# Teaching in a Multimedia Cost Accounting Classroom: Do Learning Styles Matter?[1]

**Stacy Kovar**

**Kansas State University**

**and**

**Kay Zekany**

**Ohio Northern University**

This study examines the relationship between students' learning styles and their satisfaction, confidence, and performance in a multimedia-enhanced, junior-level cost accounting classroom. Understanding this relationship is an important step toward understanding how learning occurs in different multimedia environments and, therefore, how instructors can utilize multimedia tools best to further student learning.

Marshall and Merritt's (1986) Learning Style Questionnaire (LSQ) is used in this study to measure learning style instead of Kolb's more popular, but problematic, Learning Styles Instrument. Our analysis indicates that the LSQ has very promising statistical properties warranting more complete validity testing.

The findings of the hypothesis tests indicate a weak relationship between students' learning styles and their confidence in their accounting knowledge, skills and abilities. Specifically, students with the converger learning style exhibited higher confidence than other learning styles. No relationship was found between learning style and satisfaction or performance in the course, suggesting that students of different learning styles are reasonably successful at adapting to a multimedia cost accounting environment.

The ever-increasing power of computers has virtually transformed the opportunities available to teachers. Computers open new doors for different methods of instruction, both inside and outside the classroom. As methods of delivering instruction to students change, it seems quite reasonable to expect the ways in which students learn and study also will change. Hence, as teaching methods change, new studies are needed of the relationship between how different types of students learn and perform in classroom environments that are unique in terms of both the method of instruction and course content. The primary purpose of this paper is to examine the relationship between student learning style and their satisfaction, confidence, and performance in a multimedia-enhanced cost accounting classroom.

Acknowledgements: This research was made possible by a grant from the Fogelman College of Business and Economics at The University of Memphis. We are grateful to Surendra Agrawal, Jim Townsend, the participants of the 1998 Midwest AAA meeting, Jon Marshall, David Stout and anonymous reviewers for their helpful comments and suggestions. We thank our graduate assistant, Bob Johns, for his assistance. Finally, we thank our former students for their participation.

[1] Data used in this study, as well as the research instruments, can be obtained by contacting the first author.

If current trends continue, the multimedia classroom will become the norm, rather than the exception. As a consequence, the important question we must begin to focus on is "*How* should we use multimedia tools?" rather than "*Should* we use multimedia tools?" This study works in that direction by providing preliminary evidence about how different students respond in a multimedia-enhanced cost accounting classroom. Answering this question is the first step in understanding how learning occurs in different multimedia environments and, therefore, how instructors can utilize multimedia tools best to further student learning.

Learning style can be defined as the set of characteristic behaviors that serve as indicators of how students perceive, interact with and respond to the learning environment (Merritt and Marshall 1984; Marshall 1987). Since students with different learning styles favor different learning activities, we hypothesize that students will respond differently in a multimedia-enhanced cost accounting environment (or any other environment, for that matter), depending on their learning styles. Congruence between the learning environment, course content and each learning style's preferences will dictate the relationship between student response and learning style. Butler and Mautz (1996) provide support for this general hypothesis in an accounting setting, though they examine different aspects of learning style than the current study. In their study, Butler and Mautz found evidence that students who prefer to represent information graphically achieve greater benefit from multimedia presentations than traditional, black and white presentations, while students who prefer verbal representations actually may be hindered by multimedia. Students, regardless of their preferred representation method, had more positive attitudes toward the presentation and presenter for multimedia presentations. Little other research exists on the congruence of learning style with the use of multimedia (Bryant and Hunton 2000).

Other researchers, although not focusing on multimedia specifically, also provide support for the idea that some teaching methods may appeal to individuals with different learning styles. In her model for choosing teaching methods to agree with learning objectives, Bonner (1999) suggests the importance of utilizing multiple methods to appeal to individuals with different learning styles. Also in conceptual papers, Riding and Sadler-Smith (1997), Hayes and Allinson (1996) and Sadler-Smith (1996) make strong arguments for the importance of considering learning styles when selecting corporate training methods. Although they do not address the fit between teaching methods and learning directly, Arunachalam et al. (1997) report that students with innovative problem solving styles outperform adaptors on unstructured accounting tasks. Finally, Agarwal and Prasad (1999) present support that other individual difference variables may influence acceptance of new information technologies. Because the current paper deals with the multimedia environment, their results may be germane.

To achieve the objectives of this study, both a strong theoretical framework and a statistically valid measure of student learning style are needed. We draw on Kolb's Experiential Learning Theory (Kolb 1976, 1984) as our theoretical framework. While Kolb's theory is well-founded in cognitive psychology, the most popular instrument to measure an individual's learning style, Kolb's Learning Styles Inventory (LSI), has been criticized for weaknesses in its psychometric properties (Ruble and Stout 1990, 1991; Stout and Ruble 1991a, 1991b, 1994; Marshall and Merritt 1985; Geiger, Boyle and Pinto 1992). A lesser-known alternative measure, the Learning Styles Questionnaire (LSQ) developed by Marshall and Merritt (1986), offers promising psychometric properties based on Marshall and Merritt's tests (1986). Thus, a secondary purpose of this paper is to provide further evidence about the validity of their measure.

This paper models a relationship between learning style and student responses in a multimedia cost accounting classroom environment first by examining the nature of this environment, both in terms of method of instruction and course content. Then, Kolb's Experiential Learning Theory (1984) is described. Finally, predictions about the relationship between learning style and the dependent variables of satisfaction, confidence and performance are developed and tested. Our conclusions, the study's limitations and opportunities for further research are also described.

## Background and Theoretical Development

### Characteristics of the Classroom Environment

This study was conducted as part of a cost accounting course taught at the junior level at a relatively large, AACSB-accredited, metropolitan university. Two important factors characterized the environment studied. First, multimedia was used extensively in the classroom. Second, the course took a relatively applied, decision-oriented approach. Each of these factors will be explained in more detail below.

#### The Use of Multimedia

This course benefited from receiving one of the first grants from the authors' college to develop course material using multimedia presentation tools. Hence, a unique opportunity existed to examine how students with little or no prior exposure to this style of teaching responded to the new course presentation. During two consecutive semesters, computers were introduced simultaneously into all cost accounting classrooms on a regular basis. We developed our multimedia classroom presentations from a variety of sources including our previous class notes, our existing overhead transparencies, materials supplied by the textbook publisher, and new materials specifically designed to utilize the benefits of computer technologies.

Multimedia technologies have the power to enhance instruction both synchronously (in the classroom) and asynchronously (outside of the classroom). Our use of multimedia occurred primarily in the classroom using PowerPoint and Excel. However, since all of the classroom materials were in electronic form, we also made these materials accessible to our students outside of class via the World Wide Web. The instructors frequently observed students with these materials, so we conclude that students generally took advantage of them. Thus, we observed that synchronous use of multimedia also led to changes in students' asynchronous study activities.

As many are quick to note, the use of presentation software synchronously in the classroom is not necessarily as drastic a change for students as the use of asynchronous instructional technology such as Web-based courses or even learning enhancement tools. However, after several years of using (and not using) a variety of multimedia tools to enhance classroom instruction, we are convinced that it does cause some significant changes. These changes can be described in terms of changes in the nature of faculty behavior, the content of teaching material and student behavior.

From the faculty perspective, the use of multimedia requires increased advance preparation because instructors must create teaching materials in their final form before class. Whereas one or two transparencies might have been used to illustrate a concept using an overhead projector, many different slides with descriptions of main points and color figures are likely to be used to illustrate the same concept with a comprehensive PowerPoint presentation. In addition, the organization of the presentation must be clearly thought out. Some faculty view this increase in classroom ***structure*** as a negative of

multimedia in that it limits both the flexibility and spontaneity in responding to students' immediate perceptions and needs. Yet, Penner (1984), citing his own extensive review of characteristics of student evaluations, points out that "students rank clarity and organization high on the list of the qualifications of an effective teacher (98)."

In addition to making presentations more structured, multimedia allows examples to be more extensive, ***vivid***, realistic and numerous. Photos, color graphics and even short video clips can be used strategically to add both interest and content to the presentations. Realistic numbers can be used in examples because the computer handles complex computations without delay. Morrow and Boettcher (1994) cite the ability to use more real-world, complex problems and examples as the primary benefit of using technology in the classroom.

Student behavior also changes with the use of multimedia. Through exposure to computers in the classroom, students tend to use computer technologies in completing other classroom assignments, thus building valuable business-related computer skills. If materials are made available to students prior to class, they can bring the notes with them to class. Then, they are able to concentrate on listening to and actively participating in class, and still have a clear record of what took place in the classroom. (Of course, instructors must be careful to build in active learning opportunities for student involvement other than note-taking.) If materials are made available to students after class, they can ***repeat*** the presentation to improve their learning process. In doing so, they can see and review the structure of the presentation which reflects the relationship between topics and the flow of the arguments.

Additionally, repetition of the lecture and material, both inside and outside of the class, leads students to process the material through both verbal and visual means. Spencer's (1991) review of the literature in the human information processing domain related to audio-visual aids in teaching supports the value of this type of repetition. Based on the empirical literature, Spencer concludes that individuals encode information both visually and verbally and that, as a result, using both audio and visual representations of a phenomenon can enhance learning, particularly when these two representations complement one another. Spencer's conclusions are consistent with tenets of dual-coding theory (Paivio 1986) and the empirical results reviewed by Mayer (1997).

**Applied Focus**

By its nature, cost accounting is an applied discipline. Although some cost accounting is mandated by the need to calculate a manufacturer's inventory costs for financial reporting, the benefit of cost accounting information stems primarily from its value in decision-making. As a result, the instructors in this course made a concerted effort to take an applied, decision-making focus. We used real-world cases to supplement the textbook. We enhanced slides with realistic examples and video clips from actual companies. The nature of the students, some of whom worked in accounting-related positions, also reinforced our applied focus as they brought in work experiences and asked real-world questions.

The following section of the paper discusses the theoretical framework, largely attributed to Kolb (1976), utilized to describe student learning styles. Given an understanding of this framework, the characteristics of the learning environment described above can be mapped into preferred learning activities associated with Kolb's learning styles to arrive at predictions about performance.

## Experiential Learning Theory

Based in the psychological theories of Dewey, Lewin and Piaget, learning can be represented as having four modes, or stages, represented on two orthogonal bipolar axes (e.g. Heath 1964; Gregorc 1979; Kolb 1976). These theoretical stages of learning, which serve as the basis for Kolb's Experiential Learning Theory (ELT) and are shown in Figure 1, are:

1. Concrete Experience (memory): The learner has a memorable experience.
2. Reflective Observation (principles): The memorable experience provides the basis for observation and reflection.
3. Abstract Conceptualization (questioning): These observations spark an idea or theory from which implications for action can be deduced.
4. Active Experimentation (application): These implications for action serve as guides in acting to create new experiences.

**[Insert Figure 1 Here]**

According to ELT, individuals tend to emphasize some stages more than others. That is, individuals tend to acquire or grasp information along the abstract conceptualization-to-concrete experience continuum (ACCE). Individuals vary along this continuum based on their tendency to think abstractly, breaking concepts down into parts and analyzing those parts versus their tendency to be immersed in their immediate experiences (Kolb 1976). Similarly, according to ELT, individuals tend to apply or transform information along the active experimentation-to-reflective observation continuum (AERO). Individuals vary along this continuum based on their tendency to actively test implications of hypotheses versus their tendency to reflectively interpret data already collected (Kolb 1976).

Kolb's four theoretical learning styles, presented in Figure 2 and described below, are based on evaluations on these stages (1976; Marshall and Merritt 1986; Merritt and Marshall 1984).

Accommodators, who score high on concrete experience and active experimentation, tend to rely on others for information. They like solving problems through trial and error. They are good at carrying out plans and adapting to changing circumstances. They are likely to abandon theory in favor of conflicting facts or observations (Kolb 1984).

Divergers, who score high on concrete experience and reflective observation, tend to have broad interests, be imaginative and sensitive to others. Divergers tend to observe situations from multiple points of view. They are good at generating ideas and have a strong awareness of meaning and values. They adapt by observation rather than action (Kolb 1984).

Assimilators, who score high on abstract conceptualization and reflective observation, are interested in using inductive reasoning and theory construction to assimilate observations into an integrated framework. They like theoretical models and tend to focus on logical analyses. When facing a situation where theory and facts are in conflict, the assimilator will reexamine the facts (Kolb 1984).

Convergers, who score high on abstract conceptualization and active experimentation, tend to work with technical tasks, seek practical solutions and make decisions based on logical findings. Convergers like to apply ideas to solve specific

problems. They like problems where there is a single correct answer or solution to a question or problem (Kolb 1984).

**[Insert Figure 2 Here]**

## Hypotheses

Kolb's theory of learning styles suggests that students, based on their learning activity preferences, might respond differently to the specific characteristics of the multimedia-enhanced cost accounting environment (structure, vividness of presentations, repeatability and applied nature of the material). This relationship can be addressed by mapping characteristics of the environment with preferred learning activities characteristic of how students either acquire or apply information. From this mapping, we predict which learning style preferences will be most consistent with the multimedia cost accounting environment and, therefore, should perform the best.

The ***structure*** of the learning environment, which comes with a well-developed multimedia presentation, seems most likely to influence the activity of **acquiring information**. Hence, student response to this aspect of the learning environment is likely to depend on their preference along the ACCE continuum. The structure associated with multimedia leads to a very clear, step-by-step analysis. This type of acquisition should appeal to individuals higher on abstract conceptualization because of their attraction to theory and logical analysis. As Kolb suggests, individuals high on abstract conceptualization develop abilities "...to grasp the essential of a given whole--to break up a given into parts to isolate and synthesize them, to abstract common properties reflectively, to form hierarchic concepts (1976, 22)." Additionally, individuals favoring abstract conceptualization favor "the rigor and discipline of analyzing ideas, and the aesthetic quality of a neat conceptual system (Kolb 1984, 69)."

Structure will be less appealing to individuals high on concrete experience. According to Kolb, these individuals focus on "being involved in experiences and dealing with immediate human situations in a personal way (1984, 68)." Multimedia's structure does not provide these individuals a tangible experience or appeal to their emotional understanding.

***Repetition*** is an important part of learning. The ability to view the same presentation after class that comes from distributing detailed presentations and templates is likely to appeal to those students who **acquire information** through abstract conceptualization because it helps them to further solidify the structure of the model in their minds. To individuals who focus more on concrete experience, viewing the presentation again has very little value. Repetition fails to create the additional new experiences that help them learn.

Thus, the predominance of both ***structure*** and ***repetition*** in the multimedia cost accounting learning environment imply a better fit between this environment and the preferences of students who acquire information through abstract conceptualization. This implies the following three sub-hypotheses associated with the three dependent variables in the study.

**H1a: Students who acquire information through abstract conceptualization will exhibit <u>higher satisfaction</u> in a multimedia-enhanced cost accounting classroom than those who rely on concrete experience.**

**H1b: Students who acquire information through abstract conceptualization will exhibit greater confidence in a multimedia-enhanced cost accounting classroom than those who rely on concrete experience.**

**H1c: Students who acquire information through abstract conceptualization will perform better in a multimedia-enhanced cost accounting classroom than those who rely on concrete experience.**

The benefit from the increased ***vividness*** and realism of examples of application afforded by multimedia as well as the ***applied focus*** of the course will influence classroom effectiveness based on how students prefer to **apply information**. Students who apply information through active experimentation, rather than reflective observation, focus on "actively influencing people and changing situations... emphasiz[ing] practical applications as opposed to reflective understanding; a pragmatic concern with what works as opposed to what is absolute truth (1984, 69)." These students can rely more on vivid, applied examples as a form of vicarious experience and therefore will find them more beneficial than individuals who focus on reflective observation. Individuals high on reflective observation may be hindered by the applied focus of the course and the use of vivid, focused examples, due to their preferences for "intuiting the meaning of situations and ideas and...seeing their implications (Kolb 1984, 68)" These individuals are more likely to "rely on their own thoughts and feelings to form opinions (Kolb 1984, 68)".

Thus, the predominance of both vividness and an applied focus in the multimedia cost accounting learning environment imply a better fit between this environment and the preferences of students who apply information through active experimentation. This implies the following three sub-hypotheses associated with the three dependent variables in the study.

**H2a: Students who apply information using active experimentation will exhibit higher satisfaction in a multimedia-enhanced cost accounting classroom than those who use reflective observation.**

**H2b: Students who apply information using active experimentation will exhibit greater confidence in a multimedia-enhanced cost accounting classroom than those who use reflective observation.**

**H2c: Students who apply information using active experimentation will perform better in a multimedia-enhanced cost accounting classroom than those who use reflective observation.**

Through careful examination of hypotheses 1 and 2, we hypothesize that students who prefer both abstract conceptualization and active experimentation -- convergers -- will respond more favorably than all other learning styles in a multimedia cost accounting environment. Similarly, individuals preferring both concrete experience and reflective observation -- divergers -- will respond least favorably in a multimedia cost accounting classroom, with accommodators and assimilators falling somewhere in between. Based on these conclusions, the following three sub-hypotheses can be presented:

**H3a: Students preferring the converger learning style will exhibit the highest satisfaction in a multimedia-enhanced cost accounting classroom, followed by accommodator and assimilator and finally diverger learning styles.**

**H3b:** **Students preferring the converger learning style will exhibit the greatest confidence in a multimedia-enhanced cost accounting classroom, followed by accommodator and assimilator and finally diverger learning styles.**

**H3c:** **Students preferring the converger learning style will perform the best in a multimedia-enhanced cost accounting classroom, followed by accommodator and assimilator and finally diverger learning styles.**

## The Study

Data for this study were collected at both the beginning and the end of the semester for a junior-level cost accounting course. On the first day of class, students completed a survey measuring individual student learning styles, their own assessment of their accounting-related Knowledge, Skills and Abilities (KSAs) and other demographic information. On the last day of class, students gave their perceptions of the course as well as an additional self-evaluation of their accounting-related KSAs. Completed pairs of surveys (both pre-test and post-test) were collected from a total of 85 students out of 150 students originally enrolled in the course. Of the 65 students not included in the final analysis, 31 did not complete the course[2] and the remainder (34) either did not complete the pre-test survey, did not complete the post-test survey or did not mark the survey to allow matching between pre-test and post-test responses[3].

From this information, we captured data for our study regarding three types of variables: ***control variables*** (class section, academic ability and prior experience), ***dependent variables*** (satisfaction, confidence and performance) and finally our ***independent variable*** (learning style). Each of these variable categories is described separately below.

### Control Variables

*Control variables* were measured and included in the analyses to remove the effect of three factors--course section, academic ability, and prior experience--that were not of interest in the study but might influence the dependent measures. First, although the instructors of the course shared both notes and ideas regarding multimedia usage, differences in instructor style may have influenced students' satisfaction, confidence and learning. In addition, the time of day, as well as whether this was the first or second time a particular instructor used a presentation, might influence responses. As a result, we controlled for course section. Students from five different sections over two semesters were sampled. The number of students in the final sample from each section ranged from 10 to 21.

---

[2]. This represents a withdrawal rate of 20.7 percent, which is comparable to the withdrawal rate of 20.3 percent for the academic year prior to the study.

[3]. Tests for survivorship bias were conducted. The results indicate no difference between those who completed the study and those who did not with respect to the independent variables of learning style or microcomputer playfulness. However, there is marginal evidence (at $\alpha = .10$) that stronger students, with higher academic ability and more experience, were more likely to complete the course and the post-test survey. This finding, that weaker students either drop out or fail to attend class, is plausibly a common occurrence and should not weaken the external or internal validity of our results.

Second, students' academic abilities might influence their perceptions of the learning environment as well as their learning in the course. Therefore, we included the students' prior GPA to control for academic ability. Mean GPA for the sample was 3.19 with a .44 standard deviation. GPAs were normally distributed.

Third, prior experience, with respect to both work experience and related coursework, might influence a student's ability to recognize the value of the material as well as to utilize the material for learning. As a result of our need to measure both prior work experience and related coursework, we used the students' KSA scores at the beginning of the semester as a joint measure of these two experience factors. The KSAs examined were the 19 Knowledge, Skills and Abilities (KSAs) management accounting practitioners identified as most vital to their success in practice as part of the IMA/FEI commissioned "Practice Analysis of Management Accounting" (Siegel and Kulesza 1996). These KSAs are listed in Table 1. Students were asked to indicate the degree to which they believed they possessed each KSA by circling a number between 1 (poor) to 5 (excellent). Average overall KSA score prior to the semester was 3.76 (ranging from 2.97 to 4.95).

**[Insert Table 1 here]**

## Dependent Variables

In testing our students' responses to our multimedia classroom, we examined three dependent measures: (a) student *satisfaction* with the presentations, the instructor and course overall; (b) changes in self-reported management accounting knowledge, skills and abilities, measuring subjects' *confidence* in their abilities; and (c) course grades, measuring *performance*.

*Student satisfaction* provides our first measure of the effectiveness of our classroom environment for students with different learning styles. Student satisfaction has a well-established role in measuring the effectiveness of faculty and programs. Student focus groups and surveys provide input for curriculum development in many schools. In addition, student attitude can be an important precursor for learning.

Drawing heavily on an instrument developed by Butler and Mautz (1996), we asked our students to evaluate a number of items relating to (a) the course presentations, (b) the instructor and (c) the course overall. Because our study looked only at a single classroom environment of interest, to provide a meaningful measure of student satisfaction we felt they needed some common point of comparison for evaluating satisfaction. In order to provide a point of comparison, students were instructed to "Compare the *multimedia presentations* used in this class to the traditional presentations used in your other accounting classes." Thus, presentations in other accounting classes were established as a point of comparison for their evaluations. Similarly, to provide a point of comparison for instructor evaluations, we asked students to "Compare the *instructor* of this class to instructors in other accounting classes," hence establishing other accounting instructors as the point of comparison. The resulting scales ranged from 1 (much worse) to 7 (much better) with a midpoint of 4 (about the same). We measured overall perceptions more broadly using a scale from 1 (strongly disagree) to 7 (strongly agree). We obtained scores for each of the three dimensions of student satisfaction by averaging the items from that dimension.

Average responses for the three satisfaction scores were 5.23 for presentation, 4.96 for instructor, and 5.28 for the course overall based on a scale of 1 to 7. These averages were all significantly greater than the midpoint response of 4 (p-values $< .001$). (See

Table 2) For the multimedia presentation and instructor dimensions of satisfaction, we instructed subjects to compare the presentation and instructor to their other accounting classes, and the midpoint value of 4 was labeled as "About the Same". Therefore, these means indicate that, on average, students preferred the multimedia presentations to traditional presentations used in their other accounting classes and also preferred the instructors to other accounting instructors. Additionally, the overall scores 5.28 indicate a level of satisfaction in excess of the indifference point of 4 (which was labeled as "Neutral" on the scale). Alpha reliabilities for the measures were .94 for presentation, .96 for instructor and .90 for overall perceptions.

**[Insert Table 2 here]**

We measure *student confidence* by comparing students' own assessments of their level of KSAs prior to the semester to their assessments following the semester. Average KSA prior to the semester was 3.76 (ranging from 2.97 to 4.95). Average KSA at the end of the semester was 3.92 (ranging from 2.74 to 4.95). Mean change in KSA was .18 with changes ranging from -.52 to 1.26.

We measure s*tudent performance* using students' final course grades to provide a complete and representative measure of how well students met the course performance objectives. Because we conducted the study over two different semesters and because two different, independent instructors participated, course components varied. Course section was included in the analyses as a control variable to remove the effect of systematic differences in methods for assigning points, etc. For all course sections, the primary component of course grades was examinations, which accounted for 75%-80% of final grades. The remaining portions of grades were determined by various mixes of cases (up to15%), homework (up to 15%), quizzes (up to10%) and class participation (up to 5%). For analysis purposes, final course grades were expressed on a 100-point scale. Grades for the sample (consisting only of those students who completed both pre- and post-test surveys) ranged from 60 to 106[4] with an average of 86. The grades conformed to a normal distribution.

## Independent Variable -- Learning Style

We measured *learning style* using the Learning Styles Questionnaire (LSQ; Marshall and Merritt 1986) rather than using Kolb's LSI, the more widely used (but highly criticized) instrument. Kolb's original LSI has been criticized for weaknesses in its psychometric properties, both in its original form and a modified form developed in 1985. It has been found to have poor internal consistency, classification stability, test-retest stability, response set bias, factor identification and general construct validity (Ruble and Stout 1990, 1991; Stout and Ruble 1994; Marshall and Merritt 1985; Geiger, Boyle and Pinto 1992). These problems have been attributed in part to the ordinal measures, ipsative nature of the scales, and single-scale-per-column format of the response options (Stout and Ruble 1994). Despite the psychometric weaknesses of Kolb's LSI, Kolb's theory has been used extensively in educational research. This is suggestive of the strong, attractiveness of the theory itself. The strength of the theory is further supported by its close ties to the psychological theories of Dewey, Lewin and Piaget (Kolb 1984).

---

4. One instructor allowed students to turn in extra case assignments above the minimum required to earn additional points. As a result, a small number (5) students were able to earn more than 100 points.

Based on the strength of the theory, a number of authors have developed alternative instruments to measure the constructs described by Kolb's theory that will overcome these psychometric weaknesses (Geiger, Boyle and Pinto 1993; Merritt and Marshall 1984; Marshall and Merritt, 1986; Romero, Tepper and Tetrault 1992). These instruments have many similar properties. We selected one of these instruments, Marshall and Merritt's Learning Styles Questionnaire (LSQ), in examining the relationship between learning styles and confidence, satisfaction and performance. The LSQ consists of a list of 40 word pairs located on opposite ends of 5-point (0 to 4) semantic differential scales. For each pair, subjects must indicate which one of the two words, representing the ends of either the ACCE or AERO dimension, is more characteristic of his or her style of learning. The end points of the scale are labeled "generally prefer (most of the time)", with a midpoint of "prefer about half the time". Twenty pairs consist of words representing ACCE. The other twenty pairs consist of words representing AERO. Half of the word pairs for each dimension are reverse scaled. Responses for the reverse scaled items are subtracted from the other items for that dimension, resulting is scores for each continuum that range from -40 to +40[5].

Figure 3 shows the plot of students' individual learning styles as measured using the LSQ for the sample from the current study. AERO scores ranged from -40 to 37; ACCE scores ranged from -40 to 10. Though these scores do show significant variability of students along both dimensions, our students *did not* fall equally into all four learning style quadrants. Five students were accommodators, two were divergers, fourteen were assimilators, and the majority—61 students—were convergers. Since accountants work with technical details, seek practical solutions to problems and make decisions based on logical findings, it is reasonable that the majority of accounting students are classified as convergers.

*The Validity of LSQ scores* -- Marshall and Merritt's own tests conducted during development of the scales using a sample of 543 college-aged students similar in age and demographics to our sample. These students represented a wide a variety (37) of college majors. Marshall and Merritt's test reveal high alpha reliability scores of .90 for ACCE and .93 for AERO and overall variance explained of 78% for a two-factor factor analysis. Additionally, all items load on appropriate factors in the two-factor factor analysis. However, both because Kolb's LSI upon which the instrument is based has exhibited questionable validity and because the LSQ is a relatively unused instrument, we need to assess the validity of our scores prior to performing hypothesis tests.

Using the data from the current study, principle components factor analysis with Varimax rotation suggested the presence of two factor dimensions for the LSQ scores. Alpha reliabilities for the scores were .86 for ACCE and .95 for AERO and the two factors accounted for 44% of the variability in the scores. These results indicate acceptable statistical properties. Alpha reliability scores with our relatively small database are very comparable to Marshall and Merritt's. Although our overall explained variation of 44% is well below the 78% found by the developers of the instrument, our more homogeneous set of subjects (all junior-level accounting students versus a cross-section of college students) may explain much of this difference. The correlation between the two dimensions (ACCE and AERO) was .16. This correlation is

---

5. This is mathematically equivalent to adjusting the scale for the reverse scaled items and summing the items for each learning dimension. The only difference is that the procedure used results in scores ranging from -40 to 40 rather than 0 to 80. This may be somewhat more intuitively appealing when using the instrument for clinical purposes. It makes no difference whatsoever for hypothesis testing.

insignificant (p=.14), supporting the idea that the two dimensions indeed represent two orthogonal constructs. Given the satisfactory statistical properties of the LSQ, we proceed to the results of our tests of hypotheses.

## Results

We expect students' learning styles will be related to all three dependent variables of interest in our study -- satisfaction, confidence and learning. We hypothesize that this effect will manifest itself through relationships between these dependent variables and the two dimensions of learning style—ACCE, representing how students acquire information, and AERO, representing how students apply information—as well as the four styles of learning—accommodator, diverger, assimilator, and converger.

We tested hypotheses 1 and 2 regarding relationships between the two learning dimensions and dependent variables using regression analysis. These results are shown in Tables 3 and 4. Hypothesis 3, regarding the relationship between learning styles and the dependent variables, was tested using analysis of variance (ANOVA). These results are shown in Table 5. The three control variables--course section, academic ability (measured by GPA) and prior experience (measured by initial KSA)--were included as covariates in both types of analysis. Results for each of the dependent variables are provided below.

**[Insert Table 3-5 here]**

***Satisfaction*** The analyses reveal no support for hypotheses 1-3a in terms of a relationship between either the dimensions of learning or learning style and the three measures of satisfaction.

***Confidence*** The analyses reveal only weak support for hypotheses 1b and 2b in terms of a relationship between the dimensions of learning and student confidence with p-values of approximately .10. However, when the two dimensions of learning are combined to describe the student's learning style in testing hypothesis 3b, a more clearly significant relationship emerges between confidence and learning style. Mean comparisons, adjusted for the control variables, reveal that differences are as expected. Mean confidence, measured by change in KSA, for the four learning styles was .246 for convergers, -.015 for assimilators, -.075 for accommodators and -.099 for divergers. Differences between convergers and assimilators and accommodators are significantly different for p=.05. The difference between convergers and divergers is not significantly different, most likely due to the small sample size for divergers (2 subjects). Because we were concerned that the unbalanced cell sizes in the design might be influencing our results (75% of subjects were convergers), we conducted additional tests where convergers were compared to all other learning styles. These tests suggest that our findings are robust. Convergers had significantly higher changes in KSA than all other learning styles combined (F=8.01, p=.0001) after controlling for course section, academic ability and prior experience.

***Performance*** As with satisfaction, the results presented in Tables 3-5 do not support hypotheses 1-3c with regard to a relationship between either the learning dimensions or learning style and student performance as measured by course grades.

## Conclusions

Based on the results for the three dependent variables in this study, we conclude there is a small relationship between learning style and learning in a multimedia cost accounting classroom and that this difference manifests in a relationship between learning

style and student confidence. This finding is a valuable conclusion. First, to the extent that student confidence is important to a student's decision to major in a particular field, using teaching methods that increase student confidence is important.

As much as the results regarding confidence imply action on the part of accounting educators, the lack of findings regarding satisfaction and performance has important implications as well. The lack of a relationship between learning style and satisfaction and performance indicates that instructors can use a wide variety of teaching methodologies to enhance student learning without fear of alienating certain student groups, at least based on their learning style. It likely indicates that students can adapt their learning practices to compensate for teaching methods that do not agree with their favored learning style, with little effect on satisfaction or performance.

## Limitations and Opportunities for Future Research

This study suffers from a number of limitations. First, we had a somewhat small sample size for our study (85) relative to the number of variables examined, and students were not evenly distributed between learning styles, i.e. there was limited variance. As a result of these factors, care should be taken in interpreting the findings that neither *performance* nor *student satisfaction* is related to student learning styles. Additional research with larger samples and broader groups of students is needed to provide additional power and answer questions like "Might *assimilators* benefit more if the majority of the class was composed of students sharing this learning style?" Despite this weakness, the fact that our results are consistent with findings from Butler and Mautz (1996) that positive perceptions of multimedia do not depend on whether a student prefers to represent information graphically or verbally adds to their credibility.

Second, as with any cross-sectional study conducted in a 'field' type environment, it is impossible to assure that differences (or the lack thereof) between groups are caused by the items we theorize, namely the structure, repetition and vividness afforded by the multimedia presentations and the applied nature of the cost accounting material. However, this weakness does not preclude relying on the results of the study when planning teaching strategies in a similar environment, it simply implies that caution should be exercised in extending the results to environments that differ significantly in other major aspects prior to further research in a more controlled setting.

Last, we cannot distinguish the effect of teaching method (multimedia) from the effect of course content. We test only the joint effect of these variables. Thus, though the study finds that student confidence may be related to student learning styles in a multimedia-enhanced cost accounting classroom, we do not yet fully understand whether this relationship is due primarily to the nature of the course content, the teaching method or the combination of the two. Future research must sort out this relationship. In terms of content, future research should answer questions like, "Will *convergers* still benefit more from multimedia if the course emphasizes primarily memory and principles rather than application?" and "Does the specific content, as well as its general emphasis, influence learning? If so, how?"

In terms of teaching method, future research in a more controlled setting may examine what aspects of multimedia influence its usefulness. Is it students' use of materials outside of class that makes a difference, or the nature of the materials or their use inside class? Future research in a more controlled setting can answer these questions, as well as questions about the effect of other uses of multimedia that were beyond the scope of this study such as "Will *convergers* still benefit when multimedia is used to

present cases, for instance, or to provide a self-paced learning aid or to allow students to practice solving problems?"

Finally, our results regarding validity of the LSQ, coupled with Marshall and Merritt's own work, provide positive, yet preliminary, indications that it may prove useful for further research conducted in accounting. While it is too early to celebrate the discovery of an ideal instrument to measure learning style, our preliminary research suggests that more extensive studies examining the properties of Marshal and Merritt's LSQ may prove fruitful in establishing it as an accepted measure of Kolb's theory. Future validity testing should focus on all aspects of validity including testing the test-retest reliability of the instrument and its correlation with other instruments measuring similar constructs.

**References**

Agarwal, R. and J. Prasad. 1999. Are Individual Differences Germane to the Acceptance of New Information Technologies? ***Decision Sciences***. 30(2): 361-392.

Arunachalam, V., J. Sweeney and J. Kurtenbach. 1997. The Relationship between Cognivite Problem-Solving Style and Task Structure in Affecting Student Performance. ***The Accounting Educator's Journal***. 9(1): 1-13.

Bonner, S.E. 1999. Choosing Teaching Methods Based on Learning Objectives: An Integrative Framework. ***Issues in Accounting Education***. 14(1): 11-40.

Bryant, S.M., and J.E. Hunton, 2000. The Use of Technology in the Delivery of Instruction: Implications for Accounting Educators and Education Researchers. ***Issues in Accounting Education***. 15(1): 129-162.

Butler, J. B., and R. D. Mautz, Jr. 1996. Multimedia Presentations and Learning: A Laboratory Experiment. ***Issues in Accounting Education*** (Fall): 259-280.

Geiger, M.A., E.J. Boyle, and J.K. Pinto. 1993. An Examination of Ipsative and Normative Versions of Kolb's Revised Learning Style Inventory. ***Educational and Psychiological Measurement***. 53: 717-726.

Gregorc, A. F. 1979. Learning Styles: Potent Forces Behind Them. ***Educational Leadership*** 36: 234-237.

Hayes J. and C.W. Allinson. 1996. The Implications of Learning Styles for Training and Development: A Discussion of the Matching Hypothesis. ***British Journal of Management***. (March): 63-74.

Heath, R. W. 1964. Curriculum, Cognition and Educational Measurement. ***Educational and Psychological Measurement*** 24: 239-253.

Kolb, D. A. 1976. Management and the Learning Process. ***California Management Review*** 18: 21-31.

Kolb, D. A. 1984. ***Experiential Learning: Experience as the Source of Learning and Development***. Prentice Hall: Englewood Cliffs, NJ.

Marshall, J. C, and S. L. Merritt. 1985. Reliability and Construct Validity of Alternate Forms of the Learning Style Inventory. ***Educational and Psychological Measurement*** 45: 931-937.

----------, and ----------. 1986. Reliability and Construct Validity of the Learning Style Questionnaire. ***Educational and Psychological Measurement*** 46: 257-262.

----------, and ----------. 1990. Learning Styles Questionnaire.

Mayer, R.E. 1997. Multimedia Learning: Are We Asking the Right Questions?. ***Educational Psychologist***. 32: 1-19.

Merritt, S. L., and J. C. Marshall. 1984. Reliability and Construct Validity of Ipsative and Normative Forms of the Learning Style Inventory. ***Educational and Psychological Measurement*** 44: 463-472.

Morrow, C.T. and J.V. Boettcher. 1994. Technology classroom design and support at the Pennsylvania State University. ***in Interactive Multimedia in University Education: Designing for Change in Teaching and Learning***. 165-181.

Paivio, A. 1986. ***Mental Representations: A Dual Coding Approach***. Oxford, England: Oxford University Press.

Penner, J. G. 1984. ***Why Many College Teachers Cannot Lecture: How to Avoid Communication Breakdown in the Classroom***. Springfield, IL: Charles C. Thomas.

Riding, R.J, and E. Sadler-Smith. 1997. Cognitive Styles and Learning Strategies: Some Implications for Training Design. ***International Journal of Training and Development***. (Sept): 199-209.

Romero, J. E., B.J. Tepper, and L.A. Tetrault. 1992. Development and Validation of New Scales to Measure Kolb's (1985) Learning Style Dimensions. ***Educational and Psychological Measurement*** 52: 171-180.

Ruble, T. L. and D.E. Stout. 1990. Reliability, Construct Validity, and Response-Set Bias of the Revised Learning-Style Inventory (LSI-1985). ***Educational and Psychological Measurement***. 50: 619-629.

---------- and ----------. 1991. Reliability, Classification Stability, and Response-Set Bias of Alternate Forms of the Learning-Style Inventory (LSI-1985). ***Educational and Psychological Measurement***. 51: 481-489.

The Gary Siegel Organization. 1996. ***The Practice Analysis of Management Accounting.*** Montvale NJ: Institute of Management Accountants.

Sadler-Smith, E. 1996. Learning Styles: A Holistic Approach. ***Journal of European Industrial Training***. 20(7): 29-38.

Siegel, G., and B. Kulesza. 1996. The Practice Analysis of Management Accounting***.*** ***Management Accounting*** (April): 20-22.

Spencer, K. 1991. ***The Psychology of Educational Technology and Instructional Media 2nd Ed***. Liverpool, England: United Writers Press.

Stout, D. E. and T.L. Ruble. 1991a. A Reexamination of Accounting Student Learning Styles. ***Journal of Accounting Education*** 9: 341-354.

---------- and ----------. 1991b. The Learning Style Inventory and Accounting Education Research: A Cautionary View and Suggestions for Future Research. ***Issues in Accounting Education***. 6: 41-52.

---------- and ----------. 1994. A Reassessment of the Role of the Learning Style Inventory (LSI-1985) in Accounting Education Research. ***Journal of Accounting Education*** 12 (2): 89-104.

**Table 1: Most Important Knowledge, Skills and Abilities for Management Accounting Work**

1. Work ethic
2. Analytical/problem-solving skills
3. Interpersonal skills
4. Listening skills
5. Use of computerized spreadsheets
6. Understanding the business
7. Understanding bottom-line implications of day-to-day business and accounting decisions
8. Writing skills
9. Familiarity with business processes
10. Relationship between balance sheet, income statement and cash flow statement
11. Leadership skills
12. Understanding/preparing financial statements
13. Accounting system: The “books”, cost flows, double entry, etc.
14. Use of computerized accounting systems
15. Interpreting or analyzing financial statements
16. Measurement, valuation and presentation of revenue and expenses
17. Accruals and deferrals, adjusting and closing entries
18. Speaking/presentation skills
19. Information needs of internal customers

Source: Siegel & Kulesza, ***Management Accounting***, April 1996.

**Table 2: Student Perceptions of Multimedia vs. Traditional Teaching Methods**

| Dependent Variable | Mean Score | (Mean - 4) | Std. Dev. | t-value | p-value |
|---|---|---|---|---|---|
| Multimedia Presentation | 5.23 | 1.23 | 1.16 | 9.75 | 0.0001 |
| Instructor Perception | 4.95 | 0.95 | 1.23 | 7.18 | 0.0001 |
| Overall Perception | 5.27 | 1.27 | 1.15 | 10.21 | 0.0001 |

**Table 3: Regression Results for Abstract Conceptualization/Concrete Experience Parameter Estimates**

| | Dependent Variables | | | | |
|---|---|---|---|---|---|
| **Independent Variables** | **Presentation Satisfaction** | **Instructor Satisfaction** | **Overall Satisfaction** | **Confidence** | **Performance** |
| **Intercept** | **3.5187 | **3.9130 | **4.4386 | **0.8479 | **51.3276 |
| **Section dummy 1** | 0.0678 | 0.0948 | -0.5453 | 0.1446 | 0.7635 |
| **Section dummy 2** | 0.4889 | 0.4067 | -0.6707 | 0.0314 | **-7.2961 |
| **Section dummy 3** | 0.7944 | *0.9414 | -0.2448 | 0.0398 | **-6.5511 |
| **Section dummy 4** | 0.2260 | 0.2999 | -0.1524 | -0.0173 | -3.9021 |
| **GPA** | 0.1595 | -0.3706 | 0.3740 | 0.0695 | **16.2681 |
| **Experience** | 0.2675 | *0.5331 | -0.0017 | **-0.2794 | **-3.8956 |
| **ACCE** | 0.0042 | 0.0046 | 0.0007 | *-0.0056 | 0.0557 |

* indicates significance at .10; ** indicates significance at .05

**Table 4: Regression Results for Active Experimentation/Reflective Observation Parameter Estimates**

| | Dependent Variables | | | | |
|---|---|---|---|---|---|
| **Independent Variables:** | **Presentation Satisfaction** | **Instructor Satisfaction** | **Overall Satisfaction** | **Confidence** | **Performance** |
| Intercept | **3.1717 | **3.7288 | **4.8466 | **1.0614 | **52.3835 |
| Section dummy 1 | 0.0358 | 0.0777 | -0.5081 | 0.1644 | 0.8562 |
| Section dummy 2 | 0.4650 | 0.3953 | -0.6397 | 0.0446 | **-7.1877 |
| Section dummy 3 | 0.7810 | *0.9384 | -0.2192 | 0.0428 | **-6.3926 |
| Section dummy 4 | 0.2257 | 0.2989 | -0.1541 | -0.0161 | -3.9252 |
| GPA | 0.1623 | -0.3739 | 0.3592 | 0.0738 | **16.1218 |
| Experience | 0.3637 | *0.5777 | -0.1301 | **-0.3303 | **-4.3733 |
| AERO | 0.0069 | 0.0037 | -0.0080 | *-0.0043 | -0.0196 |

* indicates significance at .10; ** indicates significance at .05

**Table 5: ANOVA Results - The Relationship Between Learning Style and the Dependent Variables**

| | Dependent Variables *F-stat (p-value)* | | | | |
|---|---|---|---|---|---|
| **Independent Variable** | **Presentation Satisfaction** | **Instructor Satisfaction** | **Overall Satisfaction** | **Confidence** | **Performance** |
| Learning Style | .63 (5.9) | .89 (.45) | .12 (.73) | 18.76 (.00) | 10.37 (.00) |
| **Covariates** | | | | | |
| Experience | 1.17 (.28) | 3.37 (.07) | .12 (.73) | 18.76 (.00) | 10.37 (.00) |
| Course Section | .00 (.98) | .00 (.98) | 2.20 (.14) | 2.55 (.12) | .12 (.73) |
| GPA | .43 (.51) | 1.26 (.27) | 1.45 (.23) | .69 (.41) | 65.60 (.00) |

**Figure 1: Dimensions of Learning**

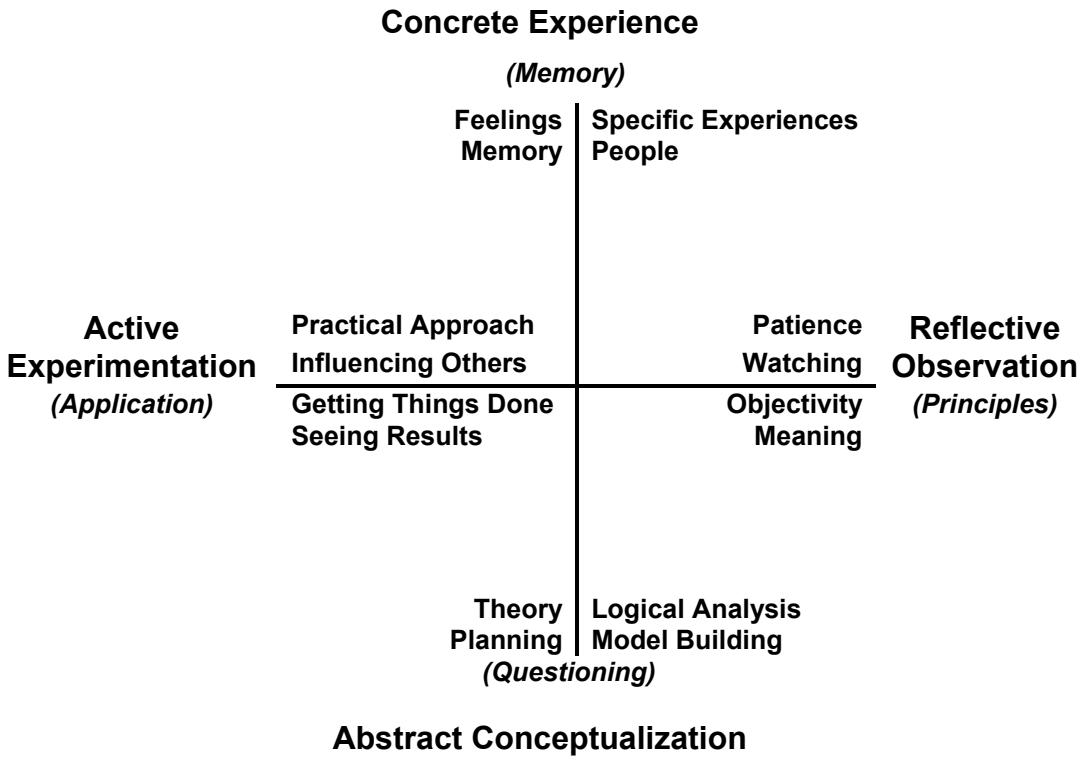


**Figure adapted from Kolb, 1984**

**Figure 2: Styles of Learning**

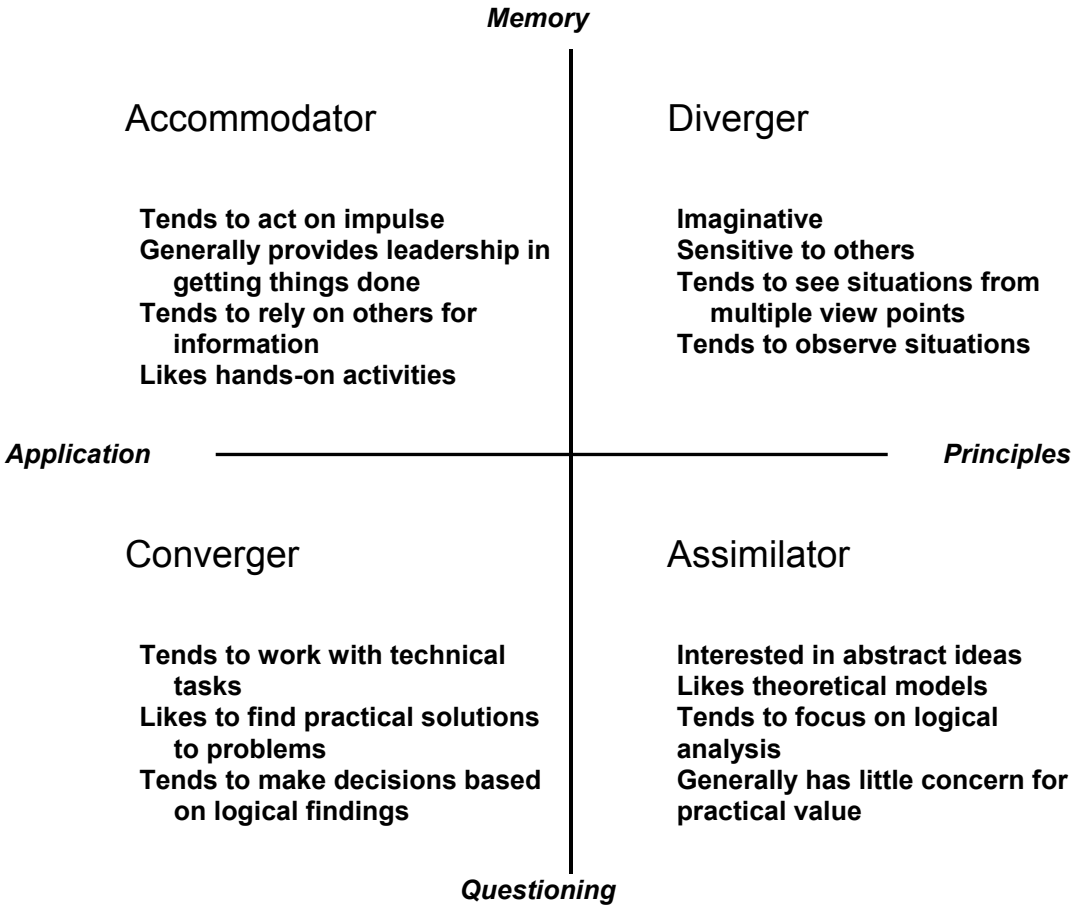


**Figure adapted from Kolb, 1984**

Figure 3: Predominant Learning Style of Cost Accounting Students