, repel bandits that roam the inter-town trade routes and plunder the economic assets of towns, provide housing and medical care for citizens, establish a defense force for the kingdom, engage in trade, develop friendly foreign relations, and maintain inter-racial harmony between the four races that inhabit the kingdom: trolls, dwarves, elves, and humans. Figure 1 illustrates the interface of the game on the iPhone, showing the town view with barracks on the left and the embassy (equivalent to the kingdom's foreign ministry) on the right.

Figure 1: Zoomed in partial view of a town showing barracks and embassy

As with all inquiry learning, it is not immediately evident to students what strategies will work to address the challenges effectively and why. It is vital, therefore, that students implement their deliberated strategies and test their effectiveness. That is, students must attempt to engineer the consequents as the desired subsequents given their ends-in-view. As a simple example, consider the first two challenges that students must deal with: several waves of epidemics and bandit attacks on towns. If, while addressing citizens' basic needs in terms of water, food, and housing, students neglect developing healing centers (akin to hospitals) as well, they will pay a high penalty in terms of citizen deaths when the epidemic strikes. Citizen deaths sensitize students to the need for healing centers. When deaths occur, students typically start directing town resources to the development of healing centers. However, this type of governance is reactive. Well before the final epidemic occurs, students begin to experience loss of food from their towns due to bandit attacks. Those with the foresight to develop army barracks in good time, and thus have a small defense force, suffer minimal loss compared with others who failed to consider this need and to act upon it in a timely way. In this manner, students quickly learn that actions, as well as their failure to act, have very real consequences. As *Statecraft X* is a 24/7 game, there is no stopping or rolling back time to "undo" past mistakes once the game commences. Students have to live with the consequences of their actions as well as inactions. In the classroom, a dialogic pedagogy is adopted. Teachers help students to engage in meaning making related to game play experience and to distill the conceptual takeaways that emerge from that experience. In the context of the present example, the important principle for students to come to understand, in relation to the formal curriculum, is the vital need, in governance, to anticipate change and act in a proactive rather than reactive manner. There are no "right answers" in playing the *Statecraft X* game. There is only more effective or less effective game play, where effectiveness is a function of striking a functional balance between a set of competing demands, not all of which can be fully satisfied (as in the real world). This mode of learning quickly sensitizes students to the personal values they bring to bear on the task of governance. Students always find that they do not have sufficient gold (the game's currency of exchange) to allow them to do all the things they wish to do. They also often experience an inverse relation between the economic prosperity of their towns and the happiness of the town's citizens. How do they choose to manage this tension? What personal values do they bring to bear in making their choices related to governance, and how are their values similar to or different from the values of their peers? Students are encouraged to reflect on these issues.

About three-quarters through the arc of game play, rumors circulate about the armies of Salfreda massing along the common border with Velar. A foreign invasion appears imminent. How will players respond to this common threat against the integrity of their kingdom? Will they band together in the face of a global threat to the nation, or will each player continue to focus on the local concerns of the towns he or she governs at the expense of the greater good?

It should be evident from the above example that the kind of learning engendered by the Statecraft X game-based curriculum is very different from that engendered by the periodic table "game" described earlier. Continuing the example related to the need for governments to anticipate change and be proactive, teachers who adopt conventional pedagogy when teaching this topic begin by telling students the pertinent principle as shown in the textbook—"Anticipate change, stay relevant"—so that students have the "knowledge". Following a Bloomian way of thinking (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), teachers then explain the principle to help students comprehend and memorize it. Next, they expect students to apply the principle. But students have difficulty doing so. Deprived of the opportunity to distill the idea through situated game play *first*, the principle, expressed declaratively, feels detached and is not imbued with meaning. Consequently, the concept is inert. Regrettably, Bloom's taxonomy, which remains the basis of much instruction in schools today, engenders the very antithesis of situated learning. This kind of misdirected thinking has pervaded the design of educational software for children since its earliest days and reproduces the worst forms of school-based pedagogy (Ito, 2009).

In contrast, through Deweyan intentional learning in the Statecraft X curriculum, practical, in-game actions get coupled to students' reflection on the efficacy or otherwise of those actions by virtue of the effects those actions have *in* the game. This trans-actional coupling between action and reflection realizes the students' meaning making processes where (1) their thinking is for the sake of their doing, as articulated by James, and (2) the subject matter of inquiry is to find out how to arrive at the destination settled upon, following Dewey. In this manner, learning is rendered intentional and meaningful. It is also contextualized and value laden. Semantics accrue to representations. Students develop capacities to act in domain relevant ways; they do not become possessors of "inert knowledge." Dualism is avoided: the knower is no longer separated from the known. Rather, the knower knows because of the developed capacity to act in situation-appropriate ways, as with Gergen's example cited above.

Discussion

It is interesting to note that Bereiter and Scardamalia (1989) criticize Dewey in the following terms: "In fact, a line of progressive educational thought descending from John Dewey (1916, p. 169) is explicitly opposed to intentional learning, holding that all learning should be an incidental consequence of action directed toward other ends" (p. 386). Turning to the cited portion in Dewey's (1916/1980) *Democracy and Education*, we find him reacting against "a peculiar artificiality to much of what is learned in schools" (p. 168), just as Bereiter and Scardamalia criticized "school-like work." Dewey, however, was keen to suggest "positive measures adapted to the effective development of thought" (p. 169). He saw opportunities in reproducing situations of life and for acquiring and applying information and ideas. Ideas are not segregated; they do not form an isolated island. Information is vitalized by its function and by the place it occupies in direction of action. In referring to these measures as "opportunities," Dewey recognized the tendency of school systems to domesticate his ideas into the kind of non-intentional learning that Bereiter and Scardamalia rightly criticize. However, as Dewey argues, the disposition on the part of upholders of "cultural" education to assume that activities reproducing situations of life are merely physical or professional and somehow non-intentional in quality, is itself a product of the philosophies which isolate mind from experience. When the "mental" is regarded as a self-contained separate realm, a counterpart fate befalls bodily activity and movements, which are regarded as not occupying a necessary place in mind nor enacting an indispensable role in the completion of thought. In pursuing knowing and learning in the context of situated activity, Dewey reconstructed philosophy in a manner that directly addresses the age-old problem of mind-body dualism. Situating learning *in* activity and constructing knowing *as* inquiry, thinking–action are approached as a unified whole. The mental realm of thinking that segregates "ideas" and "knowledge"—all of which are constituted as products of language—from the physical realm of human actions and behavior is exposed as a false dichotomy. The preeminence accorded by cognitive scientists to products of the rational "mind"—ideas and knowledge—at the expense of action and behavior is deliberately undermined. By grounding their thinking in classical cognitive science and being overly taken up with "knowledge" as an ontologically real entity to be "built," Bereiter and Scardamalia, misappropriate, miscomprehend, and misrepresent Dewey's thinking and intentions.

When delivering his presidential address to the American Association for Artificial Intelligence in 1980, Allen Newell expressed misgivings about the manner in which the term "knowledge" is conventionally used. He argued against widespread conflation between knowledge and its representation because it became increasingly clear to him that "knowledge is a competence-like notion, being a potential for generating action" (Newell, 1982, p. 100). Sadly, schools today still largely engage in pursing knowledge representation in the form of "information," "facts," and "knowledge." The capacity for action—foregrounded by the term "knowing"—has been lost sight of.

Reorienting from "knowledge" to "knowing" constitutes a critical shift in metaphysical commitments: from a substance-cum-entity ontology coupled with a knower-and-the-known epistemology to a process ontology coupled with a knowing-and-the-known epistemology. Process metaphysics holds that flux and flow is a primary ontological reality, and change is the fundamental manifestation of nature. The roots of process thinking can be traced back to the ancient Greek philosopher, Heraclitus of Ephesus, who is often cited for his insight that "one cannot step twice into the same river" (Rescher, 2008). Adhering to process philosophy, "mind" ceases to be a presumptive entity. In his final work co-authored with Bentley, Dewey declared the concept of mind redundant: "The living, behaving, knowing organism is present. To add a 'mind' to him is to try to double him up. It is double-talk; and double-talk doubles no facts" (Dewey & Bentley, 1949/1991, p. 132). Following the anthropologist Clifford Geertz (1973), we ought to use the process term "minding"—a manifestation of the capacity of humans to demonstrate mindfulness in their actions and activities—in lieu of "mind". In similar vein, it is worth noting that Frederic Barlett (1932), the pioneer on "human memory" experiments, entitled his work *Remembering* to connote a process, and not *Human Memory*, a term that carries with it the connotation (drawn from the computer metaphor) of an entity: that of a data store.

From the perspective of process philosophy, then, "meaning" is not a noun but a (continuous present tense) verb. Meaning is something that people do. Meaning is made, not taken. Consequently, Frensch's (1998) concern over a concept possibly having multiple meanings seems awkward and misplaced. Similarly, "knowledge" is not a thing to be acquired. Rather, knowing is a human capacity to be developed. Games-to-learn pursue the knowing agenda. Games-to-teach pursue the knowledge acquisition agenda.

Conclusion

Intentionality, the philosopher's term for "aboutness", is a unique feature of human cognition. In this paper, I have argued that intentionality emerges from the action–reflection dialectic in situated learning. Intentional learning, as conventionally constructed, ironically offers an account of learning that is semantics free and, hence, non-intentional. Reconstructed according to Dewey's philosophy, intentional learning is necessarily meaning-laden and, hence, intentional. If educational games are to contribute to bona fide student learning, it is vital that erroneous metaphysical assumptions and ensuing thinking be put aside in favor of more plausible assumptions that can withstand critical scrutiny. As illustrated in this paper, the implications of our metaphysical commitments impact directly on educational game design through the intermediary of learning theory associated with each kind of metaphysical commitment. As responsible 21st century educators, it is our obligation to offer students games-to-learn with, not games-to-teach.

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