BRIDGING THE IS EXPECTATION GAP: COGNITIVE LEARNING STYLES AND THE IS 2002 CURRICULUM

Tonjia Kenner Coverdale, Morgan State University, tkenner@dsc.edu
Jigish S. Zaveri, Morgan State University, jzaveri@morgan.edu

ABSTRACT

In the face of rapidly changing information technologies and increasing pressure from the Information Systems (IS) industry, IS programs are faced with the challenge of educating their graduates and providing them with the foundational skills necessary for their success as IS professionals. This manuscript proposes a micro-level cause for the IS academic-practitioner expectation gap: the relationship between teaching strategies used in the IS classroom and the individual cognitive styles of IS students.

Keywords: IS curriculum, academic-practitioner expectation gap, teaching strategies, learning styles, cognitive styles

INTRODUCTION

Information Systems (IS) practitioners have frequently criticized the professional readiness of graduates emerging from IS academic programs (18). As a result, the responsiveness of the collegiate IS curriculum to the continuously changing IS environment has been a major concern for both academics and practitioners. In the past, practitioners have faulted IS educators for teaching information technologies that are obsolete or irrelevant for current business usage. Likewise, IS educators have complained of the inadequate input from practitioners in designing the IS curriculum. As a result of these differences, there exists an 'expectation gap' between the IS curriculum and the requirements of the industry.

In order to address these concerns, professional organizations such as the Association for Computing Machinery (ACM), Association for Information Systems (AIS), and the Association of Information Technology Professionals (AITP) which has members from both academia and the industry, have collaborated to design model curricula and guidelines for IS programs. Despite the collaboration between IS academics and professionals in designing the content of IS programs, the expectation gap between industry expectation and academic preparation remains.

One possible cause for the pervasiveness of the IS expectation gap may be the teaching strategies that are employed by IS educators. Research conducted in cognitive psychology suggests that learning is a product of the agreement between teaching strategies and the individual differences among learners (7). That is, individuals are more apt to learn when teaching strategies used are compatible with their individual differences, which influence learning. Teaching IS students using strategies that create a favorable learning environment may enhance their learning experiences and promote long-term retention of the concepts presented in the classroom. This, in turn, contributes to increased concept recall and application as an IS professional.

LEARNING AND LEARNING STYLES

Learning is the relatively permanent change in behavior resulting from reinforced practice (10). The process of learning involves remembering and skillful performance based on studying, which is the cycle of information input and encoding. With adequate learning, the information that was previously encoded can be retrieved when needed.

Learning theorists recognize that there are individual differences in learning (10). The term 'learning style' is used in the examination and understanding of these individual learning differences. One dimension of learning styles is cognitive learning styles, which are information-processing habits that represent the learner's typical mode of perceiving, thinking, problem solving, remembering, and relating to others. In the classroom setting, the cognitive learning style dimension is directly affected by the teaching strategies employed and their interactions with an individual's cognitive control, which are a precursor to learning course information.

COGNITIVE CONTROL THEORY

Cognitive controls are the psychoanalytic entities that regulate an individual's perception and information processing techniques (14). Cognitive controls are concerned with the manner and form of learning and interact with an individual's cognitive style to influence the degree of learning. Cognitive controls are generally described through the continuum between field dependence and field independence (FD/I). FD/I describe the extent of an individual's analytical perception and the degree to which an individual's perception of items is dominated by the surrounding framework.

Casteneda and Gray (5) proposed the term field sensitive in substitution for field dependence, which can possibly have a negative connotation. The field sensitive mode is characterized by an individual's inability to separate parts from the whole. Field sensitive students tend to be global in their views, excel at verbal tasks, react better to academic material that relates to personal experiences, and perform in accordance with an authority figure's indications of confidence or doubt in their abilities (1, 5, 11). Field sensitive students also prefer to work in social networks and they tend to learn better in social contexts (15). Field sensitive students tend to see the entire picture and relate it to their experiences in order to create an understanding of the information. Since field sensitive students prefer a full understanding of the whole before discussing its parts, field sensitive learning can be considered as deductive in nature.

Conversely, field independence is characterized by an individual's ability to perceive items as separate from the background (3, 5). Field independent students tend to view parts of the whole, excel in analytic tasks, are more receptive to material that is inanimate and impersonal, and tend to be self-directed (1, 5, 11). Also, field independent students prefer to work independently and are object and task oriented. Field independent students are more able to select the important information from its surroundings and are not affected by external cues (14). Since field-independent students reorganize and restructure small parts of the "big picture" to create their own meanings and understanding of the presented information, field independent learning can be seen as inductive in nature.

COGNITIVE STYLE THEORY

Individuals differ in their interactions with the environment, extraction and perception of information received from the environment, and the organization of the knowledge that has been acquired. Cognitive styles, derived from cognitive controls, are psychological dimensions that represent individuals' consistencies in information processing (2, 14).

The visual/haptic cognitive style dimension describes individual preferences for visual or tactile information processing. The visualizer/verbalizer cognitive style describes the preference of processing information using visual or verbal techniques. The leveling/sharpening cognitive style dimension describes how individuals perceive and memorize images. The serialist/holist cognitive style describes the way that learners select and represent information. The analytic/relational cognitive style influences the strategy that individuals use in sorting objects and forming concepts while learning. Table 1 lists the relationships between cognitive controls and the cognitive styles.

Cognitive Styles	**Cognitive Controls**	
	Field Dependent	***Field Independent***
Visual/Haptic	Haptic	Visual
Visualizer/Verbalizer	Visualizer	Verbalizer
Leveling/Sharpening	Leveling	Sharpening
Serialist/Holist	Holist	Serialist
Analytical/Relational	Relational	Analytical

Table 1: Cognitive Controls and Cognitive Styles

IMPLICATIONS FOR IS PROGRAMS

In practice, educational institutions are not designed to consider the range of the FD/I cognitive controls and their cognitive styles. In fact, research suggests that American schools and universities operate almost exclusively towards a field independent style. Cohen (6) states that schools are extremely analytic and those students who are analytic in nature have an advantage over students who are more relational in their learning approaches. The prevalence of the field independent style is demonstrated in educational institutions' emphasis on individualism, control, rigidity, limited affective expression, task orientation, and superiority (1, 12, 17). This tendency toward field independence is also demonstrated with the widespread use of the lecture method as a teaching strategy.

The lecture method, with its dictation style of information delivery, encourages students to memorize the presented material, which can have implications for the long-term retention, retrieval, and application of the information. Also, since the lecture method is passive, where students listen to the instructor with minimal interaction among themselves and with the instructor, it tends to be more effective and favorable for students with serialist and verbalizer cognitive styles (8). This incompatibility, albeit inadvertently, places many students in a disadvantaged learning position.

As a result of using the lecture method, cognitive differences are not widely accommodated. This conflict between teaching strategies and learning styles is significant, especially since research has shown that students find greater motivation and perform at higher levels when instructional methods compliment student learning styles and instructional methods that match an individual's cognitive learning style have been found to be most effective in creating an ideal learning experience, which is a precursor to subsequent performance (4, 19).

It is imperative that IS educators consider the range of cognitive styles that are present in the classroom and design an instructional portfolio that employs a diverse array of teaching strategies. In essence, students who are accommodated through the use of alternative teaching strategies are empowered to reach a higher level of learning and understanding of the material. Through the effective demonstration by IS graduates of the critical skills and knowledge required by IS practitioners, the IS academic-practitioner expectation gap can be bridged.

IS 2002 CURRICULUM

The *IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems* is the most recent design for a model curriculum in IS. It is the second collaborative curriculum design effort by ACM, AIS, and AITP. One of the key principles guiding the design of IS 2002 is the desire for the curriculum to be designed to help IS faculty produce competent and confident entry level graduates that are well suited for the IS workplace and its responsibilities.

The Information Systems Theory and Practice (IS 2002.3) course is intended to provide an understanding of organizational systems, the planning and decision process, and how information is used for decision support in organizations (9). This course presents the basic concepts for use in subsequent courses: the systems point of view, the organization and development of a system, information flows, the nature of information systems, and basic techniques for representing systems structure.

IS 2002.3 was chosen as an example to demonstrate the use of diverse teaching strategies in the IS classroom for its foundational nature and breadth of coverage, covering both managerial and technical topics and concepts. The core topics that are covered in this course ultimately serve as a basis for the concepts used by IS graduates in their professional capacities. A strong foundation created in this course is likely to lead to increased understanding and synthesis of specialized topics presented in later courses. Therefore, this course and the topics within it play an important role in their academic preparation.

AN INTEGRATED FRAMEWORK: TEACHING STRATEGIES FOR IS 2002 LEARNING UNIT GOALS AND COGNITIVE STYLES

Using the learning unit goals of IS 2002.3 as a basis, the following integrated framework suggests alternative teaching strategies and tools that correspond to the learning objectives for the course to benefit students with characteristics of each cognitive control.

	Cognitive Controls	
Learning Unit Goal	**Field Dependent**	**Field Independent**
To introduce, discuss, and describe fundamental concepts of IS theory and its importance to practitioners	• Chart/Outline • Slide presentation of concepts • Anecdotal example	• Reading assignment • Vocabulary definition assignment • Verbal presentation
To show how an information system is a strategic and integral component of an organization	• Diagram of IS within organizational context • Narrative description	• Concept outline • List of advantages of using an IS • Detailed presentation of concepts
To discuss how an information system is developed and managed within an organization	• Peer-mediated discussion • Case study analysis/presentation • Process flow-chart	• Detailed lecture • Student search for further information • Textual outline
To present and discuss the relevance of the cognitive process and human interactions in information system design and implementation	• Role-playing • Instructor-mediated discussion • Reflective journal writing of personal interactions with computers	• Definitions of concepts • Instructor-centered discussion • Categorization of processes and interactions
To discuss how individuals make decisions and set and achieve goals	• Open-ended discussion • List containing student and instructor suggestions	• Detailed slide presentation • Matched examples/non-examples • Reflective problem-solving
To discuss the Simon Model of organizational decision making and its support by IS	• Pictorial representation of model • Outline of general points relating to the model	• List of model components and details of each • Procedural approach to lecture
To introduce systems theory, quality, and organizational modeling and demonstrate their relevance to information systems	• Summary/conceptual overview • Relate the new information to previous topics – concept mapping	• Detailed lecture • Verbal presentation • Textual outline
To discuss a systems based role for management, users, and designers	• Open-ended discussion relative to case example • Graphic of role definitions and interaction between roles	• Outline of role definitions and related tasks • Lecture focused on micro-level role related tasks
To explain physical systems and work flow and how information systems relate to organizational systems	• Process-flow diagram • Synthesis of prior IS concepts and concepts from core business classes	• Sequential presentation of work flow process • Reading comprehension exercise
To present other organizational models and their relevance to IS	• Pictorial representation of models • Developmental problem solving	• Deductive sequencing of lecture • Comparison/contrast activity
To discuss the relationship of IS planning to organizational planning	• Story line, narrative description • Instructor-mediated discussion	• Verbal presentation • Detailed slide presentation
To demonstrate specific classes of application systems including TPS and DSS	• Image of organizational levels and related application systems classes • Outline of systems within each class	• List of systems within each class • Analysis of each system relative to their role within the organization
To discuss and examine the process, standards, and policies for development of information systems	• Slide presentation of major concepts • Prototypic example • Problem solving exercise	• Outline with detailed explanations • Flowchart • Categorization of topics
To discuss outsourcing and alternate implementations of the IS function	• Open-ended discussion • Peer-mediated discussion	• Definition of conceptual terms • Detailed description of alternatives
To discuss performance evaluation consistent with quality management and continuous improvement	• Conceptual overview • Embedded questions throughout instruction	• Individual evaluation of implications • Student search for external related information
To introduce the societal implications of IS and related ethical issues	• Structured experience group exercise • Peer-mediated group discussion • Instructor-mediated discussion	• Outline of major implications • Individual analysis of key ideas • Verbal lecture presentation
To discuss and explain ethical and legal principles and issues	• Instructor-mediated discussion • Group case study analysis/presentation	• Individual case study analysis • Research project relating to ethics and legal issues in IS
To investigate issues relative to managing the information systems function	• Group project analyzing real-world situation • Open-ended discussion	• Individual analysis of related ideas • Outline of major issues • Deductive sequencing of lecture

Table 2: Integrated Framework: Teaching Strategies for IS 2002.3 Learning Unit Goals and Field Dependent/Field Independent Cognitive Controls

The proposed integrated framework can be used as a reference by IS educators to design teaching strategies that would be of maximum benefit to their students. This framework presents several teaching strategies for each learning objective. Hence, in addition to the traditional lecture method, IS educators can use other teaching strategies that are compatible with the various cognitive styles of their students. This will ease the cognitive disadvantage faced by students whose cognitive styles are incompatible with the primary lecture pedagogy. As a consequence, academia may be able to train students that are better equipped to meet the expectations of IT practitioners.

CONCLUDING REMARKS

In IS literature, there are a limited number of studies that have been conducted to explore the relationships between teaching strategies, the cognitive styles of IS graduates, and their success as entry-level IS professionals. To facilitate further studies, ideas and concepts in the fields of education and social psychology can provide theoretical support.

This manuscript also has implications for future research relating to distance learning. At first glance, it may seem that distance learning as a course delivery option presents more pedagogical options to accommodate the range of cognitive styles. However, with distance learning, there are pedagogical implications such as lack of personal interaction and the roles of self-direction, self-motivation, and personal discipline in student success, which may affect students with a field dependent nature.

The IS academic-practitioner expectation gap is at the forefront of the concerns of IS educators, IS program administrators, and IS practitioners. Although model curricula have been designed by academics and practitioners for the standardization of IS programs, there is still an imbalance between practitioner expectation and the quality of the IS graduate. This manuscript aimed to present a different perspective on the nature of the expectation gap with the hopes of introducing individual student differences as a micro-level issue to be considered in course and curriculum design. Hopefully, this manuscript is a starting point in the quest to bridge the gap by helping IS educators prepare graduates to succeed as IS professionals.

REFERENCES

1. Anderson, J.A. (1988). Cognitive styles and multicultural populations, Journal of Teacher Education, 39, 2-9.
2. Ausburn, L.J. & Ausburn, F.B. (1978). Cognitive styles: some information and implications for instructional design, Educational Communications and Technology Journal, 26, 337-354.
3. Bennett, C.I. (1986). Comprehensive multicultural education: theory and practice. Boston, MA: Allyn and Bacon.
4. Bovy, R.C. (1981). Successful instructional methods: A cognitive information processing approach. Educational Communications and Technology Journal, 29, 203-217.

5. Casteneda, A. & Gray, T. (1974). Bicognitive processes in multicultural education, Education Leadership, 32, 203-207.
6. Cohen, R.A. (1969). Conceptual styles, culture conflict, and nonverbal tests of intelligence, American Anthropologist, 71, 826-828.
7. Corno, L. & Snow, R.E. (1986). Adapting teaching to individual differences among learners. In M.C. Wittrock (Ed.), Handbook of research on teaching, 3rd ed. New York, NY: Macmillan.
8. Farquharson, A. (1995). Teaching in practice. San Francisco, CA: Jossey-Bass.
9. Gorgone, J.T., Davis, G.B., Valacich, J.S., Topi, H., Feinstein, D.L., Longenecker, Jr., H.E. (2002). IS 2002: Model curriculum and guidelines for undergraduate degree programs in information systems, ACM, New York, NY and AITP, Park Ridge, IL.
10. Hergenhahn, B.R. & Olson, M (1993). An introduction to theories of learning. Englewood Cliffs, NJ: Prentice Hall.
11. Hernandez, H. (1989). Multicultural education: A teacher's guide to content and process. Columbus, OH: Merrill.
12. Hilliard, A.G. III (1976). Alternatives of IQ testing: An approach to the identification of gifted minority children (Final report). San Francisco, CA: San Francisco State University.
13. Hilliard, A.G. III (1989). Teachers and cultural styles in a pluralistic society. NEA Today. 65-69.
14. Jonassen, D.H. & Grabowski, B.L. (1993). Handbook of Individual Differences, Learning, & Instruction. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
15. Neville, H.A. & Cha-jua, S.K. (1998). Kufundisha: Toward a pedagogy of black studies, Journal of Black Studies, 28(4), 447-471.
16. Shade, B.J. (1989). The influence of perceptual development on cognitive style: cross ethnic comparisons. Early Child Development and Care, 51, 137-155.
17. Sue, S.W. & Sue, D. (1990). Counseling the culturally different: theory and practice, 2nd ed. New York, NY: John Wiley & Sons.
18. Trauth, E.M., Farwell, D.W., & Lee, D. (1993). The IS expectation gap: industry expectation versus academic preparation. MIS Quarterly, 17(3), 293-307.
19. Vasquez, J.A. & Wainstein, N. (1990). Instructional responsibilities of college teachers to minority students, Journal of Negro Education, 59, 599-610.
20. Vasquez, J.A. (1991). Cognitive style and academic achievement. In J. Lynch, C. Modgil, & S. Modgil (Eds.) Cultural Diversity and the Schools: Consensus and Controversy. London: Falconer Press.