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TEACHING AND LEARNING HIGHER-ORDER THINKING

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Higher-order thinking skills are an important outcome of higher education. This paper discusses the paradigms of higher-order thinking in higher education in general and in business education specifically. It provides tools of teaching and learning higher-order thinking in business education.

Keywords: Higher-order thinking, Rational thinking, Design thinking, Systems thinking.

Introduction

Higher-order thinking is more than simple memorization and comprehension, and involves a variety of cognitive processes, such as making judgment, generating ideas, exploring consequences, reviewing options, monitoring progress, and so on (Wang and Wang 2011b; Perkins *et al.* 1993a; 1993b). Higher-order thinking has been studies for a long time (Dewey 1909; Paul 1985; Huitt 1998; Fisher 2001). There are have been many terms for phrasing higher-order thinking in the literature, such as critical thinking, reflective thinking, integrative thinking, good thinking, deep thinking, etc. The taxonomy of higher-order thinking has not been made clear in the literature; however, higher-order thinking has been discussed in three paradigms: non-discipline-specific and non-skill-specific, skill-specific, and discipline-specific.

Non-Discipline-Specific and Non-Skill-Specific Higher-Order Thinking

Non-discipline-specific and non-skill-specific higher-order thinking has been discussed in the educational literature (Annis and Jones 1995; Zubizarreta 2004; Batterbee and Dunham 2004). Essentially, three major paradigms of non-discipline-specific higher-order thinking are *career thinking*, *scholarship thinking*, and *extra-curricular thinking*. Here, a thinking paradigm is a higher-order thinking mode which requires certain cognitive characteristics. Clearly, there are no sharp boundaries between the three higher-order thinking paradigms. Career thinking is continuous reflection on personal mission, career path and career change, and long-term goals. Career thinking enables the individual to assess personal strengths and weaknesses of skills, abilities, motivations, and personal dispositions on her/his own. Career thinking is the mental preparation for the individual to establish and sustain competent performance in the rapidly changing world.

Scholarship thinking presents evidence of students' academic progress over time, and engages students in ongoing self-assessment of lifelong learning. Students' academic portfolios are particularly important for scholarship thinking. Scholarship thinking enables students to plan academic success, evaluate in-class learning, and recognize gaps in existing knowledge and curricula competences.

Extra-curricular thinking is based on the belief that the acquisition of knowledge and skills extends far beyond formal classroom education. Learning outside the classroom encompasses a wide range of learning scenarios. Extra-curricular thinking enables students to celebrate broad life experiences and to become self-motivated lifelong learners.

Non-Discipline-Specific and Skill-Specific Higher-Order Thinking

Non-discipline-specific and skill-specific higher-order thinking modes include *problem solving*, *self-regulation*, and *motivation* (Kirkwood 2000). Thinking and problem solving shall not be separated in learning. The problem solving thinking drives the thinker to fully understand the nature of a practical complex problem, and to identify approaches to solving the problem.

Learning involves self-regulation. Good learner possesses the thinking ability of self-monitoring, developing own learning strategies, and learning from experiences and mistakes.

Higher-order thinking is effortful. Motivation enables the thinker to initiate creative activities beyond memorization and emulation.

Discipline-Specific Higher-Order Thinking in Business Education

Research (Ericsson & Smith 1991) argues that higher-order thinking emphasizes thinking strategies and abilities across diverse situations and discipline-specific knowledge guides sophisticated higher-order thinking for the discipline. In this document, we place the focal point on the business education field.

In the business education literature, *rational thinking*, *design thinking*, and *systems thinking* are three general higher-order thinking paradigms that have been discussed widely. They are all related to problem solving in the business discipline.

Rational Thinking

Theory and practice of rational thinking were introduced to the higher education field in 1980s or earlier (Kurfiss 1988). Since then, rational thinking has been widely discussed in the business education literature (e.g., (Jenkins 1998; Page & Mukherjee 2007; Peach *et al.* 2007)). In the literature, rational thinking is often used as an exchangeable term of higher-order thinking. To better understand higher-order thinking for effective assessment of learning outcomes, it is desired to distinguish dissimilar higher-order thinking paradigms. In this document, rational thinking is the ability to explore a problem, integrate all the available information about it, derive a decision, and justify the decision (Warnick & Inch 1994; Plous 1993; Kida 2006). Rational thinking is required for solving unstructured problems or making unstructured decisions, and is a rational process of evaluating a claim or belief. Simon (1976) has laid the foundation for the theory of behavioral and cognitive processes engaged in decision making. Rational thinking involves gathering appropriate information, evaluating alternative answers pertinent to this information, and choosing the answer that is best supported by the information. In using information to evaluate alternatives based on decision making model(s), analytical thinkers recognize assumptions, biases, and uncertainty. Analytical thinkers keep observing the outcomes of the execution of the decision and develop knowledge through internalization.

In terms of cognitive style, analytical thinkers tend to be thinking (as opposed to feeling), extroversion (as opposed to introversion), judgment (as opposed to perception), and sensing (as opposed to intuition) oriented (Myers 1962) in order to make logical, analytical, objective, and empirical decisions.

Design Thinking

Design thinking is a rigorous body of knowledge about the design process as a means of approaching managerial problems (Simon 1996). Under a design-thinking paradigm, people would be encouraged to think broadly about problems, develop a deep understanding of issues, and plan a process to implement an educated idea. Design thinking is different from rational thinking in that design thinking is process-oriented while rational thinking is judgment-oriented. For instance, optimization approaches emphasize more on rational thinking, but less on design thinking. Design thinking results from the nature of design work: a project-based work flow around problems (Dunne & Martin 2006; Wang and Wang 2011a).

The literature (e.g., (Peirce 1903; Boland & Collopy 2004)) has addressed numerous aspects of design thinking. In terms of cognitive aspects, design thinking includes induction, abduction, and deduction mental processes. Induction is generalization from specific instances and is the initial stage of design thinking. Abduction is creative action to generate a good idea to address an identified managerial problem. Deduction is inference reasoning to predict the outcome of the good idea. Generally, to facilitate design thinking, project-oriented process models are needed (Dunne & Martin 2006). The major task of initiating design thinking then becomes the identification of processes to implement a plan.

Systems Thinking

Systems thinking paradigm originated from systems theories that the whole is more than the sum of the parts and every part has an effect on the whole system's behavior (Argyris & Schon 1988; Gharajedaghi 1999). There have been several schools of systems thinking: Senge's organizational learning (Senge 1990), Checkland's soft systems (Checkland 1981), and Mitroff and Linstone's multiple perspectives (Mitroff and Linstone 1993). The essence of systems thinking is focused attention to dynamic interaction factors of organizational networks (Thurston 2000). The system thinking approach allows managers to visualize a managerial problem as a system of components (structures, entities, events, and factors), and understand how interdependent components (such as social, personal, and technological) impacted each other. Applying systems thinking to management is appropriate as management involves multiple components which are interdependent.

Although there have been research into the cognitive perspective of systems thinking (e.g., (Kim 1993; Eysenck 1993)), few mental models for systems thinking have been developed beyond the traditional psychological theories of short-term memory, long-term memory, and learning and recalling. Nevertheless, a pragmatic approach to instigating systems thinking, so called system language, has been suggested (Eliot 1987; Senge 1996). A system language represents and communicates the complicated interplay among the system components. Apparently, a system language always depends on the knowledge domain.

Higher-Order Thinking Paradigms

We have discussed three general higher-order thinking paradigms: non-discipline-specific non-skill-specific, non-discipline-specific skill-specific, discipline-specific. We emphasize on higher-order thinking paradigms that are specifically pertinent to the business disciplines. Each of these thinking paradigms has its unique aspects of thinking. A comparison of the thinking paradigms is illustrated in Figure 1 and Table 1.

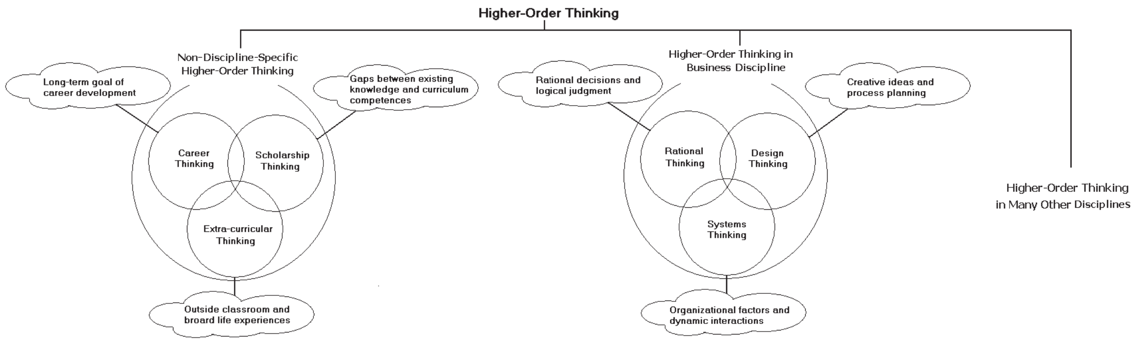

Figure 1. Higher-Order Thinking Paradigms.

Table 1. Examples of Higher-Order Thinking Paradigms.

Types of HOT Paradigms	**Examples of the HOT Paradigm**	**Description of the HOT Paradigm**
Non-Discipline-Specific and Non-Skill-Specific	Career development	Think on personal mission, career selection, and long-term goals.
	Academic accomplishment	Think to plan academic success, and to recognize gaps between the existing knowledge and curricula competences.
	Extra-curricular learning	Think to celebrate broad life experiences, to develop social skills and responsibility.
Non-Discipline-Specific and Skill-Specific	Problem solving	The thinking ability for solving practical problems.
	Self-regulation	The thinking ability to self-monitor and to learn from experiences and mistakes.
	Creativity	The thinking ability to be effortful and creative.
Discipline-Specific (Business)	Rational thinking	Think for rational decision making and judgment (e.g., Finance, Accounting, Management Science, etc.)
	Design thinking	Think to develop a plan of actions to achieve a goal (e.g., product development, IT project, organizational learning, etc.).
	Systems thinking	Think on diversified elements and factors of systems and their interconnected relationships (e.g., Human resource management, strategic alignment, etc.).

Clearly, the cut-lines between the higher-order thinking paradigms can never be sharp. Also, it is not the objective of this paper to identify other less widely discussed types of higher-order thinking. The focal point of this discussion is to gain more understanding about the different modes of higher-order thinking and to investigate how we can teach higher-order thinking in higher education.

Tools for Communicating Higher-Order Thinking in Business Education

People need to communicate higher-order thinking for teaching and learning, discussion, action or decision making, or knowledge developing. Pure natural languages can be used for communicating higher-order thinking, of course; however, natural languages lack a powerful symbolization or visualization capability for a particular discipline and are not effective in many ways. There are many tools that can support communicating higher-order. Here, we discuss tools for fostering higher-order thinking in business education which might also be applicable to other thinking paradigms.

Quantitative Models for Communicating Rational Thinking

A quantitative model is a mathematical expression of the relationships between the concerned factors (or variables) of the real word. A mathematical expression can be represented by symbols or graphics. Commonly used quantitative models in the business area including:

- statistical analysis models (e.g., *t*-test, ANOVA, etc.) and their graphical presentations;
- mathematical equations;
- two-dimensional Cartesian coordinate systems;
- decision trees;
- computational algorithms.

Quantitative models are widely used for rational thinking in many disciplines including business. The process of obtaining quantitative data is central to quantitative models because it provides the fundamental connection between the real world and the mathematical expression.

Flowchart for Communicating Design Thinking

A flowchart is a type of diagram that represents a process, showing the steps as boxes, the conditions (or situations) as diamonds, and their order by connecting them with arrows. Flowcharts are used to articulate design thinking to develop a plan of actions to achieve a goal. There are many styles of flowchart. Figure 2 shows a simple example of flowchart for communicating design thinking.

Strategic Options Development and Analysis (SODA) Map for Communicating Systems Thinking

A special type of map has been developed for strategic options development and analysis (Eden 2004), and is called SODA map. A SODA map is a hierarchical graph, as shown by a simple illustrative example in Figure 3. Factors are linked by one-way arrows. SODA maps are tree style, and there is no loop in SODA maps. This is because loops make the network analysis overly complicated. In the literature, there has been debate on the issue of missing feedbacks in SODA maps. Practically, one can break the loop by changing the descriptions of factors. Positive signs of the connections between factors are often omitted. The factors on the bottom of the SODA map are active factors, called options in SODA, for the concerned problem or issue. The factors on the top of the SODA map are goals or negative outcomes of the concerned problem or issue.

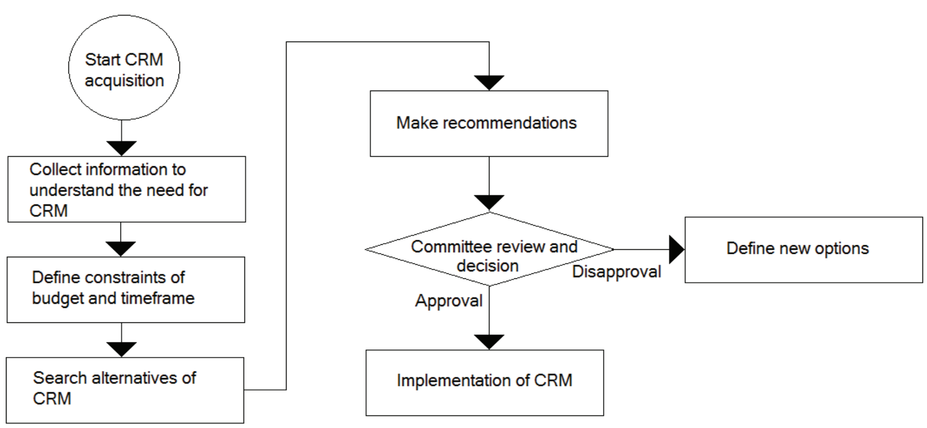

Figure 2. An Example of Flowchart

SODA maps are subjective. However, to express good systems thinking by using SODA maps, one should avoid (a) too few (important) factors; (b) too many (trivial) connections between factors; and (c) a flat shape. The effectiveness of systems thinking through SODA maps is dependent upon the skills of the identification of meaningful factors and substantial causal relationships between the factors for a particular case. A good typical ratio of connections-to-factors is about 1.20.

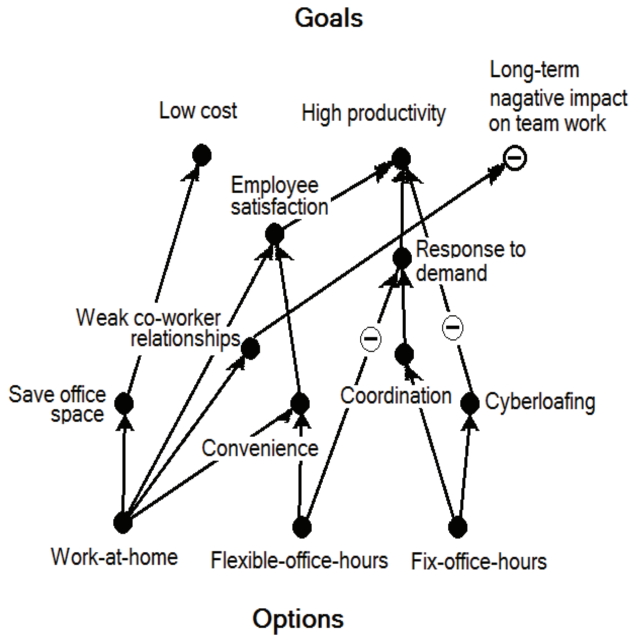

Figure 3. An Example of SODA Map

Joint Analytical Process (JAP)

JAP is a multiple-team-based teaching method. The objective of JAP is to foster higher-order thinking through knowledge sharing. A procedure of JAP includes a series of iteration cycles of knowledge-sharing meetings that engage students to participate in discussion of a business case. The entire class is divided into teams of 3-5 students. The teams could be permanent for the entire JAP procedure, or could be dynamic to reduce the group thinking effects. There are two types of meetings: team meeting and inter-team joint meeting. The instructor is the moderator and coordinates the JAP. The input for a JAP is a business case along with ordinary textbook material, and the output of a JAP include:

(a) a management process plan to solve the problem presented in a business case;
(b) analytical explanation why the concerned business case is successful or failed;
(c) justified recommendations for the concerned business case.

Each iteration cycle has its output which is in turn the input to the next iteration cycle along with the moderator's guidance.

JAP is different from brainstorming in that a JAP session must result in a consensus among the students instead of unconstrained discussion or debating. The foundation of our development of JAP is team learning (Rassuli & Manzer, 2005). The premise of JAP is that the best design of a management process can be reached when all students work together on the case under the supervision and guidance of the instructor. The JAP approach is innovative since the case analysis result becomes a tangible product of knowledge sharing among students. Clearly, in comparison with the traditional case analysis methods such as individual participation and ordinary group case competition, JAP highly underlines design thinking and systems thinking through knowledge sharing.

Summary

This paper introduces the concept of higher-order thinking. It discusses quantitative models, flowchart, SODA map, and JAP for fostering rational thinking, design thinking, and systems thinking. The higher-order thinking approach has been applied in our classes. Our observations have indicated that this teaching and learning approach is useful for students to develop thinking skills.

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