Developing a Creativity and Problem Solving Course In Support of the Information Systems Curriculum

Ben Martz
School of Business and Social Sciences
Business Administration Department
Shepherd University
Shepherdstown, West Virginia

Jim Hughes
College of Informatics
Business Informatics Department
Northern Kentucky University
Highland Heights, Kentucky

Frank Braun
College of Informatics
Business Informatics Department
Northern Kentucky University
Highland Heights, Kentucky

ABSTRACT

This paper looks at and assesses the development and implementation of a problem solving and creativity class for the purpose of providing a basis for a Business Informatics curriculum. The development was fueled by the desire to create a broad based class that 1.) Familiarized students to the underlying concepts of problem solving; 2. Introduced students to problem solving and creativity techniques; and, 3. Could act as a foundational basis for the 2010 AIS Information Systems curriculum (Topi et al., 2010). One student learning goal of the class is to have students be able to describe at least five problem solving methods or activities. Results show students satisfied this short term goal and provide support for a claim of more long term learning. The paper ends with a discussion concerning the potential for integration of problem solving and creativity into a business information systems curriculum.

OVERVIEW

The 21st century workplace needs employees with critical thinking and problem solving skills. (Partnerships for 21st Century Skills, 2008a, 2000b). In fact, 2,115 managers rated "critical thinking" as the second most desirable skill set when it comes to employee development, talent management, and succession planning (AMA 2010). In addition, three out of four of these same managers surveyed in 2010, believed the skill set would become more important 3 to 5 years in the future – targeting 2015.

Isaksen and Akkermans (2011) point out that as the world has changed through innovation and technological progress, the ability to be creative and adapt has become an essential "survival" skill. In this sense, the ability to solve problems is becoming as foundational of a skill as written communication, math skills, and teamwork for employers (Boyer Commission, 1995). As organizations value these characteristics more and more, this valuation creates a new set of requirements for educational programs. At least two studies, "Principles for Good Practice in Undergraduate Education" (Chickering and Gamson, 1987) and "What Research Says About Improving Undergraduate Education" (AAHE, 1996), discuss the problem solving and creativity characteristics as components of a student learning environment. Specifically, these position papers point to characteristics desirable for quality instruction including: more active learning as well as integrating education with experience.

Business programs are not exempt from this change. In fact, the environment in which business schools operate has changed dramatically. Influential stakeholders such as accrediting bodies, employers, and students are generating new stresses on business schools to be more responsive to their needs; some of which are in conflict with each other. In a key 1988 report to the American Assembly of

Collegiate Schools of Business (AACSB) report, Porter and McKibbin (1988) indicated that there was too little emphasis in the following areas: people skills; communication skills; creative problem-solving; the importance of the external environment; the global aspects of business; and business ethics. The results of another study, entitled *Five Years Out*, (Louis, 1990) paralleled those of the AACSB study wherein MBA students felt that their degree had been deficient in some of these same areas. Further, some "visionists" make the case that schools and curriculum actually are "educating [students] out of creativity" work against the factors that foster creativity (TED Conferences, 2006).

The gap between between academia's "espoused theory" and academia's "theory in use" is real. (Trauth, Farwell, & Lee, 1993; Barr and Tagg, 1995; Bailey and Mitchell, 2007; Clinebell and Clinebell, 2008) Essentially, when evaluated, the idea of teaching more real-world business concepts, the "espoused theory" promised, was not being delivered, ("the theory in use") by business schools. Business interviews (Fletcher, 2007), trade publications, (*ComputerWorld* Ouellette, 1998; *Strategy and Business*, Doria et al. 2003), and recent research Barrett and Tolbert (2014) continuously confirm that these concerns for business school educations linger.

Addressing this gap is important. Businesses must get employees with the needed skills and students need to have adequate skills for the employers to rely on. The business world remains an environment where employers explicitly express this desire for employees with well-rounded, broad-based technical skills complemented with soft skills (Bailey and Stefaniak, 2002; Kung, Tang, & Zang, 2006; Martz and Cata, 2008). The business world also explicitly rewards the problem solving skill set. A 2011 Canadian study (Ottawa, 2011) which looked at problem solving and the labor force found that "individuals with high scores in problem solving are more likely to be in the labour force and are even more likely to be employed than persons with low skills."

Many business schools have responded to these complaints and concerns by changing their curricula to provide more active, experiential learning opportunities for their students (Greising, 1989). This trend in business schools toward participatory, collaborative methods of instruction parallels a pervasive trend in higher education. The changes may be in part a reaction to recent reports indicating that students must be actively involved and engaged to facilitate the learning process (Goodsell, Maher, & Tinto, 1992; Johnson, Johnson, & Smith et al, 1991; Light, 1992; Nicastro and Jones, 1994). In turn, instructors are now trying (Argelagos and Pifarre, 2012) and being encouraged to adopt new teaching methods (ALA, 2000; Fulbright, 2014).

Stipulating that creativity and problem solving activities have been identified as desirable characteristics in the workplace by a very broad base of employers across multiple industries, the remainder of this paper presents the results of one attempt to develop a class that helps induce these characteristics and suggests the classes role in foundational core values of business information systems education.

Problem Solving & Creativity

When educators look for core curricular items, mathematics, written communication, verbal communication, teamwork, etc. receive attention as foundational skills. Lately, problem solving and creativity have risen to a higher level of interest as the activities of innovation and entrepreneurship are seen as growing drivers for jobs and careers. Lewis (2009) laments the need for more creativity in the high school curriculum. Couger (1996) argues for more creativity in the college curriculum and corresponding management training courses. Schank (1995) channels 1916 educational reformer, James Dewey, when he argues for more "learn by doing" in the classroom. Clearly, these skills and activities can be seen as highly interdependent. It is this interdependence that supports treating problem solving and creativity as part of the foundational skills necessary for a 21st century curriculum. If a curriculum is to make itself available for this change, there must be a way to expose students to the underlying concepts and usage early in the curriculum.

The stated purpose of the class used in this study was to provide students an introduction to general problem solving and creativity techniques. As a college-level course, this class was to be more than a simple inventory process for learning and parroting techniques. When proposed, its design included lectures, readings, and presentations included to the conceptual underpinnings of creativity and problem solving. Exemplar conceptual models for problem solving such as Churchman's Systems Approach (1968), Kepner Tregoe's Situation Analysis (1965), Adam's Conceptual Blockbusting (2001), deBono's Lateral Thinking (1970), and Jonassen's "structuredness" continuum (2004) were outlined and presented. Classical views of how the mind works and decisions are made such as Minsky's Society of the Mind (1988), Saaty's (2000), Newell and Simon's discussions on thinking (1972), Buzan's Radiant Thinking (1996), and Piaget's (1929) and Papert's observations (1980) on early childhood learning contributed to the background readings and lectures.

Themes and activities in problem solving were also reviewed. For example, the basic steps of gathering facts, sorting facts, and "illumination" provided one such theme (Whiting, 1961). Other authors provided more background on the steps for gathering and sorting facts. Examples abound. Cowan's (1986) clarification and categorization; Polya's (1957) decomposing and recombining operations of the mind; DeBono's (1970) "lumpers and splitters"; Churchman's alternative assessment (1968); Warfield's pi-sigma process (1976); are base examples. The course included discussion of problems (dysfunctions) in problem solving such as those documented by Kahneman, Slovic, & Tversky (1982) and problems with decision making such as GroupThink (Whyte, 1952, Janis, 1972). An attempt was made to have the classroom demonstrate the ideas suggested for a creative environment. Most lectures started with the class working an ice breaker question or problem. (Poundstone 2003, Wuzzles, 2013). These provided the opportunity to have students practice some of the techniques being discussed. Table 1 identifies some of the techniques embedded in the course by review, covered in a lecture or reading on the technique; demonstration (demo), hands-on use of the technique by student in class or homework; or, testing, the explicit request for recall through graded test question or homework.

Table 1
Problem Solving & Creativity Techniques

Technique	Review	Demo	Testing
6 Hats Thinking	x	x	x
Algorithms	x	x	x
Analytical Hierarchy Process	x	x	
Blockbusting	x		
Boundary Examination	x	x	
Brainstorming	x	x	
Bug List	x	x	
Causal Diagrams	x	x	
Crawford Blue Slip	x	x	
Critical Success Factors	x		
Decision Matrix	x	x	
Decision Tree	x	x	x
Duncker Diagrams	x	x	x
Expected Value Table	x	x	
Fishbone Technique	x	x	
Five P's (Blanchard & Peale)	x		
Flowcharting	x	x	x
Force Field Analysis	x	x	
Goal / Wish	x	x	
Interrogatories	x	x	
Kepner-Tregoe Situation Analysis	x	x	x
Lotus Blossom	x	x	
Mind Mapping	x	x	x
Nominal Group Technique	x	x	
PERT /CPM	x	x	x
Problem Reversal	x	x	
Statement Restatement	x		
SOLVE	x	x	x
SWOT	x		
Random Stimulation (Whack on the Side of the Head)	x	x	
Wildest Idea	x	x	
Wishful Thinking	x	x	
Z-Scores	x	x	

Hiam 1990; Couger 1995; Adams 2001; Von Oech 1983; Van deVen & Delbecq 1974; Whiting 1961; Buzan 1996; Rockart 1982; Blanchard & Peale; 1988.

Problem Based Learning

Originating from medical school practices, Problem Based Learning (PBL) has been adjusted and configured to many other areas of education including business (Martz and Shepherd 2005), K-12 education (Hunt, Lockewood-Cooke, & Kelly, 2010; Hmelo-Silver, 2004), and STEM programs (e.g., Cooper & Heaverlo, 2013; Davis, Lockewood-Cooke, & Hunt, 2011; Hunt et al., 2010). Simply, PBL at its core is "…an instructional tool that uses problems as the context for students to acquire knowledge…" Gijselaers (1995). The key components in this technique are the problem and the context; the problem provides the stimulus and the context provides the environment for understanding. Piaget (1929) argued that the learning process and what is learned becomes a collective unit. At the physiological level, Saaty (2000) contends that memory is stored according to meaning. The class activities then become the way for students to assign meaning.

Cognitive researchers believe that the brain may combine related memories into more efficient structures in order to optimize recall and processing. The concept of scripts (Schank and Abelson 1977), schemata (Thorndyke and Hayes-Roth, 1979), templates (Sanderlands, Ashford, & Dutton, 1983), and self-enacting response sequences (Roby 1966) exemplify this area of thinking. Once stored, scientists believe we tap into these structures with thought processing techniques such as analogies and metaphors. Schank (1995) suggests a process called analogical mappings wherein the inquirer asks how the current problem is similar to other problems known by the subject. Couger's (1995) Analogy / Metaphor technique uses analogy as a structured creativity inducing technique. Minsky (1988) reduces the definition of a metaphor to "that which allows us to replace one kind of thought with another." The potential for this strategy has not been lost on real world problem solving groups. 3M's "strategic stories" (Shaw, Brown, & Bromiley, 1998) and Shell Oil Company's (Hiam, 1990) scenario planning methodologies originate from the concept that problem solving groups can learn from analogies.

In Seymour Papert's problem solving world in *Mindstorms*, subjects developed models for problem solving from applying their current skills to the surrounding environment. The subject would then adapt their skills to enhance his or her solutions thereby acquiring new skills. This process of using current skills within a problem environment to develop new skills is what Papert (1980) termed appropriation. For our purposes, a PBL environment must encourage and enable its participants to "appropriate" new knowledge by using their current knowledge and skills.

In summary, Problem Based Learning works by providing the student with an environment in which that student can create and store associated memories and meanings. Ideally, these experiences evolve into behaviors or decision making processes that can be recalled and used when needed. Ultimately, to create an effective Problem Based Learning situation, we are charged with 1.) Introducing tools to students for new skills and techniques 2.) Creating a problem environment whereby the student can appropriate the skills and 3.) Helping students effectively store and retrieve their new appropriated skills.

DATA COLLECTION

The study was planned as part of piloting a new class – Introduction to Problem Solving and Creativity – in the General Education program at Northern Kentucky University. While the home department is Business Informatics, the course was proposed as a generic, freshman level class with no other college-level course prerequisites. No courses were prerequisites. The general idea for this lower level, freshman course had synthesized from the general needs for problem solving techniques and creativity that seemed deficient in students' later coursework. The specific idea of the course was to provide students exposure to problem solving and creativity techniques that could be tools for future use in his or her college career and beyond. The course was proposed in summer 2012; accepted as a pilot course by the University Curriculum Committee; and implemented in Spring 2013.

The course format was two day per week for 75 minutes classes. Three tests, 10 homework assignments and one group presentation were designed into the format. A book, readings, in-class exercises, and PowerPoint presentations represented the materials for the course. The evaluation activities for the course included, three tests, 10 homework assignments, and one group presentation. Twenty students enrolled in the class in January; seventeen completed the course and received a grade in May.

Research Methodology

The methodology undertaken here combines action science (Argyris et al. 1985) with the field and case study approaches (McGrath, Martin, & Kukla, 1984; Eisenhardt, 1989; Yin, 1991). The ultimate goal of this methodology, as with other action inquiry strategies, is to gather data and information for critical reflection (Ellis and Kiely, 2000). According to McGrath (1994), the field study "works within an ongoing natural system as unobtrusively as possible" (p. 157) to observe and gather its information. This compromise method is appropriate for this study because it 1.) Allows the system (class) to operate as it would naturally; 2.) Gathers the data as part of the class; and 3.) Recognizes that the active participation of the researcher may provide unique opportunities for observation and insights.

Instruments

Treffinger, Sleby, and Isaksen (2008) reviewed 50 years of research and development on problem solving tools and processes. Based on that review, they argue that one of the keys to learning creative problem solving starts with the understanding of one's own problem solving style. This idea was incorporated into the assessment of the class by looking for changes in problem solving style that may be attributable to the class. Two problem solving style instruments with extensive supporting research were adopted as pre and post-test measures: CREAX profile (CREAX 2014) and Rowe and Mason's Decision Style Inventory (Rowe & Mason, 1987).

Creativity self-assessment

CREAX is an innovation consulting firm with a worldwide presence. They have developed, and offer for free, a Creativity Self-Assessment questionnaire (CREAX 2014). The web assessment asks participants for some categorization data (age, country, level of schooling, industry, administrative role, years worked) and takes the subject through 40 questions in an effort to ultimately map a personal score compared to others – globally – that have taken the survey. For our purposes, the students in the class were asked to complete the questionnaire and provide their scores as one of three self-assessments in the first class. We asked all students to use the same parameters for qualifications (other), industry (other), and administrative role (other) when filling in the questionnaire to assure comparability. At the end of the semester, the students completed the survey again with the same parameters and provided their scores.

Decision style inventory

The Decision Style Inventory (DSI) was based upon a stream of research by Alan Rowe and Richard Mason (1987). The DSI uses a 20 question, forced-choice questionnaire. Each question has four answers which the subject rates exclusively as an 8, 4, 2, or 1; each rating can be used only once across the four answers to the question. The answers are in columns that when added up create a rating for the subject across four decision making styles; Analytical, Behavioral, Conceptual, and Directive. Each of these styles has a short anecdotal description that summarizes it. The subjects are able to compare their own results with Rowe and Mason's results, collected and compiled from over 2000 people, which provides the basis for their book entitled: *Managing with Style.* Comparing one's results to the averages, the subject can identify his or her dominant decision style and possibly a backup style. Rowe and Mason's work goes much deeper as they work to combine and categorize the decision styles. In the end, no single decision style is declared superior to the others, but the DSI as a whole is used as a means of self-awareness for each student. The DSI assessment was completed by the students at the beginning of the class and again at the end. Any changes in decision style ratings could then be evaluated.

RESULTS

As described above, students were requested to take the CREAX creativity self-assessment both at the beginning and at the end of the course. This web-based profile tool provides a score and radar chart as an attempt to quantify "creativity". Sixteen students took the survey at the beginning of class and 12 took it at the end. CREAX.com publishes the average of all people taking the survey (with the assigned characteristics) as 62.44. For our class, the pre-class average was 57.18 and the post class average was 63.55. The differences imply that the student's creativity profiles increased over the semester from below the average to above the average. Further analysis was available since the students labeled their profiles when they sub-

Table 2
CREAX Results

Pre		Post		Sign.
N	Avg.	N	Avg.	
16	57.176	12	63.559	
POST minus PRE			6.383	0.17138
11 Pairs	58.777	11 Paired	64.580	
			5.81	.005038*
Significant at the .05 level (Paired t-Test)				

TABLE 3
DSI RESULTS

Pre					Post					Sign
N	D	A	C	B	N	D	A	C	B	
16	64.8	80.87	83.40	70.93	11	70.91	87.73	84.55	56.55	
16	145.67		154.33		11	158.64		141.10		
POST minus PRE						6.11	6.86	1.15	-14.38	.345 (1)
						12.97		-13.23		.408 (1)
(1) No significant difference found (Mann-Whitney) on change in Behavioral only or on Conceptual + Behavioral										

mitted. Eleven students completed both the pre-class and post-class questionnaire; their pre-class average was 58.77 and this subgroup's post class average was 64.58, an average increase of 5.81. Interestingly, when a paired t-Test on this subset is calculated, the difference proves significant at the .01 level.

The Decision Style Inventory (DSI) results show that both the directive and analytical styles gained with a marked decrease in the behavioral style when the pre and post averages are compared. These shifts seem a reasonable result if the students did actually learn problem solving and creativity techniques because Rowe and Mason identified the analytical and directive styles as "left brain" or analytical thinking. Further paired analysis was hampered as the instruments were not all consistently labeled by the students.

An end of semester class questionnaire provided additional data for analysis. A preliminary analysis shows a fairly high overall rating for the class structure (4.53) and usefulness (4.29). A high percentage, 70% (12/17) of the students reported using the techniques and ideas from this class in other classes and situations outside of school. Another key data point from the questionnaire is the number of problem solving techniques the students reported "learning about," (11.12) and being "able to apply," (7.53).

Last, a final exam question adds additional data. The question required students to list and to identify 5 techniques and provided bonus points for up to 5 additional techniques. The student learning outcome for the course was met as eighty-eight percent (88%) (15/17) successfully identified five or more techniques for the final. Further analysis showed that six students were able to identify 10 techniques while only 2 students were not able to identify the required 5 techniques.

In the aggregate, the results show that students were able to recall – list and describe – the targeted number of techniques. There are some additional indicators that the learning is more long term and substantial. Independently developed instruments, CREAX and DSI, showed some indication of long term change in creativity or decision making characteristics. Over 70% of the students completing the class reported appropriating and using a technique from the class in other classes or other nonclass situations. While more formal data collection and analysis is necessary, these initial results are promising.

DISCUSSION AND CRITICAL REFLECTION

In the end, we have multiple data points leaning toward a successful class; defined as students learning 5 of more problem solving and creativity techniques. The pre and post measures for the CREAX self-assessment and DSI instruments all point toward improvement in the measure of creativity or decision making style between the beginning and the of the semester. The DSI showed a marked tradeoff for the students toward the analytical side of the measurement. The CREAX self-assessment tool's change was also consistent with the students become "more creative." Interestingly, with a test for those students providing both pre and post assessments (N=11), a significant change in their score can be observed. This result is further supported as most, (88%), of the students met or exceeded the final exam question targeting this student learning outcome specifically. In summary, the results position the course as a viable course in problem solving and creativity (Martz, Hughes, & Braun, under review). The crux of this current discussion is to position the course in support of a business informatics curriculum.

Remembering one stated advantage of the case study methodology deployed here is that the active participation of the researchers may provide unique opportunities for observation and insights, we end this paper with just such a discussion concerning the applicability of this class as supporting, at the core, the AIS 2010 information systems curriculum.

Tying the Course to 2010 IS Curriculum

While this study concentrates its analysis at the course level, the course is positioned to be a foundation for higher level courses. For example, problem solving concepts can be and, based upon the early literature review, should be applied to upper division courses in a business information systems curriculum. In fact, critical thinking and creativity are listed as recommended "high level capabilities" in the 2010 IS Curriculum Guidelines (Topi et al., 2010). Table 4 shows examples of how the problem solving and creativity techniques from Table 1 can map to the seven core courses recommended for an Information Systems curriculum.

This study discusses the development and testing of a problem solving and creativity class which is based on the premises around Problem Based Learning (PBL) and active learning. The course design concentrated on introducing students to techniques for problem solving. The goal was to introduce students to the techniques in such a way that ultimately, he or she could list and identify at least five techniques. In total, the results suggest the active learning design accomplished the goal to better engage students to "appropriate" basic problem solving. In the end, 88% of the students satisfied this goal. In addition, there are indicators of long term learning based upon decision style inventories and creativity indices. As an exploratory field study, this research suggests that the model can provide both explicit and implicit learning of problem solving and creativity techniques (Martz et al., under review). Finally, this paper offers a mapping of the course to the 2010 IS Curriculum core showing how the problem solving techniques within the course can support the suggested curriculum.

Table 4
IS 2010 Curriculum Core Courses
(Topi, et al., 2010)

Core Course	Problem Solving & Creativity Appropriation
Foundations of Information Systems	The broad concepts of Information as a Resource and Systems Thinking taught in the course map well to the underpinnings called for in the guidelines "general model of domain." (Topi, et al. 2010, p22). The more specific techniques enter the picture, in context, as the traditional survey course proceeds through its introduction of systems and development concepts, technology acquisition, types of application software, etc.
Data and Information Management	Algorithms and the fundamental graphical techniques used in flowcharting data and information flows will help prepare students for the conceptual data modeling outlined in the guidelines (p. 40). Many of the techniques such as the Analytical Hierarchy Process will help build the basis for and facilitate the discussion of decision support systems.
Enterprise Architecture	Structured interrogation techniques such as critical success factors or structured interrogatories help students explore key interdependencies and issues during information system implementation with a business perspective. Evaluation techniques such the Kepner-Tregoe situation analysis or goal/wish to identify selection of enterprise solutions.
IT Infrastructure	Many of the problem solving techniques lend themselves to quality assurance and risk management topics. Bug List, Brainstorming, and statement restatement, are techniques that help expose root problems. Decision Trees, expected value tables, and decision matrices, all help structure and quantify the root problems for decision making.
IS Project Management	PERT/CPM, Gantt Charts, z-values, are all key quantitative foundations critical to the topic of project management; the understanding and use of these is fundamental to passing the Project Management Professional (PMP) certification exam. In addition, problem solving and creativity techniques geared to encourage team work such as Nominal Group Technique, Analytical Hierarchy Process, blockbusting, etc. provide students tools to work in teams on class projects.
Systems Analysis and Design	The underlying problem solving premise of decomposing and recomposing to solve a problem is central to the area of requirement definition. Analysis techniques such as the wishful thinking, wildest idea, six hat thinking, provide building blocks for synthesis tools and techniques such as causal diagrams, force field analysis, mind mapping, etc. prepare students to specify the requirements for information systems solutions (p. 51)
IS Strategy, Management, and Acquisition	The high level evaluation techniques (SWOT, SOLVE, CSF, Lotus Blossom, Fishbone, Kepner-Tregoe) that start analyzing problems at high levels and drill down provide a set of tools for critically assessing information systems with varying perspectives. Again the systems approach and the underlying characteristics taught from a problem solving approach can prepare students to provide detailed, thoughtful analysis and synthesis.

REFERENCES

AAHE (1996). "What Research Says About Improving Undergraduate Education," *AAHE Bulletin*, April 1996.

Adams, J. L. (2001). *Conceptual Blockbusting*, Basic Books, 4th ed.

ALA. (2000). Information Literacy Competency Standards for Higher Education, American Library Association, 2000.

AMA (2010). AMA 2010 Critical Skills Survey, http://www.amanet.org/news/AMA-2010-critical-skills-survey.aspx Accessed 2-11-2015.

Argelagós, E. & Pifarré., M. (2012). Improving Information Problem Solving Skills in Secondary Education through embedded instruction**. Computers in Human Behavior, 28(2), 515-526** http://www.sciencedirect.com/science/article/pii/S074756321100241X

Argyris, C, Putman, R. & Smith, D.M. (1985). *Action Science*, Jossey Bass, San Francisco.

Bailey, J. L., & Stefaniak, G. (2002). "Preparing the Information Technology Workforce for the New Millennium." *ACM SIGCPR Computer Personnel*. Vol. 20, pp. 4-15.

Bailey, J., & Mitchell, R. B. (2007). "Industry Perceptions of the Competencies Needed by Computer Programmers: Technical, Business, and Soft Skills." *Journal of Computer Information Systems*, 47 (2), 28-33.

Barr, R. B. & Tagg, J. (1995). "From Teaching to Learning–A New Paradigm for Undergraduate Education," *Change*, Nov/Dec, 13-25, 1995.

Barrett, Robert T. & Tolbert. S.H. (2014). Problem Solving in the Workplace through Application of Business. *Journal of Business and Economics*, USA July 2014, Volume 5, No. 7, pp. 937-944

Blanchard, K. and Peale, N.V. (1988). *The Power of Ethical Management*. pub. Morrow.

Boyer Commission. (1995). Reinventing Undergraduate Education. Available at http://reinventioncenter.colostate.edu/the-boyer-report/

Buzan, T. (1996). *The Mind Map Book*: How to Use radiant Thinking to Maximize Your Brain's Untapped Potential, Plume Publishing.

Chickering, A. W. & Gamson, Z.F. (1987). "Principles for Good Practice in Undergraduate Education," *The Wingspread Journal,* Johnson Foundation, Inc. June, 1987.

Churchman, C. W. (1968). *The Systems Approach*, Delacorte Press, New York.

Clinebell S.K. & Clinebell J.M. (2008). "The tension in business education between academic rigor and real-world relevance: The role of executive professors", *Academy of Management Learning & Education*, Vol. 7, No. 1, pp. 99-107.

Cooper, R. & Heaverlo, C. (2013) "Problem Solving and Creativity and Design," *American Journal of Engineering Education*, Vol. 4, No. 1, pp. 27-38

Couger, J. D. (1996). "Creativity: Important Addition to National Joint Undergraduate I.S. Curriculum," *Journal of Computer Information Systems*, 1996, p.39-41.

Couger, Daniel J. (1995) *Creative Problem Solving and Opportunity Finding,* Boyd & Fraser Publishing, Danvers Massachusetts.

Cowan, D. A. (1986). "Developing a Process Model of Problem Recognition," *Academy of Management Review*, Vol. 11, No. 4.

CREAX 2013. http://csa.creax.com/ accessed June 2, 2013

Davis, F. J., Lockwood-Cooke, P.L., & Hunt, E. M. (2011). Hydrostatic Pressure Project: Linked-class problem-based learning in engineering. *American Journal of Engineering Education*, 2(10), 43-50.

De Bono, E. (1985). *Six Thinking Hats*, Little, Brown, & Company.

De Bono, E. (1970). *Lateral thinking: creativity step by step*. Harper & Row.

Doria, J., Rozanski, H. D., & Cohen, E. (2003) What Business Needs From Business Schools, *Strategy and Business*, Fall 2003, Issue 32.

Eisenhardt, K. M. (1989). "Building Theories from Case Study Research," *Academy of Management Review*, Vol. 14, No. 4, 1989, pp. 532-550.

Ellis, John H. M. and Kiely Julia A. (2000) "Action inquiry strategies: Taking Stock and moving forward," *Journal of Applied Management Studies*, Vol. 9, no 1, pp. 83-94.

Fletcher, G. H. (2007). "An eye on the future", *T H E Journal*, Vol. 34, No. 7.

Fulbright, S. (2014). Three Active Learning Strategies that Push Students Beyond Memorization. Faculty Focus: Higher Ed Teaching Strategies. http://www.facultyfocus.com/articles/effective-teaching-strategies/three-active-learning-strategies-push-students-beyond-memorization/

Gijselars, W. (1995). *Educational Innovation in Economic and Business Administration: The Case for Problem-based Learning*, Dordrecht, NL: Kluwer Academic Publishers, 1995.

Goodsell, A., Maher, M. & V. Tinto (eds). (1992). *Collaborative Learning: A Sourcebook for Higher Education.* State College, PA: National Center on Postsecondary Teaching, Learning, and Assessment.

Greising, D. (1989). "Chicago's B-School Goes Touchy-Feely." *Business Week*, November 27, 1989: 140.

Hiam, A. (1990). *The Vest-Pocket CEO: Decision Making Tools for Executives*, Prentice-Hall, 1990.

Hmelo-Silver, C.E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3), 235-266.

Hunt, E.M., Lockwood-Cooke, P.L., & Kelley, J. (2010). Linked-Class problem-based learning in engineering: Method and evaluation. *American Journal of Engineering Education*, 1(1), 79-88.

Isaksen, S. G., & Akkermans, H. J. (2011). Creative climate: A leadership lever for innovation. *The Journal of Creative Behavior*, 45, 161-187.

Janis, I. L. (1971). "Groupthink". *Psychology Today* 5 (6): 43–46, 74–76, November.

Johnson, D.W., Johnson, R.T. & Smith, K. A. (1991). *Active Learning: Cooperation in the College Classroom.* Edina, MN: Interaction.

Jonassen, D. H. (2004) *Learning to Solve Problems*, San Francisco, CA, Pfeiffer.

Kahneman, D., Knetsch, J. and Thaler, R. (1991). "Anomalies: the endowment effect, loss aversion, and status quo bias", *Journal of Economic Perspectives*, Vol. 5, No. 1, pp.193–206.

Kahneman, D., Slovic, P., and Tversky, A. (1982). *Judgment Under Uncertainty: Heuristics and Biases*, Cambridge Press, 1982.

Kepner, C. H. & Tregoe, B.B. (1965). *The Rational Manager: A Systematic Approach to Problem Solving and Decision-Making.* McGraw-Hill.

Kung, M., Yang, S., and Zhang, Y. (2006). The Changing Information Systems (IS) Curriculum: A Survey of Undergraduate Programs in the United States, *Journal of Education for Business*, July, 2006, pp. 291-300.

Lewis, T. (2009). "Creativity in technology education: providing children with glimpses of their inventive potential". *International Journal of Technical Design Education*, Vol. 19, pp. 255-268.

Light, R. (1992). *The Harvard Assessment Seminars: Second Report*. Cambridge, MA: Harvard University Press, 1992.

Louis, M.R., (1990). "The Gap in Management Education." *Selections: The Magazine of the Graduate Management Admissions Council,* Winter: 1990, pp. 1-12.

Martz, Jr., W.B.& Shepherd, M. (2003). "Testing for the Transfer of Tacit Knowledge," *Decision Sciences Journal of Innovative Education*, Vol.1, No. 1, Spring.2003.

Martz, B. & Cata, T. (2008). Student's Perception of IS Academic Programs, IS Careers, and Outsourcing, *Journal of Education for Business*, pp. 118-125, November/December 2008.

Martz, B., Hughes, J., Braun, F. (2015). Creativity and Problem Solving: Making the Case for Active Learning (under review).

McGrath, J. E., Martin, J. & Kulka, R.A. (1984). *Judgment Calls in Research*, Sage.

McGrath, J. E. (1994). "Methodology Matters: Doing Research in the Behavioral and Social Sciences," *Human-computer Interaction*, Pages 152-169 Morgan Kaufmann Publishers Inc. San Francisco, CA, USA

Minsky, M. (1988). *The Society of the Mind.* Simon and Schuster.

Newell, A. & Simon, H. (1972). *Human Problem Solving,* Englewood Cliffs, Ca. Prentice-Hall Inc.

Nicastro, M. L. & Jones, D.A. (1994). *Cooperative Learning Guide for Marketing Teaching Tips for Marketing Instructors*. Englewood Cliffs, N J: Prentice-Hall.

Osborn, A.F. (1963) *Applied Imagination*, Scribners.

Ottawa (2015). *Education Matters*. Vol 9, No. 1, http://www.statcan.gc.ca/pub/81-004-x/2012001/article/11651-eng.htm

Ouellette, T., (1998). "Boot Camps Drill Tech Business Skills," *ComputerWorld*, March, 1998.

Papert, S. (1980). *MindStorms*, Basic Books, 1980.

Partnership for 21st Century Skills. (2008a). Key findings: Are they really ready to work? Retrieved from http://www.p21.org/storage/documents/key_findings_joint.pdf

Partnership for 21st Century Skills. (2008b). Preparing every child for the 21st century. Retrieved from http://www.cpb.org/stations/reports/PreparingChildren-21stCentury.pdf

Piaget (1929). *The Child's Conception of the World*, New York: Harcourt, Brace & Co, 1929.

Polya, G. (1957). *How to Solve It*, 2nd edition, Princeton University Press.

Porter, L. W. & McKibbin W. (1988). *Management Education: Drift or Thrust into the 21st Century?,* NY: McGraw-Hill, 1988.

Poundstone, W. (2003). *How Would You Move Mount Fuji?* Little, Brown Inc., 2003

Roby, T. B. (1966). "Self-Enacting Response Sequences," *Psychological Reports*, 19, 1966, pp19-31.

Rockart, J. F. (1982). "The Changing Role of Information Systems Executive: A critical Success Factors Perspective," *Sloan Management Review,* Vol. 24, no. 1, 1982.

Rowe, A. & Mason, R.O. (1987). *Managing with Style: A Guide to Understanding, Assessing, and Improving Decision Making*, Jossey Bass Business and Management Series.

Saaty, T. L. (2000). *The Brain: Unraveling the Mystery of How it Works*, RWS Publications, 2000.

Sandelands, L. E, Ashford, S.J. & Dutton, J. E. (1983). "Reconceptualizing the Overjustification Effect: A Template-Matching Approach," *Motivation and Emotion*, Vol. 7, No. 3, 1983

Schank, R. & Abelson, R. (1977). *Scripts, Plans, Goals and Understanding,* Lawrence Erlbaum Associates, 1977.

Schank, R. C. (1995) *What We Learn When We Learn by Doing.* (Technical Report No. 60). Northwestern University, Institute for Learning Sciences. Accessed at http://cogprints.org/637/1/LearnbyDoing_Schank.html

Shaw, G., Brown, R. & Bromiley, P. (1998). "Strategic Stories: How 3M is Rewriting Business Planning." *Harvard Business Review*, May-June, 1998, Reprint no. 98310

TED Conferences, LLC. (2006). *Ken Robinson says schools kill creativity*. Retrieved from http://www.ted.com/talks/ken_robinson_says_schools_kill_creativity.html.

Thorndyke, P. & Hayes-Roth, B. (1979). "The Use of Schemata in the Acquisition and Transfer of Knowledge," *Cognitive Psychology*, Vol. 11, 1979, pp82-106.

Topi, H., Valacich, J.S., Wright, R.T., Kaiser, K., Nunamaker, Jr., J.F., Sipior, J.C., & de Vreede, G. (2010). "IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems," *Communications of the Association for Information Systems*: Vol. 26, Article 18. Available at: http://aisel.aisnet.org/cais/vol26/iss1/18

Trauth, E.M., Farwell, D. and Lee, D., (1993). "The IS Expectation Gap: Industry Expectations versus Academic Preparation," *MIS Quarterly*, Volume 17, Number 3 (September), 1993: 293-307.

Treffinger, D. J., Selby, E. & Isaksen, S. (2008). "Understanding individual problem-solving Style: A key to learning and applying creative problem solving," *Learning and Individual Difference* – Special Issue on Creativity, Vol. 18, Iss. 4, pp. 390-401.

Van de Ven A. H & Delbecq A. L., (1974). "The Effectiveness of Nominal, Delphi, and Interacting Group Decision Making Processes", *The Academy of Management Journal*, Vol. 17, No. 4 (Dec., 1974), pp. 605-621.

Von Oech, R. (1983). *A Whack on the Side of the Head: How You Can Be More Creative*

Warfield, J. N. (1976). *Societal Systems*, John Wiley & Sons.

Whiting, C. (1961). *Creative Thinking*, Reinhold Press.

Whyte, Jr., W. H. (March 1952). "Groupthink". *Fortune*. pp. 114–117, 142, 146.

Wuzzles (2013). http://www.trademarks411.com/marks/73493270-wuzzles accessed 11-11-2014.

Yin, R. K. (1991). *Case Study Research: Design and Methods*. Sage Publications, Newbury Park, 1991.