Reaching AIS Students With Diverse Cognitive Styles: A Flowcharting Project As An Example

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Abstract

The cognitive styles literature suggests that there may be a variety of preferred cognitive styles among students. These differences in information gathering and processing styles may be related to differences in learning preferences, as well as how students approach decision making. Focusing on one cognitive model – Raudsepp – this paper suggests that educational effectiveness may be improved through enhancing students' awareness of their own problem solving styles. Also suggested is that broadening the types of learning activities across the various styles may enhance student learning. A flowcharting project is used as an example that illustrates implications for teaching AIS.

Introduction

As the world has become increasingly defined in recent years by information technology, global interactions, and rapidly changing environments, leading employers of accounting majors have been calling for differently abled graduates. They still say they want students deeply competent in technical accounting subjects. In addition, they want graduates skilled in research, critical thinking, teamwork, and communication, along with having a firm working knowledge of general business practices. Traditional approaches to higher education, such as those which focus on routine problem solving, thus may be not optimal. Yet a further complication is encountered if one considers differences in students' cognitive styles.

At the most fundamental level are differ-

ences in the brain functions (often referred to in the popular media as “left” versus “right” brainedness) involved in information gathering and processing. Some theorists argue that these basic brain functions are overlaid by cultural values and attitudes [E.g., Lumsdaine, M. & Lumsdaine, E. (1995)]. One way to relate these items is to think of them as an avocado. Attitudes represent the avocado's peel, the layer most evident when dealing with an individual. This outermost layer includes management style, for example. Attitudes are relatively changeable, as suggested by the large number of self help books devoted to this subject.

At the deeper level beneath the peel is the flesh of the avocado, in this model representing cultural values. These are believed by some commentators to be deeply influenced by early family interactions, and thus relatively fixed aspects [Id.]. Hofstede (1991) refers to this as the

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“software” of the mind. Finally, at the deepest level, is the “hardware of the mind”— such as “left” or “right” brain dominance. (In the avocado model, this is the pit, the highly fixed core of the individual.)

The “avocado model” approach has been operationalized in a number of cognitive models, including a simplified version of the Myers Briggs Type Indicator (MBTI), Kolb’s Experiential Learning Model (ELM), and the Herrmann Brain Dominance Model (HBDM). Each of these models attempts to characterize brain functions using four different types, styles, or quadrants. These elements can be used as a basis for describing four different problem solving patterns based on differences in how individuals gather and process information. The model used in this paper [Raudsepp, 1992] determines preferences in four fundamentally different means of gathering and processing information: A=analytical, B=procedural, C=interpersonal, and D=conceptual.

Research [Hulme, 1999; Baker, et al., 1987] suggests that accounting students can have very diverse problem solving styles, along with various preferred learning styles inferred from their problem solving preferences. If so, it may be possible to enhance teaching effectiveness by using a wide variety assignments in order to better match students’ various preferred learning styles, at least a portion of the time [Taschetta, J.J. & Achor, J.R. (1990)]. This approach leads to a broader range of activities than the procedural, preparation activities typical of traditional accounting courses. For example, the more comprehensive approach includes collaborative learning activities that allow consideration of more complex unstructured problems, as well as development of a meaningful interpretation of accounting information for a non-accounting decision making audience.

More importantly, this varied approach to designing coursework may lead to graduates who have developed the enhanced abilities being de-

manded by employers. Students may develop greater skills in research, critical thinking, teamwork, and communication because they have practiced using these skills in the classroom. Similarly, this more comprehensive teaching approach may lead to graduates with greater working knowledge of general business practices because they need more of that knowledge to deal with less structured assignments.

Although employers may be getting more of what they say they want, accounting students may not be inclined to appreciate a more comprehensive teaching style. Raudsepp data on business majors at the introductory level [Hulme, 1999] indicates that accounting majors may prefer the **procedural** quadrant of the model. Applying this thinking pattern to the best match of teaching with learning styles suggests that accounting majors may prefer assignments in which they are to determine the “right” answer to a highly structured problem. This preference may not hold for accounting graduates, however, particularly those drawn to AIS (Accounting Information Systems). In any event, the data also indicate that even at the introductory level accounting majors do have a diversity of cognitive styles [Id.]

The remainder of this paper is organized as follows. First is a discussion of the accounting literature focusing on education change and the application of the problem solving styles model to educational design. Second is a detailed discussion of the problem solving styles model. Third is a discussion of the educational implications of such research, in particular a sample project for use in AIS courses to reach differently inclined students. Fourth are observations from the use of such a project in an introductory AIS course.

Literature Review

The purpose of this section is to review the literature dealing with certain accounting education change efforts. In 1986, U. S. accounting

educators, in the Bedford Committee Report [AAA, 1986], recommend that accounting education should change the emphasis in accounting courses to include the interpretation of accounting information as well as the traditional emphasis on the information preparation functions. In discussing pedagogy, the report promotes greater use of active-learning methods because the traditional lecture method coupled with the solving of well-structured problems is "inadequate, primarily because [such methods] are not conducive to creative thinking" [AAA, 1986, p. 177]. Further, in discussing general education, they specifically mention exposing students to "international and multicultural experiences" [AAA, 1986, p. 181]. Practitioners responded in the "White Paper" [Kullberg, et al., 1989], issued by a consortium of the Big 5 international CPA firms, with similar calls for broadening the skills developed in accounting students. Specifically mentioned were skills in communication, creative problem solving, dealing with unfocused facts, interpersonal relations, and international issues.

The Big 5 firms then funded the Accounting Education Change Commission (AECC). Its Statement No. One, *Objectives of Education for Accounting* [AECC, 1990, p. 2], repeated the call for educators to develop students "ability to identify and solve unstructured problems in unfamiliar settings" mentioned in the White Paper and further states that the "focus should be on developing analytical and conceptual thinking not on memorizing professional standards."

Despite these calls for reform, the emphasis in many accounting courses may still be on the procedural aspects of accounting for economic transactions [Pincus, K.V. (1995)]. Many students in this environment may not comprehend the basic structure of business transactions. A consequence of this emphasis is that the typical traditional course becomes very procedural and rule based with an undue emphasis on calculating the right answer [Wolcott, S.K. & Lynch, C.L. (1997)]. This traditional educational approach

was reasonably well suited to the pre-1980s accounting work environment where the accountants' job was to record accounting transactions by hand and success was measured by getting the numbers right. But with the widespread use of computers in business the procedural aspects of accounting have been automated. Pincus [1995, p. 91] addresses these changes and points out that future "accountants [will be] valued more for their ability to create new kinds of information and to interpret information for use by nonaccountants than for their ability to 'crunch the numbers'."

One study [Hulme, 1998] describes a course design that addresses many of the U.S. accounting education change concerns in terms of a whole brain model. Recall that Raudsepp's Problem Solving Styles model determines preferences in four different ways of gathering and processing information: A=analytical, B=procedural, C=interpersonal, and D=conceptual. This study proposes students with different whole brain preferences can be better taught by expanding the activities used in accounting classes. For example, writing and computer activities may be preferred by students with a Quadrant A preference. The lecture/problem solving activities typical of most traditional accounting classes might have greater appeal to Quadrant B students. Group discussions and presentations are anticipated to be preferred by Quadrant C students, and case analysis and discussions using the Socratic approach may have greater appeal for Quadrant D students. Such a broadened group of activities also may lead to students trained to interpret the meaning of accounting information as opposed to just preparing the numbers that go into financial statements, who are better able to deal with unstructured problems, incomplete information, and an uncertain ill-defined business environment.

The Raudsepp Model

Most cognitive models, such as Kolb's Learning Style Inventory, the simplified version

of Myers-Briggs Type Indicator, and the Herrmann Brain Dominance Model, prove expensive to administer, and often require specialized training to interpret [Stout, D.E. & Ruble, T.L. (1994)]. A cognitive model that can provide an inexpensive and readily accessible basis for accounting education research is the Raudsepp Problem Solving Styles Inventory [Raudsepp, 1992]. (A Raudsepp instrument can be viewed at www.csupomona.edu/~jekarayan/brain/brain.)

The Raudsepp model begins with the now popular notion of complementary brain hemispheres, where the left hemisphere is characterized by a tendency to concentrate on facts and details and the right hemisphere seeks and constructs patterns and uses a “big picture” or holistic information gathering style. In addition to this left-right dichotomy, individuals are modeled as processing information using either a “new brain” thinking mode, by applying logic and a step-by-step approach, or a “mature brain” experiential (experimental) mode, (a more active approach) where individuals attempt to solve problems using instinctual methods or prior experience.

The foundation for the second processing dimension is found in MacLean’s Triune Brain model [MacLean, 1990], which shows that the neocortex (the uniquely human brain) evolved on top of a more primitive mammalian brain that still exists in humans today. Words describing the new brain activities are: logic, objectivity, precision, analysis, and technology. This is in contrast with mature brain activities that rely on skills such as motivation, dealing with people, innovation, memory, and understanding the big picture. The new brain works much like a computer and is able to solve very complex problems, but, like a computer, it must be programmed to understand all of the steps necessary to get to the solution. However, when something sidetracks the new brain, such as conflicting factors (or, more generally, the need to look at problems in new innovative ways), one must

be able to tap into the mature brain to access these skills.

In the Raudsepp model the preferred quadrant indicates a propensity to use a certain pattern in preference to others. In this regard the preference is something like handedness. Data from the whole-brain model can be used by students to obtain insights into their preferences. This can help them understand in what learning situations they will be the most comfortable. Beyond that, such information can be used to point to where students and faculty need to devote attention if the objective is to develop a more balanced profile.

Educational Implications

Each of the four quadrants of the whole-brain model is thought to have a related preference for specific learning activities. At the simplest level, is left-brained learning, taught through lectures and textbooks. Contrasted to this is right-brained learning, which allows time for reflection, idea synthesis, visualization, and insight. Expanding the four quadrants of the model produces the preferred learning activities shown in the Table appended to this paper. Whether or not one chooses to use the whole brain model in designing classes, the use of a broader variety of activities may very well lead to greater learning and understanding. While a majority of business students are left-brained (quadrants A and B), a significant minority of students in the introductory accounting course will have right-brain (quadrant C and D) information gathering and processing preferences [Hulme, 1998].

In addition to faculty making a broader choice of activities in teaching accounting, using the whole-brain approach can lead to several other benefits. First, providing a range of activities allows each student to feel comfortable with some of what is happening in the course. Second, students are using and developing *all quadrants*. In fact, one educational goal in using the

model is to work toward a balanced pattern rather than to concentrate on a single dominant quadrant. Third, greater use of group discussion makes students more sensitive to others' points of view and their own uniqueness, leading to a more diversified learning environment. Fourth, if one believes that the typical college student can focus on a task for only about 30 minutes before losing concentration, by altering the class activities an instructor is helping the students to maintain their interest. Finally, allowing instructors to experiment with teaching methods outside of their own comfort zone may make them more effective teachers. To summarize the educational implications of the whole brain model, one may be able to more effectively teach students with different whole brain preferences if a more balanced group of activities is included in coursework.

An AIS Application: A Flowcharting Project

A flowcharting project may be a good way to implement these ideas in an AIS class. To review, the four learning styles which can be developed from the Raudsepp Model can be labeled as follows: A=analytical, B=procedural, C=collaborative, and D=conceptual. Students with a Quadrant A preference may find assignments focusing on writing and computer activi-

ties more to their liking. The lecture/problem solving approach may be most appealing to Quadrant B students. Group discussions and group presentations are anticipated to be preferred by Quadrant C students, and case analysis and discussions using the Socratic approach are likely to have greater appeal for Quadrant D students. AIS classes can present the opportunity to offer projects and assignments that embody all four quadrants.

A good example of an AIS project illustrating the "multi-quadrant" approach to teaching is the construction of flowcharts using flowcharting software. In this assignment, students use off the shelf software to draw flowcharts (both document and system) from case narratives. Note that the use of case analysis encourages Type D thinking. It is also suggested that, before the project is started, students be offered a workshop class session in which they learn the rules and techniques of designing a well drawn flowchart. The rules presented, and the workshop format, should appeal to the Quadrant B student.

At the end of this session, the students can be given the flowchart assignment. This can be done simply by passing out hard copy, which seems to appeal to Type B students. However,

Table:
Preferred Learning Activities for Whole-Brain Quadrants

<p>A</p> <ul style="list-style-type: none"> Collecting data Organizing information Reading textbooks Studying problems and solutions Writing a critical review 	<p>D</p> <ul style="list-style-type: none"> Looking for the big picture Asking "what-if" questions Doing problems with many "right" answers Leading brainstorming sessions Thinking about hidden possibilities
<p>B</p> <ul style="list-style-type: none"> Making lists Doing detailed homework Following directions Listening to detailed lectures Learning and applying algorithms Writing a "how-to" manual 	<p>C</p> <ul style="list-style-type: none"> Listening to and sharing ideas Experiencing sensory input Participating in group study and case discussions Keeping a journal Tutoring other students

students practice more real world skills when the assignment is distributing via a class listserve; the best approach seems to be merely posting the assignment on the instructor's Web site. This use of pull technology requires an active search by the students, albeit a simple one, which can gently introduce more passive B Quadrant types into a more D Quadrant active research mode. For variety, it is suggested that the project be based on two narratives; the project also seems to work best when students have about two weeks to complete it. Narratives are not difficult to find in AIS textbooks, and should be changed each term.

As to software, it is suggested that students have the option of using VISIO, MS Office, SmartDraw, or any other package for the assignment. One reason is that this can reduce the students' costs in obtaining software: almost all students have access to MS Office. It also can reduce unnecessary "wetware" costs (that is, the time necessary to learn the peculiarities of a new application even though they already are familiar with another suitable application). More importantly, by encouraging discussion the costs and benefits of alternatives on a class listserve, students can be found using Type C collaborative and Type A analytic skills in a real world environment.

In order to practice real world critical thinking and communications skills, students should be encouraged to use color coding, notes of explanation, and auditor working paper techniques. Above all, grading should focus on whether students have achieved clarity of presentation in the flowchart.

To practice teamwork skills – both in building teams and in operating within them – students should be encouraged to work in groups. Note that this use of group and communications skills should appeal to the Quadrant C student. This approach seems to work best when students are given the option of working in groups of up to 4 students registered (in the same section) in

the course. Self-selection into small groups can help to minimize wasting faculty time and effort in policing group work, while also allowing flexibility to students with special dependent care, health, religious, or cultural needs. This also allows students who are hesitant to work in groups to learn the benefits of doing so in discussions with their peers.

One of the downsides to assigning group work is that some students may "freeload". To ensure that all students actually learn how to flowchart, it is recommended that the next exam in the course contain a flowcharting narrative, which students must draw (independently) during the test period. Note that while the use of computer software encourages Type A Quadrant thinkers, independent test taking may be more appealing to Type B students.

A Flowcharting Project In An Introductory AIS Course

Considerable success with this project has been experienced in an introductory Accounting Information Systems class. Both students and practitioners have expressed positive feedback. Many reasons have been offered for this. Some point to the increased interaction students experience in building successful teams. The construction of a flowchart from a description of a business process is a complex unstructured task, and the students feel considerable achievement once they have mastered it. The project seems to reach Quadrant C and Quadrant D students in ways other accounting assignments do not due to the visual and relationship orientation of the project.

Students also find that reading a flowchart is much simpler than constructing one. They learn to translate the spoken or written word into a comprehensive, cohesive picture of an accounting information system. To do this successfully, they must develop skills in information filtering, an essential skill in the Type D Quadrant. In information filtering, students learn to use only the

relevant information that is presented to them. This skill should not be under-rated: as information technology progresses, more and more information becomes available, suggesting that information filtering will be a critical skill to succeed in the world of the near future.

Indeed, flowcharting can be viewed as an important component of the language used by Information Technology (IT) professionals. In order to work effectively with these professionals, accounting graduates need to understand as much of their language as possible. Traditional distinctions between accountants and Information Technology professionals are unraveling in the real world. Accounting graduates likely will be expected to take on many responsibilities previously delegated to IT. Knowledge of the language used by IT, and experience in solving problems faced by IT professionals, can only help accounting graduates as professional accountants move into the IT realm.

Non-random surveys of employers suggest that the experience and skill students develop using the flowcharting software is appreciated by accounting practitioners and audit firms. The first hand knowledge of this software is uncommon in accounting graduates. This project also provides students with experience designing audit working papers. It enables them to develop proficiency in flowcharting software while they complete the analytical exercise of diagramming a business process from a narrative.

Faculty can benefit, too. Aside from developing a familiarity with flowcharting technique and software, instructors can see just how valuable flowchart construction can be in teaching analytical problem solving, crucial to Type D thinking. Students must learn the proper sequencing of events to design the correct flowchart. They enjoy doing the project with the software and bringing their flowchart designs to life.

Summary

In a changing world, university students may no longer be adequately prepared by a narrowly framed education emphasizing solving routine problems. Instead there may be a need to emphasize creative problem solving involving the mining of complex, unstructured factual situations to identify key issues and the use of IT tools to communicate alternative responses. One approach to achieve this goal is to broaden the scope and activities in accounting courses to embrace all four quadrants of the whole brain model. Among the benefits may be a course that appeals to a more diverse group of students, demonstrating a more balanced approach to problem solving, recognition of the many and varied contributions students can make, a greater variety of activities in a class period, and an opportunity for instructors to experiment. This may result in a more challenging course which attracts increased interest. The AIS project presented above seems to fit the bill.

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