

MANAGING COMPLEXITY: APPLYING THE CONSCIOUS-COMPETENCE MODEL TO EXPERIENTIAL LEARNING

Hugh M. Cannon
State University
hugh.cannon@wayne.edu

Andrew H. Feinstein
California State Polytechnic University, Pomona
andyf@csupomona.edu

Daniel P. Friesen
Wayne State University
dy8750@wayne.edu

ABSTRACT

The concept of complexity is central to the literature on simulation and experiential learning. This paper considers the evolution of the construct, and suggests how it might be managed to enhance learning effectiveness. Specifically, it suggests that Bloom's revised taxonomy of educational objectives provides a useful framework for understanding the cognitive aspects of the complexity problem. It then discusses the complementary role played by the traditional affective and psychomotor taxonomies in managing it, integrating them together through the consciousness-competency model of experiential learning.

INTRODUCTION

Few subjects have troubled researchers in the area of simulation and other forms of experiential learning more than that of complexity. To illustrate, 479 of 2,403 -- roughly 20% -- of the papers found in the 2009 Bernie Keys Library archive explicitly address complexity in one form or another. Cannon (1995) articulates the central problem in the form of what he calls the *complexity paradox*. He argues that, on one hand, simulation games should provide a realistic laboratory in which students can experiment with decision making, receiving feedback on the consequences of their decisions. On the other hand, any simulation that is realistic enough to provide meaningful feedback is so complex that participants cannot see the cause-effect relationships that link decisions to consequences, thus defeating the purpose of the laboratory.

The paradox is not unique to simulations. Indeed, it has to be even more characteristic of real life. Increasing the complexity of a simulation merely seeks to make it more like a real organization. But how do managers make

decisions in real organizations, if not by anticipating the cause-and-effect relationships that link decisions to consequences?

Cannon suggests that organizations use various "simplifying" mechanisms to reduce the amount of information managers must process at any given time, thus making the task more manageable. However, in a follow-up article, Cannon and his colleagues (Cannon, Friesen, Lawrence, and Feinstein 2009) suggest that the process of "simplification" -- applying the mechanisms by which organizations cope with information overload -- is in itself a highly complex operation. They refer to this as the *simplicity paradox*. According to the paradox, complexity consists of two dimensions: *information load* and *uncertainty*. The resolution of the paradox is to attack the *uncertainty* dimension by developing higher-level thinking skills, such as those suggested in Bloom's classic taxonomy of educational objectives (Bloom, Englehart, Furst, Hill, and Krathwohl 1956). These will enable students to apply the simplifying mechanisms and in so doing address the *information load* dimension as well.

The *knowledge* and *cognitive process* dimensions of Bloom's "revised" taxonomy of educational objectives (Anderson and Krathwohl 2001) correspond roughly with the *information load* and *uncertainty* dimensions of the *simplicity paradox*, suggesting that the new taxonomy might be a powerful tool for managing complexity. In one sense, it does. It is very useful for understanding complexity, and hence, for selecting learning activities that will not be too complicated at any given stage of students' development (Cannon and Feinstein 2004; Ben-Zvi and Cantor 2008). In another sense, however, it does not provide a good picture of the educational process, such as might give us insight into how we can learn more efficiently. Whereas the revised taxonomy classifies the educational tasks, and arranges them by difficulty, it does provide a framework for

understanding how students will know when to engage in one task versus another.

The purpose of this paper will be to develop such a framework, drawing on what has come to be known as the *conscious-competence* model (Howell 1982). First, it will review the concept of complexity in business simulation and other forms of experiential learning, summarizing the *complexity paradox*, the *simplicity paradox*, and the mechanism by which they impact on learning effectiveness. Second, it will introduce the *conscious-competence* model as a framework for understanding the complementary roles played by the cognitive (Bloom, et. al. 1956; Anderson and Krathwohl 2001), affective (Krathwohl, Bloom, and Masia 1964) and psychomotor (Dave 1970; Harrow 1972; Simpson 1974) educational taxonomies in experiential learning. It will then discuss the practical implications for curriculum design.

THE THEORETICAL UNDERPINNINGS OF COMPLEXITY

In the context of experiential learning, working definitions of complexity at times have been vague or even left undefined, as if the reader should know what complexity is without further elaboration. For example, Burns, Gentry and Wolfe discuss “simplicity of the concept versus its complexity; the ease with which the concept is understood” (1990, p. 275). Ultimately, the theoretical basis of complexity rests in information theory. The more complex the simulation game, the more information participants must process to make effective decisions. Biggs (1990) reviews the literature on game complexity and notes that it can be conceptualized in terms of *game-variable complexity* and *computer-model complexity*. In its simplest conception, game-variable complexity depends on the number of decision inputs per round of game play (Keys 1977), but in a broader conception, it can be seen as the amount of information needed to effectively play the game (Biggs and Greenlaw 1976). Wolfe (1978) operationalizes this through the number of words included in the simulation’s instruction manual. Conceptually, he defines the information needed as “...the number of functions and sub-functions modeled in the game, and the degree of abstraction possessed by the concepts employed...” (Wolfe 1990, p. 280)

Computer-model complexity tends to address issues related to computer hardware and software issues. These too call for information processing, although they do not involve the substance of the simulated business experience.

THE COMPLEXITY PARADOX

Cannon’s (1995) *complexity paradox* can be seen as a derivative of *game variable complexity*. The more a computer model seeks to capture the essence of real business situations (*verisimilitude*), the more variables it incorporates and the more information participants need to

process if they are to effectively play the game. The resulting complexity makes the game very difficult to play effectively, because participants cannot process all the information needed for proper decision making. As we have noted, Cannon addresses this by discussing various simplifying mechanisms players (and in some cases, simulation designers) might use to reduce their information load:

- *Strategic chunking* reduces information load by making a single strategic decision provides a template for making a host of simpler tactical decisions. For instance, adoption of a “quality” strategy implies investments in R&D, relatively high prices, advertising to promote the brand’s quality, and so forth.
- *Sequential elaboration* reduces effective complexity by breaking complex thinking into smaller, less complex parts, spreading them out over time. For instance, game participants might begin by analyzing the competitive environment, followed by development of strategic alternatives, then proceeding to specific product, pricing, promotion, or distribution decisions.
- *Organizational specialization and coordination* follows the same decompositional approach as sequential elaboration, but the tasks are distributed among different players, coordinating the individual efforts to ensure they are consistent and complementary. For instance, a player might be given responsibility for production and inventory, a task that would be carefully coordinated with the firm’s marketing activities.
- *Intermediate measures of performance* provide a mechanism for coordinating specialized tasks, whether distributed over time and/or people. Given the difficulty in tracking the effects of any single decision on the over performance of a simulated company, players may target their efforts towards smaller, task-relevant criteria. For instance, sales force decisions might be evaluated in terms of sales or sales efficiency rather than on the overall impact of the sales force on company performance.

The last three of these mechanisms might be characterized as what Gentry (1990) calls “divide and conquer” approaches. While he was speaking more of lecture-based pedagogy – breaking a subject down into its component parts to be addressed separately – this is certainly what sequential elaboration, organizational specialization, and intermediate measures of performance seek to do. His criticism is that they ignore the complexity that occurs when the various parts are integrated back into a whole.

Strategic chunking addresses this problem by fitting the parts into meaningful patterns. However, as Burns and Gentry (1980) note, “Complexity mounts as the results of input decisions become more vague, are subject to more unsystematic variation, and as the scope of the problem broadens.” (p. 18). Unfortunately, no strategic pattern maps perfectly onto a given business situation. The vagueness, unsystematic variation, and breadth of scope require

strategies to be abstract, calling for the application of sophisticated judgments to make them work. In other words, the price of strategic chunking is greater abstraction, which is in itself a source of complexity. Instead of managing information about a large, but relatively well defined, set of cause-and-effect relationships, as conceptualized in *game-variable complexity*, *abstraction* requires the selecting appropriate concepts from a relatively poorly defined set that might fit a given strategic pattern. The uncertainty regarding what information is likely to be relevant represents a potentially very large increase in the information-processing load, because decision makers have fewer guidelines to restrict the kind of information they must consider.

THE SIMPLICITY PARADOX

The contribution of uncertainty to information-processing load is the basic idea behind Cannon et. al.'s (2009) *simplicity paradox*. Their *information load* dimension can be taken to represent *game-variable complexity*, while their *uncertainty* dimension is related to the complexity resulting from *abstraction*. The key to the paradox is that the complexity created by abstraction can be reduced by learning to use the simplifying mechanisms, by learning a thinking process. In this sense, rather than referring to *game-variable complexity*, a more theoretically meaning distinction might be *content* versus *process complexity*.

The *content/process* distinction is consistent with the link Cannon, et. al. (2009) establish between their two-dimensional model of complexity and Bloom's "revised" taxonomy of educational objectives (Anderson and Krathwohl 2001; Cannon and Feinstein 2005). Exhibit 1 connects the two approaches. Note the axes. In the complexity model, the vertical axis is *information load*; in the taxonomy, it is *knowledge*. Both represent similar *content* categories. The horizontal axes are *uncertainty* versus *cognitive process*. Uncertainty is resolved by high-level thinking, a *cognitive process*. In a sense, the two models complement each other. The complexity model addresses the information problem, and the taxonomy, the solution – the mental constructs through which the information might be handled. In the complexity model, *information load* looks at the amount of information that must be processed in order to establish decisions based on complex cause-and-effect relationships. The taxonomy's *knowledge* dimension suggests different categories of knowledge (*factual, conceptual, procedural* and *meta-cognitive*), arranging them roughly according to the amount of information that must be encoded to complete the required knowledge structures. In the complexity model, *uncertainty* looks at the ambiguous nature of the information load, requiring the sorting, matching, adapting, and evaluation of knowledge structures to address cause and effect. The taxonomy's *cognitive process* dimension suggests different categories of thinking (*remembering,*

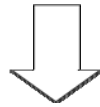
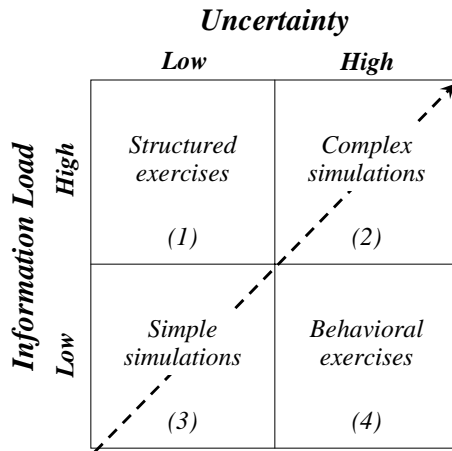
understanding, applying, analyzing, evaluating, and creating) that might be used to resolve the ambiguity, again arranged according to the difficulty of the task. As we have noted, the difficulty can be ultimately be seen in terms of information load, but the focus is on the process of accessing, comparing, organizing, prioritizing, and ultimately selecting a subset of the potentially relevant information to create the knowledge structures needed for a address a given decision.

So, how do we resolve the complexity paradox? We only have two choices: One is to decrease the complexity, and the other is to increase students' capacity for coping with it. Given that the world of business is inherently complex, the purpose of education must be to help them cope, which seems to answer the question.

Exhibit 1 provides part of the answer. Evoking *simplifying mechanisms* only makes the problem worse when student have no skill in using them. As students gain experience solving problems, they develop this facility. In terms of Exhibit 1, they create knowledge structures in which they encode the results of their past problem-solving activities, so they can draw on them in the future. For instance, consider the process Cannon, et. al. (2009) allude to in their critique of Wolfe and Castrogiovanni's (2006) experiment with MBA students where were confronted with a simulation that called for an application of Duncan's (1972) environmental uncertainty framework to guide for deciding how to organize their international operations (functionally versus geographically). The purpose of Wolfe and Castrogiovanni's study was not to determine how well MBA students applied a particular theory to simulated management decision making, but to see whether students would perceive critical differences in a simulated business environment – a necessary condition for using simulations as a strategic management research laboratory. But the failure of the students to perceive theoretically relevant aspects of a simulation environment raises fundamental questions regarding the use of simulations as a learning tool as well. Why did they fail? Where did the learning process break down?

Using Exhibit 1 as a framework, we can model the thinking processes that would likely have been needed for students to succeed. We can also anticipate how these would change with experience. In our discussion, we will use the column number from the lower part of Exhibit 1 to represent the appropriate cognitive process and a letter to represent the row portraying the appropriate kind of knowledge. A combination would indicate the column and row that best characterizes the thinking task a student would have had to complete. For instance, *1A* would represent remembering factual material. In fact, this is where students would have had to start. Students would have had to remember Duncan's framework from their lecture material (*1A*) and understand how it works (*2A*). Having done this, the result would be stored as conceptual knowledge (*B*), so it could be retrieved again as students played the game. The more experience they have, the more knowledge structures would

**From the Two-Dimensional Model of Simulation Complexity
to Bloom's Revised Taxonomy
Exhibit 1**



<i>The Knowledge Dimension</i>	<i>The Cognitive Process Dimension</i>					
	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
D. Meta-cognitive Knowledge						
C. Procedural knowledge						
B. Conceptual knowledge						
A. Factual knowledge						

Adapted from Hugh M. Cannon, Daniel P. Friesen, Steven J. Lawrence, and Andrew H. Feinstein. "The simplicity paradox: Another look at complexity in design of simulations and experiential exercises." *Developments in Business Simulations and Experiential Exercises*, 36, p. 246; and Lorin W. Anderson and David R. Krathwohl. *A Taxonomy for Learning, Teaching, and Assessing*. New York: Longman, 2001, p. 28.

be available from memory, and the less demanding the cognitive processes would be. For instance, in the Wolfe and Castrogiovanni case, students would have had to remember that theories could actually be used to help make informed decisions in a simulated environment (1D). However, to really know this, they would have probably required some personal experience analyzing a situation in light of the theory's precepts (4D), evaluating alternative

strategies using the results of the analysis (5D), and creating alternative scenarios (6D) to represent how the game would play out if the theory is correct. Once this has been done, the results will be available in memory, reduced to a procedure, and ready for application to other, similar situations (3C).

The point of experiential learning, of course, is to give students the practice they need to develop and store the knowledge structures needed to simplify complex business

problems. As we shall see, the downside – the message of the *simplicity paradox* – is that an overly complex situation can lead to random decisions, potentially storing experiences in memory that detract from, rather than contribute to, the quality of their education.

THE ROLE OF BOUNDED RATIONALITY

From a cognitive perspective, both *information load* and *uncertainty* require information processing capacity. That is, both the retrieval of information and cognitive processing make a call on mental resources. Indeed, it is the demand on mental capacity that makes these two dimensions complex. People have limited capacity; they simply cannot access and process all the relevant information they might have available, either internally (from memory) or externally (from external stimuli). This limitation leads to what Simon (1957, 1978) refers to as *bounded rationality*. The economic definition of rationality is "...the assumption that an individual will compare all possible combinations of goods and their prices when making purchases (Collins English Dictionary 2003). Or, in the case of decision making in general, it is the assumption that an individual will compare all possible alternatives, considering all the relevant information that is available. The key is in the codicil, "...that is available." Having information stored in long-term memory does not mean it will be available in short-term memory when you need it. *Bounded rationality* is indeed rational, but only within the boundaries of a person's information processing capacity at the moment of decision.

As a practical matter, people come to recognize their limitations and restructure the amount of effort they put into a given decision by adjusting their level of aspirations. This is expressed through the principle of *satisficing*, where they consider a problem until they encounter the first acceptable solution, rather than trying to find the best one available (Simon 1957, 1978).

Information processing and decision-making capacity may fluctuate, but for practical purposes, we can view it as bounded by the amount of mental effort required to find or retrieve information, the decision-maker's cognitive ability, and the time available. The decision-maker often selects preferences during, rather than prior to, the decision process (Bettman, Luce and Payne, 1998). From the perspective of the *simplicity paradox*, in the typical simulation game the learner must "make do" with the best information s/he can quickly employ with significant time constraints. The *satisficing* principle often causes them to lower their level of aspirations and simply make decisions, with little or no conceptual basis.

We might anticipate at least two different problems resulting from this kind of ill-considered decision-making in a simulation or other experiential learning environment. They hinge upon the quality of the feedback students receive. First, if the feedback is good, students will recognize that they performed poorly. Believing that they

worked hard and did the best job they could, this would decrease their expectation that effort will lead to performance. This would have a depressing effect on their motivation, and hence, future learning (Yakonich, Cannon and Ternan 1997).

Second, given the fact that students often get relatively poor feedback regarding their performance, students may believe that they performed well. This would cause them to believe that their aspirations and decision-making approaches were appropriate, and to store them in memory as part of their learning experience. Teach (1987, 1990, 1993a, 2007) argues that this kind of erroneous feedback is common in simulation games, where students are often evaluated based on the (financial) performance of their simulated companies. Teach suggests that such performance may be caused by any number of different factors over which the students have no control, thus degrading the value of their feedback. He suggests that students should be evaluated based on their ability to predict the outcomes of their decisions, something over which they do have control. This would provide a better quality of performance feedback, thus heading off the problem of random reinforcement.

Teach's suggestion remains the subject of considerable controversy (Wolfe 1993a,b,c; Teach 1993b). However, as the *conscious-competence* model suggests, the quality and detail of the feedback students receive as a result of their experiential decision-making is critical to successful learning experience.

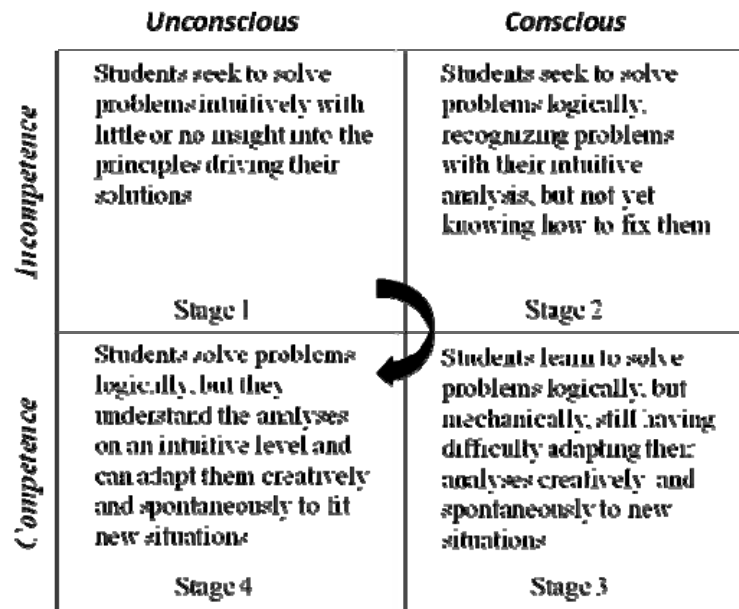
THE CONSCIOUS-COMPETENCE MODEL

The literature is unclear where the *conscious-competence* model was developed. It is generally attributed to William Howell (1982), but it is not clear whether he originated it, or simply mentioned it and was subsequently quoted. This, however, does not detract from its appeal as a way of looking at the experiential learning process. As suggested by Exhibit 2, it views learning along two dimensions, *consciousness* and *competence*, moving through a four-stage progression from *unconscious incompetence* to *conscious incompetence* to *conscious competence* to *unconscious competence*.

THE ROLE OF DISCONFIRMATION

From the perspective of the *conscious-competence* model, we see why accurate feedback is so important. It provides the disconfirming signal to students that their aspirations and/or process is wrong and needs fixing, thus moving them from *unconscious incompetence* to *conscious incompetence*. In this context, Teach's (1987, 1990) forecasting approach for evaluating student performance represents a very important issue. At a more general level, the importance of valid feedback attaches more significance to studies suggesting that traditional measures of company financial performance are poor indicators of student learning

The Conscious-Competence Model Exhibit 2



(Thorngate and Carrol, 1987; Anderson and Lawton, 1990; Washbush and Gosen, 2001).

Of course, measures of student performance are not the only source of potentially disconfirming feedback students get in an experiential learning environment. The fact that many academic simulations and experiential exercises are conducted in groups provides a setting where students get continual feedback from their peers.

Even more important is the role of direct instructor feedback, or what we refer to as *debriefing*. Warrick, Hunsaker, Cook, and Altman (1979) identify six key objectives for the debriefing process (p. 95):

1. Identification of different perceptions and attitudes of what occurred.
2. Linking the exercise to specific content theory for this segment of the course.
3. Linking the exercise to skill-building techniques useful at the time of the exercise and subsequent class sessions).
4. Development of a common set of experiences for further data analysis.
5. Making sure that each participant, or group of participants, receive feedback on the nature of his involvement and his specific behavior.
6. Reestablishing the desired classroom climate of trust and reassure the students that exercises will always be purposeful.

The underlying principles behind the objectives drive to the two dangers of experiential learning – on one hand, the potential for reinforcing the wrong behaviors through inaccurate feedback (disconfirmation), and the demotivating effect of feeling that one cannot succeed on the other.

Clearly debriefing involves positive learning as well as disconfirmation. However, the debriefing process does both. It carefully guides students through analyses of their experiential exercise, helping them interpret and store the knowledge components that will help them in future situations. The process of gaining insight into what was really happening, and seeing how it could have been different, not only disconfirms inappropriate behaviors and expectations, but the supportive atmosphere and focus on what could have been done helps protect students from discouragement.

Warrick et. al.'s objectives are normative. In a comprehensive review of what writers say about debriefing, and Strang (2003) conclude that, "It is clear that debriefing lacks a clear, concise theory." They recommend that the theory might be anchored in Bloom's traditional taxonomy of educational objectives (Bloom, Englehart, Furst, Hill, and Krathwohl 1956). This, of course, is precisely what we would suggest, but with a more detailed agenda. The learning process involves a complex web of problem-solving and information storage and retrieval processes. Debriefing is the dialog the exercise's coach has with her players, helping them recognize the importance of the disconfirmation process, facilitating their classification of knowledge, and inspiring them to grapple with the higher-level thinking skills required as they strive for a higher level of competence.

BEYOND THE COGNITIVE DOMAIN: RETRIEVING INFORMATION CONSCIOUSLY AND UNCONSCIOUSLY

The motivational link – students seeing not only that their behavior was deficient in the experiential learning setting, but also seeing specifically how it could have been better – provides the impetus to go beyond disconfirmation and transition from *conscious incompetence* to *conscious competence*. The process is as we have described it: Students are led through the thinking steps necessary to acquire the knowledge they need to perform successfully in the simulation environment. In our earlier example from Wolfe and Castrogiovanni (2006), they would need to learn how to use a theoretical model in general, learn the terminology, concepts, and procedures attendant to Duncan’s environmental uncertainty framework, and then apply it in the context of Wolfe and Castrogiovanni’s simulation. The debriefing process would help them reflect on the steps they would need to take, and eventually had taken, helping them encode the knowledge for future use.

In the end, however, competence requires that students not only learn how to deal with the kinds of problems they face in a simulation game or exercise – that is, have the relevant knowledge structures stored in memory – but they must also be able to retrieve the relevant structures when they are needed. Researchers in cognitive psychology and cognitive science (artificial intelligence) have made considerable progress in this area. For instance, Anderson’s (1987) ACT-R (adaptive control of thought – rational) theory suggests that people solve problems by developing “production rules,” or elements of *procedural knowledge*, that specify what one should do in a given situation. They begin by searching memory for a rule that appears to address a similar problem. They break the problem down into component parts in an hierarchical set of goals, looking for analogous rules for each part. For instance, in the Wolfe and Castrogiovanni case, students would look for a procedure that would enable them to map strategy based on environmental conditions. Lower in the hierarchy would be goals of mapping environmental conditions to the specifics of the simulation. This, in turn, would require a rule that enabled them to classify specific market characteristics into the general categories that fit the model. If they were successful in classifying the environmental characteristics, reasoning by analogy might move them to look for a similar scheme for classifying strategic alternatives.

Clearly, such an approach would require students to have *conceptual knowledge* of the relevant theoretical categories (environmental and strategic classifications) and *procedural knowledge* of how to match the appropriate category of environmental conditions with the corresponding strategy. But neither of these would be useful if students didn’t have the *metacognitive knowledge* that such a process was possible. But even so, how would the students know to look for environmental conditions in the first place? How would they know to apply their

metacognitive and *procedural knowledge* of the theory to this, or any other, situation? If this sounds abstract, consider Wolfe and Castrogiovanni’s students. They had studied and presumably acquired the requisite knowledge, but it apparently didn’t occur to them to apply it in this situation.

Anderson and his colleagues address this problem by integrating neurophysiological triggers into the advanced versions of their theory, linking specific brain functions to different components of the problem-solving process (Anderson, Bothell, Byrne, Douglass, Lebiere, and Qin 2004). We need not be that rigorous. Cannon and Burns (1999) address this as follows:

Note that Bloom’s taxonomy addressed cognitive learning, or learning that addresses how to consciously acquire and manipulate ideas. Subsequent work addressed the question of feelings – values and attitudes. It acknowledged the fact that success is more than thinking. It involves a great deal of socialization, molding to the culture in which business (or other types of) success takes place. The result was a second, affective, taxonomy (Krathwohl, Bloom, and Masia 1964) which involved such things as the propensity to pay attention to the appropriate cues, to the tendency to prioritize effectively, to the internalization of a set of appropriate values as a basis for governing one’s behavior.

Finally, the third dimension addressed the fact that neither conscious knowledge nor values and attitudes are sufficient to explain effective performance as we observe, or indeed, as we experience it. There is a third dimension – the ability to act quickly and effectively on an almost unconscious, instinctual level. This kind of ability, or skill, is incorporated in a psycho-motor taxonomy (Simpson 1974). It addresses such things as the ability to carry out a specific sequence of guided activities to the ability to improvise appropriate sets of complex behavior. (p. 41)

For convenience, we have summarized the initial taxonomies in Exhibit 3. As Cannon and Burns suggest, the affective domain of the educational taxonomies (Krathwohl, Bloom and Masia 1964) provides the key to memory retrieval by representing learning about what is important, as suggested by Exhibit 4.

Cannon and Burns (1999) go on to suggest that the affective domain is not really sufficient to explain what happens as people become truly competent in organizations. They not only retrieve and use information, but they do it quickly and instinctively, almost unconsciously. In fact, in many cases, it is unconscious. This is the *unconscious* dimension, in the *conscious-competence* model. It is analogous to the physical responses associated with playing sports. In fact, Howell (1982) notes that *unconscious competence* is like when you “...have learned to ride a bike very successfully” (p. 33). A full explanation of how it works would no doubt have a strong physiological component. However, the psychomotor domain appears to

The Three Domains of Educational Taxonomies

Exhibit 3

<i>Cognitive Domain</i>	<i>Affective Domain</i>	<i>Psychomotor Domain</i>
Knowledge , or the ability to recall ideas such as facts, concepts and theories	Receiving , or the tendency to recognize and pay attention to important stimuli	Perception , or the ability to sense objects, qualities and relationships via sensory organs
Comprehension , or the ability to understand and make intellectual use of knowledge	Responding , or the tendency to act in appropriate ways as a result of a stimulus	Guided response , or the ability to perform a specific act under the guidance of a teacher
Application , or the ability to map concepts onto actual objects, events or phenomena encountered in the real world	Organization , or the arrangement of values into a coherent, stable system	Complex overt response , or the ability to perform a complex pattern of acts
Analysis , or the ability to break ideas down into their parts and logical premises	Characterization by a value , or the use of values to control one's behavior	Adaptation , or the ability to alter an act to meet the demands of a new situation
Synthesis , or the ability to develop new ideas from apparently unrelated parts		Origination , or the ability to develop new acts through the application of unrelated skills
Evaluation , or the ability to judge the merit of ideas for given purposes		

Adaped from Hugh M. Cannon and Alvin C. Burns (1999). "A framework for assessing the competencies reflected in simulation performance." *Developments in Business Simulation and Experiential Learning*, Vol 26: pp. 41-42.

capture much of its essence, as suggested by Exhibit 5. It is what Polanyi (1966) refers to as *tacit knowledge*, that is, knowledge that is understood and utilized in the course of every-day living, but which operates under the level of conscious reasoning. This is not to say that it is illogical. To the extent that it represents *unconscious competence*, it is superbly logical. But it is internalized logic, responsive to nuances of a situation that are so subtle that they would require considerable analysis to explain. It's what Gentry, Commuri, Burns, and Dickinson (1998) call "street smarts." For instance, consider a meeting in which a colleague is not acting quite right. It could be as subtle as a minor change from his or her normal variation in tone of voice or simply a minor change in facial expression, and you immediately ask, "What happened?" Or a colleague describes an attractive sounding business proposal and your "instincts" tell you something is wrong with it. In a simulated environment, an unconsciously competent player would come to instinctively grasp patterns embedded in the results and see implications or questions that must be addressed while other students are still laboring over the reports.

One of the strengths of experiential learning is that it is particularly potent in its ability to stimulate affective learning by attaching realistic consequences to the quality of one's analyses and decisions. It is even more potent for stimulating psychomotor, or tacit, learning by exposing students to an on-going stream of related analyses and decisions, featuring subtle variations to which the student must be attentive and responsive. The contribution of the model is to focus our attention as educators on the structure,

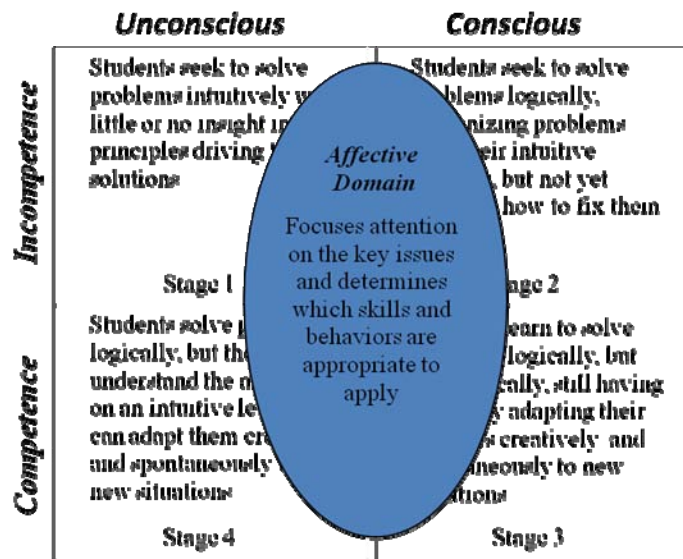
duration, and placement of experiential learning opportunities, and to carefully orchestrate our student feedback, so students will have the opportunity to progress as efficiently as possible through the stages of the *conscious-competence* model.

DIRECTIONS FOR FUTURE RESEARCH

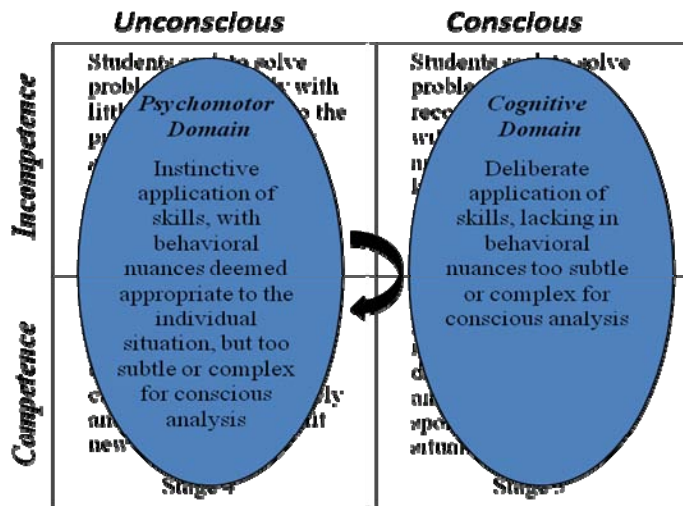
As we have just noted, the notion of the *conscious-competence* model provides a highly intuitive and useful method of organizing the way we think about experiential learning. However, it also provides useful guidance for future research. For instance, we have seen how the various levels of the *knowledge* and *cognitive process* dimensions of Boom's revised taxonomy (Anderson and Krathwohl 2001) might provide a vocabulary for classifying the various elements of problem-solving within the context of a simulation game or other form of experiential learning. This provides an operational way to content analyze thought protocols where students describe how they handled different aspects of the learning experience, investigating what happens as they pass from *unconscious incompetence* to *conscious incompetence* to *conscious competence* and, finally, to *unconscious competence*.

Given the proposed relationship of the *affective* Krathwohl, Bloom and Masia 1964) and *psychomotor* taxonomies (Dave 1970; Harrow 1972; Simpson 1974) to the *conscious-competence* model, the basic knowledge classifications (*factual, conceptual, procedural, and metacognitive*) might also be combined with the process

The Role of the Affective Domain in Information Retrieval Exhibit 4



The Role of the Psychomotor Domain Exhibit 5



elements of the *affective* and *psychomotor* classifications. This would provide a practical way of operationalizing the way students describe their non-cognitive learning experience as well, helping us explore issues of tacit knowledge.

There are, of course a host of other approaches we might take. For instance, Gentry, Stoltman, and Mehihoff (1992) and Macintosh, Gentry, and Stoltman (1993) have suggested using a framework developed by Wagner (1987) to classify tacit knowledge. Without discounting its importance, we note that the development and application of educational taxonomies has been an active and fruitful field of research among educational psychologists since the late 1940s. More to the point of our research, they also

constitute the single most common theoretical resource for work in ABSEL, using citations in the Bernie Keys Library as an index (Cannon and Smith 2003, 2004). Given the investment we have already made in this area, it makes sense to capitalize on the investment as an initial point of attack.

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