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USING COGNITIVE MODELING IN BUSINESS MANAGEMENT EDUCATION

Phillip J. Decker, University of Houston-Clear Lake
Roger Durand, University of Houston-Clear Lake
M. Femi Ayadi, University of Houston-Clear Lake

ABSTRACT

This exploratory study demonstrates the superiority of a training method based on cognitive modeling in business education. Academic accrediting standards for business schools have led to the development of competency models for guiding continuous improvement of the curriculum. Furthermore, business school curricula have been criticized for emphasizing theories and declarative knowledge (what students know) over action skills (how students apply knowledge and do things). Consequently, accrediting bodies are requiring assessment of higher-level performance competencies beyond knowledge only. In this study, cognitive modeling, a little-researched method of teaching non-observable skills, is compared to lecture with case analysis. The vehicle used to test these teaching methods is decision making competence. The study investigates ability to use the Normative Model of Leadership to decide the degree employees should be included in decision making. Results showed that training involving cognitive modeling was superior to lecture/case analysis in facilitating identification by business students of the "leadership style" appropriate to different situations. The use of cognitive modeling may be a promising avenue to explore in teaching competencies at multiple levels of learning in business.

INTRODUCTION

Governmental mandates and accrediting body standards have led to the development of competency models to guide educational program curriculum planning and improvement in health and business management (Calhoun, et al., 2008; Garman & Johnson, 2006; Calhoun, et. al., 2009). Yet, as educators in all fields have learned, developing competency models does not insure outcomes, nor does it ensure that competencies will be obtained by students at any level beyond knowledge.

Indeed, a number of critiques have challenged schools of business to become more relevant and accountable to market needs (Keys & Wolfe, 1988; Rubin & Dierdorff, 2009). Among such critiques, Rubin & Dierdorff (2009) have shown a misalignment between the outcomes thought critical by practicing managers and MBA programs while research by Wren et. al. (2007) found that there is an increasing emphasis towards teaching theory in business disciplines.

Business School Education

Current evaluation criteria, including accreditation standards, in business schools, have been criticized for being biased toward knowledge retention and analytical models over technical skills or values (Barnett, 2005; Ghoshal, 2005). At the same time, business educators have been challenged to shift their pedagogical emphasis to skill development (Mintzberg, 2004; Chia & Holt, 2008). However, business schools have done little to respond to these criticisms, and have continued to focus more on the learning of knowledge outcomes (Stokes, et. al., 2010). Consequently, business education leaves students with little practice to become competent in the action skills necessary for good management (Bennis & O'Toole, 2005; Belasen &

Rufer, 2007). Concomitantly, more understanding of the related pedagogy for facilitating learning at the behavioral or higher cognitive skill level in the health and business professions seems needed (Calhoun, et. al., 2009).

Recently, Calhoun, et. al. (2009) and Decker et al., (2006) have shown in health management education that there has been a predominant emphasis on retention and faculty-driven learning activities such as lecture, with less time mapped for career-like activities widely acknowledged as key discriminators in future leadership roles (McClelland 1973, 1988; McClelland, Clark, & Lowell, 1976; Spencer & Spencer, 1993). Additionally, faculty typically are unfamiliar or uncomfortable with teaching methods and evaluation tools regarding cognitive and affective domain learning, including student ethics, values, predispositions, and other personal attributes (Anderson and Lawton, 2009).

Cognitive Modeling

Taylor, et. al. (2005), in a meta-analysis, have shown that behavior modeling training (BMT) has become one of the most widely used, well-researched, and highly regarded training interventions in a number of disciplines. The BMT approach, based on Bandura's (1977) social cognitive theory, differs from other training methods with its emphasis on (a) describing to trainees a set of well-defined behaviors (skills) to be learned, (b) providing a model or models displaying the effective use of those behaviors, (c) providing opportunities for trainees to practice using those behaviors, (d) providing feedback and social reinforcement to trainees following practice, and (e) taking steps to maximize the transfer of those behaviors to the job (Decker & Nathan, 1985; Goldstein & Sorcher, 1974).

The body of published research (Taylor, et. al., 2005) on BMT has demonstrated it to be an effective training intervention that has been used to produce sustainable improvements in a diverse range of skills and post- training behavior. Despite its overall effectiveness as a training method, several disadvantages have mitigated the application of BMT. First, Keys and Wolfe (1988) noted that it can be quite expensive. Second, behavioral modeling may be difficult or impossible to adapt for some tasks (i.e., those lacking in observable behaviors). Examples of this might include tasks that are performed primarily through cognitive processing (e.g., those drawing heavily on judgment or analysis) (Gist, 1989).

An alternative form of modeling is based on a process of attending to a model telling how to perform a cognitive process – often using an algorithm or series of questions – and then practicing by "listening" to one's *thoughts* as one performs the activity and utilizing self-instructional thoughts (or "statements") to guide performance. This form of modeling, *cognitive modeling (CM)*, has received promising, though extremely limited, application in training contexts (Harmon & Evans, 1984; Gist, 1989). Gist (1989) has shown that CM enhances performance. Her study examines the value of cognitive self-instruction for idea generation during innovative problem-solving in an organizational training setting. She suggests the method of cognitive modeling should be assessed for its effectiveness in other training content areas. She also suggests it may provide a low cost alternative to behavioral modeling. Also of interest, she suggests that similarity between the cognitive models used in her study and the typical rule encoding used by Decker (1982, 1984) suggests that the capacity of a modeling training design to produce relevant, symbolic coding might be a more important theoretical concern than whether the modeling is behavioral or cognitive per se. Coding is an important element of modeling (Decker 1982) and is particularly difficult with no observable behavior. It must be done with an algorithm or set of questions. An algorithm is a step-by-step procedure for solving a problem or accomplishing some end such as the steps to complete some action on a computer. While BMT uses verbal rules or descriptions of behavior to guide practice, CM uses algorithms or questions.

There are other bodies of research that argue for a cognitive modeling approach which incorporates the use of modeling guided by an algorithm used in the cognitive skill. Zhang & Huang (2008) found that teacher clarity – "a cluster of teacher behaviors that contribute to the fidelity of the instruction and reduce ambiguity, insufficient examples, and uncertainty (p. 11)" – increased student motivation and cognitive learning. Laakso et. al. (2009) have shown the relationship between algorithm visualization in training and cognitive learning. Carifio & Perla (2009) have reviewed the literature from computer science to neuro-psychology on the use of diagrams, graphs, and other visual ads in instruction. They argue strongly for visualization and mental imaging of cognitive processes in education. Thus, cognitive modeling offers clarity, needed algorithms, visualization and mental practice of complex cognitive skills.

A second theoretical implication of Gist's study arises from the finding that cognitive modeling training enhanced self-efficacy – an affective component. Therefore, the use of cognitive modeling may be a promising avenue to explore in teaching competencies at multiple levels of learning in healthcare and business education. Cognitive modeling requires practice (as well as assessment) and this is often done with a case analysis. While case analysis has been shown to be an effective in developing higher order cognitive learning and critical thinking ability (McNaught et al.2005; Shugan, 2006, Wood, et al. 2001; it does not really engage the student in any meaningful action, and therefore the student does not become truly involved in learning by doing (McHann & Frost, 2010). But, this is exactly what is necessary for leaders and managers to overcome the knowing-doing gap. As McCarthy and McCarthy (2006) point out, the traditional case study is just not enough to prepare leaders and managers with the skills they need. Rather, we believe the added modeling and practice processes found in of CM are needed.

Levels and Types of Learning

Instruction, particularly in business schools, should be designed to incorporate learning theories that explain how skills are developed. Bloom (1956; Bloom, et al, 1956), identified three domains of educational activities: ***Cognitive***, ranging from retention of factual material to complex cognitive skills such as decision making and evaluation; ***Affective***, growth in feelings or emotional areas; and ***Psychomotor***, manual or physical skills. Bloom identified six levels within the cognitive domain, from the simple recall at the lowest level to the highest order which is evaluation. The levels can be thought of as degrees of difficulty. A goal of Bloom's Taxonomy is to motivate educators to focus on all three domains.

The work of Dominguez et. al. (2009) and Pringle et al., (2010) suggest that the key discriminators in future leadership roles of the kind demanded in business depend upon much more than declarative knowledge (Anderson, 1976). Kolb (1984) and Kolb et al. (2000), on the other hand, describe two primary dimensions of the learning process. One dimension has active experimentation at one end and reflective observation at the other. The other dimension moves from abstract conceptualization of events to concrete experiencing at the other. Kolb emphasized individual differences in learning style, with learners exhibiting different preferences along each dimension. But he went on to argue that learning requires each of these four abilities or "quadrants" (experimentation, reflective observation, conceptualization of events, experiencing events). Building upon Kolb's work, Simon (2000) shows that lecture and case analysis, more typical to business schools, fall in the reflective/abstract conceptualization quadrants while cognitive modeling incorporates elements of all four quadrants in Kolb's model.

In this study, we did not focus on trainee learning styles of the kind described by Kolb and implemented by Simon. Rather, as will be seen below, we used these dimensions to frame our hypothesis and choose the control group training condition. In our view, cognitive and behavior modeling is expected to outperform lecture/case analysis as it takes aspects of both and adds the aspects of observational learning, active practice, and reinforcement (Bandura, 1977).

Problem Statement and Hypothesis

The purpose of this research is to investigate the use of cognitive modeling to teach a business skill - decision making - in business administration classes. This process helps ensure students visualize and practice complex cognitive skills and therefore obtain the competencies needed in a business degree program. This is needed because accrediting bodies are asking schools to teach beyond the knowledge level of Bloom's taxonomy of learning domains. Moreover, as noted briefly above, there is need for faculty in schools of business to become more familiar and comfortable with teaching methods and evaluation tools regarding cognitive and affective domain learning, including student ethics, values, predispositions, and other personal attributes.

Since lecture/case study is common as a business school training pedagogy (Burke & Day, 1986), it was selected as the training framework for the control group. This study compares cognitive modeling against lecture/case study in teaching decision making –

specifically, the ability of students to actually use the well-known "Normative Model of Leadership" (Vroom and Yetton, 1973) to decide the degree to which employees should be included in decision making. More specifically, we test the following hypothesis:

Hypothesis: Business students who receive cognitive modeling training will outperform in accuracy in using the Normative Model than those students who receive lecture/case study only training.

The results of this investigation will be important to instructors needing improved methods to teach and assess competencies at the cognitive domain levels in programs. This is especially so where accrediting bodies are demanding competence assessment from schools of business across the different cognitive levels of Bloom's taxonomy.

METHODS

Subjects and Assignment. Research subjects were 56 students in two classes in a business school. One of the classes was an undergraduate management class; the other was a graduate class in health care management. All subjects volunteered for the study and were randomly assigned to condition. Subjects were split randomly into two groups (29 control and 27 experimental) to receive the training: a "cognitive modeling group" (experimental) and a "lecture/case analysis group" (control). The training was conducted separately in each group. No differences in gender, age, level of study (undergraduate versus graduate), and managerial experience were found between the experimental and control group at the .05 level of statistical significance (data not shown, but available upon request). This latter finding of "no differences" is of critical importance. It shows that these latter variables were not a source of spuriousness in the results of this study and could not produce manipulation artifacts.

Experimental Design. A true experimental design with random assignment of subjects was used to test the hypothesis. The dependent variable was the "leadership style" chosen in a case using the Vroom and Yetton Normative Model of Leadership. "Training method" –

cognitive modeling versus lecture/case analysis alone -- was the sole independent variable in the design.

Training Methods. A lecture session using a case analysis of approximately 30 minutes duration was developed for the Normative Model (Vroom, 1973) to instruct subjects in the nature of the Model as well as how to use it. The lecture, reading materials, and cases were taken from standard textbooks used in the business school's management courses. The reading material that accompanied the lecture provided a graphic display of the Normative Model and the seven questions indicated by Vroom and Yetton (1973) for its use. It also explained the resulting five alternative leadership styles in the Model, styles ranging from autocratic to group-based.

Control subjects were given a brief explanation of the Model, a graphic display of the model and the questions used in it, and a description of the leadership styles. They were then given a case to analyze using the Model. After their individual analysis of the case, the control group students were provided the correct answers to the seven questions utilized in the Model, and the correct leadership style according to the Model for that particular case.

In contrast, the experimental group was provided the same lecture, reading material and cases. Additionally, however, they were also provided with an actual demonstration (or model) of how the Normative Model works using a second case, with step-by-step progression through the questions of the model, and with the correct answers at each step. The demonstrator was the instructor who told the subjects how the issues in the case related to the answering of the model questions.

Thus, both control and experimental subjects were provided a graphic description of the Normative Model and an explanation of appropriate leadership styles for a case situation. Additionally, both sets of subjects had an opportunity to practice the cognitive process required and received feedback following that practice. The only difference in treatment was that experimental subjects were provided an actual, live demonstration by the instructor of how one would think through the questions of the Normative Model and apply the questions to an actual case.

Performance Tasks. The dependent variable, accurately choosing the "correct leadership style" based on the Vroom & Yetton model
was measured by simply asking both the experimental and control group to apply the Normative Model to a third case used only as the dependent variable and, based on that, to select the preferred the leadership style (the cases are not reproduced here but can be provided by the researchers). The subjects had the Model, the questions, and the leadership styles at hand to perform this task. The Model describes a situational leadership theory and asks seven questions requiring yes/no answers. The Model was displayed graphically so that by following the nodes dictated by the correct answer to each, one would reach a leadership style that, according to Vroom and Yetton, is the correct style to use in that situation to be an effective leader.

Analysis and Results

In order to avoid alternative possible explanations for results, especially "treatment interference," a manipulation check was conducted. A separate group of students was asked to examine the materials used in each group for similarity (in reality, the materials were exactly the same) and listen to the lecture/discussion. This subjective analysis of the similarity of course content and presentations across the groups yielded no differences at statistically significant levels. Additionally, measures of course satisfaction (Idea Center, 2011) and reactions to the course were studied, but showed no differences between training conditions at statistically significant levels ($p=.05$). It is possible, of course, that this course-wide measure was not sensitive enough to register true differences in the experimental groups. Yet, in this experiment, the information learned was not complex or particularly difficult and was a part of the regular curriculum. Further, the differences in the two training methods were intended to be subtle enough to have little effect on subjects' overall course satisfaction.

Data collected from the experiment described above were analyzed to this expectation. The table below shows the percentages of experimental and control subjects that selected the "correct" leadership style according to the Vroom and Yetton Model. As can be seen in the table, experimental subjects – those receiving the cognitive modeling treatment – clearly outperformed control subjects.

Table 1: Cognitive Modeling Experimental Results Regarding the Vroom-Yetton Normative Model (total n= 56)*

Group:	**Experimental**	**Control**
Correct	78%	28%
Incorrect	22%	72%
Totals:	100% (n=27)	100% (n=29)

As shown in the above table, 78% of the experimental group was able to select the correct Vroom-Yett leadership style for the case compared to just 28% of controls.

In addition to the percentage, two different measures of the strength of association, Lambda Asymmetric and Cramer's V, were calculated. (Both were calculated because they involve somewhat different underlying statistical assumptions. Further, both were calculated utilizing SPSS.) The value of Lambda Asymmetric, for the relationship between "group" (experimental versus control) and the test answer (correct versus incorrect) regarding the VY Normative Model was .481 with a $p<=.011$. Cramer's V was found to be .502. Further, an analysis of variance was also conducted; an analysis which showed that the between-groups (experimentals versus controls) F was 18.185, which at 1 df yielded a significance level (p value) of .000).

Both strength of association measures and the analysis of variance were found to support the claim that knowing which training method (experimental or control) allows one to predict with considerable success the likelihood of selecting the correct leadership style according to the Vroom and Yetton Normative Model. Thus, the evidence presented in the table support this study's hypothesis.

DISCUSSION

This study explored several key issues pertaining to the design of training programs for decision-making in schools of business. The superiority of a training method based on cognitive modeling was impressive. Its ease of use in the classroom is remarkable. While both training conditions covered identical reading and lecture content and offered very similar practice opportunities with decision making with an algorithm (graphic display of the Model), the cognitive modeling method appreciably enhanced performance.

A number of practical implications arise from these findings. First, they show that an economical and effective method that can be used in the time and space limitations of most classrooms to teach and measure a higher-order cognitive skill needed for competence attainment on the part of managers/executives. Therefore, the use of cognitive modeling may be a promising avenue to explore in teaching difficult-to-observe competencies at multiple levels of learning in business and healthcare education where accrediting bodies are demanding competence assessment across the domains of Bloom's taxonomy.

Further, this study extends Gist's (1989) findings to students developing competence at a higher cognitive level. Future studies might explore whether these techniques would generalize to other types of classes and content (e.g., affective level). Of course, the performance measures used in this study were measures of training task performance. More knowledge is needed about whether cognitive modeling would lead to superior training transfer (from the classroom to the job situation), students' self-efficacy, and on other affective variables such as satisfaction with the instruction or motivation to learn. This study has shown cognitive modeling to be superior to lecture/case analysis *in immediate task performance*. To the extent that cognitive modeling pedagogy generalizes to other types of classroom content, and that it leads to high transfer and retention, it may provide a low cost alternative to teach and assess other complex cognitive skills.

A second theoretical implication of this study is about the use of all components of BMT. Whether cognitive modeling may not require the same set of process components as BMT or can be used alone or with fewer of the BMT components was not assessed. It appears that the cognitive modeling was a more effective method because it provided superior symbolic coding to guide the participants as they applied the learning principles to task performance. Thus, this study offers an alternative to behavioral modeling training. These results are preliminary, yet they suggest a need for the development and testing of other, alternative modeling interventions. Collaborative efforts between educators and researchers may accomplish this end. A significant challenge remains for the wider exploration of the effectiveness of educational methods in schools of business when coupled with training for different content and skills.

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About the Authors:

Phillip J. Decker, Ph.D. is Professor of Healthcare Administration at the University of Houston Clear Lake, Texas Medical Center where he teaches human resources management, healthcare administration, and evaluation of health services. Formerly he was a Personnel Research Specialist for General Electric Co., an Assistant Professor of Management at the University of Missouri St. Louis and an Associate Professor of Management at the University of Hartford. He is a veteran of the US Navy and has consulted in numerous companies & hospitals in the U.S. and internationally. Dr. Decker has published over 80 articles, been principal investigator on nine major grants, and written twelve books in various areas of competency assessment, management, training, and nursing management.

Roger Durand, Ph.D., is Professor in the School of Business at the University of Houston – Clear Lake where he specializes in management and program evaluation. Formerly, he served as Senior Analyst, U.S. Department of Health and Human Services, in Washington, D.C., and as an adviser to the White House Domestic Policy Council. He is the author of numerous publications including recent articles in *Learning and Development in Organizations*, the *International Journal of Organizational Analysis*, and the *International Journal of Culture, Communications and Conflict*.

M. Femi Ayadi is an Associate Professor in the School of Business, Healthcare Administration Program at the University of Houston Clear Lake (UHCL), where she teaches courses in health economics, healthcare finance and public health.
Formerly, Dr. Ayadi was a health economist at the Division of Reproductive Health, Centers for Disease Control and Prevention, (CDC) in Atlanta GA. Dr. Ayadi has publications in several professional journals and serves on the editorial advisory Board for two European journals. Dr. Ayadi was recently awarded a Fulbright grant to Covenant University, Sango Otta, Nigeria for the 2011/2012 academic year.