

Chapter 2

Games-to-Teach or Games-to-Learn: What's the Difference and Why It Matters

In this chapter, I articulate the distinction between what I refer to as “games-to-teach” and “games-to-learn.” I critically interrogate why games-to-teach are deeply problematic if the goal is to educate rather than school children. I do so from the perspectives of knowing, being, doing, and valuing; i.e., from epistemological, ontological, praxiological, and axiological frames of reference. I then elaborate on the vital differences between the two perspectives from the standpoint of making a commitment to schooling children or to educating them.

2.1 Games-to-Teach

The activity of play has permeated human culture from the earliest days of civilization (Huizinga 1938/1955). Play continues to be widely acknowledged as an essential means through which young children learn and develop cognitively and socially (Pellegrini 2009). Technology-based modes of play, accessed via virtual environments and digital games, have become commonplace in children's lives due to rapid penetration of personal computers and mobile digital devices in developed and developing economies, attendant upon the enhanced performance of hardware and on falling prices. Given this context, it is perhaps not surprising that from the late 1970s until well into the 1990s, there was a thriving market for children's educational software that rode upon the affordances of multimedia and animation that permitted the presentation of subject content in more attractive and engaging ways (Ito 2009).

The publication of Prensky's (2001) book on “Digital Game-based Learning” can perhaps be understood as a logical development and part of the evolution of

digital games for learning. Seen in this historical light, it is telling that Prensky defined digital game-based learning in the following terms:

Most simply put, Digital Game-Based Learning is any marriage of *educational content* and computer games. The premise behind Digital Game-Based Learning is 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)

Repeated emphasis on educational content coupled with a comparison with traditional learning methods suggests a lack of dissatisfaction with “business-as-usual” schooling (Youdell 2011) or, at least, contentment with the *status quo* in children’s formal education, except for one thing: unhappiness over how school learning often leads to disinterested and disengaged students. Prensky describes his professional focus as “reinventing the learning process to provide more engagement, combining the motivation of video games and other highly engaging activities with the driest content of education” (Prensky 2006, p. 253). Might there be a deep contradiction in wanting to enhance students’ motivation and engagement for the driest content of education?

Insistence on educational content that students are supposed to learn suggests an overly narrow understanding of and vision for education, especially twenty-first-century education. Content centrality succumbs to Postman and Weingartner’s (1969) critique of the idea that a classroom lesson comprises two components: content and method. Content is considered to be the “substance” of the lesson: It is something that students are supposed to “get.” Content is conceived of as having independent and prior existence to students, and it is indifferent to the media by which it is “transmitted.” Method, on the other hand, concerns the manner in which content is presented, whether it is achieved by means of a computer game or some other means. Such thinking is rooted in the tradition of instructional design (Smith and Ragan 1999), which arose during the Second World War as a mechanistic process for producing reliable training. It combines the ideas of operant conditioning and reinforcement with communications theory that emphasizes the conveyance of ideas (Jonassen and Land 2000) and views learning as entailing knowledge transmission accompanied by drill and practice.

I turn now to critically examining several examples of educational games that can be found on the Internet. These games provide the reader with concrete examples of games-to-teach. They are located in the domain of chemistry. They came to light during the process of searching for “state-of-the-art” chemistry games, as part of developing the curriculum for our chemistry game *Legends of Alkhimia*.¹

A certain online Web site hosts a chemistry “game” that is positioned in the following way. On accessing the Web page, one is presented with a screen that states:

¹See Chap. 5 for details.

“This is a fun little game that quizzes you on element names, symbols, and uses.” Clicking the button “Start Element Quiz,” a student is presented with a question such as:

Hydrogen is

- (a) H
- (b) Yd
- (c) He
- (d) Hg

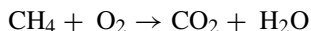
The page also contains an on-screen hyperlink that says, “How do I play this?” Clicking the hyperlink yields the following instructions: “Click on the answer link for each question and a message will pop up letting you know if it’s correct. If you miss one of the 43 questions, don’t worry, it’ll come up again until you get it right.”

It requires little intelligence to discern that this “game” is merely a multiple-choice question, a popular mode of assessment in schools, disguised as a game. It is striking how the author of the Web site positions the activity as “a fun little game” and going so far as to pose the question “How do I *play* this?” to users. It is perhaps even more remarkable that the author appears to attach great value to students mastering fragments of “factual” content, such as “Hydrogen is H.” This example illustrates how laypersons tacitly understand, and thus frame, the activity of formal education in terms of the mastery of content accomplished by means of some instructional method.

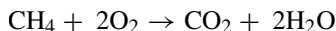
My second example is drawn from a fee-paying Web portal that ostensibly markets educational games. One such game deals with the periodic table. Students are shown a diagram of the periodic table with this instruction: “Click on the element with the atomic mass of 58.693.” In all likelihood, a student will engage in this activity by making random guesses. Selecting an incorrect answer triggers the following system response: “Oops, that is incorrect. Please try again.” If the student tries again and still selects an incorrect element—a very likely outcome given that there are 106 different elements to choose from—the system flashes the correct answer, which happens to be “Ni,” representing the element nickel. Selecting the Ni button leads to the system feedback “Correct!!!” accompanied by presentation of extensive information about nickel, which students are presumably expected to remember. It should be apparent that this “game” reduces to a trivial exercise in the delayed presentation of subject content. Although this activity has an impressive user interface, it is ill conceived from a pedagogical point of view.

My third and final example revolves around the use of chemical equations. Yet another chemistry Web site seeks to teach students how to balance such equations correctly. On an interface comprising textual instruction and molecular representations, students are asked to “balance the equation for the combustion of methane.” On the left side, the “Reactants” methane and oxygen are shown. On the right side, the “Products” carbon dioxide and water are shown. The following instruction is

given: “Click on each of the molecules in turn, until you have a balanced equation, then click OK.” The original, unbalanced equation shown is:



while the correct balanced equation is:



That is, one molecule of methane and two molecules of oxygen react to form one molecule of carbon dioxide and two molecules of water. Given that the molecular products of the reaction are already shown in the original equation, the exercise reduces to an arithmetic manipulation to ensure that the number of each type of element is the same on the left-hand side and the right-hand side. No substantive understanding of the chemical reaction is needed to obtain the right answer.

The three examples described above may be regarded as a continuation of the kind of thinking that pervaded the era of computer-aided instruction (CAI). CAI software was designed to drill students to obtain correct answers to questions framed such that they would have unambiguously “right” versus “wrong” answers. In this context, “right” answers are authority determined. Thus, even complex questions that, in principle, offer no unambiguously “right” answer—for example, “what is a good citizen?”—are railroaded into a clichéd format that conforms to the a priori requirement of there being a “right” answer. Unfortunately, this right-versus-wrong answer mind-set carried over into the field of intelligent tutoring systems (ITS) in the 1980s and 1990s where computerized tutors, augmented with the powers of artificial intelligence, were developed to train students to obtain right answers in problem-solving domains such as arithmetic, geometry, and algebra (Larkin and Chabay 1992). Concerns over effectiveness (getting the right answer) and efficiency (getting the right answer in the least amount of time) were paramount in the design of such tutors. Making mistakes in the process of problem solving was viewed as inefficient and a “waste of time.” Hence, it was something to be avoided. In short, making mistakes was seen as having no value in relation to the learning process. The mantra of “getting it right in the shortest time” became dogma.² There was little understanding of and tolerance for the importance of expectation failure (Schank 2002), arising from the commission of error to the learning *process*. Educators were—and continue to be—fixated on learning *products* or outcomes. Consequently, they do not focus on learning as such.

Another type of online learning tool positioned as an educational “game” is the virtual chemistry laboratory. Such virtual laboratories are designed to replace the procedures that students traditionally perform in a school chemistry

²There is nothing wrong, of course, in wanting students to be able to generate the correct answer to mathematical problems. The issue here is that for a deep *understanding* of the problem space to be achieved, students need to grasp the solution space *in relation to* the error space. This point is elaborated later.

laboratory with an online virtual version. They may support fairly sophisticated manipulation of laboratory equipment and performance of experiment procedures, but always subject to the condition that students execute mandated steps in a predetermined sequence the way they normally do in school. In short, students are not permitted to experiment when performing the (predetermined) experiment: a self-contradicting design for learning. Prensky argues the need to distinguish between simulations and games. He states that a “pure simulation” focuses on the thing or process being simulated, while a “pure game” focuses on the user’s experience. A pure simulation is intended to support practice. It copies reality, is life-paced, assumes an externally defined meaning, and entails no goals, story, or struggle. Pure games, by contrast, include elements of fantasy, are game-paced, require students to construct their own meaning, and involve struggle to achieve meaningful goals within a narrative flow. From this perspective, virtual chemistry laboratories are simulations rather than games. As evident from the foregoing explanation, they replicate schooling practices, albeit in a digital format.

Based on the foregoing examples, it seems reasonable to infer the following. First, there is widespread preoccupation, among game designers and developers (and likely instructional designers as well, to the extent that such professionals are involved in the game design process), with using educational games as tools for teaching subject content. To the extent that such games focus on skills, they do so in a limited way that emphasizes strict execution of correct procedure. Second, with respect both to learning domain content and skills, the stress is on “getting it right.” Any outcome that diverges from the prescribed “right answer” and “right procedure” is regarded as having no value. Consequently, the commission of errors by students, as part of the learning process, is viewed as inefficient and undesirable. Hence, it is something that should be avoided. Third, game designers and instructional designers have weak understanding of epistemology that is essential to effectively design for human learning. Specifically, they fail to understand that human meaning making is relational in nature. Just as the conceptual idea “black” has meaning only in relation to its opposite, “white,” a “right” or correct answer can acquire its sense of “rightness” only in relation to all that is “not right.” But if students are discouraged, even precluded as in the virtual chemistry laboratory, from experiencing why wrong answers are “not right,” their understanding of why right answers are “right” will be fragile at best. In such a circumstance, the warrant for “rightness” can only be based on authority. Thus, when asked for an explanation for why some claim is correct, students can only appeal to an authoritative source—be it the teacher or the textbook—as the basis of their claim, given that they have no personal basis that can serve as warrant for the claim. Lacking the opportunity to engage in a rich meaning-making process that entails making mistakes—something that games readily afford—students frequently end up “knowing the facts” but without a working understanding of what they know.

2.2 Interrogating the Thinking Underlying Games-to-Teach

In this section, I interrogate the conundrum of “knowing” and yet not understanding alluded to in the preceding section. I do so in terms of four distinct facets of what I shall later argue are interrelated aspects of a common underlying theoretical problem. These four facets are the epistemological, ontological, praxiological, and axiological aspects of human behavior.

2.2.1 *Epistemological Confusions*

Epistemology addresses the subject of knowledge and how we, as humans, come to know. Although epistemology is of deep relevance and consequence to education, it is perhaps a sad reflection of the normative emphasis on schooling rather than educating that the typical schooled adult lacks substantive understanding of this subject matter.

Typical adults tend to think of knowledge as something that a person “has.” People with “more knowledge” are deemed to be better off than those with “less knowledge.” Furthermore, libraries are commonly regarded as storehouses of knowledge. With the advent of the Internet, knowledge is widely viewed as “residing online” in formal repositories such as Wikipedia, as well as other institutional and personal Web pages.

Thinking about knowledge in the manner described above, however, is deeply problematic from an epistemological point of view. First, knowledge is conceived of as an object; hence, it is some *thing* that a person can “have.” Such thinking is erroneous and is a manifestation of what I refer to as the *fallacy of knowledge possession*. An illustration might be helpful. A newspaper article that I read some-time ago sought to highlight how easily students today can “obtain knowledge” from the Internet. The title of the article boldly proclaimed “Trawling for knowledge.” Drawing upon the conceptual and evocative power of metaphor (Lakoff and Johnson 1980), the writer portrayed knowledge as being like fish: some *thing* that can be “caught” by trawling, presumably by using an Internet search engine such as Google Search. But can knowledge really be “caught”? If knowledge is indeed catchable, would teaching not be reducible to the simple act of giving students handouts or assigning bookmarked Web pages to read: a case of “sharing the fish caught,” as it were?

Schoolteachers often instruct young children to “find” the meaning of a word they do not know by looking it up *in* a dictionary. Suppose that a child encounters the word “rhinoceros” in a (non-picture) book for the first time. Not knowing what the word means, she searches the dictionary and finds the following definition: “massive horned mammal.” Delighted, she memorizes this definition and thinks that she now knows what a rhinoceros is. In other words, she thinks that she is

now in possession of “new knowledge.” While such new knowledge might serve her well in multiple-choice tests in school that require the recognition of a correct definition of what a rhinoceros is, would she necessarily recognize one when she encounters it in the zoo or in the wild? The answer is an emphatic “No.” Knowing the textual definition of the word “rhinoceros” does not translate into knowing what a rhinoceros is in the real world because all that (printed) dictionaries contain is carbon on paper. Just as a laser printer prints pages by fusing carbon powder in the toner cartridge onto the page, a (printed) dictionary likewise only contains carbon on paper. Consequently, such dictionaries do not contain word meanings and, hence, do not contain knowledge. The textual, symbolic forms inscribed in carbon on the pages of a dictionary are, in and of themselves, inert and meaning-free. Hence, they do not constitute knowledge. All dictionary users must make the effort to *interpret* the inherently meaningless representations found in dictionaries to render the representations personally meaningful. Only then can they be said to know.³ Consequently, human knowing entails engagement in a meaning-making process. Possession of representations of knowledge, such as dictionary definitions, does not translated directly to, and hence is not equivalent to, knowing. As Korzybski (1994) argued, the map is not the territory. Consequently, having possession of the map, which is merely a form of pictorial representation, does not translate directly to being able to navigate the territory represented by the map. While the map may be an aid to navigating the territory, it does not, of itself, bestow the capacity to navigate the territory represented. In short, possessing a *representation* of knowledge is clearly not the same as having knowledge as such because to genuinely “have knowledge” requires the concomitant capacity to act in ways consistent with that knowing. From the foregoing, it also follows that merely being able to repeat a dictionary definition or to regurgitate memorized passages from a textbook or from the Internet fails as a test of knowing. To believe otherwise is to fall prey to what I call the *inadequacy of knowledge profession*. Being able only to profess through a linguistic means of expression—as is the case with oral and written examinations held in schools—merely perpetuates the illusion of knowing when a student only knows *about* something. Just as knowing swimming differs vastly in its entailments from knowing *about* swimming, the restricted capacity for profession, without a concomitant capacity to act upon one’s profession, manifests a pervasive outcome of school-based learning, namely inert knowledge (Whitehead 1929).

The second reason why the primary error of treating knowledge as an object is problematic is that such thinking leads to the secondary error of believing that knowledge can be measured and quantified. While a student can be in possession of a greater or lesser amount of knowledge representations—for example, through the quantity of information resources, such as textbooks, that she possesses—it

³Whether they know “correctly” or otherwise—that is, whether they genuinely understand—is a separate matter.

makes little sense to speak of having more or less knowledge if one accepts that knowledge is not a thing to begin with.

Third, to think that knowledge can be stored in online digital repositories, as well as physical media and books for that matter, is to commit the *error of knowledge reification*. Delivering his presidential address to the American Association for Artificial Intelligence in 1980, Allen Newell expressed serious misgivings about the widespread conception of knowledge as a thing. He argued that such thinking conflates knowledge and its representation. While knowledge representation takes a material form, knowledge, Newell suggested, “is a competence-like notion, being a potential for generating *action*” (Newell 1982, p. 100, italics added). In the context of artificial intelligence, encoded representations of machine behaviors have the potential for generating actions useful to humans. However, Newell recognized that the representations alone were incapable of any such action. Thus, he sought to reconstruct the notion of knowledge as some kind of material stuff in terms of “actionable knowledge” instead, so as to distinguish knowledge from its inert representation. This idea of actionable knowledge is precisely what Dewey and Bentley (1949/1991), in their seminal work *Knowing and the Known*, refer to as “knowing.” Thus, when a person acts in a knowing way—that is, in an informed manner when in a specific situation—laypeople impute the person with “having” knowledge. But this “having” arises from imputation, as a matter of custom and social habit, rather than as a scientific fact.⁴ This social practice leads directly to the fallacy of knowledge possession described earlier.

From the foregoing, we may conclude that the thinking underlying games-to-teach is based on the epistemological error of conflating human knowing with the possession of representations of knowledge. Avoiding the fallacy of knowledge possession leads to my argument in Chap. 3 for the necessity of framing learning in terms of human performance—a central tenet of this book.

2.2.2 Ontological Errors

Ontology is the branch of classical Western philosophy that deals with the principles of pure being; that is, it addresses the question of existence and of “what *is*.” A key idea from ancient Greek thought concerns the idea of *theoria*, which refers to the activity of mental contemplation directed toward the establishment of truth. *Theoria* was juxtaposed against *praxis*, which relates to the realm of human action in the lived and sensed world. According to Aristotle, *theoria* is directed toward the “eternal and unchanging *objects* and is the highest and best activity of which a human being is capable. A man engages in contemplation not *qua* man but in

⁴A person who is asked to show you his or her knowledge (as a material object) will be hard pressed to do so. Laypeople may be apt to point to their heads, but when pressed further to be more specific, they are likely to show signs of exasperation.

virtue of the divine intellect (*nous*) in him. Contemplation is higher than *practical reason* and is the supremely valuable life, providing complete human happiness” (Bunin and Yu 2009, p. 684). Truth, for Plato, is exemplified in mathematics and geometry, and it can only be apprehended through the exercise of rational thought. The world perceived with our senses—that is, *phenomena*—is only a corrupted copy of this ideal Truth. But beyond this world of phenomena, Plato believed that there lies a *fixed* world of Ideas—a kind of transcendent Platonic heaven—that is the real object of knowledge, namely (eternal) Truth. Based on Plato’s theory of forms, this truth constitutes ultimate *reality*. Based on this general worldview, it is hardly surprising that the ancient Greeks prioritized rational thought above action in the world. Western thinking, as a legacy of ancient Greek thought, continues to embody this bias.

The notion that there is a world of fixed and eternal ideas—namely, Truth—that can be discerned through focused mental contemplation has led, through the history of premodern and modern times, to the prioritization of representational forms, language being the most dominant form, that supposedly mirror how things are in the world. However, Rorty (1979) has cogently argued in this seminal work, *Philosophy and the Mirror of Nature*, that assuming a correspondence between a word, proposition, or thought to some objective reality or truth presupposes a correspondence theory of language—an ontological assumption—and a spectator theory of knowledge—an epistemological assumption. Unfortunately, both assumptions are seriously flawed. We know, from the domain of semiotics and language studies, that the relation between a word and its meaning in the world is entirely arbitrary (Hayakawa and Hayakawa 1990). Two people can use the same word to mean very different things, and consequently, the correspondence theory of language fails. Likewise, two people who share a common experience—say that of witnessing a car accident while walking together along a road—can (and, as a practical matter, invariably will) express that experience in different words because it is not possible for them to stand removed from the phenomenon of concern and render a singular impartial and objective account of what was “actually seen.” The spectator theory of knowledge, however, assumes that people possess a kind of “immaterial eye” that can impartially view what is taking place in the “reality” that lies before them and thereby render a unique “objective” account of what took place. Clearly, this is not possible, and hence, the spectator theory of knowledge is also rendered false. Consequently, what humans know—commonly spoken of as their knowledge—is formed through a sociocultural process that requires interpretation and construction. What they know does not, and cannot, arise merely from “recording,” “finding,” or “discovering” it. As humans, we do not have the privilege of adopting a God’s-eye-view of the world and to see the “true” account of “how things really are.” Rather, we were born into the world and became socialized into our roles and positions in the world long before we could even consider engaging in inquiry or scientific research. Consequently, our engagement in such enterprises is fully impregnated with values, beliefs, and understandings that arise from prior enculturated practice in this world. To think otherwise would be to fall prey to what Dewey (1925/1988) called *the philosophic*

fallacy, namely the error of “confusing the *consequences* of linguistic meaning making and logical inquiry with *antecedent* metaphysical existence” (Garrison 1999, p. 929). In short, Dewey emphasized the importance of acknowledging that words and language are a human construction that comes *after* the existence of the physical world, and not before. Regrettably, many philosophers, educators, and laypersons continue, like Descartes, to uphold the dictum of *cogito ergo sum*—I think therefore I am—thereby assuming the possibility of thinking as prior to being. In doing so, they commit the error of assuming the existence and availability of language for thinking before granting the existence of the physical world, and of themselves, to which that thinking is directed.

The ontological errors described above are further compounded by the *error of hypostatization*: construing purely conceptual entities as having real existence. In his celebrated book *The Concept of Mind*, Ryle (1949/2009) describes the case of a foreign visitor being shown around his university. As described by Greetham (2006, p. 208):

He sees the colleges, the libraries, the playing fields, the museums, the scientific departments and the administrative offices. And then, having seen all this, he asks “But where is the university?” He has made a category mistake in that he has assumed that the university is an entity over and beyond what he has seen.

It is vital to grasp that “the university” as an entity is purely conceptual and ideational. It has no separate material existence. Consequently, in the physical sense, it is not “real.” It is essential, therefore, to distinguish between the reality of physical objects that we apprehend directly through our senses and the “ideational reality” of human concepts that arise solely from natural language and our capacity for language use. This language capacity gives rise to our further ability to construct multiple layers of abstraction, with each layer possessing less detail and specificity. Thus, Hayakawa and Hayakawa (1990) speak of the operation of the abstraction ladder in everyday language use. They cite the following as an example of climbing the ladder of abstraction: “Bessie” (the name of a particular cow)—“cow”—“livestock”—“farm assets”—“asset”—“wealth.” It should be evident that as we move up the abstraction ladder, each category term becomes more general, and hence less concrete, and also subsumes all lower category terms. Thus, cows are a type of livestock; livestock are a type of farm assets, etc. Because higher order categories become more abstract, we are less able to derive a *sense* of what they refer to. Like the concept of “university,” these terms, brought forth through language, have no physical existence. Hence, in this sense, they do not exist.

What exists then? Continuing with Hayakawa and Hayakawa’s example, we find two additional levels depicted as we go *down* the abstraction ladder. Beneath the level “Bessie,” the name of the particular cow that we observe lies the wordless level at which the cow is perceived and experienced, as determined by our human nervous system. Moving yet another level down the ladder, we arrive at the *process* level wherein the specific instance of the cow being observed is constituted by the elements—atoms, electrons, etc., as made out by present scientific understanding—out

of which it is composed. This level is a complex of interactions that is continually changing and whose characteristics are, in principle, infinite. Consequently, when we think of what we are seeing and experiencing as a type of animal—namely, a cow—we are already abstracting multiple levels away from the process level and reducing the richness and multiplicity of the process reality of the cow. Viewed in this light, we come to understand that what is generally called Nature is a “primary reality” that is wordless and antedates humankind. It is the world of physical and material existence. Our capacity for language, however, allows us, as humans, to engender and bring forth a “secondary reality” that is ideational and conceptual. However, we must recognize that if students only have access to this secondary reality at the expense of access to primary reality, they would be just like the students (referred to in Sect. 2.2.1) who can only speak and write *about* swimming but not be able to swim. Such learning would be impoverished, indeed bankrupt, because it creates little or no value for students as individuals. The ability *only* to use words—as is often the case in school-based assignments and examinations—is akin to building castles in the air because the words used are unanchored, ungrounded, and not rooted in the reality of living and acting in world. There are two important takeaways to be cognizant of then. First, primary reality is not constituted of or from words. Consequently, learning that revolves around the “play of language” alone is debilitating at best. If learning is to be of value to students, it must empower them to *act* in the world to create value for themselves, as well as for others in their family, community, and society. Second, from an ontological point of view, primary reality does not consist of objects—ideational or otherwise—that are fixed and eternal, as made out by Plato and the ancient Greeks. Rather, primary reality is fundamentally a process, characterized by ongoing flux and change. This metaphysical worldview, antagonistic to the object ontology of the early Greeks and which is still dominant in lay thinking today, is well established in the domain of process philosophy (Chee 2010, 2014; Mesle 2008; Rescher 1996, 2000).⁵

Getting a grip on the deep ontological errors articulated here helps us to approach learning in a different light. It should now be evident that the value attached to “having knowledge,” to “knowing stuff,” and to developing cognitively oriented skills in the absence of developing the ability to do useful things related to such knowing and thinking would be to miss the forest for the trees. The consequence is a form of learning that is domesticated because it is reduced to that which is easy to instruct and assess, with student disengagement as a widespread side effect.

To summarize, we must understand the following key ideas. First, what humans know arises from a process of social construction rather than one of discovery of eternal and immutable Truth; consequently, human understanding shifts over time. Second, language allows us to create a secondary reality based on words, but words on their own furnish no access to the primary reality of Nature;

⁵The implications of adopting a process-relational worldview are vast and beyond the scope of this chapter.

consequently, we should not believe that abstract words refer to real, material objects. Third, teaching and learning that is based on the use of language alone, whether written, spoken, or both, is misdirected because it does not empower students or grant them agency with respect to what they know *about*.

In closing this section on ontological errors, I draw attention to a further related issue: that of the interdependence between epistemology and ontology. What there is (ontology)—insofar as we can make it out, scientifically or otherwise—is dependent on how we come to know (epistemology). Access to new forms of scientific instrumentation, such as microscopes and telescopes, has thus been instrumental to the ways in which our understanding of the world has advanced. By the same token, our coming to know what we now know (epistemology) is dependent upon the nature of primary reality; that is, on what there is (ontology). Consequently, ontology is a function of epistemology and vice versa. As both ontology and epistemology are each dependent on the other, the two are inseparable in principle. This insight unravels yet another tenet of classical Western philosophy, derived from the Greeks, which treats ontology as an independent subject of study from epistemology, thereby creating a false dualism. Given their mutual interdependence, ontology–epistemology is constituted by a unity and hence must always be considered together. For the sake of conceptual clarity, I addressed these two aspects separately. But we must always remember that this domain, referred to in the literature as onto-epistemology, is a singular domain (Barad 2003, 2007).

2.2.3 *Anti-praxiological Bias*

The onto-epistemological issues discussed above have led to preoccupation with language-based symbolic representations in the activity of schooling, at the expense of helping students develop the capacity for performing personally meaningful and socially useful activities with what they supposedly know. Grounded upon a bias that favors *theoria*, the realm of *praxis*—relating to human action in the lived and sensed world—has traditionally been regarded as deficient and inferior owing to the inescapable contingency and particularity of its objects of concern (Fairfield 2000). Modern foundationalist thinking (Brown and Stenner 2009; Fairfield 2000), perpetuating Platonic thinking, attempts to generalize and theorize from a vantage point *external* to human practice on the premise that practice, if it is to be done “right,” needs to be grounded upon some higher order set of axiomatic tenets so that certain knowledge can be derived. As Dewey (1929/2008) argued, however, the quest for certainty is illusory because there is no thing, end, or essence that is eternal, immutable, or necessary: “A thing may endure ... and yet not be everlasting; it will crumble before the gnawing tooth of time, as it exceeds a certain measure” (cited in Garrison 1999, p. 294). Furthermore, contemplation alone, in the quest for theory, can never bootstrap the knowledge construction process because, as Aristotle (1941) himself acknowledged, if we are to be always deliberating, we shall go on to infinity.

Understood in this light, it is not difficult to grasp why Bloom's taxonomy of educational objectives in the cognitive domain (Bloom et al. 1956) remains dear to the heart of instructional designers and school practitioners alike. These professionals subscribe to the notion of "cognitive levels" of increasing mental complexity of school-based tasks reflected in the categories (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis, and (6) evaluation. The formulation of these cognitive levels serves as a crutch, external to practice, which can be drawn upon to direct the design of instruction. Whether one adheres to Bloom's original formulation or to some more current variant, such as the one put forward by Marzano and Kendall (2007), the substance of the cognitive aspects of the taxonomy remains the same. Marzano and Kendall augment Bloom's formulation by adding consideration of metacognition and what they call "self-system thinking," to encompass attitudes, beliefs, and emotions. While this move may not be a bad thing in itself, two critical weaknesses remain. First, their conception and treatment of the cognitive system remain rooted in the psychology of human information processing, based on the computer metaphor, whose representational basis is known to be deeply problematic (Coulter and Sharrock 2007; Still and Costall 1991; Toomela and Valsiner 2010) and which has already been critiqued in the foregoing subsections. Second, Marzano and Kendall position themselves as offering something superior to what Bloom had to offer because their taxonomy, they say, "presents a model or a *theory* of human thought as opposed to a *framework*.... By definition, Bloom's Taxonomy is a framework in that it describes six general categories of information processing" (p. 18). Apart from the issue of remaining trapped in the metaphor of information processing, it must be understood that Bloom did not intend his six categories to be understood as increasing *levels* of cognitive complexity. His taxonomy constituted a codification of the kinds of questions that students in school faced in *his* time: that is, during the late 1940s to the early 1950s. In executing his work with his co-authors, "it was agreed that the taxonomy should be an educational—logical—classificatory system.... It was further agreed that in constructing the taxonomy, every effort should be made to *avoid value judgments* about objectives and behaviors" so that the taxonomy "would permit the inclusion of objectives from all educational orientations. Thus, it should be possible to classify all objectives which can be stated as *descriptions of student behavior*" (Bloom et al. 1956, pp. 6–7, italics added). Evidently, Bloom did not intend and never suggested the six categories of educational objectives be treated as a linear ordering implying increasing difficulty. Neither is there anything to suggest that Bloom and his co-authors intended that the classification was suitable as a basis for conducting student assessment. On the contrary, they spoke of the taxonomy expressly as descriptions of student behavior. The element of ordering and of implied progression appears to have been introduced, either intentionally or neglectfully, by practitioners of instructional design. For this reason, Marzano and Kendall's criticism of Bloom's taxonomy constituting only a framework is misdirected at best. It should also be emphasized that Bloom's taxonomy represents a codification of the types of questions asked in school assessments in *his* time. There is nothing to suggest that Bloom intended the taxonomy to apply

to all peoples of the world for all time. Using Bloom's taxonomy, in whatever form, to design for student learning will serve only to perpetuate the practice of schooling and the attendant development of "inert knowledge" (Whitehead 1929).

If learning is to lead to actionable outcomes rather than "inert knowledge," it must be embedded in and take the form of meaningful real-world activity; that is, it must be located in human praxis. Dewey (1949/1991) argued that inquiry-based learning is central to the development of all (actionable) human knowing. Knowing, as inquiry, is triggered by the occurrence of some event, in the normal uninterrupted flow of life activity, which interferes with its ongoing and smooth flow. This interference deflects the activity into a "reflective channel" whereby the person deliberately contemplates the interference with a view to finding a way to resume the disrupted activity. The activity of knowing is thus always located in the lifeworld of human activity in which unexpected events, or problems, that arise are deliberated upon with a view to establishing a means for overcoming the encountered problem. Thus, as framed by Dewey (1949/1991, p. 323), knowing is "an intermediate and mediating way of behavior... constituted by determination of subjectmatters as on one hand means to consequences, and on the other hand of things as *consequences* of means used." As a result, human agents act upon hypothesized solutions to their problems and, in so doing, determine which hypothesized solution actually yielded the desired outcome. In this manner, learning, entailing both deliberation and action, is empirically grounded. Such learning also, as a by-product, establishes relations between means and ends so that should a similar situation arise in future, the problem does not have to be solved "from scratch." Instead, solutions that have been efficacious in the past are brought to bear upon fresh problems faced in the present. Framed in this manner, learning is said to be transactional "so that 'thing' is in action, and action is observable as thing, while all the distinctions between things and actions are taken as marking provisional stages of subject matter to be established through further inquiry" (Dewey and Bentley 1949/1991, pp. 113–114). Consequently, inquiry remains an open and ongoing process because conclusions drawn thus far, based on prior experience, are always provisional and subject to re-evaluation and revision. From the pragmatic stance of Dewey's philosophy (Garrison and Neiman 2003), knowing is thus a process that entails *both* existential and symbolic operations. In this way, the Gordian knot of mind–body dualism is severed. The existential realizes the means to consequences through action in the world, while the symbolic furnishes the mental projection of consequences that would arise from exercise of the means used. Subsequently, such action is no longer experimental but rather intentional, anticipatable, and instrumental. It thus allows for intelligent, meaningful, and targeted human behavior. In short, "real" learning takes place.

Based on the foregoing analysis, it should be evident why an emphasis on *theoria* and declarative modes of instruction, so widespread in schools, harbor an anti-praxiological bias. However, "the realm of *praxis* is the preeminent location in human existence of meaning and identity formation" (Fairfield 2000, p. 9). An anti-praxiological bias leads unsurprisingly to the malaise of "inert knowledge." In the absence of being given opportunities to act productively in pursuit of learning,

meaning making and developing a sense of self are compromised. Learning only *about* subject matter creates little personal value for students. Games-to-teach are firmly located within this anti-praxiological agenda. They are non-empowering and give rise to disengagement from classroom lessons and disenchantment with what students are led to believe constitutes “education.”

2.2.4 Axiological Neutrality

There is a pervasive belief that facts and values are fundamentally separate and independent of each other. Owing to the rise of modernity and advances in the physical sciences, “facts” are perceived as “real” and “objective.” They are regarded as “proven knowledge” by laypersons and seen to be of universal application. “Facts” are accorded higher standing than “values,” which are often described in disparaging terms such as “fuzzy,” “subjective,” and “unprovable.” This difference in valuation between that which is ontological—pertaining to “facts”—and that which is axiological—pertaining to values—is especially evident in school curriculum, where the amount of time devoted to “hard” subjects such as science and mathematics far exceeds that allocated to “soft” subjects such as civics, moral education, and the literature. Furthermore, teaching of the “hard” subjects is conducted in a manner that positions subject domain “facts” as being completely objective and value-free. Unfortunately, such thinking is misguided because it fails to acknowledge that what is known in these domains, as with the “soft” subjects, is part and parcel of the *social* construction of reality as we know it (Berger and Luckmann 1966).

The idea that facts are independent of values is a myth. The social process of constructing what “is” is inherently inseparable from the exercise of human values subsumed in executing the process. This putative separation is rejected by Whitehead (Leue 2005) and by process philosophers. Putnam (2002) shows how normative judgments are presupposed in all aspects of human life, including intellectual life, and, consequently, the fact–value dichotomy collapses. To illustrate, theory construction in the hard sciences is driven by the value of parsimony, while the construction of theory in mathematics is driven by the value of elegance. Parsimony and elegance are altogether subjective human criteria. Similarly, reasoning about epistemology is significantly influenced by the values of consistency, coherence, applicability, and adequacy (Mesle 2008). These criteria are often applied tacitly and hence lurk in the background. Ferré (1996, p. 14) further argues that:

our values precede our theories in real life and lead us in their construction (or approval). Even in the sciences, we have become aware of the degree to which expectations, including such factors as hopes and career commitments, influences what we notice within the total range of the presented data. Attention is selective. We should expect, therefore, that our values will have a role in suggesting possible fruitful lines of thought. In addition, these values will play a decisive role in influencing us on how long to hang on to a theory, model, or worldview threatened by problems.

It should be evident from the foregoing that human valuing is inseparable from all human being, doing, and knowing. The acts of human valuation—our valuing—directly indicate the kind of person that we, as humans, seek to become. They are based on an envisionment of the kind of social and cultural conditions that an individual believes is the one to be preferred. Values thus undergird the dispositions of individuals, leading them to act, as well as to prefer to act, in certain ways and not others. Values are central to the very notion of human existence. As expressed by Whitehead (1926, p. 100):

Value is inherent in actuality itself. To be an actual entity is to have a self-interest. This self-interest is a feeling of self-valuation; it is an emotional tone. The value of other things, not one's self, is the derivative value of elements contributing to this ultimate self-interest. This self-interest is the interest of what one's existence. . . comes to. It is the ultimate enjoyment of being actual.

From the above, we see that contemporary schooling practices commit two grave injustices. First, by misrepresenting the inherently social underpinnings of the *practice* of the “hard” disciplines, it misleads students into believing that scientific theories become immutable when “proven,” thereby failing to grant that scientific work can only falsify theories and never prove them (Popper 2002). Second, students are led to the mistaken belief that theories are in need of proving despite the construct of proof not being applicable to science in the first place, because science deals with open systems—such as Nature—while the notion of proof applies only to closed systems of reasoning—such as mathematics and the propositional calculus (Bateson 1979). Thus, the modernist instantiation of schooling practice and games-to-teach—as an embodiment of the schooling mind-set—project an aura of axiological neutrality and tacitly reject the idea that our understanding of the world is socially constructed. In doing so, schools perpetuate the miseducation of students.

2.3 Games-to-Learn

Unlike the thinking embodied in games-to-teach, the paradigm of games-to-learn is based on a vastly different set of assumptions and aspirations. Chaps. 4–6 of this book furnish detailed descriptions of three exemplars of games-to-learn located in the domains of social studies, chemistry, and physics, respectively. For this reason, I shall limit myself to a more conceptual explanation of the thinking underlying games-to-learn in this section.

Games-to-learn are founded on a model of inquiry learning articulated by John Dewey. For Dewey, learning is triggered by an interruption to meaningful activity in a person's lifeworld. The interruption leads naturally to contemplation directed to achieving a successful resumption of the activity. For this reason, knowing as

inquiry is something that we, as humans, literally *do*, as described in Sect. 2.2.3. Dewey (1938/1991) defines inquiry in the following terms:

Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole. (p. 108, original emphasis)

The inquiry process is characterized by five logically distinct steps: “(i) a felt difficulty; (ii) its location and definition; (iii) suggestion of a possible solution; (iv) development by reasoning of the bearing of the suggestion; and (v) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief” (Dewey 1909/1991, p. 246). Consequently, knowing is always located within the process of the ever-changing dynamic coupling between an organism and its environment. Separation between a normative or prescriptive logic of inquiry from an empirical or descriptive methodology of inquiry is explicitly rejected (Dewey 1938/1991). The two parts are inherently coupled and part of a functional whole. For a transformation to occur, as part of constructing a practical solution to a problem that is encountered, two distinct kinds of operations are required: (a) existential operations executed in the world that bring about changes in the situation and (b) conceptual operations that arise from thinking and reflecting. As explained by Biesta and Burbules (2003, p. 59), “[w]hat distinguishes inquiry from trial and error is the fact that the transformation of the situation is *controlled* or *directed* by means of reflection or thinking” (original emphasis). Executing a hypothesized solution and observing the consequences of the executed action allow an inference to be made as to whether one’s understanding of the situation was indeed warranted. If the empirical feedback is consistent with one’s expectation, there is then a concrete basis for making an assertion or claim about the nature of the situation. However, if the expectation is not affirmed, then one’s understanding of the situation is clearly suspect. In this manner, a functional correspondence develops between (a) relations between symbols that arise through the mental act of *inferencing*, and (b) the actual connections, or significance, of real-world events that arise by means of *acting* in the world. Because of this, the habituated actions of a person become increasingly tuned to those that yield preferred outcomes in the world. Concurrently, a change in the relationship develops between the symbols—the basis of explicit thinking rooted in language—and gives rise to a new understanding, and hence a new meaning, to the situation at hand. As Dewey (1916/1980) argues, “analysis is ultimately physical and active; ... meanings in their logical quality are standpoints, attitudes and methods of behaving toward facts; and ... active experimentation is essential to verification” (p. 367).

Based on Dewey’s articulation of learning as entailing the process of inquiry, game-based learning curricula instantiate, intentionally and by design, an inquiry process that students must work through. Such curricula are characterized by the periodic occurrence of problems. These problems occasion the sense of a felt difficulty that disrupts the smooth flow of events in the learner’s in-game experiential lifeworld. Learners must first try to frame the problem by ascribing to it

a certain location and definition. They must then generate, through imaginative thinking, alternative courses of action that might yield a solution. These alternative solution paths must then be critically considered to evaluate which path is the one most likely to produce the desired outcome. Whether the preferred alternative actually gives rise to the desired outcome can only be determined by putting the idea to an empirical test. By executing the action or actions implied by the idea, accompanied by careful observation, an evidence-based justification for a belief about the real world (or otherwise) can be derived. In a nutshell, this cycle of action constitutes the heart of scientific inquiry. In like manner, when learners take the next step by communicating their personal meaning making with other students, with teachers, and with the wider community, they begin to participate as social constructors of meaning in a scientific community of inquiry. In this manner, their thinking, always coupled to their actions, develops into an understanding of the world: an understanding that is laden with significance because it is transactionally coupled to acting in the world. Consequently, learning of this kind is inherently grounded in the world and hence situation specific. As the repertoire of unique experiences grows, distillations from the unique instances become possible through the power of language (as explained in Sect. 2.2.2), allowing the development of categories and classifications, and more abstract modes of thinking and speaking. In this manner, the power of generalization arises primarily via an inductive mode of thinking rather than a deductive one.

Learning with games in the manner described above leads to outcomes different from that of the games-to-teach paradigm. Whereas the latter results in inert knowledge due to being “lost in representations” and an inability to act upon what one knows about, games-to-learn deliberately foster (a) the ability to act in situationally appropriate ways and (b) the construction of meaning by grounding language use in action. The outcome is best described as meaningful learning, unlike the meaningless cognition of machines.⁶ Meaningful learning inherently requires students to be deeply engaged in the process of learning. Consequently, the challenge of disengaged students is averted by means of a paradigm shift.

⁶Machines, such as computers, whose “intelligence” is at best artificial can only mimic human cognition in a syntactically driven and semantics-free manner. Thus, inputting “ 3×5 ” on an electronic calculator will yield the display “15”. But the calculator’s output is constituted by the numerals “1” followed by “5”. This output is very different from how a human usually reads the output: as the *number* 15. A number is a semantically laden notion in the field of arithmetic, but a numeral is (only) a representation of a number. Indeed, multiple numeral systems exist, for example, the Arabic numeral system and the Roman numeral system. Consequently, numerals are *arbitrary representations* of number. There is no single one-to-one mapping between numeral and number. In this sense, numerals are said to be meaningless.

2.4 The Difference and Why It Matters

The fundamental difference between the paradigms of games-to-teach and games-to-learn is broadly mirrored in the distinction between schooling children vis-à-vis educating them. The practice of schooling today is manifested in its discourses, in particular the discourse of knowledge acquisition and that of repetitive drills for practicing skills. Knowledge transmission (so called, but actually the verbalization of knowledge representations) is evidenced by the dominant practice of teacher expository talk and the culture of getting students to complete worksheets correctly to demonstrate that they have adequately mastered the target knowledge and skills. Teachers' pedagogical practices will not change unless society in the broad recognizes the limitations of current schooling outcomes and initiates the necessary steps to shift teachers' professional practice from schooling to educating children and young adults under their care.

Schooling practice is rooted in institutional norms that accord primacy to student achievement evidenced by high test scores aligned to standards-based national examinations and international benchmarking tests. Rooted in an overriding desire for objective comparison across students, across schools, and across nations, curricula are designed in a reductive fashion, and assessments favor narrow closed questions so that assessment outcomes can be claimed to be valid, reliable, and fair. This approach aligns with an epistemology in which knowledge is seen as (i) formal, produced by rigid adherence to a particular research methodology; (ii) intractable, grounded on the assumption that the world is an inert, static entity; (iii) decontextualized, being constructed by researchers who have been able to isolate a phenomenon from its context; (iv) universalistic, by virtue of following strict scientific procedures that yield discoveries applicable to all domains of the world and the universe; (v) reductionistic, focusing on factors that lend themselves readily to measurement; and (vi) one-dimensional, being shaped by the belief that there is one true reality that can be discovered and completely described by adherence to correct research methods (Kincheloe 2008). Armed with this mindset, there is little room for non-orthodox answers to test questions and for answers that may be novel yet still valid. An attitude of intolerance toward interrogation, not only of assessment means but also of ends, has led to a stagnant practice that lauds innovation rhetorically while eschewing change in the name of preserving stability.

A well-known truism in education is that assessment drives learning. The field of educational assessment draws a distinction between content standards and performance standards. The former define essential knowledge, understandings, and skills that should be included in curriculum, while the latter specify "how much" students should know and be able to do (McMillan 2008). This perspective is problematic in at least three respects. First, test performance is not the same as learning. Learning itself is unobservable, and, hence, for assessment purposes, reliance is placed on observable test performance (Maxwell 2009). Consequently, conventional school assessments evaluate only learning *outcomes*;

they do not evaluate learning as such. Learning remains enigmatic and unaccounted for. Thus, Maxwell (2009, p. 267) argues that “[s]tandards that service learning may need to be represented differently from standards for performing a [school] task,” especially in light of the needs of twenty-first-century education. Second, conventional assessment practices, according to McMillan (2008), address the evaluation of products, such as a Web page, and skills, such as reading. Such assessments are carried out because “[t]eachers want to know *how much* students understand before they begin a unit of instruction, *how much* students are progressing in their understanding during instruction, and *how much* students have learned at the end of the unit” (McMillan 2008, p. 6, italics added). The bias toward objectification, quantification, and measurement should be self-evident. However, like learning, understanding is not directly observable. How, then, does one measure some “thing” that is not observable in the first place? Third, McMillan’s assumptions related to assessment reveal a strong cognitive bias. It is limited to three “cognitive levels.” The first level—knowledge—is represented by operations such as retrieving, selecting, naming, and reproducing. The second level—understanding—is represented by operations such as converting, translating, explaining, comparing, and illustrating. The third level—application—is represented by operations such as analysis, synthesis, and transfer. It should be evident that McMillan’s language is rooted in Bloom’s taxonomy of educational objectives in the cognitive domain. The weaknesses of this classification, as appropriated into the space of instructional design, have already been critiqued in Sect. 2.2.3.

Given the dominant forms of assessment described above and the truism that assessment drives learning, teachers naturally engage in instructional practices that attempt to bridge the gap between content and performance standards on the one hand and conventional modes of assessment on the other. Broadfoot (2009, p. vii) laments that “despite a growing recognition of the limitations of a scientific approach to assessment, the twenty-first century is nevertheless finding it hard to escape from the assessment thinking and practices that were characteristic of the twentieth century.” The regrettable outcome of conventional teaching and schooling practice is thus one of inert knowledge and of students not being able to think critically, systematically, and creatively for themselves.

In Whitehead’s (1929) seminal book, *The Aims of Education*, he describes a well-informed man with scraps of information as “the most useless bore on God’s earth” (p. 1). He appeals thus to teachers:

With good discipline, it is always possible to pump in the minds of a class a certain quantity of inert knowledge. You take a text-book and make them learn it. So far, so good. The child then knows how to solve a quadratic equation. But what is the point of teaching a child to solve a quadratic equation? There is a traditional answer to this question. The mind is an instrument, you first sharpen it, and then use it; the acquisition of the power of solving a quadratic equation is part of the process of sharpening the mind. (p. 6)

Similar to other historical attempts to teach Latin and computer programming because they supposedly “sharpen the mind,” Whitehead denounces the conception

of mind as an instrument in need of sharpening as “one of the most fatal, erroneous, and dangerous conceptions ever introduced in the theory of education” because:

The mind is never passive; it is a perpetual activity, delicate, receptive, responsive to stimulus. You cannot postpone its life until you have sharpened it. Whatever interest attaches to your subject-matter must be evoked here and now; ... whatever possibilities of mental life your teaching should impart, must be exhibited here and now. This is the golden rule of education, and a very difficult rule to follow. (p. 6)

Thus, Whitehead argues against the notion that schooling constitutes a preparation for life in some non-determinate future and in favor of making education relevant to the life of the child in the here and now. He asserts that we must “eradicate the fatal disconnection of subjects which kills the vitality of our modern curriculum. There is only one subject-matter for education, and that is Life in all its manifestations. Instead of this single unity, we offer children—Algebra, from which nothing follows; Geometry, from which nothing follows; Science, from which nothing follows” (pp. 6–7). A curriculum from which nothing follows with respect to the life of the child is misdirected at best. Perhaps educators today would be well served to pay heed to Whitehead’s words of wisdom.

Like Whitehead, Dewey was much concerned with the disconnect between curriculum subject matter and the life of the child. In his pedagogic creed, Dewey (1897/2004) argues that “[t]he child’s own instincts and powers furnish the material and give the starting-point for all education. Save as the efforts of the educator connect with some activity which the child is carrying on of his own initiative independent of the educator, education becomes reduced to a pressure from without” (pp. 17–18). He further insists that the “school must represent present life—life as real and vital to the child as that which he carries on in the home, the neighborhood, or on the playground” because “education is “a process of living and not a preparation for future living” (p. 19). For Dewey, schooling as a modern-day practice fails because it neglects the fundamental principle of the school as a form of community life, creating instead an alternative form of institutionalized social life.

With respect to teaching science, Dewey (1897/2004) observed:

One of the greatest difficulties in the present teaching of science is that the material is presented in purely objective form.... In reality, science is of value because it gives the ability to interpret and control the experience already had. (p. 21)

However, to learn science effectively, meaningful activity must be placed at the center of student learning. The active side must precede the passive in the development of the child because:

Ideas result from action and devolve for the sake of the better control of action.... [R]eason is primarily the law of order or effective action. To attempt to develop the reasoning power, the power of judgment, without reference to the selection and arrangement of means of action, is the fundamental fallacy in our present methods of dealing with this matter. As a result we present the child with arbitrary symbols. (p. 22)

I have already highlighted the deep difference between learning *about* swimming and learning swimming in Sect. 2.2.1. Here, I wish to add that the modes

of instruction implied by each goal are also vastly different. Traditional modes of instruction entailing content transmission and worksheet completion may well yield excellent test performance on an *about*-swimming curriculum. However, it will not produce children who can swim competently. Clearly, to produce students who can swim, a coaching approach requiring students to learn to swim (typically) in a swimming pool is vital. The issue that needs to be grasped here is that the coaching approach does not imply sole reliance upon the actions of learning. Rather, as the foregoing excerpt from Dewey indicates, the challenge is to develop the coupling between the action and the thinking, or reflecting, upon that action. Consequently, there are three conceptual parts to learning: acting, thinking, and the couple constituted by acting–thinking. Traditional schooling focuses almost exclusively upon the cognitive and representational aspects related to thinking. By omitting acting and acting–thinking, it yields a non-performative outcome: Students are unable to do anything useful and personally meaningful in their own lifeworld. Consequently, generations of students may become schooled, but, educationally, they end up as generations lost. Society pays a high price for this mistake.

From the foregoing, I hope to have made the case why clearly understanding the difference between games-to-teach and games-to-learn, together with what each implies and entails when acted upon, is vitally important. As educators, it behoves us to restore the missing component of action back into educational practice so that the acting–thinking relation can be made the centerpiece of a *bona fide* and revamped practice. Consider what twenty-first-century education might look like if a question like the following, suggested by Postman (1995), were to appear in examinations:

Describe five of the most significant errors scholars have made in (biology, physics, history, etc.). Indicate why they are errors, who made them, and what persons are mainly responsible for correcting them. You may receive extra credit if you can describe an error that was made by the error corrector. You will receive extra extra credit if you can suggest a possible error in our current thinking about (biology, physics, history, etc.). And you will receive extra extra extra credit if you can indicate a possible error in some strongly held belief that currently resides in your mind. (p. 128)

It is most unlikely that any student can respond to the question competently and intelligently if she or he has not developed a working *competence* with the subject domain in question. Mere “head knowledge” would not suffice to demonstrate subject competence. Memorization, as a learning strategy, would not yield any dividends. In the next chapter, therefore, I argue for pedagogy that is based on a theory of performance so that the vision of game-based learning may be realized.

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2016, XVI, 190 p. 52 illus., 51 illus. in color., Hardcover

ISBN: 978-981-287-517-4