DOES GLO-BUS© STRATEGY SIMULATION DEMONSTRATE NOVAK'S LEARNING THEORY?

Rebecca Bunkley Schmeller
Ashland University
rschmell@ashland.edu

ABSTRACT

Strategy simulations are standard in both undergraduate and graduate business capstone courses (Gove, 2012). In the literature, there has been a call for more focus on teaching methods to assure strategy simulations are maximally effective (Clapper 2015). This analysis takes a look at foundational learning theories, particularly Novak's Meaningful Learning, in attempt to explain which elements of strategy simulation (especially Glo-Bus©) correspond to the elements identified for meaningful learning. This analysis will help business capstone professors to include in their teaching the aspects of strategy simulation that are most contributive to deep learning.

INTRODUCTION

As higher education seeks to provide more experiential learning to students, simulation software is growing in use (Gove, 2012). Professional colleges at the university level (colleges of business, nursing, aviation, manufacturing, education, etc.) have embraced computer simulations as a way to give students safe, hands on learning opportunities (Abdullah, Hanafiah, & Hashimh, 2013; Karriker & Aaron, 2014).

Regarding nursing education, Horne (2005) reported, "With simulation technology, students improve skills in a safe, non-threatening, experiential environment that also provides opportunities for decision making, critical thinking, and team building" (p. 31). Regarding business education, Adobar & Daneshfar (2006) states, "Simulations may be especially useful as a learning tool because they model some aspects of reality in a safe environment, thereby enabling users to make errors without any loss of investment" (p. 153). Business schools typically include strategy simulations in capstone classes (Gove, 2012) because they focus on the total enterprise, giving students a top level, CEO view (Thompson, Stappenbeck, Reidenbach, Thrasher & Harms, 2013). Karriker & Aaron (2014) stated, "Simulations allow students the opportunity to practice their integrated, strategic management skills in a relatively risk-free environment or 'live case'" (p. 770). For this analysis, Glo-Bus© Strategy Simulation was chosen because it is used globally (22 countries) by approximately 317 business schools with 32,600 students per year to teach corporate strategy in senior business capstone courses (Gamble, Thompson & Peteraf, 2013).

Nursing schools have students learn how to thread a breathing tube or insert a needle through software and mannequin simulation, avoiding the risk of patient injury. In addition, aviation, automobile safety, dental hygiene, environmental science, and legal education all use simulations for these risk-free, student experience purposes (Allaire, 2015, Stave, Beck & Galvan, 2014; Tun, Alinier, Tang, & Kneebone, 2015). Efficacy of such simulations, across several fields, is generally agreed upon (Gove, 2012).

Simulation Teaching Methods in the Literature

In addition to grid-based simulation, most business school capstone courses also include extensive use of case studies. The challenge for capstone course instructors is to maximize efficacy of both methods – simulation and published case studies. This analysis considers simulation specifically.

For business simulations to be effective teaching tools, professors must embrace proven learning theories in teaching protocol. As Clapper (2015) stated, "Many theories guide simulation-based instruction as a learning tool, and the wise facilitator is familiar with the theories that support best practices" (p. 131). This analysis aims to provide Clapper's (2015) recommended familiarity with one learning theory that supports best practices. Novak's learning theory was chosen for this analysis because its elements are so closely linked to grid-based simulations. Novak's elements include: learner prior knowledge (critical aspect of a capstone course), meaningful material (grid-based simulation's mimic of corporate ERP systems), and learner choices (premier aspect of grid-based simulations is the set of choices/decisions students make).

A literature review revealed that several strategy simulation research studies have raised questions about teaching and learning theory, addressing a perceived lack of teaching and learning expertise in business schools. In addition, AACSB (Association to Advance Collegiate Schools of Business (2013) has added scholarly research about teaching and learning to its accreditation requirements. Some examples of researchers who include teaching methods in their analysis of strategy simulations are: Adobar (2016), Alstete & Beutell (2014), Arnab, Berta, Earp, Sara, Popescu, Romero & Usart (2012), and Jones, Matlay, Penaluna, & Penaluna (2014). Their comments follow:

1. Adobar & Daneshfar (2016) called on business game administrators to "narrowly define objectives" (p. 164) and to

address a "research imperative to understand what conditions promote simulation effectiveness" (p. 152).

2. Alstete & Beutell (2014) noted that Pedagogical Content Knowledge is as important as Subject Matter Expertise when delivering the business capstone course.
3. Arnab, Berta, Earp, Sara, Popescu, Romero & Usart (2012) mentioned the rapid pace of tech innovation and that serious games are a way for higher education to embrace this and to liven up a relatively stagnant education environment. Arnab, Berta, Earp, Sara, Popescu, Romero & Usart (2012) also pointed out the pivotal role of the educator and game deployment methods.
4. Jones, Matlay, Penaluna, & Penaluna (2014) wrote, "The innovative approach to combine these education ideas (e.g., Pedagogical Content Knowledge) with prevailing thinking in the enterprise education domain has facilitated a model for collective action" (p. 56).

Pedagogical Content Knowledge (Shulman, 1986) implies balance between subject matter expertise and teaching method expertise. Jones, Matlay, Penaluna, & Penaluna (2014) and Clapper (2015) reported that in professional schools (e.g., business schools and nursing schools), instructors are too firmly focused on subject matter expertise, to the demise of teaching method expertise. Clapper (2015) noted, "Too often, those conducting simulation miss an opportunity to employ effective instructional design practices that can lead to better educational outcomes (p. 4)." Clapper used various frameworks and literature to support his claim.

Clapper (2015) also noted, "Applying Vygotsky's Zone of Proximal Development (ZPD) to simulation-based learning may enhance simulation instruction. Gaps in simulation instruction can lead to ineffective practices" (p. 148). Clapper's mention of ZPD refers to the notion that fitting new learning into an existing set of previous knowledge results in better comprehension and retention. This aspect of Vygotsky's theory is similar to Ausubel's (1960, 1978) and Novak's (2010) theories, which are examined and applied to the Glo-Bus strategy simulation in this analysis.

Applying Glo-Bus© Simulation to Learning Theories

In grid-based strategy simulations, each set of decisions is linked (via formulas) to other decisions. For example, in Glo-Bus©, one marketing decision is the length of a warranty period. If a simulated company decides on a six month warranty and the industry average is one year, the six month warranty company's market share and revenue will be negatively affected.

In the same example, having a longer one year warranty results in higher warranty claims costs; therefore, the one simulated company gains market share but increases warranty claims costs. This small example is one of dozens where simulated strategy decisions are linked to larger and multi-functional results. For a marketing major student, this concept of cost ramifications (and consequently, earnings and EPS ramifications) gives a finance and cost view not previously studied in marketing classes.

Also in the above example, the marketing student is learning cost considerations by adding on to previous knowledge about marketing. This demonstrates cluster and concept learning addressed by Vygotsky (1978) and Novak (2010). Another example of concept learning in simulations is the way that cash allocation decisions are clustered into conceptual groups. In the warranty example, students are exposed to the concept of higher level cost accounting. Warranty periods are not typically considered a marketing expense, but in the larger cost accounting realm, service costs (e.g., warranty and tech support) are accounted for as marketing costs. This is another example of how strategy simulations group strategy concepts and general business concepts into clusters or concepts for more meaningful comprehension and retention.

Strategy simulation students encounter several layers of concepts that are wholly integrated. Each decision screen (divided by corporate function – product design, marketing, etc.) includes dozens of data points and cost calculations designed to give revenue, cost, and profit projections.

To inform decisions about cash allocation, students have access to reports which provide competitive financial ratio and market analysis – data about how their decisions impact the market and impact their financial status. These tools and techniques, in addition to being reflective of real-world businesses, also carry students to Novak's (2010) conceptual level of learning. To make sense of so much data, students must navigate and scope in and out, reinforcing various concept levels.

Below, the components of Novak's Meaningful Learning are examined, vis a vis Glo-Bus© Strategy Simulation – so that professors can better match the simulation execution to requirements for deep learning.

NOVAK'S (2010) MEANINGFUL LEARNING

Novak (2010) provided the following explanation of meaningful learning, based on Ausubel's (1978) research.

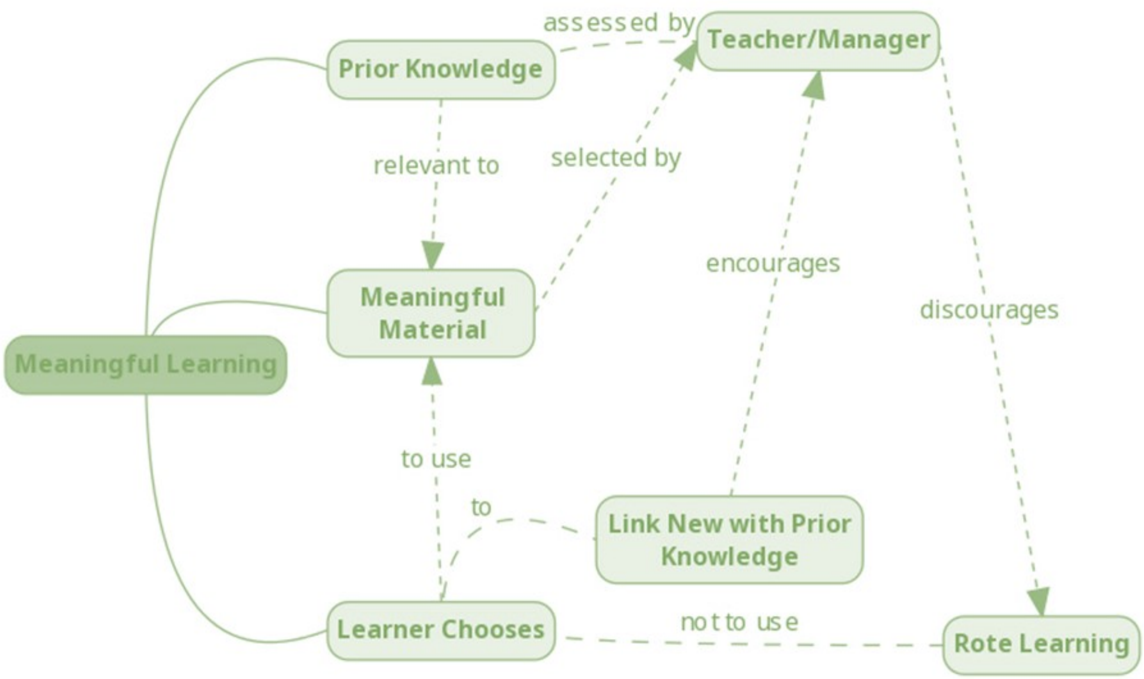
> The central idea in Ausubel's theory is what he described as meaningful learning. To Ausubel, meaningful learning is a process in which new information is related to an existing relevant aspect of an individual's knowledge structure. However the learner must choose to do this. The learner must actively seek a way to integrate the new information with existing relevant information in her or his cognitive structure….Ausubel contrasts meaningful learning with rote learning, where the learner makes no effort to integrate new knowledge with existing relevant knowledge (p. 59).

Novak's (2010) "Three Requirements for Meaningful Learning" (see exhibit 1) shows the conceptual connections between *prior knowledge*, *meaningful material*, and *learner choices*. This model can be used to understand aspects of simulation learning, specifically prior knowledge, meaningful material, and learner choices. *Prior knowledge* is a built-in factor in strategy simulation (as the next section details) because senior business capstone students arrive to the class with previous course-provided and internship-provided understanding of multiple functions in a whole business enterprise (product, marketing, assembly, labor, social responsibility, finance). Other prior knowledge students bring to the class includes ability to read reports, accounting practices, business analysis tools, and market demographic understanding.

Meaningful material is also a built-in aspect of strategy simulations. Regarding motivational meaning, 30% of students' final capstone course grades are typically based on simulation (Gamble, Thompson & Peteraf, 2013). Regarding practical application meaning, students make cash allocation decisions that mimic real-world business processes and decisions. Part of effective simulation teaching includes matching simulated decisions (e.g., hiring and firing employees) to news of real companies doing the same.

Lastly, *learner choices* most directly relates to strategy simulations – as learners make choices about login activity (frequency, duration, and tasks) and choices about multi-functional cash allocation. Both of these sets of choices are complex and learner-driven.

EXHIBIT 1
THREE REQUIREMENTS FOR MEANINGFUL LEARNING, NOVAK, 2010, P. 60



To apply this model to strategy simulations, below is an explanation of each component of the model vis a vis the Glo-Bus© strategy simulation.

Learner's Prior Knowledge

When business school students reach the capstone course, they have completed most required courses for their major. The set of learning outcomes the student brings to the capstone class serves as prior knowledge. For example, Supply Chain majors have mastered topics such as assembly schedules, green manufacturing, cycle time, forecasting accuracy, days inventory, and freight costs. Conversely, Finance majors have mastered topics such as debt versus equity financing, issuing shares of stock, repurchasing shares of stock, and dividend payments. When students see those same supply chain metrics and finance metrics in simulation, they are exposed to how analysis of supply chain metrics (Days Inventory) is related to analysis of finance metrics (Earnings per Share, Dividend Payout Rate, etc.). This enables the learner to apply prior learning to the current task.

Meaningful Material

In this example, the simulation software serves as the meaningful material. Simulated decision-making materials can be broadly categorized into three categories: reports, projections, and decisions. When students study and analyze these materials (presented in software screens), they are making connections of meaning referred to by Novak (2010). Students' ability to make meaning from the materials is critical in Glo-Bus© and is the way to avoid the pitfall Karriker & Aaron (2014) referred to as a "guessing game" (p. 772).

Learner Choices

Lastly, the requirement of learner choices addresses the student's choice to stay on the surface with rote memorization or to go deep with synthesis of concepts. Novak (2010) attributed these concepts of surface learning and deep learning to Marton and Saljo (1976). Novak (2010) also explained that these three requirements are part of Ausubel's assimilation theory. Assimilation theory was Ausubel's (1960, 1978) explanation that new knowledge is meaningful only when assimilated with prior knowledge. Novak includes the prior knowledge aspect in his explanation of learner choices in meaningful learning. Novak wrote, "With continued learning of new information relevant to information already stored, the nature and extent of neural associations also increase" (p.60). This difference in learner choice (link new with prior versus rote learning) is a key aspect of strategy simulations because of the dozens of linkages between current decision rounds and prior decision rounds.

The learner choice demonstrated in Glo-Bus strategy simulation is about login activity and about simulated cash allocation. Students choose when and how often and how to interact with the three material types (reports, projections, and decisions). This material is presented in dozens of computer screens/spreadsheet formats, and has been reported as overwhelming and confusing (Gove, 2012). The challenge to instructors is to embrace Novak's (2010) theory by using pedagogy that makes the materials meaningful (and not confusing) as reported in the literature. Each of Novak's principles can be applied to reduce confusion. The list below connects each principle to an aspect of Glo-Bus©. Capstone professors can use this as a checklist to assure all principles are being applied.

One benefit of the software is that when learners exercise choice about how to allocate cash, they become more engaged and immediately see the consequences of their choices. This immediate result/feedback is a part of a learner choice cycle unique to few teaching methods, including grid-based software.

NOVAK'S SIX PRINCIPLES FOR TEACHING AND LEARNING

Novak (2010) emphasized that concepts are not words, but rather organized and intricate knowledge clusters. This applies to simulations because they combine concepts and principles (strategy analysis tools) within a context (simulation decisions).

Grid-based simulations directly demonstrate Novak's six principles for teaching and learning. Below are examples of how each principle (motivation, existing knowledge, organized, context, teacher, and evaluation) (Novak, 2010, p. 275) is illustrated by strategy simulations.

Motivation

Simulation scores are frequently a large portion of capstone students' course grade (Gamble, Thompson & Peteraf, 2013). This provides one form of extrinsic motivation. Another form of extrinsic motivation is enterprise management skills. ERP Enterprise Resource Planning is the standard operating system for most businesses (large and small), and the nature of simulation linkages between functional costs and corporate revenues directly mimics ERP methods.

For example, when students decide to invest in green initiatives, there is a direct cost of $500,000 to their $2 million dollar revenue company. This cost is immediately reflected in pro forma statements, which indirectly affects profitability ratios. Understanding these cost and revenue relationships familiarizes students with real-world ERP systems, which serves a motivation to become workplace ready.

Existing knowledge

When a student has completed foundational courses for his/her major, that student is more of an expert in that function than other business majors. Participating in strategy simulations builds on that functional expertise. Each decision screen has components that have been introduced in previous classes. For example, the labor and compensation screen gives students a decisions to make about salaries, benefits, training, and bonuses. For an HR major, these parts of compensation have been studied in depth in compensation classes. Deciding on compensation rates and ranges for camera company employees is enhanced because of existing/previous knowledge.

Organized

Decision screens, reports, practice rounds, login activity guidance/requirements, debriefing sessions all contribute to Novak's (2010) "organized conceptual knowledge" (p. 275). Crookal (2014) research also supports this principle because it finds debriefing to be the most important aspect of simulations.

Context

Competitive environment, analysis tools, comparisons to case studies and internships all contribute to the contexts mentioned by Novak (2010). Specifically, Novak expands the "organizational context" (p. 182) with explanations about peer relations (p. 191) and learning materials (p. 195). Simulation companies/teams directly support peer relations because co-CEOs see strategy concepts in individual ways due to various majors and internships. Bouncing these diverse perspectives off of each other deepens the learning. Regarding learning materials, simulation reports (mimics of real life syndicated market and financial reports) reflect shared materials which can be clustered and scoped in and out to provide deeper and conceptual meaning.

Teacher

Debriefing, team process facilitation, and login guidance demonstrate Novak's (2010) principle of the teacher being sensitive to the learner. Novak (2010) clarifies the awareness/monitoring required by the teacher, to truly facilitate learning. Simulations, due to their interactivity, require close monitoring by the teacher. This aspect of login activity is called out by Umbach (2005) and Der Sahakian (2015) who found that faculty parameters, guidance, and debriefing are critical to simulation meaning. In Glo-Bus©, this is exemplified by finance and cash flow deicions. Students must decide if they will use debt financing or equity financing to generate the needed cash flow for expenses in product, marketing, HR, etc. To choose between debt and equity, students must make meaning of complex reports that show industry averages for each type of financing. Teacher guidance is critical – leading students to the right industry reports.

Evaluation

Aspects of simulation which relate to Novak's (2010) evaluation principle are simulated company performance and contribution to capstone course grade. Simulation as part of total grade is typically 30% at minimum – which serves to provide evaluation of students' ability to apply course concepts and analysis tools. Because simulations and student login activity are a direct reflection of input, process, output, and feedback systems, the open system model including evaluation through feedback applies (Cummings, 2009).

Other elements of Novak's findings also relate to simulation login activity. Novak (2010) stated, "deep learning is a process that inevitably is driven by the learner" (p. 215). This notion directly corresponds to login activity – as student choice about simulation frequency, duration, and report reading are all self-directed.

SUMMARY

Strategy simulations can be especially impactful to students because of their use of Novak's Requirements for Meaningful Learning and Requirements for Teaching and Learning. Business capstone professors should consider these links when using strategy simulations – to assure that teaching methods fully deliver strategy simulation's unique ability to meet Novak's requirements and principles.

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