Gender, Listening, and Learning: Enhancing Educational Environments through Cognitive Styles Awareness

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Abstract

The cognitive styles literature suggests that there may be a variety of ways with which students prefer to gathering and processing information. These cognitive styles may also be related to differences in learning preferences. Focusing on one cognitive styles model – Raudsepp – we performed an empirical analysis with students' choice of major and gender as independent variables and Raudsepp's styles quadrants as the dependent variable. This analysis shows that the average accounting major prefers Raudsepp's procedural quadrant, and tends to avoid the conceptual quadrant. Other quantitative-type majors prefer the analytical quadrant, and non-quantitative majors prefer the interpersonal quadrant. Women appear to avoid the conceptual quadrant but have a preference for the interpersonal quadrant. Because the procedural quadrant is preferred only by male accounting majors, passive learning pedagogies (e.g., lecture/problem solving), traditionally used in accounting courses, might be a poor match for many students.

Keywords: Cognitive Styles, Gender, Course Design

1. Introduction

As the world has become increasingly defined in recent years by information technology, global interactions and rapidly changing environments, leading employers want students deeply competent in technical subjects, but they also want graduates skilled in research, critical thinking, teamwork and communication. Traditional approaches to higher education, which focus on solving routine problems, may not be enough to prepare students for this "brave new world." Yet a further complication is encountered if one considers differences in students' cognitive styles that they bring to the classroom.

Cognitive styles theory deals with the possibility of patterns in individuals' information gathering and processing (Pashler, McDaniel, Rohrer, & Bjork, 2009; Kitchener, 1983). The theory is rooted in neurological research suggesting that humans have complementary brain hemispheres, where the left hemisphere is characterized by a tendency to concentrate on details and the right hemisphere by a search for patterns (Camerer, Loewenstein, & Prelec, 2005; Taggart & Robey, 1981). A second processing dimension is based on notions of the neocortex -- a uniquely human portion of the brain -- having evolved on top of a more primitive mammalian brain that still exists in humans (MacLean, 1990).

The "new brain" thinking mode seeks and processes information by applying deductive logic and a step-by-step approach. This is in contrast to the "mature brain" experiential (experimental) mode, which relies on instinct and prior experience along with motivation, dealing with people, innovation, memory, and understanding the big picture.

In addition to the influences from brain structure "hardware", some argue that "software" can be overlaid by cultural values and education (Chand, Cummings, & Patel, 2012; Hofstede, 1991; *cf.*, Chabris & Simons, 2010 and Tan & Pilay, 2008), and that this can have an impact on what accountants do and why they do it (Dye & Carland, 1995; *e.g.*, Gray, 1988, Chow, Shields, & Chan, 1991, and Harrison, 1993). Research has found that cognitive styles can affect student performance on exams (Jones & Wright, 2012) projects (Hulme, Martin, & Karayan, 2000), and tasks (Honn & Ugrin, 2012), as well as students' successful use of certain study aids (Jones & Wright, 2010). Cognitive styles may also impact choice of majors (Gaqrcis-Sedeno, Navarro, & Menacho, 2009). Learning styles may have similar effects (Li, Chen, & Tsai, 2008; Smedley, 2007), particularly among international students (Stewart, 2007; Wagner & Huang, 2011). Research (*e.g.*, Hulme, 1999) also has indicated that accounting students can have very diverse problem solving styles.

2. Cognitive Styles

Cognitive styles theory has been operationalized in a number of models, such as the well-known Myers Briggs Type Indicator, Kolb's Experiential Learning Model (Baker, Simon, & Bazeli, 1987), Herrmann's Brain Dominance Model (Lumsdaine & Lumsdaine, 1995), and the Raudsepp Problem Solving Styles Inventory (Raudsepp, 1992)[1] which was used in this study. Like most cognitive styles models, Raudsepp proposes four fundamental patterns of human cognition: A=analytical, B=procedural, C=interpersonal, and D=conceptual.

A person whose highest score is in A may be described as analytical, logical, and quantitative. Mr. Spock on the old Star Trek series is almost a perfect "A" person. If the highest score is a B, the individual likely is a detail person, a list maker, practical, and well organized. When B's are faced with a problem they roll up their sleeves and get to work. C's are concerned about feelings, both their own and those of others: they tend to be emotional and empathetic, and prefer working in a group. Finally, D's are likely to be imaginative, intuitive, and innovative. They often excel at getting the big picture, but may have difficulty expressing ideas to others.

3. Students' Preferred Styles and Teaching Effectiveness

Research [Hulme, 1999; Baker, et al., 1987] suggests that accounting students may have very diverse problem solving styles, along with different ways of learning inferred from these problem solving preferences. If so, it may be possible to enhance teaching effectiveness by using a wide variety of assignments in order to better match each students' preferred way of learning, at least a portion of the time. Such an 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 and consideration of more complex unstructured problems, as well as development of a meaningful interpretation of accounting information that can be understood by a decision making audience without sophisticated training in accounting.

In addition, this varied approach to designing coursework may lead to graduates who have developed the enhanced abilities being demanded 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, a 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 problem solving style to the best match of teaching activities suggests that accounting majors may prefer assignments in which they are simply required to determine the "right" answer to a highly structured problem albeit following a complex set of rules.

[1] A self-scoring Raudsepp inventory, designed to enable students to discover their dominant preferences, and to use this information to build more effective teams, enhance their abilities to solve unstructured problems, and reduce friction with "others", is available at *http://faculty.woodbury.edu/karayanj/brain/brain*.

Introductory accounting classes are typically based on such activities and are implicitly viewed as the first course in accounting for accounting majors. The non-accounting majors in the class, who typically are in the majority, are in effect ignored or viewed as just along for the ride. However, some view introductory accounting courses as business decision making classes. Such a shift in the objective suggests not only a change in content, but also a shift in teaching methods to match the inferred learning preferences of these non-accounting majors.

4. Empirical Results

Raudsepp cognitive styles data was obtained from 651 students in introductory accounting courses at a large American public university. These courses were required of all business majors. In the Raudsepp instrument used to measure the dependent variable, a higher score for a quadrant represents a greater preference for the skills associated with that quadrant. The breakdown of scoring preferences for the Raudsepp instrument is as follows: <55 indicates an avoidance of this quadrants skills; 55-70 indicates use (neither a preference or avoidance) of a quadrants skills; and >70 indicates a preference for a particular quadrants skills.

In order to formulate and test hypotheses, the majors were grouped into quantitative majors (which included computer information systems, finance, and operations management majors), accounting majors, and qualitative majors (which included hotel/restaurant, management, and marketing majors). Also included was information from students (primarily community college transfers) taking an introductory accounting course called "orientation to professional accounting".

The following hypotheses on the anticipated preferences for each major group were tested:

1. Quantitative majors (n=203) will have the highest preference for quadrant A.
2. Accounting majors (n=148) will have the highest preference for quadrant B.
3. Qualitative majors (n=210) will have the highest preference for quadrant C.
4. Accounting majors will have an extreme avoidance of quadrant D.

This expectation is based on the fact that diagonally opposite quadrants -- that is, A and C &B and D-- represent the greatest or most extreme opposites in the model. Hypothesis 4 is based on a similar result from a pilot study by Hulme [1999].

4.1 Anova

A one-way ANOVA statistical analysis of the Raudsepp problem solving styles quadrant data for each of the three major groups was used to test these four hypotheses. The analysis testing for differences in the preference scores for each group (hypotheses 1-3) of majors,analyzed by quadrant, is presented below.

Quadrant A by Major:		Quadrant B by Major:		Quadrant C by Major:	
Major Group (Mean)	Tukey (HSD)	Major Group (Mean)	Tukey (HSD)	Major Group (Mean)	Tukey (HSD)
Quantitative (68.50)	I	ACC (67.26)	I	Qualitative (65.74)	I
ACC (67.87)	I	Qualitative (65.03)	.I	ACC (61.26)	. I
Qualitative (63.22).	I	Quantitative (64.59)	. I	Quantitative (60.30)	. I
F=29.651 p=.000		F=6.836 p=.001		F=20.135 p=.000	

Cases included 561 Missing Cases 90

Here it can be observed that all major groups had their highest score for the predicted quadrant. All the major groups had their lowest scores in quadrant D. In fact the average scores of 56.21 and 55.42 for the quantitative and qualitative majors respectively are very low, and close to the cut-off for avoidance of this quadrant (which is <55). Note that the 53.30 score for the accounting majors indicates that accounting majors are likely to avoid this quadrant in their thinking and problem solving. This is a troubling finding in that two of the skills associated with quadrant D are1) creativity, which is necessary for solving the unstructured problems that are becoming more common in the business world accounting, and 2) critical thinking, which is often listed as an essential skill for business graduates.

Further analysis is required to determine the reason for the avoidance of quadrant D by accounting majors and the relatively low scores for this quadrant by the other major groups. One possible explanation relates to the age and/ or maturity of the subjects in this analysis, who were primarily sophomore students. For people this age it might be less reasonable to expect a preference for quadrant D. Among other reasons, this might be because of possible biases created by primary and secondary education systems, which by their nature concentrate more on factual information rather than searching for meaning.

4.2 T-Tests of Problem Solving and Gender

In order to develop expectations related to expected gender differences, it is necessary to return to the more widely known cognitive models mentioned earlier. The Herrmann Brain Dominance Model [Herrmann, 1996] is structurally very similar to the Raudsepp Model in that it has four quadrants A, B, C, and D describing people who prefer to Analyze, Organize, Personalize, and Strategize. In describing gender patterns of individuals using this model, Herrmann [1996, p. 52, 53] states "the most preferred quadrant for the males was the A quadrant and the most preferred quadrant for females was the C quadrant." Because of the similarities between the Herrmann Brain Dominance Model and the Raudsepp Problem Solving Styles Model, it was suggested that these same preferences would show up in the empirical analysis in this study.

There were no statistically significant gender differences in quadrant B. The analysis testing for gender differences in quadrant preferences in the other quadrants is presented below:

Quadrant A by Gender:		Quadrant C by Gender:		Quadrant D by Gender:	
Gender	Mean	Gender	Mean	Gender	Mean
Male	67.5	Male	60.6	Male	56.4
Female	75.7	Female	65.7	Female	54.1
p=.0039		p=.0000		p=.0002	

Cases included 618 Missing Cases 33

As hypothesized, men do have a statistically significant preference for quadrant A, the analytical quadrant, while women have a statistically significant preference for quadrant C, the interpersonal quadrant. Also note that both men and women have their lowest preference for quadrant D, the conceptual quadrant. In fact, the average score for women of 54.1 places them in the avoid category for this problem solving style.

For educators these finding are of particular interest because there are many forces at work in education to encourage collaborative learning. Women, who have a preference for quadrant C, should prefer the learning activities associated with quadrant C. These include participating in group studies and listening and sharing ideas. Since women have a stronger preference for quadrant C then men, we might expect women to be more comfortable with such learning environments. Also, changes in the accounting profession, particularly automation of accounting record keeping, may have led to more value being placed on conceptual problem solving (quadrant D) as opposed to its polar opposite, procedural problem solving (quadrant B).

As was pointed out by Pincus [1995, p. 91] in the future "accountants [will be] valued more for their ability to create new kinds of information and to interpret information for use by non-accountants [quadrant D skills] than for their ability to 'crunch the numbers' [a quadrant B skill]." As with the data presented earlier for accounting majors, which indicated accounting majors avoid quadrant D thinking (accountants average score for that quadrant was 53.28), women also avoid quadrant D problem solving skills. The average quadrant D score for the women in this study was 54.1. Hulme [1999, p. 68] in commenting on similar data in an earlier pilot study states that "this evidence is particularly troubling for accounting educators attempting to develop creativity and critical thinking in accounting students." This same comment could be made for the female students in the present study.

5. Conclusions

Each of the four quadrants of the Raudsepp problem solving styles 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 below.

A	D
Collecting data	Looking for the big picture
Organizing information	Asking "what-if" questions
Reading textbooks	Doing problems with many answers
Studying problems and solutions	Leading brainstorming sessions
Writing a critical review	Thinking about hidden possibilities
Making lists Doing detailed homework	Listening to and sharing ideas
Following directions	Experiencing sensory input
Listening to detailed lectures	Participating in group study and case discussions
Learning and applying algorithms	Keeping a journal
Writing a "how-to" manual	Tutoring other students
B	C

Source: Taschetta, J.J. & Achor, J.R. (1990).

Relating the preferred learning activities listed above to the active and passive labels commonly used in education, note that only quadrant B has a preponderance of passive teaching activities. Whether or not one chooses to make specific use of the Raudsepp model in designing classes, the use of a broader variety of activities may very well lead to greater learning and understanding. As noted above, while most accounting majors prefer quadrant B, students who have chosen other majors have preferences in quadrant A or C. Relating these problem solving preferences to related learning activities, it is anticipated that non-accounting majors would prefer a greater use of active learning activities.

The results of this study suggest that students with different problem solving styles might be better taught by expanding the activities used in accounting classes (*cf.*, Lum, Bradley & Rasheed, 2011).. For example, writing and computer activities may be primarily 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. It is felt that such students are better able to deal with unstructured problems, incomplete information, and an uncertain ill-defined business environment. This study also provides further empirical evidence of the diversity of introductory accounting students' problem solving styles. Only students with a quadrant B (Procedural) preference are thought to be most comfortable with the passive (lecture/problem solving) approach to learning typical of most traditional introductory accounting course(s).

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