

**Commerce Division
Discussion Paper No. 64**

**STUDENT PERCEPTIONS OF
THE PEDAGOGICAL FEATURES
OF A COMPUTER-AIDED LEARNING
PROGRAM IN INTRODUCTORY
ACCOUNTING**

*Sidney Weil**
*Murray Clark***
*Trevor Wegner****

February 1999

Commerce Division
PO Box 84
Lincoln University
CANTERBURY

Telephone No: (64) (3) 325 2811
Fax No: (64) (3) 325 3847
E-mail: weils@kea.lincoln.ac.nz

ISSN 1174-5045
ISBN 1-877176-41-9

- * Senior Lecturer in Accounting, Lincoln University, New Zealand
- ** Senior Lecturer in Accounting, Lincoln University, New Zealand
- *** Associate Professor in Statistical Sciences, University of Cape Town, South Africa

Abstract

Computer usage in accounting education is increasing, with computer-aided learning (CAL) packages becoming readily available. A consequent challenge facing accounting educators is to ensure that the increased use of computers occurs in a way that maximises its contribution to student learning.

Some studies have examined whether CAL packages produce performance benefits for students. Few studies, however, have investigated the pedagogical features of these packages. This study identifies such features and measures student perceptions about the features used in a particular package, and their perceived value in meeting stated educational outcomes.

Data was gathered by way of a questionnaire, and the responses analysed using the Analytic Hierarchy Process. The results indicate that the package was regarded as a highly beneficial learning resource, with the content and available support mechanisms rated as the two most useful pedagogical features.

Contents

| | |
|--|----|
| List of Tables | i |
| List of Figures | i |
| 1. Introduction | 1 |
| 2. Literature Review | 2 |
| 3. The Research Study | 7 |
| 3.1 Methodology | 7 |
| 3.2 Data Collection and Analysis Approach | 8 |
| 4. Analysis of Research Findings | 10 |
| 4.1 Learning (Teaching) Approach | 13 |
| 4.2 Content | 14 |
| 4.3 Attributes Relating to Support Mechanisms | 16 |
| 4.4 Assessment Methods Attributes | 17 |
| 4.5 The Overall Value of Acclab as a Learning Resource | 18 |
| 5. Limitations of the Study | 20 |
| 6. Conclusion | 20 |
| References | 23 |

List of Tables

| | | |
|----|---|----|
| 1. | Respondent Clusters and Their Attribute Profiles | 11 |
| 2. | Perceived Relative Value of Learning (Teaching) Approaches in Acclab as Being Beneficial in Learning the Accounting Cycle | 13 |
| 3. | Perceived Relative Value of Content-Related Features in Acclab as Being Beneficial in Learning the Accounting Cycle | 15 |
| 4. | Perceived Relative Value of Support Mechanisms in Acclab as Being Beneficial in Learning the Accounting Cycle | 16 |
| 5. | Perceived Relative Value of Assessment Methods Used by Acclab as Being Beneficial in Learning the Accounting Cycle | 17 |
| 6. | Likert Rating Scales Response to the Value of Acclab Overall as a Learning Resource | 18 |
| 7. | Trade-Off Responses Between Lectures and Acclab | 19 |

List of Figures

| | | |
|----|--|---|
| 1. | Analytical Hierarchy for Acclab Pedagogical Features | 9 |
|----|--|---|

1. Introduction

Needles and Anderson (1991) note that the expanded use of computers in the accounting classroom has been slow in developing. When used, the usual approach has been to prepare students for a computer-intensive work environment - teaching students to do accounting using technology, rather than to learn accounting using technology. The emphasis has been on what students do with technology, rather than on how technology is used to support both the teaching and learning components of the process. When used in an attempt to improve student learning, progress has been mixed (Borthick and Clark, 1987b, Togo and McNamee, 1997). Borthick and Clark (1987b) attribute this in part to the lack of a supporting cognitive theory for computer-aided learning (CAL).

Computer usage is clearly on the increase in accounting education. Borthick and Clark (1987b, 174) encapsulate this trend by stating, "The question is not whether computing will eventually pervade accounting education, but whether it will occur in ways that maximise its contribution to student learning". This outcome is not a foregone conclusion. Togo and McNamee (1995, 1997) specify several problems associated with computer usage in accounting education, for example, a deemphasis on the importance of learning accounting concepts in favour of expending greater effort on computer projects, a negative shift in student attitudes and added time pressure on students. In similar vein, Williams et al. (1988) caution against expectations of dramatic gains in student learning from individual computer-based exercises.

Many reasons have been suggested as to why computer usage should improve accounting education, the "...most obvious one being the transfer of the computational burden to the machine so students can concentrate on accounting rather than on tedious calculation" (Borthick and Clark 1987b, 175). This is also the view of Jensen and Sandlin (1992a). Kachelmeier et al. (1992) argue that learning aids which expedite the mastery of accounting procedures might free more class time to enable students to concentrate on the issue, judgments, and controversies surrounding those procedures.

Needles and Anderson (1991) contend that technology can be useful in supporting learning objectives on the teaching cycle and cognitive responses on the learning cycle. While Needles and Anderson (1991) view the computer as one of several technological aids available to accounting educators, this study will be limited to the use of computers only.

Several studies have been conducted in the area of CAL in accounting education. Some of these studies refer to computer-based instruction, computer-assisted instruction or computer-managed instruction; others to computer-based education. This paper does not focus on the differences between the different fields (Jensen and Sandlin, 1992a and b), but includes them all under the description of CAL, which is defined by Er and Ng (1989, 320) as, "...the use of the computer as the medium of instruction for assisting the reader in a learning process....".

Most of the studies in accounting education have attempted to measure the effect on student performance of CAL. Few studies have focused on the design of CAL material and, in particular, the pedagogical features included in CAL packages to facilitate learning. This study focuses on the latter issue, that is, the design of CAL material. The study investigates and identifies pedagogical features used in the development of CAL material and measures the perceived value of specific pedagogical features used in a particular CAL program¹. This is done by measuring student perceptions about the relative value of these pedagogical features in assisting them to master the accounting cycle.

2. Literature Review

Considerable research has been conducted in the field of computer-aided learning in a range of disciplines, particularly since the 1980's (Kulic and Kulic, 1986). Most of these studies have focused on determining whether the use of computers in teaching has improved student performance and have reported a significant positive overall effect of computer-aided learning in higher education.

¹ An interactive tutorial designed to provide students with a foundation of procedural and technical skills in the accounting cycle and merchandising activities (Jones et al., 1994).

In accounting, studies of the effectiveness of computer-aided learning have produced inconclusive results. McKeown (1976), Groomer (1981) and Friedman (1981) attribute significant performance improvements to computer-aided instruction, when used as a general problem-solving tool. Improvements in specific applications, such as audit sampling (Anderson et al., 1988), lease classification (Böer and Livnat, 1990) and pension accounting (Kachelmeier et al., 1992) are also reported. Only marginal improvements in performance, however, are found in studies of computer applications in intermediate accounting (Dickens and Harper 1986; Fetters et al., 1986) and Management Accounting (Oglesbee et al., 1988). Togo and McNamee (1997) find that computer use in a cost accounting course adversely affects examination performance. The mixed results obtained from the research into the performance effectiveness of computer-aided learning, lead Er and Ng (1989, 322) to conclude that CAL appears to have doubtful value and that, "...computing was irrelevant to the learning of accounting concepts". Their conclusion ignores the performance benefits found in some of the studies, as well as the different ways in which CAL is used in the various studies. Jensen and Sandlin (1992a, 40) caution against an overhasty conclusion on the efficacy of CAL, stating that, "the CAL of yesterday that embodied older technology is far different from the CAL opportunities of tomorrow, due to the pace at which new CAL opportunities are emerging".

Other studies and reviews have focused on the development of CAL material for use in accounting education and, in particular, the pedagogical principles and learning theories underlying this process (Clark and Salomon, 1986, Borthick and Clark, 1986 and 1987b, Jensen and Sandlin, 1992a, 1992b and 1995, Bagranoff, 1993, Maher, 1993, and Togo and McNamee, 1995). Clark and Salomon (1986), in a review of media in teaching, call for less of an emphasis on the use of media *per se* and more of a focus on the underlying cognitive processes which may be enhanced by specific features of media innovations. Borthick and Clark (1987b), in a review of the usage of computers in accounting education, call for research on the effects of computing in accounting education, in order to identify the extent of learning effects associated with computer usage, as well as to establish whether computers are being integrated into curricula in ways that maximize learning. Borthick and Clark (1987b) cite several learning theories which are applicable to accounting education and which could be incorporated usefully into CAL material. These include productive thinking² (Wertheimer,

² Productive thinking (Wertheimer, 1945, 1959) is learning based on understanding rather than on rote memorization.

1945, 1959), attention directing³ (Broadbent, 1953, Feuerstein et al., 1980 and Weil, 1989) and metacognition⁴.

Jensen and Sandlin (1992a and b) identify several advantages of CAL. One of these is the provision on the computer of course material for studying and revision. Ward and Sweller (1990), however, contend that too much explanation can cloud learning and hinder subsequent performance, and that a balance is required in instructional material if learning is to be enhanced.

A further advantage of CAL identified by Jensen and Sandlin (1992a and b) is the development of an interactive approach, particularly in respect of conditional branching options, where the response of a student determines what part of a lesson is encountered at the next stage of the teaching/learning process.

Computers possess the means to assist students when they encounter difficulties, that is, to act as intelligent tutors (Sleeman and Brown 1982). This is a need identified by Er and Ng (1989) in respect of the design of CAL programs; namely, how to identify students' errors and respond to them in a remedial manner, based on the needs of each student.

Computers permit the use of structured approaches to teaching, frequently with the assistance of a spreadsheet and an algorithmic approach (Ijiri, 1983, Kachelmeier et al., 1992, Ahadiat, 1992, Togo and McNamee, 1994). Jensen and Sandlin (1995) report the widespread use of spreadsheets in accounting education. Gagné (1961) and Gagné and Paradise (1962) contend that computer-aided learning lends itself towards sequential processing of new knowledge and procedures; if a CAL program is structured in this manner, it captures the cognitive benefits of sequential processing.

One way of structuring a CAL program is through the creation of a simulation environment. The use of simulation as a learning technique is examined in a study by Basu and Cohen

³ Attention directing (Broadbent, 1953) is the directing of students' attention towards important stimuli. Feuerstein et al. (1980) and Weil (1989) regard the identification of relevant cues as an important component of effective cognitive functioning.

⁴ Defined as, "...one's awareness of what one is doing to accomplish goals and how one is doing it" (Borthick and Clark, 1987b, 178), or the active monitoring of one's work (Collins et al, 1989).

(1994), who report resistance to accounting as a major subject, due to a lack of stimulation in the introductory course because of a more rigid, rule-based approach. Basu and Cohen (1994, 364) used a simulation-based approach, suggesting that, "...exposing students to a real-life company, with the accompanying complexities, makes them realise that accounting is not a black-and-white field where rules and standards are applied blindly."

A simulation environment lends itself to the use of integrative, rather than piecemeal material. Borthick and Clark (1986) report that students experience greater learning with integrative assignments, rather than repetitive, non-integrative assignments. Williams et al. (1988) contend that CAL is a more effective learning tool with integrative problems than with small problems. The accounting cycle (Wu, 1986) is an example of a topic suitable for CAL adaptation.

Jensen and Sandlin (1992a, 1995), in reviewing course management software (CMS) designed for CAL, identify some of the deficiencies of existing CMS. These include, inter alia, inadequate coverage of course contents, a lack of animation in design⁵, lack of feedback by way of inadequate problem solutions, lack of interactive facilities and lack of conditional branchings for interactive learners.

From the above studies and reviews, several pedagogical features can be identified which may enhance the design of CAL material in accounting. These can be summarised as follows:

Learning approach - the use of simulation and interaction, as well as integrative, rather than individual, once-off assignments.

Content - the inclusion of course-specific material for learning and/or revision purposes.

Support mechanisms - features which allow the student to monitor his/her understanding and progress and which guide the student to a correct solution.

⁵ For example, Jensen and Sandlin (1992a) state that animation can be used to illustrate the flow of transactions through the accounting cycle.

The inclusion of these features in CAL program design will meet two of the Accounting Education Change Commission's (AECC) recommendations for the first course in accounting, namely, that interactive learning by students should be promoted through the use of simulations, and that emphasis should be on teaching the student to learn on his or her own (AECC, 1992).

Some studies have measured student perceptions about the use of CAL in accounting (Borthick and Clark, 1986, Ahadiat, 1992). Borthick and Clark (1986) report that students feel the microcomputer helps them to learn. Borthick and Clark (1986) furthermore find that students favour integrated computer assignments over non-integrative textbook assignments. Ahadiat (1992) finds a significant change in elementary accounting students' perceptions of computer use in an accounting course – their attitudes have become less favourable, compared to the pre-computer stage. Ahadiat (1992) suggests several reasons for this negative outcome, including, *inter alia*, lack of familiarity with the computer and time demands. Ahadiat (1992) also compares perceptions towards computer usage between elementary and intermediate accounting students. He finds that intermediate accounting students have more positive perceptions than elementary students. Hildebeitel et al. (1990) also find negative shifts in student attitudes towards CAL after completing computer assignments. Togo and McNamee (1997) find that despite performing more poorly after computer integration, students advocate continued computer integration into the course. The students also report favourably on the amount of accounting that they have learnt from the computer project.

The literature does not examine student perceptions about the pedagogical features of CAL programs. As these perceptions may influence students' attitudes towards computer integration into the curriculum, this study addresses this issue. The following is an outline of the research methodology employed in the study.

3. The Research Study

3.1 Methodology

The objective of this study is to investigate student perceptions of the pedagogical features used in a CAL program in accounting. This is achieved by measuring the relative value to accounting students of those features in assisting them with their understanding of the accounting cycle. The pedagogical features of a CAL program which are considered important in promoting effective learning, as identified from the literature review, are the *learning (or teaching) approach*, the program's *content* and the *support mechanisms* to aid the learning process. The empirical research seeks to measure student perceptions about the value of each of these features in a specific CAL program in promoting effective learning.

The study was conducted within the context of a CAL program used in Introductory Accounting⁶ at Lincoln University in New Zealand. The program operationalizes the pedagogical features identified in the literature by using several instructional tools. The *content* of the program is implemented by way of four instructional tools, namely practice problems, compulsory exercises, tutorials and on-line reference books (an on-line review mode to allow students to review previous mistakes while providing on-line text explaining the answer). The *learning (teaching) approach* is operationalized by the use of a simulation environment and the associated features of interaction and immediate feedback. The *support mechanisms* are manifested in the program by a hint button, a show me button, context specific help options and again, on-line reference books.

In addition to including the pedagogical features identified in the literature, the program also incorporates the extensive use of assessment methods. This pedagogical feature is thus also included in the study. *Assessment methods* are implemented in the program in the form of compulsory exercises, practice examinations (to assist students in assessing their comprehension of the material as well as provide content-specific feedback for each question)

⁶ The Introductory Accounting Lab (Acclab) (Smith and Birney 1994a, 1994b). See footnote 2. Acclab (the program) was used to supplement lectures on the accounting cycle. In order to minimize additional workload for students (Togo and McNamee, 1997), lectures devoted to the accounting cycle were reduced by 50 percent.

and promotion (competency) examinations (for which prerequisite marks for proceeding to the next module may be set).

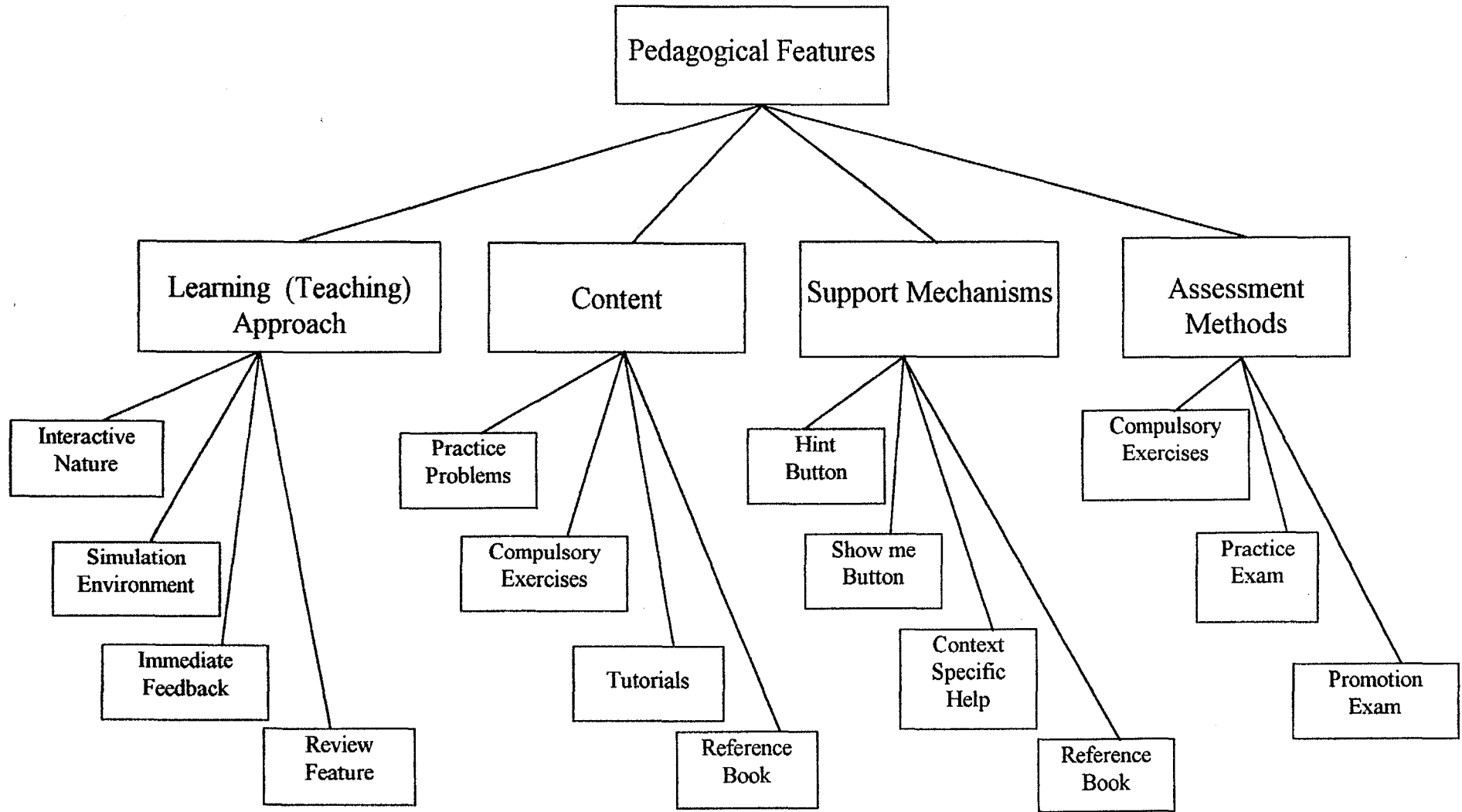
The CAL pedagogical features and associated instructional tools are displayed hierarchically in Figure 1.

Student user perceptions of the relative value of each of the specific pedagogical features and associated CAL instructional tools were gauged using the Analytical Hierarchy Process (AHP) (Saaty 1980; Wind and Saaty 1980; Arrington et al 1984; Lin et al 1984). The AHP is a methodology which translates subjective assessments of the relative value of largely qualitative attributes into numeric scores. In the context of this study, these numeric weights reflect the relative value (or importance) that an accounting student has implicitly attached to the pedagogical and CAL design features defined in figure 1.

3.2 Data Collection and Analysis Approach

The target population was all students registered for the *Introduction to Accounting* course at Lincoln University, New Zealand. A response rate of 65 percent (59 students) was achieved.

The hierarchical structure shown in Figure 1 was evaluated on completion of the course by each student user of the CAL program. Data was gathered using a structured self-administered questionnaire. The questionnaire was structured in a manner which facilitated data collection for the Analytical Hierarchy Process. It comprised of six sections. Section one elicited student responses on the relative importance of the pedagogical features indicated at the first level of the hierarchy in Figure 1, while sections two to five evaluated the relative usefulness of the instructional tools within each pedagogical feature at the second level of the hierarchy.



6

Figure 1
Analytical Hierarchy for Acclab Pedagogical Features

Data collection for the Analytical Hierarchy Process is based on pairwise comparisons of alternatives. All possible pairs of pedagogical features (at level 1) and instructional tools (at level 2) were evaluated by the student respondents. For each pair of alternatives, a student was required firstly to identify which of the two alternatives the student regarded as being more helpful for learning the accounting cycle, and secondly to indicate the intensity of such preference, based on a nine point rating scale (1 = equal value, to 9 = absolute value).

The final section of the questionnaire, comprised of three Likert-scaled questions, requested students to indicate the extent of their agreement (on a 1 to 5 rating scale) with the following three statements:

- “I can learn everything about the accounting cycle from Acclab only”
- “The self-paced style of Acclab helped me learn the accounting cycle”
- “Acclab was easy to use”.

The trade-off matrices of response ratings compiled by the pairwise comparison of alternatives were analysed using the Analytical Hierarchy Process to generate measures of relative value for each pedagogical feature (at level 1) and instructional tool (at level 2). Cluster analysis was applied to the derived measures of relative value of the four pedagogical features to identify homogeneous groupings of student perceptions. Thereafter, all student responses within each homogeneous grouping were profiled to determine the overall value of the various instructional tools in CAL programs to promote effective learning of the accounting cycle.

4. Analysis of Research Findings

The homogeneous clusters of respondents in respect of the pedagogical features of the program and their respective sizes (in terms of the number of respondents) are summarised in Table 1. The figures in brackets represent the *rank order* of the attributes (1 = most important; 4 = least important).

Table 1
Respondent clusters and Their Attribute Profiles

Cluster A

| Cluster Number | Number of Students | Average Attribute Weights | | | |
|----------------|--------------------|------------------------------|---------------------|--------------------|--------------------|
| | | Learning (Teaching) Approach | Content | Support Mechanisms | Assessment Methods |
| | 37% | | | | |
| 1 | 10 | 0.071 (4) | 0.624 (1) | 0.160 (2) | 0.145 (3) |
| 2 | 6 | 0.091 (4) | 0.335 (1) | 0.264 (3) | 0.310 (2) |
| 3 | 6 | 0.287 (2) | 0.510 (1) | 0.118 (3) | 0.086 (4) |

Highest ranked attribute : Content
 Second highest ranked attribute : Support Mechanisms
 Percentage support from sample : 37% (22 students)

Cluster B

| Cluster Number | Number of Students | Average Attribute Weights | | | |
|----------------|--------------------|------------------------------|---------------|---------------------|--------------------|
| | | Learning (Teaching) Approach | Content | Support Mechanisms | Assessment Methods |
| | 27% | | | | |
| 4 | 9 | 0.213 (4) | 0.265 (2) | 0.304 (1) | 0.217 (3) |
| 5 | 4 | 0.047 (4) | 0.0237 (2) | 0.607 (1) | 0.109 (3) |
| 6 | 3 | 0.199 (2) | 0.118 (3) | 0.580 (1) | 0.104 (4) |

Highest ranked attribute : Support Mechanisms
 Second highest ranked attribute : Content
 Percentage support from sample : 27% (16 students)

Cluster C

| Cluster Number | Number of Students | Average Attribute Weights | | | |
|----------------|--------------------|------------------------------|--------------|--------------------|--------------------|
| | | Learning (Teaching) Approach | Content | Support Mechanisms | Assessment Methods |
| | 20% | | | | |
| 7 | 7 | 0.576 (1) | 0.164 (3) | 0.174 (2) | 0.085 (4) |
| 8 | 2 | 0.355 (1) | 0.261 (3) | 0.314 (2) | 0.064 (4) |
| 9 | 3 | 0.363 (1) | 0.198 (2) | 0.081 (4) | 0.358 (3) |

Highest ranked attribute : Learning (Teaching) Approach
 Second highest ranked attribute : Content/Support Mechanisms
 Percentage support from sample : 20% (12 students)

Cluster D

| Cluster Number | Number of Students | Average Attribute Weights | | | |
|----------------|--------------------|------------------------------|--------------|--------------------|--------------------|
| | | Learning (Teaching) Approach | Content | Support Mechanisms | Assessment Methods |
| | 15% | | | | |
| 10 | 5 | 0.048 (4) | 0.203 (2) | 0.146 (3) | 0.602 (1) |
| 11 | 4 | 0.189 (2) | 0.157 (3) | 0.141 (4) | 0.512 (1) |

Highest ranked attribute : Assessment Methods
 Second highest ranked attribute : Content/Support Mechanisms
 Percentage support from sample : 15% (9 students)

The clustering process reveals a *range of perceptions* across the sample of respondents. While 11 separate clusters can be identified, each cluster reflecting a different *perceptions profile* of the relative value of the four *pedagogical features*, there are 4 main groupings. Each of these is identified by a separate pedagogical feature ranked first. The ranks of the subclusters within each main cluster are similar, but not identical.

The largest grouping of respondents, namely 37%, identify the *content* of the program as being the **most helpful** for learning the accounting cycle, followed by the *support mechanisms* in the form of 'help' and 'revision' provided. The second major grouping of respondent's, namely 27%,

regard the same two attributes as being the **most** and **second most helpful** features of the program for learning the accounting cycle, *but in reverse order*. Thus over 60% of the sample (64%) view the most useful design features of the program to be *content* and *support mechanisms*. The latter finding confirms the need of students for diagnostic and remedial features to be included in CAL programs (Er and Ng, 1989).

The relative value of the various pedagogical features can be explored further by examining the specific instructional tools within each feature.

4.1 Learning (Teaching) Approach

With regard to the program's *learning (teaching) approach*, four instructional tools are employed. They are the *simulation environment*, *the program's interactive nature*, its *review feature*, and its *immediate feedback* facility. The AHP analysis of the relative rankings of these tools is shown in Table 2, presented within the homogeneous groupings of respondents from Table 1.

Table 2
Perceived Relative Value of Learning (Teaching) Approaches in Acclab as Being Beneficial in Learning the Accounting Cycle

| Cluster | Number of Students | Average Attribute Weights for Acclab's Teaching Approaches | | | |
|---------|--------------------|--|--------------------|-----------------|--------------------|
| | | Simulation Environment | Interactive Nature | Review Features | Immediate Feedback |
| A | 22 (37%) | 0.168 (4) | 0.243 (3) | 0.281 (2) | 0.328 (1) |
| B | 16 (27%) | 0.169 (4) | 0.186 (3) | 0.308 (2) | 0.338 (1) |
| C | 12 (20%) | 0.223 (4) | 0.242 (3) | 0.248 (2) | 0.287 (1) |
| D | 9 (15%) | 0.142 (4) | 0.190 (3) | 0.323 (2) | 0.344 (1) |

Highest ranked attribute : Immediate Feedback
 Second highest ranked attribute : Review Features

The *immediate feedback* teaching facility receives unanimous support from *all* respondents. This teaching facility is rated *first* by respondents across all 4 groupings of respondents. Unanimous responses are also received for the *second most important* teaching facility of the program, namely the *review features* which Acclab offered. Again, all four response groups rate this feature highly, but not above the *immediate feedback* facility.

The inclusion of *review features* permits students to monitor their progress, a component of metacognition. Although ranked second to *immediate feedback* as a *learning feature*, the relatively high ranking of *review features* nevertheless provides support for Borthick and Clark's (1987b) contention that metacognitive features could be incorporated usefully into CAL material. It could also be argued that *immediate feedback*, by advising students of the correctness of their solutions, is also facilitating metacognition. It is noteworthy that neither the use of a simulation environment, as suggested by Basu and Cohen, (1994), nor the interactive nature⁷ of the program, as encouraged by Jensen and Sandlin, (1992a), are perceived to be relatively very helpful by students.

4.2 Content

From a *content* perspective, Acclab offers the following features: *optional practice problems*, *compulsory exercises*, *tutorials*, and a *reference book*. The respondents rate these attributes as shown in Table 3, presented within the homogeneous groupings of respondents from Table 1.

⁷ This finding should not necessarily be interpreted as being against the use of interactive CAL material, as many of the instructional tools which are ranked highly by the respondents (see the remaining results) are of an interactive nature.

Table 3
Perceived Relative Value of Content-Related Features in
Acclab as Being Beneficial in Learning the Accounting Cycle

| Cluster | Number of Students | Average Attribute Weights for Acclab's Content Attributes | | | |
|---------|--------------------|---|----------------------|--------------|----------------|
| | | Practice Problems | Compulsory Exercises | Tutorials | Reference Book |
| A | 22 (37%) | 0.266 (2) | 0.372 (1) | 0.191 (3) | 0.171 (4) |
| B | 16 (27%) | 0.149 (4) | 0.308 (1) | 0.269 (3) | 0.274 (2) |
| C | 12 (20%) | 0.192 (4) | 0.341 (1) | 0.203 (3) | 0.265 (2) |
| D | 9 (15%) | 0.133 (3) | 0.495 (1) | 0.130 (4) | 0.242 (2) |

Highest ranked attribute : Compulsory Exercises

Second highest ranked attribute : Reference Book

As with the *teaching approach* criteria, there is also a dominant *content feature* which is considered the most important feature by all groups, namely the *compulsory exercises*. Respondents in the 4 major groupings all regard the *compulsory exercises* as being the most helpful *content-related* feature for learning the accounting cycle. This finding provides support to Jensen and Sandlin (1992a), who contend that the use of “compulsory exercises” in the learning (teaching) approach gives students feedback on their understanding of course material, without compelling them to wait for examinations.

There is relatively strong support for the *reference-book* facility as the *second most important* content-related feature of Acclab, followed, by almost equal support for the remaining two features, namely the *tutorials* and the *practice problems*. The support for the *reference-book* feature supports the contention of Collins et al. (1989) that cognitive learning is enhanced when the teaching material explicates the general principles underlying the specific problem to be solved. The provision of appropriate reference material in CAL design is also recommended by Jensen and Sandlin (1992a), as an example of course material which can be retrieved easily for revision purposes.

It appears as if the "optional" tasks, namely the *tutorials* and the *practice problems*, are less helpful to students in learning the accounting cycle than the mandatory set of exercises. This may be due to some students not completing the optional tasks, as they are not a prerequisite for continuing the module.

4.3 Attributes Relating to Support Mechanisms

Acclab offers four features to *assist* the student to learn the accounting cycle. They are the *hint button*, the *show me button*, a *context-specific help* feature, and a *reference book*. The respondents rate these attributes as shown in Table 4, presented within the homogeneous groupings of respondents from Table 1.

Table 4
Perceived Relative Value of Support Mechanisms in
Acclab as being Beneficial in Learning the Accounting Cycle

| Cluster | Number of Students | Average Attribute Weights for Acclab's Available Assistance | | | |
|---------|--------------------|---|---------------------|-----------------------|---------------------|
| | | Hint Button | Show-me Button | Context Specific Help | Reference Book |
| A | 22 (37%) | 0.180 (4) | 0.266 (2/3) | 0.267 (2/3) | 0.287 (1) |
| B | 16 (27%) | 0.200 (4) | 0.256 (3) | 0.276 (1) | 0.267 (2) |
| C | 12 (20%) | 0.199 (3) | 0.343 (1) | 0.184 (4) | 0.274 (2) |
| D | 9 (15%) | 0.176 (4) | 0.256 (3) | 0.300 (1) | 0.268 (2) |

Highest ranked attribute : Reference Book
 Second highest ranked attribute : Context-specific Help/Show-me Button

The similarity between the relative weights for three of the attributes, viz. the *reference-book*, the *context-specific help* and the *show-me button* indicate almost *equal importance* attached to each in assisting the student to learn about the accounting cycle. There is, however, a slight preference for the *reference book* facility (by virtue of being consistently ranked either first or second across all groupings).

Although no strong preference for the different types of support mechanisms is discernible from the findings, the importance attached to support mechanisms by students should not be ignored. Its ranking as the second most helpful design feature, supports the contention of Sleeman and Brown (1982), that CAL should incorporate support mechanisms to assist students when they encounter difficulties. The support mechanisms, particularly the *hint* and *show me* buttons, incorporate the principles of *attention directing* (Broadbent 1953; Borthick and Clark 1987a), by directing the students' attention towards important stimuli in the solution of a problem.

4.4 Assessment Methods Attributes

There are three *assessment methods* offered by Acclab, namely *marking compulsory exercises*, a *practical examination*, and a *promotion examination*. The respondents rate these attributes as shown in Table 5, which is presented within the homogeneous groupings of respondents from Table 1.

Table 5
Perceived Relative Value of Assessment Methods Used by
Acclab as being Beneficial in Learning the Accounting Cycle

| Cluster | Number of Students | Average Attribute Weights for Acclab's Assessment Methods | | |
|---------|--------------------|---|----------------------|-----------------------|
| | | Compulsory Exercise | Practice Examination | Promotion Examination |
| A | 22 (37%) | 0.553 (1) | 0.204 (3) | 0.243 (2) |
| B | 16 (27%) | 0.451 (1) | 0.283 (2) | 0.266 (3) |
| C | 12 (20%) | 0.541 (1) | 0.171 (3) | 0.287 (2) |
| D | 9 (15%) | 0.346 (1) | 0.317 (3) | 0.337 (2) |

Highest ranked attribute : Compulsory Exercises
 Second highest ranked attribute : Promotion Examination/Practice Examination

The *marking of compulsory exercises* offered by Acclab is considered, by far, to be the *most important* assessment method by *all* groupings of respondents (by virtue of this attribute being

ranked first in all groups). There is less, but equal, importance attached to the two *examinations-oriented* features in assisting the students to learn about the accounting cycle.

4.5 The Overall Value of Acclab as a Learning Resource

There is a high degree of consensus amongst all respondents as to the relative *value* of the various specific *design features* which characterise the Acclab learning resource. Of the *learning (teaching) approach* adopted by the program, the *immediate feedback* and *review features* are rated the highest (first and second respectively) in helping students learn about the accounting cycle. The *compulsory exercises*, and to a lesser degree, the *reference book* are the important learning aids for the *content-related* support features of the program. With the minor exception of the *hint-button* (which is rated marginally lower), the remaining three *support mechanism* features are regarded as almost of equal importance in helping students learn about the accounting cycle. Finally, it is the *marking of compulsory exercises* which receives the strongest support of all the *assessment methods* available through Acclab.

Respondents are also asked to rate their support for three statements concerning the value of the program as a learning resource. The response profile is given in Table 6.

Table 6
Likert Rating Scales Response to the Value of Acclab Overall as a Learning Resource

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|--|--------------------------|-----------------|----------------|--------------|-----------------------|
| I can learn everything about the accounting cycle from Acclab. | 6 (10%) | 12 (20%) | 16 (28%) | 22 (37%) | 3 (5%) |
| The self-paced style of Acclab helped me learn the accounting cycle. | 1 (<2%) | 1 (<2%) | 12 (20%) | 27 (46%) | 18 (31%) |
| Acclab was easy to use. | 2 (3%) | 0 (0%) | 8 (14%) | 25 (42%) | 24 (41%) |

From statement 1, only 42% of all respondents consider that the program has the ability to teach a student everything about the accounting cycle. Respondents offer *cautious responses* to this statement, with over a quarter (28%) not committing themselves to forming an opinion and

another 30% disagreeing with this statement. The profile of responses to this statement (namely 85% expressing no view or only mild support/nonsupport) implies that students are not fully convinced that everything about the accounting cycle can be learned from this CAL program.

From statement 2, the *modus operandi* of Acclab (viz. its self-paced learning capability) is appreciated by over three quarters of all respondents (77%). This learning facility clearly enjoys *majority support* in terms of assisting students to learn about the accounting cycle.

From statement 3, there is little doubt that Acclab is an *easy-to-use* learning resource. Well over eighty percent of all respondents (83%) believe that the program is easy to use.

These responses can be viewed in the light of a direct question in the questionnaire, where students are asked which method of instruction (ie. lectures and the Acclab facility) has taught them more about the accounting cycle. The trade-off responses are summarised in Table 7.

Table 7
Trade-Off Responses Between Lectures and Acclab

| | Number | Percent | Strength of Support |
|----------------------|--------|---------|---------------------|
| Support for Lectures | 5 | 8% | 0.0847 |
| Support for Acclab | 50 | 85% | 0.854 |
| Indifferent | 4 | 7% | 0.0678 |

The clear majority of respondents (85%) strongly favor the Acclab approach to learning about the accounting cycle. The strength of their preference is indicated by the high (0.854) relative importance measure (1 being absolutely superior). There is only a small minority (8%) who strongly favour lectures over the CAL approach.

5. Limitations of the Study

The response rate of 65%, being typical of average class attendance, suggests that the results of the study may be biased in favour of enthusiastic students, that is, those who attend classes regularly. It is also possible that the novelty value of the program, which was being used for the first time, may have favourably influenced students' overall perceptions, but not their relative perceptions of the learning features of the program.

A further variable which may impact on the results is variability in students' computing backgrounds (Borthick and Clark, 1987b). Significant variability in prior computer experience could produce large differences in students' computer dexterity and also anxiety, and hence influence their perceptions.

The study does not attempt to compare students' perceptions between the pedagogical features in Acclab and those which exist in other CAL programs. This was not done for two reasons; firstly, the available time did not permit students to be exposed to other accounting CAL programs, and secondly, as Acclab contained many of the pedagogical features evident from the literature, the study focused on students' relative perceptions of those features only. A more encompassing comparative study of CAL accounting programs' pedagogical features could be a topic for future research.

6. Conclusion

This study focuses on the perceptions of students about the usefulness of a computer-aided learning program to study the accounting cycle. The empirical study conducted utilizes the Analytic Hierarchy Process, a procedure which enables respondents' perceptions of mainly qualitative attributes to be measured and analyzed. This study examines the perceived value of the pedagogical features of Acclab which promote the learning process, rather than the relative evaluation of student performances. The aim of the study is to identify and measure the relative

value of those pedagogical features which students consider to be the most helpful for learning the accounting cycle.

From the analysis of the results, it can be concluded that Acclab is a *highly beneficial* learning resource (as seen from statement #2 responses and the strong support and high strength of preference given to it). It has many desirable instructional tools, which are regarded by respondents as promoting the learning process of the accounting cycle, as observed from the relative value analyses (see Tables 2, 3, 4, 5), but is not considered to be a replacement for the traditional lecturing method (as seen from statement #1 responses). The responses to statement #1 indicate that students view Acclab as an important supplementary method of learning about the accounting cycle.

The results provide useful information for educators in respect of the design of computer-aided learning materials. Thirty-seven percent of the respondents consider the “content” (in terms of its relevance to the course objectives) to be the most important pedagogical feature. The “support mechanism” (assistance available to the user) is ranked as the second most important feature (27 percent of respondents).

Sixty four percent of the respondents thus consider “content” and “support mechanisms” to be the two most important pedagogical features - either “content” followed by “support mechanisms”, or vice versa.

Within each of the pedagogical features, there is considerable consensus for the various instructional tools which students perceive as enhancing their learning process. “Immediate feedback” is perceived to be the most beneficial component of “learning (teaching) approach”; the “compulsory exercises” are seen to be the most beneficial component of the “content” of Acclab; the “reference book” is seen to be the most beneficial “support mechanism”; and the “compulsory exercises” are seen to be the most beneficial “assessment method”. These findings should be borne in mind by educators when designing and/or selecting a CAL program for their specific tuition program.

In general terms, the results of this study indicate a favourable attitude towards computer integration into Introduction to Accounting at Lincoln University by the student respondents. Clearly, students perceive instructional materials which incorporate sound pedagogical features, such as those encouraged by Borthick and Clark (1987b) and Jensen and Sandlin (1992a) as being helpful to them in their studies. Despite the clarity of the findings of this study, the results should be treated with caution, as subject responses may be biased favourably by the novelty of the computerised learning environment.

References

- Accounting Education Change Commission [AECC] (1992). The first course in accounting: Position Statement No.2. *Issues in Accounting Education* (Fall), 249-251.
- Ahadiat, N. (1992) A Study of Work Values of Computer Education in Accounting. *Computers Education*, 19(4) 369-380.
- Anderson, U., May, R. G., and Miles, C. A. (1988) Variables Sampling Software: Development and Classroom Testing. *Issues in Accounting Education*, (Spring) 156-173.
- Arrington, C. E., Hillison, W., and Jensen, R. E. (1984) An Application of Analytical Hierarchy Process to Model expert Judgments on Analytical Review Procedures. *Journal of Accounting Research*, (Spring), 298- 312.
- Bagranoff, N. A. (1993) Adopting Commercial Software in the Accounting Classroom: a Focus on Learning. *Journal of Accounting Education*, 11 275-286.
- Basu, P., and Cohen, J. (1994) Learning to Learn in the Accounting Principles Course: Outcome Assessment of an Integrative Business Analysis Project. *Journal of Accounting Education*, 12 (4) 359-371.
- Böer, G. B., and Livnat, J. (1990) Using Expert Systems to Teach Complex Accounting Issues. *Issues in Accounting Education*, (Spring) 108-119.
- Borthick, A. F., and Clark, R. L. (1986) The Role of Productive Thinking in Affecting Student Learning with Microcomputers in Accounting Education. *The Accounting Review*, 143-157.
- Borthick, A. F., and Clark, R. L. (1987a) Improving Accounting Majors' Writing Quality. *Issues in Accounting Education*, (Spring) 13-27.
- Borthick, A. F., and Clark, R. L. (1987b) Research on Computing in Accounting Education: Opportunities and Impediments. *Issues in Accounting Education*, (Fall) 173-192.
- Broadbent, D. E. (1953) Classical Conditioning and Human Watch-Keeping. *Psychological Review*, 60 331-339.
- Clark, R. E., and Salomon, G. (1986) Media in Teaching, in M. C. Wittrock, ed., *Handbook of Research on Teaching*, 3rd ed. New York: Macmillan: 464-478.
- Collins, A., Brown, J. S., and Newman, S. E. (1989) Cognitive Apprenticeship: Teaching the Crafts of Reading, Writing, and Mathematics, in Resnick, B. L., ed., *Knowing, Learning, and Instruction: Essays in Honor of Robert Glasser*. Hillsdale, NJ: Lawrence Erlbaum Associates 453-494.

- Dickens, T. L., and Harper, R. M. (1986) The Use of Microcomputers in Intermediate Accounting: Effects on Student Achievement and Attitudes. *Journal of Accounting Education*, (Spring) 127-146.
- Er, M. C., and Ng, A. C. (1989) The Use of Computers in Accountancy Courses: A New Perspective. *Accounting and Business Research*, (Autumn), 319-326.
- Fetters, M. J., McKenzie, J., and Callaghan, D. (1986) Does the Computer Hinder Accounting Education? An Analysis of Some Empirical Data. *Issues in Accounting Education* (Spring), 76-85.
- Feuerstein, R., Rand, Y., Hoffman, M., and Miller, R. (1980) *Instrumental Enrichment*, University Park Press.
- Friedman, M. E. (1981) The Effect on Achievement of Using the Computer as a Problem-Solving Tool in the Intermediate Accounting Course. *The Accounting Review*, (January), 137-143.
- Gagné, R. M. (1962) The Acquisition of Knowledge. *Psychological Review*, (July), 355-365.
- Gagné, R. M., and Paradise, N. E. (1961) Abilities and Learning Sets in Knowledge Acquisition. *Psychological Monographs: General and Applied*, Whole No. 518.
- Groomer, S. M. (1981) An Experiment in Computer-Assisted Instruction for Introductory Accounting. *The Accounting Review*, (October), 934-941.
- Hiltebeitel, K. M., Jones, S. K., and Harmon, W. K. (1990) Student Attitude Shifts Attributable to Accounting Microcomputer Projects. *Journal of Accounting and Computers*, 6 56-64.
- Ijiri, Y. (1983) New Dimension in Accounting Education: Computers and Algorithms. *Issues in Accounting Education*, 168-173.
- Jensen, R. E., and Sandlin P. K. (1992a) Why Do It? Advantages and Dangers of New Waves of Computer-Aided Teaching/Instruction. *Journal of Accounting Education*, (10), 39-60.
- Jensen, R. E., and Sandlin P. K. (1992b) How to do it. Getting Started in Authoring Computer-Aided Teaching/Instruction and what Software Features to consider. *Journal of Accounting Education*, (10), 61-93.
- Jensen, R. E., and Sandlin P. K. (1995) Who's Doing It? Sources of Public and Private Computer-Aided Learning Materials for Accounting Education. *Journal of Accounting Education*, 13(2), 119-148.
- Jones, K. H., Doran M. S., Weber G. J. and others of the School of Accountancy, Arizona State University (1994) *The Redesign of Introductory Accounting at Arizona State University*. Unpublished.

- Kachelmeier, S. J., Jones, J. D., and Keller, J. A. (1992) Evaluating the Effectiveness of a Computer-Intensive Learning Aid for Teaching Pension Accounting, *Issues in Accounting Education*, 7 (2), 164-178.
- Kulic, C. C., and Kulic, J. A. (1986) Effectiveness of Computer-Based Education in Colleges. *AEDS Journal*, (Winter/Spring), 81-108.
- Lin, W. T., Mock, T. J., and Wright, A. (1984) The Use of the Analytic Hierarchy Process as an Aid in Planning the Nature and Extent of Audit Procedures. *Auditing: a Journal of Practice & Theory*, 4 (1), 89-99.
- Maher, J. J. (1993) Developing Accounting-System Concepts and Computer Skills with a Spreadsheet Program and a Database Manager. *Issues in Accounting Education*, (Fall) 404-422.
- McKeown, J. C. (1976) Computer-Assisted Instruction for Elementary Accounting. *The Accounting Review*, (January), 123-130.
- Needles, B. E. Jr., and Anderson, H. R. (1991) A Comprehensive Model for Accounting Education. *Models of Accounting Education*. Accounting Education Change Commission, 49-70.
- Oglesbee, T. W., Bitner, L. N., and Wright, G. B. (1988) Measurement of Incremental Benefits in Computer Enhanced Instruction. *Issues in Accounting Education*, (Fall), 365- 377.
- Saaty, T. (1980) *The Analytic Hierarchy Process*. New York, McGraw-Hill.
- Sleeman, D., and Brown. J. (1982) Eds. *Intelligent Tutoring Systems*. New York, Academic Press.
- Smith, E. S., and Birney, R. (1994a) *The Introductory Accounting Lab. An Interactive Tutorial*, McGraw-Hill.
- Smith, E. S., and Birney, R. (1994b) *User's Manual. The Introductory Accounting Lab. An Interactive Tutorial*, McGraw-Hill.
- Togo, D.F., and McNamee, A. H. (1994) A Transfer-of-Learning Approach to Computer Integration. *Journal of Accounting and Computers*, 10 41-51.
- Togo, D. F., and McNamee, A. H. (1995) Computer Integration into the Accounting Curriculum: Learning Benefits, Problems and Guidelines. *Journal of Accounting Education*, 13(2), 149-158.
- Togo, D. F., and McNamee, A. H. (1997) Computer Integration in Accounting Education: Guidelines and Pitfalls. *Accounting Forum*, 20(3/4) 381-397.
- Ward, M., and Sweller, J. (1990) Structuring Effective Worked Examples. *Cognition and Instruction*, 137-166.

- Weil, S.H. (1989) *Addressing the Problems of Cognition in a First Year Accounting Course at the University of the Western Cape*. Unpublished doctoral dissertation, University of the Western Cape.
- Wertheimer, M. (1945) *Productive Thinking*. Enlarged Edition, Michael Wertheimer, Ed. (Harper and Row, 1959 [originally published 1945]).
- Williams, J. R., Tiller, M. G., Herring, H. C., III, and Scheiner, J. H. (1988) *A Framework for the Development of Accounting Education Research*, Sarasota FL: American Accounting Association.
- Wind, Y., and Saaty, T. L. (1980) Marketing Applications of the Analytic Hierarchy Process. *Management Science*, 26 (7) 641-658.
- Wu, F.H. (1986) Spreadsheet Software: a Tool for Teaching Managerial (Cost) and Financial Accounting. *The Journal of Information Systems*, 1, 121-136.