

COMPUTERS, TEACHING AND CURRICULUM
IN FARM BUSINESS MANAGEMENT

by

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in Partial Fulfillment of the Requirements
for the Degree of

Master of Education

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ABSTRACT

A qualitative research methodology, the grounded theory paradigm, was used to identify what changes occurred in teaching and curriculum as computers were integrated into the teaching of Farm Business Management in the University of Manitoba diploma program. The reasons why changes took place were clarified by identifying the causal conditions for the phenomenon of using computers to teach the curriculum, the context, the intervening conditions, the actions and interactions and the consequences.

By comparing the findings in the Mainframe Period (1983-87) to the Micro-computer Period (1987-91), changes to teaching were identified in the following areas: the number of staff teaching with computers, the staff computer training, instructional methods used, student questions, assignments, evaluation practices, classroom management, resources and support required, equipment, software, and classroom layout. Conclusions were drawn about the effects of computer use on the curriculum goals, curriculum content, sequencing of curriculum content and development of curriculum knowledge. The reasons why changes occurred in teaching and the Farm Business Management curriculum as computers were introduced were: changes in administrative policies, greater integration of computer use in the courses, greater experience using and teaching with computers and computer software, advances in computer technology and software technology, and administrative and teaching staff identified needs.

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CHAPTER I: INTRODUCTION

A. Purpose

Between 1983 and 1991 computers were integrated into the teaching of farm business management in the agricultural diploma program at the University of Manitoba. The major purpose of this study was **to gain an understanding of the use of computers in teaching farm business management** in the School of Agriculture by examining what and why changes occurred to the curriculum and teaching as computers were introduced. This was done by comparing the use of mainframe computer from 1983 to 1987 to the use of microcomputers between 1987 and 1991. These periods are referred to as the Mainframe Period and the Microcomputer Period.

A second purpose was **to clarify further the codes and conventions of using computers in teaching that make curriculum events** "(e.g. activities, assignments, student reactions and typical mistakes, time allocations)" (Doyle, 1990, p. 26) more intelligible. These codes and conventions are a "community of norms, expectations, and preferences" (*Ibid.* p. 24) that teachers using computers may share. This was done by identifying the specific characteristics of using computers to teach farm business management in the School of Agriculture.

A third purpose was **to identify a means to plan for changes in using computer technology to teach farm business management**. If influencing factors (characteristics of teaching and curriculum, causal and intervening conditions,

context, actions and consequences) could be identified, then, potentially, these factors could be manipulated to create further change towards specific goals.

B. Organization of Study

This study is organized into five chapters. Chapter I, the Introduction, includes the purpose, the organization of the study, the background, the rationale, the research question, the definition of terms, the assumptions and the limitations of the study. Chapter II is a review of related literature about computers in education, teaching, curriculum, learning and qualitative research methodology. Chapter III describes the research methods used. Chapter IV presents the findings. Chapter V describes the conclusions and recommendations.

C. Background

1. The Diploma in Agriculture Program

The Diploma in Agriculture Program is a two year program in farm management consisting of production and business courses. This program is offered at the University of Manitoba and administered by the School of Agriculture within the Faculty of Agriculture. The courses offered are separate from the degree programs. The School of Agriculture has three administrative staff who coordinate and facilitate the admissions, registrations, course offerings and communications between the students, staff and community.

The farm business management courses in the diploma program are taught by professors within the Department of Agricultural Economics and Farm Management. The professors are ultimately responsible for the courses and the curriculums. The farm business management lab instructors are hired by the School of Agriculture. The lab instructors are generally farmers and graduates of the program.

Although there is a core set of courses, the students may take more courses related to the type of farm operation that is of interest to them-- grain, livestock, dairy, horticulture, apiary, mixed farming. At the end of the two year program the students are required to present and support a farm plan based on work completed during the two years. The emphasis in the diploma courses is on practical application of the knowledge and skills.

The students are required to have a University

Entrance high school diploma or mature student status.

Approximately one third of the 60 to 80 students per year are mature students. The school year runs from October to the end of March to enable those students who are farmers to attend after harvest and before seeding.

2. Overview of Computer Use

In the 1970's, on at least two occasions, a mainframe program called CANFARM was used in the teaching of farm business management in the diploma program at the University of Manitoba. Use of this program

involved each student listing farm financial information on forms which were then sent to a central location where the information was input into the mainframe computer. This was not done on campus. The computer printout was then sent back to the farmer or, in this case, the professors who distributed them to students. If incomplete information was put on the forms, this had to be corrected before the computer printout was correct. This led to time difficulties in the offering of the farm business courses, as the turn around time with all the corrections that needed to be made, meant that students might not have the accounting statements they needed in order to complete assignments. This resulted in the students using the reports that they had completed by hand. The computer printout, if available, was supplemental information used to support the results that the student had developed by hand, but was seldom actually used by the students in developing farm plans. The use of this program was discontinued.

In the Microcomputer Period, the compiled spreadsheet templates used in the microcomputer labs and the computer assisted learning program allowed students to:

- (a) maintain a General Ledger for a farm business;
- (b) print out a set of Historical Financial Statements;
- (c) create Enterprise Plans for future implementation;
- (d) create and print out Projected Financial Statements;
- (e) review concepts about using futures markets for hedging crops.

During the Mainframe Period, c and d were possible.

Whereas the mainframe computer reports were an addendum to assignments, the microcomputer reports were an integral part of the students' lab results. The microcomputer was used to develop both historical and projected financial statements--Income, Cash Flow and Balance Sheet. The programs also calculated liquidity, profitability, solvency and efficiency ratios. These reports and ratios were required for the report on last year and the financial analysis of proposed plans. The computerized generation of budgets was used to analyze alternative enterprises. These budgets also were used in considering potential markets. The budgets and revised projected financial statements were used in the section about risk analysis.

The farm management course descriptions and outlines changed in 1990. The five courses referred to are:

- a. Introduction to Farm Business Management (61.042, previously 41.149);
- b. Economics of Farm Business Management (61.043, previously 41.150);
- c. Advanced Farm Business Management (61.066, previously 41.277);
- d. Farm Planning Project (65.062, previously 41.283);
- e. Agricultural Marketing (61.041, previously 41.145).

The lab manuals were rewritten by the instructors for these courses. These new lab manuals included specific instructions for all labs taught using microcomputers.

In 1983 a research assistant taught all the computer labs on the mainframe computer. By 1991, this research assistant was now the Micro-

computer Lab Coordinator. He supported the microcomputer lab, wrote all the spreadsheet templates, and supported instructors using the lab not only with specific hardware and software problems, but also with instructional methods to use in the microcomputer lab. Five lab instructors did all the actual teaching using the microcomputers.

In 1983 one professor worked with the research assistant to plan how to incorporate the use of a computer program into the planning project. By 1991, all the professors teaching farm business management interacted on a weekly basis with the diploma instructors, as together they planned how to deliver the courses and integrate the use of the computer in all the farm business management courses.

In 1983, one professor determined that computers should be used to teach farm business management. By 1991, three professors teaching diploma students farm business management concepts referred to the use of the microcomputer in their lectures and required that the microcomputers be used in completion of assignments. Since marketing has become a factor in farm business management, some data was collected about the marketing course. A graduate student, teaching a diploma marketing course under supervision of a fourth professor, was using microcomputers.

In 1983 there were concerns expressed by the administration about the validity of using a mainframe computer in an applied course in farm

business management. By 1991, the administration supported the use of the microcomputers with the diploma students.

In 1983, the AMDAHL mainframe computer, Model 470V8, and the printer were located in the Engineering Building, two blocks from the terminal room in the Agriculture Building where the students entered the data.

By 1991, the Faculty of Agriculture Microcomputer Lab consisted of 20 microcomputers which were 80286 machines with 640 K RAM. They were 12 MH machines and had 5 1/2" high density 1.2 MB disk drives. A few had a second 3 1/4 " low density drive. The remaining machines had a mouse attached. Nineteen of the machines had VGA monitors and the twentieth had a CGA monitor since it was connected to a CGA Liquid Crystal Display (LCD) panel. Three dot matrix printers were connected to the microcomputers by a Local Area Network (LAN). The Unisys Novell compatible LAN had a file server with a 130 MB hard drive. During the Microcomputer Period all of the microcomputer lab equipment was located in one location.

3. Farm Business Management Curriculum

In order to consider the changes that have occurred in the curriculum and teaching of farm business management and why these changes occurred it is necessary to know what farm management is and how the field of farm management has changed over time.

Appendix 1 contains the diagram the professors and instructors decided to use in the fall of 1991 to illustrate the elements of farm business management decision-making to the diploma school students. In the past, the teaching of farm business management did not incorporate all of these topics.

Bauer and Blanch (1991) describe how farm management as a field of study started as a supplementary course to production courses. It consisted of keeping track of production costs and revenues and comparing these to other farms. The purpose of keeping records was to encourage farmers to adopt new production methods and approaches in agriculture. This comparative analysis approach is one method still used today.

In the postwar era, farm management involved economic analysis of production alternatives (Ibid.). Terminology used for good production technique included least cost, or maximum revenue, or maximum profit solutions. With the introduction of computers, linear programming was used.

An accounting approach to the teaching of farm management (Ibid.) became more feasible with the advent of computers. A number of farm record keeping and accounting programs have been developed including a mainframe program called CANFARM, originally supported by the federal government and still used today, largely by the accountants that serve the farm population. A considerable number of microcomputer programs are

also available in the market place. The general debate has been based on the difference between cash and accrual approaches to keeping records. Canadian farmers have traditionally kept cash records for tax purposes. Accrual records enable farm management decision making. Considerable work has been done recently to develop and encourage standardizing terminology and accounting reports for farms (Deloitte Touche, May, 1991).

Finance originally consisted of studying agricultural credit. Financial management (Bauer and Blanch, 1991) was considered in the context of accounting, but has moved from production management and accounting to financial management. Financial management includes acquisition and financing of assets and financial control.

Marketing (Ibid.) has recently become part of farm business management as the need to be competitive internationally has become evident. Although marketing was taught, it was considered more as a separate area. The farm management curriculum was based more on the view that farmers, as individuals, were not influential in the market place. Their own costs were traditionally the basis for adjusting output levels instead of the potential product price. In the 1980s, marketing became an activity of the farm manager.

Human relationships and managing people (Ibid.) are also concerns of the farm manager. Possibly because labour was replaced by machines,

there was little emphasis in this area. This topic has increased interest today with multiple owner operations, typically with family members as partners. Also consequences with relation to income tax and inheritance are considered part of this area. The human working inter-relationships and the goals of the individual partners are also considered an important aspect of farm management. The goals developed by the students in their projects take into consideration the different family members needs.

The organizational chart of a farm business, developed by Bauer and Blanch (1991) and found in Appendix 2, provides insight into the structure of the farm as a business. Frequently the people with these tasks are the same people. However, the identification of these as separate areas of responsibility helps to clarify the areas of farm management. Decisions about the business structure and general policy and direction are the responsibility of the owners. In order to carry out the policy set, the general manager must determine what specific objectives can be reached given the situation. The production manager is concerned with answering "three basic questions: What should be produced? How much should be produced? and How should it be produced?" (*Ibid.*, p.5). Technical and market conditions affect the answer to these questions. The marketing manager considers potential prices for products as these affect the decisions about purchase of inputs and product sales. The financial manager considers future cashflow and income factors which affect decisions about

acquiring assets, how to finance the purchases and how to control the business finances in order to ensure cashflow. The personnel manager considers the human resources which may be family members or hired staff. Communication between personnel, training, motivation and satisfaction need to be considered.

Much of the computer use is related to the financial management area. Two concept maps, found in Appendix 3, (Josephson, Petkau, Srivastava, Luterbach, 1991) illustrate the financial statements, how these financial statements are interrelated and the source of the financial information used for decision making. One reads this map from the top down and uses the propositions to link the concepts. The extent of the records typically needed for farm management decision making is illustrated by a series of graphics of the filing cabinet of a farm manager found in Appendix 4 (Scudamore, 1985).

D. Rationale

Although this study focuses on one specific program at one location, **consideration of a specific situation may be useful to others.** A study by Wiske, et. al. (1988b) indicated that both researchers and teachers in various subject areas would endorse observational studies of classrooms as a way of clarifying the effects of the computer on classroom life. The study by Brink and Josephson (1986, p. 32) on the impact of microelectronics in agriculture recommended "a

high priority on regular exchange of information on and experience from initiatives that governments and other institutions take to use microelectronics".

Farm business management was selected as the focus of the study as there now appears to be **a need for farm business management computer skills**. The availability of the microcomputer and software is making it possible for farmers to significantly expand their use of financial statements in farm management. On many Manitoba farms a record keeping book called Farm Records II is used to keep records manually. Ontario and other provinces have similar record keeping books in general use. In many cases a farmer turns this book and supporting documents over to a private accountant who uses the information to develop the farm business financial statements. The Farm Records II book is a required manual for the Diploma students at the University of Manitoba.

Personal use of the microcomputer to keep financial records **provides a means for the farmer to use financial statements for planning and for control of the farm operation**. This planning may be done either by the farmer alone or in consultation with others such as provincial or private business farm management consultants. Until recently farmers used these financial statements largely for loan applications and for tax purposes. Two facts limit their use for financial management and control of the farm operation. First, some of these statements are developed on a cash instead of an accrual accounting basis because of tax considerations for the farm. Secondly, these prepared statements are usually not available in time to be used for management decision-making.

As a record keeping machine which can provide accurate information on a timely basis, **the computer has the potential to enhance the farmer's business management decision-making.** Use of a computer can greatly reduce the size of the task and the tedium of calculations required to consider alternative options for the farm manager. Since totalling and transferring numbers in manually kept records is a huge task, total confidence in the accuracy of the results is frequently lacking. Reduced confidence in the accuracy reduces the confidence in using the information for planning and control. In the past the students in the diploma program were allowed a percentage error in their records used for their final farm plan presentation, a composite of their effort over two years. The need for accurate financial records was one of the reasons for the move to using a computer in the diploma program.

In the study done by Brink and Josephson (1985), **farmers indicated that their two main uses of microcomputers were for purposes of production management and financial management.** These farmers "rated most important future uses of microelectronics on the farm to be in the areas of production, marketing and financial decision making and gathering current information about the farming environment (e.g., prices and weather)" (*Ibid.* p. 20). In this same study the area of farm analysis and planning were also identified by the government agricultural extension personnel as the greatest potential use for microcomputers. Both groups indicated a need for more computer training and suitable farm business management software.

There appears to be a **demand for farm business management education and training**. In 1990-91 over thirty community college short courses on farm business management topics were offered in Manitoba. A number of these courses involve computer usage. In November, 1990, there was an agriculture-related computer conference attended by 150 people in Brandon, Manitoba. Applicants to this conference had to be turned down because it was full. The Manitoba Department of Education piloted an agricultural course in the high schools in two locations in 1991. Part of this curriculum deals with farm business management. With the new Farm Management Initiatives which will come into effect in 1992, the Canadian federal government policy will be to support increased farm business management training and education programs.

There is a **change in the number of farmers owning microcomputers**. In 1991, farmers continue to suffer financial strain. This need to better understand the financial position on the farm has resulted in the increased interest in using the computer by farmers. In 1985, it was estimated that between 1 and 2% of the farm population owned computers (Brink and Josephson, 1985); a survey in 1991 by the research department of United Grain Growers showed that this number is now as high as 25.9% within their own membership (AgDecision Research and Consulting, February, 1990).

In the business and public sector there are changes under way in the software tools and methods used to consult with farmers about the farm business. The Manitoba Agricultural Credit Corporation, the Federal Credit Corporation,

the Manitoba Department of Agriculture and banks, including the Royal Bank and the Commerce, have recently completed or are in the process of developing farm accounting and/or planning software. These provincial government farm management consultants, agribusiness firms and financial institutions are developing training programs for staff about using this software when consulting with farmers.

E. Research Question

In the transition from the Mainframe Period to the Microcomputer Period in the School of Agriculture at the University of Manitoba:

1. what changes occurred in the teaching practices;
2. what changes occurred in the Farm Business Management curriculum; and
3. why did these changes take place?

F. Definition of Terms

The following definitions will be used in this thesis:

1. Curriculum:

The concept of 'curriculum' is a composite of definitions. First the intended curriculum is identified and second, the curriculum is developed and confirmed through classroom events. Curriculum involves consciously selecting and organizing knowledge for teaching and learning in a given environment (Poonwassie, 1990). Once specified, curriculum is experienced as a set of enacted events between teachers and students who jointly negotiate content and meaning (Doyle, 1990). This "event-structured conception of teaching as a curriculum process" (Doyle, 1990. p. 28) forms the framework for the inquiry. All the different classroom activities of teaching make up curriculum events. Knowledge and interpretation are central to curriculum processes. Interpretation:

directs the analysis to the frameworks of meaning students and teachers bring to a situation and how these interact with

the curriculum contexts in which they find themselves. This perspective also suggests that moving through the curriculum successfully involves a large amount of basic theoretical work as categories are reformulated, propositions understood, and interpretation revised. (Doyle, 1990, p. 24).

2. Teaching

Teaching "is the process by which one person interacts with another with the intention of influencing his learning" (Johnson, 1982, p. 81).

3. Teacher

The concept of 'teacher' is partially based on Streibel's definition (1985, 1986) as being the central agent in a dialectical community of learning. The teacher forms a triadic relationship with the learner and the subject matter (Greene, 1978). This definition is expanded to be a quadratic relationship by including a fourth factor, Schwab's "governance" (1969, 1970, 1971, 1973) or the milieu or environment in which teaching takes place. Although this paper focuses on teaching and curriculum, all four factors are considered important since they are all part of the "lived" experience (Hutchinson, 1986, p. 52) of curriculum in a classroom. Teachers use a frame of reference through which they perceive and process information, including personal perspective; conceptual system; principles of practice; construct system; practical knowledge; and implicit theories to interpret experience and act rationally (Shulman, 1986).

4. Education and Training

Training involves the transmission of a set of clearly identified skills. Students are expected to assimilate these skills in the manner prescribed by the trainer, the employing agency or the certification board. In education, on the other hand, the learners are encouraged to examine the assumptions underlying the acquisition of skills, to consider alternative purposes, and to place skill acquisition in some broader context (Poonwassie, 1990).

As discussed by Peters (1966), education includes the concepts that the knowledge and skills taught are valued and there is an intention to develop the learner's commitment to these; that knowledge, understanding and cognitive perspective lead to a change whether in thinking or action; that the learner knowingly chooses to participate in learning; and that any transfer of knowledge is done in a morally acceptable way.

5. Farm Business Management:

Farm business management is defined as "the art and science of making decisions about the use of available resources, and acting on those decisions in an uncertain world so that the short and long term goals of the business owners are as fully satisfied as possible" (Bauer and Blanch, 1991, p. 3).

G. Assumptions:

1. This study makes the assumption that knowledge is not a value-free construct. This assumption is founded on the work of Jurgen Habermas (1968, 1981), who developed a theory of knowledge which revealed "knowledge constitutive of human interests embedded in basically different paradigms" (Hlynka and Belland, 1991, p. 66). Habermas claims that knowledge is constituted in different interests: technical, practical and critical. The technical interest is associated with science, positivism and objectives. The practical view is associated with interpretive sciences and specific situations. The critical view is seen "within the dialectical framework of practical action and critical reflection" (*Ibid.* p. 75). Paulo Friere (1970, 1973) refers to this as praxis.
2. The view accepted in this research is that curriculum "is locally produced and jointly constructed as teachers and students go about enacting and accomplishing tasks" (Doyle, 1990, p. 25). This is supported by the assumption that students' curricular knowledge is "deeply embedded in the fabric and culture of a classroom" (*Ibid.* p. 24-25; Doyle, 1986; Heap, 1985; Golden, 1989; Green, Weade, and Graham, 1988).
3. This research adopts the assumptions of the teacher cognition and decision-making paradigm, which include (Shulman, 1986):

- a. Instructors are rational professionals who make judgments and carry out decisions in uncertain and complex environments to help students reach worthwhile educational and training outcomes.
 - b. Instructors learn from the consequences of their decisions.
 - c. In complex situations like teaching, individuals create simplified models to explain the situation, based on the persons' perceptions, thoughts and learning in past experiences.
 - d. Students' schemata are subject matter specific.
4. This research is based on the premise that "events constitute the basic form of representation of teachers' knowledge" (Doyle, 1990, p. 25; Carter and Doyle, 1987; Nelson, 1986). The framework for this inquiry is based on this "event-structured conception of teaching as a curriculum process" (Doyle, 1990, p. 28). The intended curriculum is developed and confirmed through classroom events.

H. Limitations of the Study

This study is limited to a specific teaching situation at the University of Manitoba in the Faculty of Agriculture between the years 1983 and 1991. Only the farm business management courses and fifteen personnel involved with diploma program in the School of Agriculture were considered.

Although a substantive theory can be said to be valid only for the studied population, the theory "will inevitably identify a basic social process relevant to people in similar situations" (Hutchinson, 1986, p. 59). Only through further studies can this be verified.

CHAPTER II: LITERATURE REVIEW

A. Overview

This study started from the position that knowledge is the result of a social construction of reality (Berger and Luckmann, 1966; Berger and Keller, 1981; Habermas, 1966, 1981). The literature was reviewed as data collection occurred. The literature was selected in order to better understand the findings in the situation under study. Schwab's (1970) curriculum writings provided support for considering practical curriculum development for specific situations. The literature reviewed included: uses of computers for teaching, curriculum, teaching, learning and qualitative research methodology.

B. Research in Uses of Computers for Teaching

Research suggests that while teachers may be enthusiastic about the promise of computers in classrooms (Underwood and Underwood, 1989), there is evidence to suggest that the frequency of use is low (Gardner, 1984; Opacic and Roberts, 1985). The reason may be that teachers, though they value the computer, do not know how to use it in teaching (Underwood and Underwood, 1990).

The value of using computers in teaching is supported by three areas of research (Simonson and Thompson, 1990). First, the behaviorism theory looked at outcomes. Second, systems theory considered factors affecting entire entities. Third, cognitive theory looked at the learners.

According to behaviorist theory (Skinner, 1954; Thorndike, 1969), instructional design should lead to observable and quantifiable behaviors in the learner. The ways in which the behaviorist paradigm influenced the design and use of computers in teaching include: behavioral objectives; pretests to assess student's previous learning prior to instruction; starting a student at a point where early, high successful achievement can be reached; positive reinforcement; subdivision of large tasks into simpler ones; using continuous assessment to provide feedback for revising lessons; and organization of learning from simple to more complex tasks.

Systems theory, first proposed by Otto von Bertalanffy (1968), considered the form and structure of entire organizations. Ways in which this theory affected the development of teaching software include: providing prescriptive methods where students learn a method of logical problem solving like the scientific method; designing instruction to be self-correcting; providing rational procedures for designing instructional programs; and by incorporating methods of considering all contingencies in looking at complex organizational problems.

Cognitive theory focused on students' learning processes. Researchers in this field include Bruner (1960), Carey (1986) and Hilgard and Bower (1975). Cognitive theorists believe that the ways students internally organize or structure knowledge impacts on whether new learning occurs. This theory has provided research to support: focusing on the organization and structure of knowledge; the sequencing of instructional material based on the learning style of the individual; the readiness for learning; the form and packing of feedback at a time and place

where correction can be made; and discovery learning concepts based on the value of intuition as an intellectual way of arriving at plausible though tentative conclusions which can then be confirmed through further study.

Elements of the three theories are found in all the categories of computer software used in teaching: drill and practice, tutorial, computer simulations, problem-solving software, tool software, programming and computer-managed instruction (Simonson and Thompson, 1990; Bitter and Camuse, 1984).

Drill and practice programs provide a means of individualizing instruction, provide immediate feedback, may provide record keeping functions and help motivate students because of graphics, sound, immediate feedback and the novelty of working on a computer. Use of this software helps to free up teacher time for other purposes.

Tutorials provide interaction with the material presented; individualization, because the pace of the presentation can be adapted to each student and branching allows students to cover material according to their own needs; and efficiency in meeting individuals needs because of absenteeism. Discussion focused around concepts and assumptions presented in tutorials may also help to promote students' cognitive development. Intelligent tutoring systems provide the potential means to direct further learning based on more complete understanding of the student and knowledge in the subject domain.

Computer simulations provide opportunities for students to apply their learning to models of real-life situations without real-life consequences. Frequent-

ly simulations required students to apply, analyze and synthesize their knowledge. Problem-solving software and adventure games enhance the teaching and learning of problem-solving methods. Students manipulate variables and receive feedback based on the results of the manipulation.

Tool software such as word processors, data-based managers, spreadsheets, graphics programs and statistical analysis packages are being integrated into many subject areas to enhance learning. By using such software students learn to manage information through active involvement. Such software also provides the teacher the freedom to consider many alternative ways to help students manipulate and access information. Tool software concepts are transferred between subject areas and expand as students complete more complex applications. This makes this software more cost-effective as it can be used in various subject areas.

Teaching students to program in courses other than computer science is controversial. However, one argument for teaching programming is that students gain an understanding of the strengths and limitations of the computer which, in turn, will affect students' abilities to function in a technological age. Another advantage mentioned is that students learn effective problem-solving methods.

Computer-managed instruction can save teachers time and increase efficiency and productivity. Such software can be used to keep track of students' progress and success and can help to diagnose and prescribe appropriate instruction and testing.

Thomas and Boysen (1984) created a taxonomy of educational uses of computers. Depending on how a program is used, it may be classified in different areas in this taxonomy. The taxonomy starts with experiencing and sets the stage for later learning. Informing or delivering information is the second level. The third level includes reinforcing programs used to confirm learning after instruction has taken place. Software is used for integrating learning by having students apply previous learning to new situations. Utilizing is considered to be at the highest level in this taxonomy. Here students use the computer to manipulate the subject matter.

More research is required in the diploma program in the area of evaluation and the development of student profiles. Both these topics involve the theory of testing. A recent text edited by Peter L. Dann, Sidney H. Irvine and Janet M. Collis (1991, p. ix) provides an overview of how computers have "aided enquiry into the nature of learning and abilities". The technology of testing and the theory of test responses has been significantly affected by the use of computer technology. Ferraris states that the use of computers in test construction and administration means that it is possible "to improve the quality of assessment through highly individualised tests and the reduction of routine work required for test construction and administration" (Ferraris, 1991, p. 219). Prescriptive tests versus ability test performance tests have the potential for assisting in the instructional decision-making (de Leeuw, van Daalen, Beishuizen, 1991).

Consideration of the alternative ways that computers have been used in teaching as identified in the literature review was important to this study. The strengths and weaknesses in the way computers were used in the situation under study were clarified by comparing the actual use to the alternatives identified in the literature.

C. Curriculum

In the agricultural diploma courses at the University of Manitoba, the educational objectives appear to be derived more from the knowledge and interpretation of concepts in subject matter (Bruner, 1960) than from desired changes in learning and behaviour of students. This differs from the more "traditionalists" (Giroux, Penna, Pinar, 1982) approach used in many courses in community colleges in Manitoba and Saskatchewan and many of the school and college agriculture courses in the United States. However, the planning of the implementation of the diploma curriculum at the University of Manitoba appear to be more in line with the Reconceptualist approach (Pinar, 1991).

The traditionalists are associated with a view of curriculum "as the organization of time and activities to be managed according to sound business principles" (*Ibid.*) R. W. Tyler's model exemplifies the "principles of efficiency, control and prediction" (*Ibid.*) central to the traditionalists' approach. Other names in this group include Franklin Bobbitt and W. W. Charters. Many specific objectives were written based on the traditionalists' curriculum theory. Examples include the vocational teacher competency profile for microcomputer applications (Tesolowski

and Roth, 1986) and the performance objectives written for the Canadian Farm Business Management program (Corbridge and Petersen, 1976). Another example is the list of objectives developed for agriculture and agribusiness microcomputer instruction at Madison Area Technical College (Scheid, Almquist and Mountford, 1983).

The curriculum work of another group called the conceptual-empiricists (Giroux, Penna, Pinar, 1982) supports determining purposes based on the knowledge and interpretation of that knowledge as a starting point for curriculum development. Jerome Bruner (1960), a cognitive psychologist, is illustrative of this group. The difference between the conceptual-empiricists and the diploma school approach appears to be that the goals are defined locally in the diploma school, not by a distant group of experts. Based on the statement of curricular applications by the North Iowa Area Community College (Hecht, *et. al.*, 1986), their approach to using computers in curriculum appears to be similar to the approach taken by The University of Manitoba's School of Agriculture. The computers were intended to be used only as a tool in achieving the curricular goals based on knowledge and interpretation of that knowledge of Farm Business Management.

Bruner (1960) claimed that curriculum should teach the fundamental structure of a subject to make it more comprehensible. He argued that understanding fundamentals makes a subject more comprehensible; that unless detail is placed into a detailed structure it is easily forgotten; that understanding something

as a specific instance of a more general case is to have learned not only a specific thing but also a model for understanding other similar things.

Learning a subject according to Bruner (Ibid.) involves three simultaneous processes: acquisition of new information; transformation or the process of manipulating knowledge to make it fit new tasks; and evaluation, checking whether the way we have manipulated information is adequate to the task. He believed in a spiral curriculum built around the great issues, principles and values of a society.

Another theme found in Bruner's writings (Ibid.) relates to the nature of intuition. This idea is important to this study because lack of extensive tools for looking at alternative farm financial plans has meant that many farmers do their planning largely in their heads. Frequently farm planning in a practical situation appears to involve using heuristics and intuitive reasoning, as well as confirming the guesses through collecting supportive information.

Bruner (Ibid.) discussed intuition as an intellectual technique of arriving at plausible but tentative formulations without going through the analytical steps. Intuition implies the act of grasping the meaning, significance, or structure of a problem or situation without explicit reliance on the analytic apparatus of one's craft. He suggests that emphasis on the structure or connectedness of knowledge increases facility in intuitive thinking. The application of heuristic rules, or rules of thumb, include use of analogy, the appeal to symmetry, the examination of limiting conditions, the visualization of the solution.

Bruner (Ibid.) suggested that there is a need for students to be trained to make good guesses as we are often forced in life to act on the basis of incomplete knowledge, taking into account probability and cost. Intuitive thinking seems to involve manoeuvres based seemingly on an implicit perception of the total problem; a familiarity with the domain of knowledge involved and with its structure, which makes it possible for the thinker to leap about, skipping steps and employing short cuts.

For Bruner (Ibid.), intuitive and analytic thinking are complementary--through intuitive thinking the individual may often arrive at solutions to problems which he would not achieve at all or, at best, more slowly through analytic thinking. Once achieved by intuitive methods, the solutions should, if possible, be checked by analytic methods, while at the same time being respected as worthy hypotheses for such checking. Bruner even suggested that it may be of the first importance to establish an intuitive understanding of materials before we expose our students to more traditional and formal methods of deduction and proof. To foster intuitive thinking requires the development of self-confidence and courage; a different bases of grading to recognize intuitive thinking and providing conditions in which intuitive thinking can be effective--where conformity is not emphasized and that an intuitive mistake is recognized for what it is rather than handled by the teacher as a stupid or ignorant mistake.

As mentioned earlier, the implementation of the curriculum in the School of Agriculture appears more related to some of the work done by the Reconcep-

tionalists, an "umbrella term referring to a diverse group whose common bond was opposition to the Tyler rationale, to behaviorism in curriculum conceptualization (including behavioral or performance objectives, quantitative evaluation, mastery learning, time on task) and to the ahistorical and atheoretical character" (Pinar, 1991, p. 35) of the curriculum field. Aoki (1984) pointed out that the technical assumptions about knowledge production and use were not adequate in terms of the complexity of practice. Aoki's (1986) examination of curriculum theory suggests that there are three modes of operation--technical, situational-interpretative and critical-theoretic. Hlynka (1989) states that although educational technology belongs within the technical mode, "educational technology should be perceived as potentially belonging within both the situational-interpretative realm as well as the critical-theoretic" (Hlynka, 1989, p. 27). Hlynka argues that technology is "a logical supplement to the natural state of the classroom" (*Ibid.* p. 32). This expansion of the role of computers to other modes of operation may be important as new goals for using the computers are selected. Consideration needs to be given about how to use the computer when teaching students more about interpretation and critical analysis of the farm business situation.

A theme found in the work of the reconceptualists is that it is essential "that the world-views of teachers be recognized, appreciated and privileged" (Bennison, Jungck, Kantor and Marshall, 1989, p. 71). In questioning curriculum implementation as a practice Carson identified a recurring theme among educators, "the need for time to meet, reflect, and to make revisions during the change

process " (Carson, 1992, p. 93). The teaching staff in the diploma program were directly involved in the curriculum development and implementation. The staff discussed the implementation during the weekly staff meetings. This time for discussion is important, as Carson goes on to point out that the curriculum implementation process is generally more than a change of technique or specific teaching strategies. It is "a different way of teaching" (Ibid., p. 95).

The literature review of curriculum is important to this study as it shows that there is a foundation for the curriculum approach taken in the diploma program at The University of Manitoba in the curriculum work of the conceptual-empiricists. The curriculum goals of the diploma courses were based on knowledge of farm business management and interpretation of that knowledge. The curriculum implementation process used in the diploma program is also supported by the more recent curriculum research writings of the reconceptualists.

D. Teaching

Computer use was integrated into the teaching of farm business management in the diploma courses. Literature was reviewed to determine if there were alternative reasons for using computers in teaching. Also, the teaching staff in the diploma program had to learn a considerable amount in order to teach using computers. The literature was reviewed to better understand this learning process.

A survey by Wiske, et. al., (1988b) indicated that the computer usage enables teachers: to present ideas in new ways; to represent and manipulate

abstract concepts in more concrete form; to help students to visualize ideas and perform operations that would otherwise be impossible; and to include new topics and teach traditional ones more thoroughly. Another suggestion made in the Wiske study was that building more links between computer teachers and subject matter teachers may lead to integration of the new technology across the curriculum. One comment in the study indicated that changing from lectures to facilitating problem solving in small groups or individually results in a change in teaching style to one where the teacher circulates serving as a coach or facilitator of student learning. However, the report by Wiske *et. al.* (*Ibid.*) stated that the physical location of computers in the schools and the ease of scheduling access to them affect the extent to which computers influence the curriculum.

The teaching of farm financial management involves teaching problem solving processes and changing attitudes. Instructional methods which promote discussion may be useful to achieve these goals. When comparing lecture and discussion methods McKeachie (1963) concluded that it depends on the goals. Kulik and Kulik (1979) concluded following their review of literature that both lecture and discussion are equally effective for learning factual material, but that discussion is more effective for cognitive objectives such as developing problem-solving ability or changing attitudes. Dunkin's (1986) writings also suggest that discussion might be more effective than lectures to achieve higher cognitive learning and attitude changes. Discussion is also supported by other adult education researchers such as Brookfield (1986), Kidd (1973) and Freedman (1987).

Lindeman (1926, 1930) gives examples of the use of the discussion method as the main teaching medium. These examples included Danish folk high schools, the Swedish study circles, and the Canadian Farm Forum experiment.

The computer may be used just as films and videos are used to encourage group discussion. In the agricultural degree courses it was noted that students did form discussion groups on their own around a computer assisted learning farm case study (Luterbach and Srivastava, 1989).

Concepts of teaching were considered when thinking about how people learn to teach with computers. One study by Scardamalia and Bereiter (1987) identified three teacher models: an Exercise, a Knowledge-Base and an Intentional learning model. In the Exercise model students complete many exercises to learn competencies. The Knowledge-Based model argues that higher-order skills and strategies are developed first within specific knowledge domains. The Intentional Learning model uses many of the same instructional methods as the Knowledge-Based. However, there is an intrinsic sequentiality to the Intentional Learning Model so that students gradually become the ones who set the goals, create the context, and take the motivational, strategic, analytical and inferential actions originally carried out by the teacher.

It is possible that these three models illustrate levels that teachers go through as they move from novices to expert teachers. Research has identified major characteristics which relative experts have in common (Bereiter and Scardamalia, 1986): the complexity of skills, the amount of knowledge, the

knowledge structure, and problem representation. The expert is more able to respond to more kinds of information and to voluntarily control strategic elements in the process. Not surprising, experts actually know more about their area of expertise. This knowledge, in turn, helps them to retain new facts as they have developed the ability to link new information to the central ideas. The knowledge that experts have is cognitively structured into levels, with many connections within and between these levels. Finally, experts consider problems in terms of the abstract structure of the problem and are able to solve problems quickly because they recognize the problem as a specific type and can apply learned procedures for solving problems of a specific type.

A study by Wiske, et. al. (1988b) describes a series of composite teacher profiles, illustrating the stages teachers may go through as they learn to use the microcomputer for teaching purposes. In the same study teachers indicated that using computers can help students move from an approach that focused on memorization of facts and algorithms to active inquiry with more open-ended problems. In another study (Hawkins & Sheingold, 1986), teachers noted that by circulating among students working at computers, they notice more about the way their students are learning, and consequently are more aware of the learning needs of the students.

The literature reviewed about teaching was important to this study as it provided a means to better understand the process of learning to teach and alternative instructional methods when using computers. Before the instructors

could teach students to use the computer as a Farm Business Management tool, the teaching staff in the School of Agriculture had to first learn how to teach with computers.

E. Learning

The diploma student population could roughly be divided into one-third mature students and two-thirds sequential students, students who had just completed their high school. When planning instruction for the diploma students it would be useful to consider the different general characteristics of the sequential student and the adult learner and the general differences in how these two groups learn. This literature review focused on the characteristics of the sequential and adult learner, learning styles and some implications for using computers to link concepts learned. To better understand the potential farm business manager, reference is made to research done by Statistics Canada (Bollman, 1988) which profiles farmers with computers.

A summary by Brundage and Mackeracher (1980, pp. 11-12) of the basic differences between adults and children as learners is found in Appendix 5. Learning refers both to the *process* which individuals go through as they attempt to accumulate, change or enrich their knowledge, values, skills or strategies, and to the *resulting* knowledge, values, skills, strategies and behaviours possessed by each individual (*Ibid.*). Child learning involves forming (acquiring, accumulating, discovering, integrating) while adult learning is viewed as transforming (modifying, relearning, updating, replacing) knowledge, skills strategies, and values through

experience (Brundage and Mackeracher, 1980; Knowles, 1973; Hart, 1975; Cropley, 1977; Mezirow, 1978).

For the students without farm background considerable presentation of situations and facts appears to be required. However, adult students, who are farmers already, bring a great deal of experience and knowledge related to farm financial management to the classroom. Since their past experiences are unique to each individual, the instructor cannot assume that every learner possesses all background necessary for new learning experiences. At the same time Brundage and Mackeracher (1980) suggest that the instructor needs to acknowledge the past experience of these students; respect it as a possible resource for learning; and accept it as a valid representation of the learner's experience.

For the teacher planning instruction for adult learners, there is an additional concern about how to encourage the student to make connections between their past experience and the present required learning activity. Feringer (1978) and Ornstein (1972) suggest the use of analogies and metaphors to make this connection. Other activities suggested include synectics, brainstorming, games, simulations, mythology, and case studies (Brundage and Mackeracher, 1980) which allow for divergent, non-sequential, non-logical cognitive processes. Such activities provide the learner time and opportunities to transform the meanings, values, strategies, and skills derived from past experience in a non-threatening environment. Such activities should also meet another suggested adult learning principle, that "when learning focuses on problem-solving, the solutions must come from, or

be congruent with, the learner's experience, expectations, and potential resources, rather than being prescribed by an "expert" " (Ibid., p. 36).

The research of Brundage and Mackeracher (1980) supports the suggestion that the learners life role as an adult--marriage, children and actual day-to-day operation of the farm--influence the learning. The implication of this is the initial need to provide a supportive, non-threatening learning environment in which the individual can determine how to comfortably participate.

Since learning involves change, learners will frequently experience instability within his own organized meanings, values, skills and strategies. Brundage and Mackeracher (Ibid.) noted that ambiguity and instability are part of the process of learning. As a result, anger is frequently also a basic component of learning activities. Other reactions may be confusion, frustration, disorientation, fear, depression, etc.. This implies that the teacher needs to be able to make distinctions between and respond to distressed learning behaviours without labelling these as childish. The instructor needs to finds ways to temporarily reduce the anxiety and compensate for the temporary decline in the learner's ability.

Another means to facilitate the learner in these situations is to provide for two-way communication between the instructor and learner giving the learner opportunities to talk, self-reflect, clarify and summarize.

In addition to the sequential and mature level groups in the student population, student differences in interest in using computers were noted. Could this be related to differences in learning styles? Research indicates that students

do have different learning styles (Cawley et al., 1976; Messick, 1976; Even, 1977; McKenney and Keen, 1974). The learning cycle model developed by Kolb and Fry (1975) found in Appendix 6, suggests both a cyclical process in which the learner can start at any point and proceed around the circle, as well as a two-dimensional model of learning style. The vertical axis relates to conceptualizing processes ranging from the concrete to the abstract. The horizontal axis relates to cognitive activities varying from active to reflective. The four quadrants created by the two dimensions represent a preferred learning style which, in turn, can be used by the teacher to identify which activities the learner will prefer and which will be avoided.

Since the learning cycle is cyclical and the starting point reflects a particular learning style, by selecting a beginning activity the instructor chooses a starting point in this learning cycle and favours a particular type of learner.

Other learning models (Ibid.) where feedback, success and satisfaction appear near the beginning or as the activity progresses may be used to increase motivation. The humanistic model begins with analysis of information for personal meaning and value and begins with activities aimed at helping the learner recall and reflect on relevant information. An experiential model begins by the instructor creating a specific situation in which the learner acts and shares this action with others.

When students started to use the computers for farm business management they appeared to have difficulty linking their knowledge of the farm business

management subject matter to their knowledge of how to use the computer. In learning the programs they appeared to not be thinking about farm management. The problem of linking different concepts was noted by Novak and Gowin (1977, 1981, 1984). They developed two computer programs which may facilitate this making connections between concepts. These two researchers suggest that the individual learner constructs meaning and that such learning can only take place if the learner can identify the concepts and make connections between the new concepts and his or her own personal concept structure. They suggest that learning occurs only when the students use the new meaning to reorganize what they already know in a way that changes their experience. Two microcomputer programs have been developed based on Gowin's Concept Maps and Novak's Vee Diagram (*Ibid.*), methods used to facilitate this connecting of concepts and reorganizing to incorporate greater understanding. Through concept mapping, not only are the concepts identified, but also the connections between the concepts are clarified by the propositions. Gowin's concept maps may provide a vehicle for discussion and a means of identifying possible misconceptions or absences of major concepts from the students understanding. They also provide a means to show students that the world is not black and white, and that there are many situations where different perspectives can be supported by equally valid points. Novak's Vee Diagram provides a means for a student to clarify the important points in a research question. Such a diagram may prove useful for organizing thoughts, for presentations and as an outline for focusing discussion.

Another observation which led to literature reviews was the fact that students in the microcomputer classroom seemed to support each other by answering each others questions and the lab instructors appeared to encourage such interaction. According to Goodlad (1984) computer use can result in changes in the social organization in the classroom which leads to students taking more responsibility for their own learning and for helping each other learn, working together to solve problems. The introduction of computers may create new opportunities for leadership and for learning in the classroom, especially for students that do not respond well to the lecture-type lessons (Wiske, et. al., 1988b; Hawkins & Sheingold, 1986).

Demographic information helps to identify similarities and differences among farmers and potential students from farms who may have experience using the computer in the farm operation. The 1986 Canadian statistics showed that "specialty farms (eg. goats, mushrooms, nursery products, greenhouse, other livestock specialties, poultry) had over twice the average proportion [of farmers] with computers whereas farms specializing in dairy, grain, or cattle had a proportion with computers below the overall average" (Bollman, 1988, p. 19). The size of the milk cow herd, the type of pig herd, and the age of the farm operator were other factors affecting use of the computer. Male and female farmers, as well as new farmers and continuing farmers, were equally likely to own computers. Although farms with more complete legal organizations were more likely to own a computer, this might have been because these farms tended to have larger gross

sales. Without looking at age groups, some differences were seen when farm operators were considered by the language they first learned and still spoke-- Dutch being more likely to own computers while Ukrainian are somewhat less likely to own computers. Based on the reported net farm cash income, one suggestion made was that either farmers with computers have higher costs or farmers with computers have more accurate data on what their costs actually are. As illustrated by the efforts made by the Manitoba provincial farm management program (Therrien, 1989), Canadian provincial extension people have been promoting the use of microcomputer technology among farmers by using farm business management software tools in consulting with farmers and by making this software available to farmers.

This literature review of learning focused on the characteristics of the sequential and adult learner, learning styles, implications for using computers to link concepts learned and some variables common to farm business manager with computers. All three areas were relevant to this present study. The student population in the School of Agriculture consisted of both adult and sequential learners. All the students had to learn to use a computer as a tool at the same time as they learned farm business management. Finally, understanding variables common to farm business managers with computers helps to provide understanding of which students would find that the computer helps to meet their farm business management needs.

F. Research Methodology

Grounded Research Methodology, a qualitative method, outlined by Glaser and Strauss (1967), Schatzman and Strauss (1973), Glaser (1978), and Strauss and Corbin (1990) was the basis of the research about the effect of computers in teaching farm business management. Findings are grounded by "both the interpretation of the data and checking upon that interpretation by the gathering of more data" (Schatzman and Strauss, 1973, p. 117). A literature review of grounded research methods is included in Appendix 7 to clarify and provide supporting explanation of how this type of research is done. The information is provided as reference about qualitative research since many of the professors teaching farm management did their own research using quantitative methods.

Triangulation (Patton, 1990) methods are used to confirm the validity of data collected. Denzin (1978) refers to four different ways of using triangulation: methods, sources, analysts, and perspectives. Methods triangulation involves checking consistency of findings generated by using different data collection methods. Using the same method, but checking the consistency of the data by using different data sources is referred to as triangulation of sources. The other two methods involve using multiple analysts or using multiple theories to interpret the data.

The research about the use of computers to teach farm business management began from a situational-interpretive evaluation framework where the focus was on collecting data to describe what had occurred in the teaching of farm

business management during each Period. To clarify the reasons for the actions taken, the research moved into the critical-theoretical framework (Aoki, 1986). Evaluation frameworks by Aoki (Ibid.), found in Appendix 8, provide a basis for alternative ways of evaluating curriculums. Using Habermas' theory of knowledge (Habermas, 1981) as a foundation, Aoki compares three alternative evaluation frameworks which he calls Ends-Means, Situational Interpretive, and Critical Theoretic. The comparison is made under the headings of "cognitive interest, form of knowing, and mode of evaluation". The critical theoretic perspective of Aoki serves to highlight the need to be aware of hidden assumptions and intentions so that one not only knows, but uses the knowledge to improve the human condition.

CHAPTER III: RESEARCH DESIGN AND METHODOLOGY

A. Procedure Overview

The grounded theory paradigm was used to identify and explain the changes which occurred during the move from using the mainframe computer to microcomputers in the teaching of farm business management. The **grounded theory paradigm** is (Strauss and Corbin, 1990):

- (A) CAUSAL CONDITIONS -> (B) PHENOMENON ->
- (C) CONTEXT -> (D) INTERVENING CONDITIONS ->
- (E) ACTION/INTERACTION STRATEGIES ->
- (F) CONSEQUENCE

In both the Mainframe and the Microcomputer Periods the **causal condition** or reason for using computers was the need to teach diploma students to produce more accurate farm financial statements. The **phenomenon** studied in this research paper was the use of computers to meet this need. Figure 1 below lists the **properties** or categories about teaching and curriculum identified in the collected data. The potential ways computers could have been used varied. This range was referred to as the **dimensions** of the identified properties. By comparing the specific dimensions of various properties of teaching and curriculum during the Mainframe Period and the Microcomputer Periods, the **context** within which computers were used was established. The **intervening conditions, actions**

and consequences were clarified through reviewing the classroom and staff meeting observations, interviews and collected documents.

At the start of the study the specific causal conditions were not known. However, teaching and curriculum were considered integral to the causal conditions for using computers. To begin the data collection, field research methods were used to identify properties or categories under teaching and curriculum.

The field research method used was **observations of the classrooms and the staff meetings**. These written observations were coded into **substantive codes** (Ibid.) (meaningful words that described the objects or actions in the setting). These codes labelled the perceived **regularities** in the objects or events observed. These substantive codes could be used for a variety of incidents which exemplified the same type of action or object. The **properties** or categories under curriculum and teaching were derived from grouping the substantive codes. Appendix 9 is a sample of how observations in a computer lab were coded into substantive codes and grouped into properties.

The next step was a **further literature review** to substantiate the identified properties of teaching and curriculum. A literature review was also done about learning and students since this made it easier to understand what and why teaching methods were selected. Also, this literature review provided a means to clarify the **potential dimensions** (range of characteristics that these properties might exhibit) in terms of the phenomenon of using computers. The literature review is given in Chapter III above. The properties of teaching and curriculum

which were identified and the dimensions of these properties are listed in Figure 1 below.

Figure 1
 PROPERTIES AND DIMENSIONS
 OF TEACHING FARM BUSINESS MANAGEMENT USING COMPUTERS

<u>Properties</u>			<u>Dimensions</u>
I. TEACHING			
A. Number of Staff Using Computers for Teaching	None	-->	Many
B. Staff Computer Training	None	-->	Extensive
C. Instructional Methods	Lead to Rote Learning	-->	Lead to Meaningful Learning
	Oral	-->	Visual
	Sequential	-->	Holistic
	Facilitate Reception Learning	-->	Facilitate Autonomous Discovery Learning
	Structured	-->	Unstructured
	Provide experiences with computer	-->	Computer use is integrated into curriculum
D. Student Questions	For Individuals	-->	For Groups

		Factual	-->	Critical Thinking
		None	-->	Many
E.	Assignments	Technical	-->	Subject-related
		One Authority	-->	Many Authorities
		Indiv.	-->	Group
F.	Evaluation Practices	Optional	-->	Required
		One	-->	Many
		Little Feedback	-->	Much Feedback
		Gross Record	-->	Detailed Record
		No comp. record maint.	-->	All records maintained on computer
G.	Classroom Management	No marks for comp. work	-->	Many marks for computer work
		Little/No Preparation Before Class	-->	Considerable Preparation Before Class
		Many Activities at Beginning of Class	-->	Many Activities at end of Class

		No Time Management Issues	-->	Considerable Time Management Issues
		Individual-->		Teamwork
		Few Interrup.	-->	Many Interruptions
H.	Resources and Support Required	No Funds	-->	Extensive Funds
		No Support	-->	Many levels of Support
I.	Equipment	Small Size	-->	Large Size
		Limited Capab.	-->	Extensive Capabilities
		Instructor Controlled	-->	Externally Controlled
		Limited Access	-->	Easily Accessed
		One machine per class	-->	One machine per person
		No instr. display	-->	Good instruct. display
J.	Software	One	-->	Many
		Simple	-->	Comprehensive
		Content Specific Software	-->	General Purpose Software

		Reg. Lab Classroom	-->	Computer Lab
K.	Location and Layout of Computer Lab	Unplanned Room Layout	-->	Planned Room Layout

II. CURRICULUM

A.	Curriculum Goals	Not changed by comp.	-->	Not changed by computer
B.	Conception of Curriculum Content	Not changed by comp.	-->	Greatly changed by computer
C.	Sequencing of Curriculum Content	Not changed by comp.	-->	Greatly changed by computer
D.	Form of Knowing the Curriculum	Not changed by com.	-->	Greatly changed by computer

The **context** of using computers to teach the farm business curriculum was clarified by identifying the specific characteristics of each property during the Mainframe Period and the Microcomputer Period. Each characteristic could then be compared to the range of potential characteristics which could have been exhibited to determine how this property had been affected.

The **next step involved using axial coding** to reconstruct the substantive codes into theoretical constructs based on the grounded theory paradigm (*Ibid.*). Axial coding meant that the substantive codes were grouped and identified as

causal conditions, properties and dimensions which clarified the context within which the phenomenon of using computers occurred, intervening conditions, actions or consequences. These were then identified by time and reconstructed according to the grounded theory paradigm to explain the changes which occurred over time.

Interview questions were developed to substantiate and further clarify the causal conditions, intervening conditions, context, actions and consequences identified during classroom and staff meeting observations. The centre column of the table in Appendix 10 contains a list of the formalized questions used during the interviews with the teaching and administrative faculty.

In order to identify patterns in the interviews a **concept map** of the interview questions was developed. A concept map is a two-dimensional representation of your knowledge about a subject at a point in time (Gowan and Novak, 1984). The interviewees' responses were mapped according to the concept map created for the interview questions. This map of the interview responses included concepts that several people interviewed had in common. This is not an exhaustive cognitive map of all the interviews, but sufficient to confirm that this the concepts identified were shared by the staff. Since more than one person's responses were included, the map of interview responses is referred to as a collective **cognitive map**. Whereas concept maps are representative of an area of knowledge which could be agreed on by experts, cognitive maps are idiosyncratic.

Appendix 11 includes part of the concept map of the interview questions, in this case to clarify how the computer may affect the curriculum.

Further **supporting documents** were collected as they were identified during the interviews. Among these additional documents were the proposal for the microcomputer lab and the faculty review. A review of these documents helped to confirm observations and interview responses.

Triangulation was used to confirm the validity of the collected data.

Triangulation was created by comparing the interviews, observations and documents. Comparisons were made of the responses of 15 participants to the interview questions and to informal questioning of staff; of the classroom and staff meeting observations; and of supporting documents, including curriculum guides, classroom hand outs, lab manuals and textbooks. Triangulation was also created by comparing the interviews of personnel with three different perspectives on the situation: administrators, professors and lab instructors.

Recommendations for research were developed by considering how to collect data about changes which could be made to the conditions in the paradigmatic chain and consideration of what could happen because of the change. Change could occur in the set of causal conditions which changes the context and a related change in action; the intervening conditions which lead to changes in action or interaction; or the consequences of previous actions or interactions which could feed back to add new conditions or alter the interaction between existing conditions.

B. Clarifying the Situation

A series of subquestions was asked in order to gain an understanding of the situation. These questions were asked about the past and present situations.

The questions included:

1. What part of the farm financial management curriculum was taught using computers?
2. What experience did the faculty have with computers?
3. What purposes did the faculty have for using the computer?
4. What computer facilities were available?

The following alternative methods were used to collect information about the curriculum and teaching:

1. Curriculum Content

Information about farm financial management curriculum content was collected, including representations of a farm business organization chart, concept maps of the effects of the four areas of the farm operation on financial statements and the use of financial statements in evaluating a farm operation, and graphical illustrations of farm records. The textbooks and the lab manuals were also reviewed. Together, these presented an overview of the financial planning process and financial statements taught in the courses. Both the old and current course outlines provided a means to confirm the changes in the intended curriculum. Interviews with instructors provided a means to confirm what curriculum content was taught using the computers, the sequencing of the curriculum, the purposes for using the computer and the computer facilities. Classroom and staff observations

provided support for the interview findings and confirmation that classroom events supported the intended curriculum as printed.

2. Teaching

The faculty started to use microcomputers in order to solve specific problems and address specific concerns. These problems and concerns were identified during group discussions and interviews with the individual faculty members about their involvement and their concerns. Further confirmation was provided by reviewing the document used to justify the establishment of the microcomputer lab. The teaching staff were interviewed to determine the approaches they took to integrating the computer in their courses and the instructional methods used. It was expected that teachers with different concepts of teaching and different concepts of the knowledge area would use computers in different ways.

Examples of the situations observed were:

1. a professor lecturing in the diploma courses in farm business management.
2. diploma instructors and the Lab Coordinator teaching diploma computer labs.
3. the weekly coordinating meetings of the professors, Lab Coordinator, five diploma instructors and two administrators of the School of Agriculture.

C. Clarifying Changes Between Periods

The following questions were asked, as they related to the use of computers in the teaching of farm financial management, in order to clarify the changes that occurred between the Mainframe and Microcomputer Periods:

- a. What needs did the faculty identify?
- b. What educational purposes did the faculty select to address?
- c. Did other purposes arise, not originally targeted by the faculty?
- d. What educational experiences involved using the computer?
- e. How were these educational experiences organized?
- f. Have the needs changed, leading to selection of new purposes?
- g. Are changes in the educational experiences and organization required in order to meet these purposes?

Data collection procedures included a formalized interview with the teaching and administrative faculty. The questions asked during the interviews are found in the centre column of Appendix 7.

The data were used first as a basis for drawing conclusions and these conclusions were then confirmed through further literature reviews, observations and interviews. The final conclusions will be presented to the teaching faculty for confirmation during a staff meeting and informal discussion with individual instructors.

D. Summary of Research Methods

In summary, grounded research methods were used **to gain an understanding of the use of computers in teaching farm business management** in the School of Agriculture during the Mainframe (1983-87) and Microcomputer Periods (1987-91) by:

1. clarifying the causal and intervening conditions which affected the process of integrating computers into the teaching of the farm business management curriculum in one specific situation;
2. clarifying the process the teaching staff went through as they learned to teach with computers;
3. identifying specific properties or characteristics of teaching and curriculum found in this situation;
4. clarifying the potential dimensions or range which each property or characteristic might exhibit;
5. clarifying the context within which teaching and curriculum changes occurred by comparing the actual characteristics exhibited in this situation to the potential range;
6. clarifying the actions and consequences of these actions in the process of changing from the mainframe computer to microcomputers.

CHAPTER IV: FINDINGS

A. Introduction

The question under consideration in this thesis is:

In the transition from the Mainframe Period to the Microcomputer Period in the School of Agriculture at the University of Manitoba:

- (1) what changes occurred in the teaching practices;
- (2) what changes occurred in the Farm Business Management curriculum; and
- (3) why did these changes take place?

Following from this question, the findings are presented under the three headings--Changes in Teaching Practices; Changes in the Farm Business Management Curriculum; and Why Changes Took Place. The changes are grouped by properties or characteristics identified under the categories of "teaching" and "farm business management curriculum".

The properties identified in the area of "teaching" are:

1. Number of staff using computers for teaching
2. Staff Computer Training
3. Instructional Methods
4. Student Questions
5. Assignments
6. Evaluation Practices
7. Classroom Management
8. Resources and Support Required
9. Equipment
10. Software
11. Location and Layout of Computer Lab

The properties identified for "farm business management curriculum" are:

1. Curriculum Goals
2. Conception of Curriculum Content
3. Sequencing of Curriculum Content
4. Knowledge of the Curriculum

The five groups of reasons for the changes in "teaching" and "curriculum" include:

1. Change in administrative policies
2. Greater integration of computer use in the courses
3. Greater experience using and teaching with computers and computer software
4. Advances in computer technology and software technology
5. Administration and teaching staff identified needs for change

B. Changes in Teaching

Refer to Appendix 12 for an overview of the changes which occurred in "teaching". In this appendix the changes are summarized in terms of the dimension or specific attribute of each property or characteristic of "teaching" identified in the data collected about the Mainframe and the Microcomputer Periods. A discussion of the changes by property follows:

1. Number of Staff Using Computers for Teaching

The number of teaching staff using computers increased from the Mainframe Period to the Microcomputer Period. During both periods the professors did not use the computer during the lectures. The professors did attend some of the computer labs in both periods to assist in answering students' questions.

One person did all the instruction with the **Mainframe** computer. By 1991, late in the **Microcomputer** Period, **all five lab instructors** were teaching some microcomputer labs. The Lab Coordinator was supporting the lab instructors. At least one the professors attended portions of the microcomputer lab sessions on a regular basis and two other professors attended less frequently. A fourth professor supported his graduate student using the microcomputer in teaching a course.

The change occurred when the ability to use a computer became a **requirement of the lab instructor's position** in the Microcomputer Period. The Job Descriptions for the lab instructors had changed and a new position had been established. A second contributing factor was the **creation of a new position**, that of Microcomputer Lab Coordinator. The Lab Coordinator was given the tasks of writing the code for the programs and supporting the teaching staff. A third factor was that the **professors and lab instructor** teaching farm business management **redesigned their courses** to include the use of computers during the Microcomputer Period.

2. Staff Computer Training

Learning to use computers for teaching was a major hurdle in accepting and using computers to teach. The lab instructors had to learn to deal with their personal reaction to the computer and the fact that the software was not necessarily applicable to their own farm situation.

Referring to the Mainframe Period, one lab instructor stated:

It was a bit of a kicking and screaming and dragging affair to get us to use it at that time because none of us were computer people at all. We had never worked with them before and we tried it out on our own individual farms before we were to endorse it or give an opinion and after we tried it out we didn't find it was very flexible or it didn't suit our situations very well so we felt it probably would be cumbersome for the students too. And as it turned out, for the most part it was a source of aggravation right at the start. It got better, mind you, over the years and then PC's or the stand alone units came in."

In both periods the lab instructors entered their own farm data into the programs in order to learn the software so that they would be able to answer farm business management questions which students asked as they used the programs.

In the **Mainframe Period** only the one Research Assistant, who taught all the computer labs, learned to teach using the computer. Teaching with computers was learned by trial and error. **No formal staff training was done.**

During the **Microcomputer Period** the learning stage for the remaining five lab instructors was **more extensive** and they were supported by the Lab Coordinator. There was access to microcomputers for staff use and some opportunities to take free training in general purpose software through Microcomputer Services. This microcomputer access helped the original staff to learn the disk operating system (DOS), a word processor and spreadsheet software. However, because the lab instructors were part-time sessional staff who taught on the days when they were on campus, the opportunities to take these short courses were limited. Some instructors mentioned that the fact that they did not type limited the personal value of the computer. They felt that they could do the work faster by hand and then have a support staff person type their work into the computer.

The lab instructors had to learn how to evaluate farm management software as they decided whether to buy or develop their own software to meet the specific needs of the teaching situation. They also had to learn the particular farm management software which would be used in class. The lab instructors entered their own farm plans to become familiar with

the microcomputer and software. They also entered the case farm and assignments used by students.

Initially, the research assistant developed the microcomputer templates and taught the labs. The professors and lab instructors learned about program development as they helped to define what the programs should do and what problems they were faced with when the programs were used. At this time, a lab instructor said, that the rest of us:

would try to work something from our own farm through that situation, try and give some advise as to the problems we'd run into. We were in a sense students as well.

The research assistant would then solve the problems. As one instructor said:

It gave him a chance to see some of the potential problems. It gave us a chance to experience the whole thing so that we could help out as well, but he was considered the resident expert.

All the lab instructors used the software to consider possible student errors and the solutions to these errors so that they would know what would happen if students made the same mistake in the microcomputer lab.

They also had to learn how to teach with the computers, what instructional methods to use, how to used the Liquid Crystal Display (LCD) panel connected to the computer, how to deal with minor technical problems which occurred with the use of the hardware in the middle of a

class such as putting paper into the printer, and how to deal with the variety of questions which occurred in any one class period.

In summary, during both the Mainframe and Microcomputer Periods there was very little formal staff training. However, the people teaching Farm Business Management had requested the microcomputer lab be established. Consequently, when the budget was identified for the microcomputer lab, the **administration in the School of Agriculture required the instructors to know how to use a computer.** The administration assisted by providing a microcomputer for the lab instructors' office. The administration also provided the teaching staff with in-house support by establishing a Lab Coordinator's position. The staff knew a year in advance that they would be required to teach the computer in the classroom and took advantage of this time. Together they planned how they could learn to use the software for teaching. As they learned to use the computer, they provided each other with support.

3. **Instructional Methods**

Instructional methods used were similar in both periods. The **difference** was that only one instructor used these methods during the Mainframe Period and the computer was an optional component of only one class, the Farm Planning Project. In the Microcomputer Period the **microcomputer use was integrated into the curriculums of all the Farm**

Business management courses with all lab instructors teaching the micro-computer labs.

During the Mainframe Period all the students using the computer were expected to have produced the statements first by hand. During the Microcomputer Period the first year students did everything they were exposed to in the microcomputer lab by hand first. As one instructor said:

It's a little bit more effort, but they'll get the concepts down a little bit better. Once they have the ideas down then they can use the computer budgeting program to speed up the process for them.

The lesson formats in the computer labs followed a similar **structured and sequential** pattern in both periods. **Written instructions** were given. **Verbal instructions** were given during a **demonstration**. The formats of the lessons were described by an instructor:

So once the material is discussed in the lab outside of the computer area, and then when the computer lab comes in they are presented with a set of instructions about how that particular program works, right from turning on the machine, through how its used and saving and retrieving and so on ... and then they are shown, by demonstration, using the PC with the overhead projection. Hopefully that won't take more than an hour to explain to them, to show them the demonstration and then, basically, turn them loose using the information or the data that they would have generated by hand and enter it into the budgets and the projected financial statements.

During the first year the farm business management concepts are taught **sequentially**. The mini farm presentation at the end of the first year

helps clarify the total picture of farm business management. During the whole second year the students are working on their farm presentation. This second year approaches a more **holistic** method of teaching as students must consider a variety of factors in developing their farm plan when they use the computer. However, the steps identified to develop this farm presentation are set out sequentially.

A mixture of **oral instructions** and **visual materials and demonstrations** were used. Appendix 13 provides a lab schedule example, in this case for the course 61.043, and the handouts for the two microcomputer labs for this course. Appendix 14 are handouts showing the microcomputer report layouts for the Balance Sheet, Cashflow, Projected Income Statement, Gross Value of Production and Reconciliation. Though not included, a handout is also available showing the financial ratios which are calculated on the microcomputer.

The microcomputer lab lessons began with a brief statement about the purpose. This was followed by a demonstration of the program and the steps the students had to follow in order to use the computer to complete the lab assignments. A hand out was provided at the beginning of class stating these steps. The students then were given time to work on the lab assignment and the instructors circulated, answering individual questions. The students had been handed the assignment at the last lab and were expected to come to the lab with the entry sheets already completed.

The lesson formats didn't change between periods partly because the person who taught the original computer labs on the mainframe provided the direction and instruction to the rest of the staff about how to use the computer in teaching. By this time the original research assistant had become the Microcomputer Lab Coordinator and it was part of his job to demonstrate to others how to use the lab. One way in which the other lab instructors learned was by observing the Lab Coordinator teaching classes. The lab instructors found that the lesson format helped them meet the varied needs of the students. As one instructor stated:

It's a group with a very mixed set of needs and by going over instructions quickly and having lots of people to work with them, you maybe don't penalize the people who understand very well and you don't go too fast for the people who have no clue whatsoever as to what's going and we do get the two extremes.

In the lectures and the labs much of the teaching involved telling the students what to do before they did it. This type of instruction **facilitated reception learning** since the information was provided directly to the learners. Another method used by a few lab instructors was to take the portable microcomputer to a regular lab session. This use of the microcomputer facilitated **discovery learning** since the learners selected some of the information to be learned. One instructor stated that this method was used to enter:

partial budgets or demonstrate a budget concept. Let students feed the numbers to you--wheat, sunflowers. Hopefully get a feel that the machine can calculate. Apply personal touch--not a prepackaged thing; need the flexibility to mesh with student's individual wants.

Generally the work on the computer was **individualized**. However, during the second year some **group** work occurred when groups were asked to consider alternative enterprise scenarios in the Advanced Farm Business Management course.

During the first year the microcomputer use may have led to **rote learning** as students were never asked to explain their results or to consider alternatives that they hadn't already considered on paper. However, during the second year the students were required to consider alternative enterprise budgets on the computer without entering directly from input sheets and to discuss their work in groups. This potentially could have led to **more meaningful learning**.

To summarize, the instructional methods did not change extensively. What did change was the number of people who had learned to use these instructional methods. Secondly, by integrating the use of computers into more courses, the focus of the computer instruction **moved from experiencing to utilizing** the computer in farm business management.

4. Student Questions

During both periods the lab instructors indicated that students asked **many varied questions** throughout computer labs. There was some indica-

tion that there were more questions and a greater variety of questions in any single computer lab period than there were in the regular lab periods when computers were not used. This was partly because the students were dealing with how to use a computer and program as well as thinking about the subject matter. Another reason was that, although the students were working on the same lab, they completed the lab at varying speeds. This meant that the lab instructor needed to be prepared for and flexible enough to deal with a large range of questions in the same class period. Questions varied from **technical questions, to software specific questions, to farm business management questions.**

Another reason for the variety of questions asked is the fact that, as one instructor summed it up:

it's not a homogeneous group...the lab groups are determined by their schedule and which courses they're taking. It's not determined on the basis of where they're at in terms of their skills.

In the computer lab, the student questions varied from **factual to critical thinking** questions. More factual questions appeared to be asked in first year when students were learning how to use computers and learning the basics of farm business management. In second year when students were developing their own farm plans, more critical thinking questions appeared to be asked.

There was a difference between the Mainframe and Microcomputer Periods in the number of **authorities** who could answer all the varying

types of questions. During both Periods all lab instructors and professors answered student farm business management questions about the reports produced by the computer. Only the research assistant teaching with the mainframe and the programmer in the Department of Agricultural Economics and Farm Management could answer the more technical questions. More of these types of questions were fielded by the other lab instructors and professors during the Microcomputer Period. One instructor expressed a common feeling about this change between Periods, stating that in the Mainframe Period:

you would have specialists brought in and I think it is beneficial to have the instructors of the course doing the computer teaching as well.

Examples of more technical questions included questions about disk operating system commands, handling of diskettes and location of information in different files, and explanations about what the program was doing.

The change in the type of questions asked by students reflects a major change between the Mainframe and Microcomputer Periods. The questions asked by students and their success in completing assignments confirms that more students actually learned how to use the software to do farm business management. According to the teaching staff, during the Mainframe Period many student questions related to how to use the computer and software. By the end of the year of classroom observations during the Microcomputer Period, more questions were being asked about

farm business management during the microcomputer lab periods and fewer student questions related to how to use the computer. One reason for this change was the fact that the microcomputer software designed for use in the class was simplified so that more students could effectively use the software for more tasks. Another contributing factor was the fact that the students had increased opportunities to use the computer in the farm business management courses since computer use was integrated into all the farm business management courses. Also, there were more teaching staff who knew about the software and how to use the computer since all the lab instructors now taught the microcomputer labs. This meant that there were more people who could help the students when they did have computer-related questions.

5. **Assignments**

Student assignments during both Periods in the computer lab were done by **individuals**. The mainframe simulation was used by individuals to prepare the projected financial statements. In the first two Farm Business Management Courses during the Microcomputer Period the students worked on assignments by themselves using the historical and financial planning software to enter a case farm and to enter their own farm records. In the Farm Planning Project the students completed the microcomputer part of their project by themselves.

However, in the **Microcomputer Period** some group work was used to consider alternative plans and to do analysis in the Advanced Farm Business Management course, 61.066. This was a change from the earlier period. One instructor stated that in this class the students:

use the computer as a quick calculator and they make some decisions, given the results from the computer.

The Advanced Farm Business Management course had become a requirement for one of the majors during the Microcomputer Period and optional to the remaining students. With fewer numbers and with students who had chosen to major in farm business management it was easier to do extensive farm planning exercises with small groups working on the computer.

In the **Mainframe Period** the computer assignments were originally considered to be **optional**. By the end of the Mainframe Period and throughout the **Microcomputer Period**, assignments completed on the computer were **required**. One lab instructor's comments illustrate the difference between the periods:

Right now, for example, the micro printouts are used directly as part of their assignments. They hand that in with their assignments on a lot of the labs, in the final press, in a lot of places. Before it was just an assignment they did and pulled numbers off of those. It was just kind of an aside thing they did parallel but now when they do those assignments, that is the assignment. It goes into the next step and stuff.

Compared to the beginning of the Mainframe Period, the students completed many more assignments using the computer during the Micro-computer Period and received more marks for computer output. However, by the end of the Mainframe Period the students were using the computer to complete budgets and projected financial statements. By the end of the Mainframe Period these computer programs were similar in their results to those developed for use in the Microcomputer Period.

To recap, the number of assignments completed using a computer increased throughout both Periods as the computer use became a required part of all the farm business management courses. The majority of these assignments were done by individuals. However, some group work on the computer was done in the Advanced Farm Business Management course during the Microcomputer Period as class sizes were smaller and more manageable. Smaller class sizes in some courses occurred when 'majors' were created for the second year in the Diploma course.

6. Evaluation Practices

Evaluation practices changed gradually between Periods. At the start of the Mainframe Period there were few marks given for using the mainframe computer. These marks were given for the optional computer-generated reports as part of the final Farm Planning Project mark only. As revisions were made to the mainframe program, a few computer-generated reports were required assignments in the second year courses.

During the Microcomputer Period the allocation of marks to topics in the farm planning project in second year changed slightly from the Mainframe Period. An example given by one instructor illustrates this:

We still try to evaluate all the areas of the planning project for instance, the same areas are still evaluated, but we've put more marks on--they're such subtle changes. I've noticed there's less marks for your financial statements and so there's more marks put on the other areas, just sort of smoothed into the other areas of the presentation, say the objectives might get a few more marks or the analysis will probably have a few marks.

In the **Microcomputer Period**, marks were given for more **computer-generated reports** than during the Mainframe Period. Frequently, these reports were done by hand first and then were generated by the computer. Students received a few marks for each small report created in each microcomputer lab. However the students did not receive the marks if the assignments were not handed in on time. As one instructor stated:

We still give grades on areas the computer is doing for them--for spending time.

During both Period the students had considerable **opportunities for feedback** about most assignments. However, all the computer work was marked by one research assistant during the Mainframe Period so that this person had less time available to provide feedback to any one student about the computer assignments. During both periods, the lab instructors discussed assignments during scheduled meeting times with students. The

lab instructors were always available to students both in and out of scheduled classes. Regular lab time was used to discuss assignments. Little discussion about marked assignments occurred during the computer lab periods.

The **preciseness of the feedback increased** during the Microcomputer Period. The instructors used a **detailed** breakdown of marks on the assignments which enabled them to explain and to justify student marks should a student question the marks received. The University Student Records Department **maintained the final marks on the mainframe computer during both Periods.** The professors submitted the final mark to the School office. Plans were under way to allow staff in the school office to enter the marks directly into the Mainframe Student Records program. In the past the School office staff submitted the marks to Student Records where the marks were then entered into the program.

During the Mainframe Period, the professors and lab instructors calculated the marks by hand, using a calculator. **During the Microcomputer Period, the computer was used more extensively to maintain marks.** The lab instructors developed a microcomputer spreadsheet template for calculating marks quickly. The professors also used spreadsheet templates to record and calculate marks. Some professors and lab instructors kept their student marks up-to-date on the microcomputer while others main-

tained the marks by hand and only entered them into the mark program for the final mark calculation.

To summarize, changes in evaluation practices occurred when staff and students were given easier access to microcomputers. Detailed marks were maintained and calculated on the microcomputer. As students handed in assignments completed on the computer, the instructors were able to spend less time checking calculations and had more time to consider content. The maintenance of more complete records meant that the instructors could discuss the students' work in more detail with them.

7. **Classroom Management**

Classroom management issues using the computers did not change between periods to any great extent, except that **more teamwork** was involved by the teaching staff. During both Periods **considerable preclass preparation** was required to prepare illustrations using the software and to prepare the handouts. During the Microcomputer Period the spreadsheet templates were copied onto diskettes for the students. There were also **considerable organizational activities at the beginning of the computer labs** during both Periods to set up the demonstration and to have all the handouts and files available for the students.

During the Microcomputer Period some organizational activities were reduced. During the year of observation the lab manuals were being rewritten. After this year there would be fewer handouts to be distributed

at the beginning of class as these would be part of the lab manual that the students purchased at the beginning of the term. However, diskettes were also distributed as these contained some of the files for the spreadsheet templates used on the microcomputers.

Time management varied between Periods. In the Microcomputer Period there was considerable activity to finish printing before the next class began. In the Mainframe Period the students had to go to another building to get their printouts whenever they had the opportunity. During the Microcomputer Period the printing was all done in the same classroom. This meant less frustration for the students, but the instructors had to plan time for printing during the class period. This also meant more confusion in the classroom at the end of the class and between periods.

There was another time management change. Generally, during the Mainframe Period, a full lab period was used for instruction. Usually the students did not have time to do the assignment until another lab period or on their own time. During the Microcomputer Period the students frequently had time to complete the assignment during the same lab period as the instruction was given. The microcomputer spreadsheet templates were developed in modules. The instructors broke the instruction down into sections based on these modules. Generally a module could be managed in one lab period. The complete lab manual was revised and incorporated the microcomputer labs.

The timing of activities differed between periods partly because of the layout of the rooms. It would have been difficult to have a class in the terminal room and give instruction whereas the microcomputer lab floor plan allowed this. Also, the large monitors had to be booked from Student Support Services during the Mainframe Period but the display unit was a permanent part of the microcomputer lab.

Another reason for the difference in timing was the fact that smaller program modules were used. The fact that the programs were more modular during the Microcomputer Period meant that the students could complete a section during one lab session.

One classroom management concern that was mentioned by all was the fact that **some students did not manage the computer lab time well.** They would not stay to complete their assignments in labs. One instructor said:

It's been a problem. With first years we found we'd introduce the computers to them and they're really - they'll get the material and walk out. They won't try it out. We've got 2 hour labs, but they'll stay until the talking is done and decide that they've got better things to do with their time. And we're in an environment where it's not like...high school or something where the teacher says sit down and get to work and we don't do that here. And then there's also a tendency, once some people feel comfortable with the machine, they'll just skip labs. They'll get the material later from a student or more than likely come into our office and ask us for it and think that they can fly it alone.

Although there were attendance problems with some students, others demonstrated more **teamwork** in the classroom. During the Microcomputer Period students were observed working cooperatively to help each other to answer questions about the computer and the assignments. The classes seemed to direct questions to one or more students in the group who were recognized as having more experience with the computer when the lab instructors were busy with other students. Some students appeared to pair off or group themselves to assist each other with completing the assignments on the computer. However, some experienced students appeared to prefer not to answer questions and quickly completed their assignments and left the lab.

Also, there were usually at least two lab instructors and possibly a professor in many of the computer labs during the Microcomputer Period. They helped each other answer the many questions the students had.

During both Periods there were **interruptions** in classes because of the open access to the computer lab during class time so that the facilities would be as fully utilized as possible. Students not taking the lab were allowed in during the lab time to use the terminals or microcomputers if there were any free. During the Microcomputer Period these students were not allowed to use the printers as they were in the same room. There were also interruptions caused by students using the computers when the

instructor was talking to the whole class or by the sound of printers or keys held down too long.

In summary, though the details of classroom management differed, there was much advanced and in-class preparation, many time management issues and many classroom interruptions in both the Mainframe and Microcomputer Periods. The major difference was that there was more instructor teamwork in dealing with the classroom management issues in the Microcomputer Period because the instructors planned goals, developed classroom materials, designed and tested the spreadsheet templates and supported each other in the microcomputer labs.

8. **Resources and Support Required**

Resources and support available increased from the Mainframe to the Microcomputer Periods. There was **greater financial support** for computer use during the **Microcomputer Period**. Financial resources were required for the set up and maintenance of the microcomputer lab. Faculty administrative support was demonstrated by the provision of a substantial Faculty budget for maintenance of Microcomputer facilities. The original funds for the purchase of equipment came from the School of Agriculture with contributions from other departments for specific additions which these departments would need if they were to use the lab for teaching.

More resources were available for the microcomputer lab both when it was established and as an ongoing entity. There was sufficient money available to establish a planned facility as the School of Agriculture had applied for and received the funding to establish the microcomputer lab. The school also provided one of their classrooms to use for the lab. The Faculty of Agriculture showed commitment to the lab for use by the whole faculty by establishing the maintenance fund and by paying part of the Lab Coordinator's salary.

During both periods a **Faculty Committee provided one level of support**. During the Mainframe Period this committee was not formally established, had a limited advisory function and it met infrequently. Through this committee there was some opportunity for open communication about the use of computers. This committee was given the responsibility to identify faculty needs for computers. During the Microcomputer Period the Faculty Computer Committee took on more responsibilities and was formally established within the committee structure of the Faculty. This committee facilitated communication about microcomputer uses within the Faculty of Agriculture. A survey was made of the faculty to identify what software they were presently using on the microcomputers and what software they would use to teach which courses and topics if it was available in the microcomputer lab. The faculty committee was given the responsibility of developing the budget for and administering the funds

provided for maintenance of the Microcomputer Lab. The Microcomputer lab was considered to be a resource for both the School of Agriculture and the Faculty of Agricultural and Food Sciences.

During both periods there was **some technical support**. A person was required to develop the software to be used in teaching Farm Business Management. However, during the Mainframe Period, this person was only directly responsible to the Department of Agricultural Economics. More technical support was provided by the university's Computer Services and by another programmer in the Department of Agricultural Economics and Farm Management during both periods.

In the Microcomputer Period, a Microcomputer Lab Coordinator position was created with responsibilities for setting up and maintaining the lab facilities. This coordinator also provided technical support for the lab instructors learning to use the microcomputers, developed the software and provided direction about the teaching methods.

The Microcomputer Lab Coordinator provided technical support and received support from other programmers in various departments in the Faculty. However, the programmer in the Department of Agricultural Economics and Farm Business Management and the University of Manitoba Computer Services remained the main sources of support for the Lab Coordinator. For a period of time some support was also provided by programmers in the Solomon Sinclair Farm Management Institute in the

Faculty of Agriculture. Some software support was provided by the companies which make the software, such as WordPerfect. There was also a monthly meeting for all the people involved in supporting the Microcomputer Local Area Networks and labs on campus.

To conclude, an improvement in the amount of resources and support provided for computer use occurred when the microcomputer lab was established as a Faculty of Agriculture facility. Significant operating funds, administrative and technical support were provided for the lab.

9. **Equipment**

The available **technology** changed. However, during both Periods the **hardware capabilities were sufficient** to meet the needs of teaching farm business management. The components of microcomputers and mainframes were essentially the same: a Central Processing Unit (CPU), a keyboard for input and a monitor and printer for output. Also the computer memory requirements for the farm business software were adequately met using both systems.

The **size and capabilities** of the hardware components and the **location and arrangement of components affecting ease of access** were considerably different. The mainframe computer was more powerful than the microcomputers in terms of the size of its memory, calculating speed and storage capabilities. Yet, by the time of the Microcomputer Period,

the microcomputers had sufficient capabilities for the farm business managements courses.

During the Microcomputer Period with 20 microcomputer stations and appropriate lab scheduling, there was **one machine per person** in each lab period. There were 10 terminals, not sufficient for one student per lab in the Mainframe Period.

During the Microcomputer Period the **Lab Coordinator controlled** the operation of the equipment in the lab. This meant that the teaching staff had fewer organizational activities related to lab maintenance. The lab instructors did not need to be concerned about the lab supplies and facilities themselves as the Microcomputer Lab Coordinator dealt with these issues. The instructors still could easily access the coordinator if they needed assistance during a class as the Lab Coordinator's office opened into the lab. On the other hand, during the Mainframe Period, the person teaching also was responsible for arranging for the maintenance of the mainframe terminals. The lab itself was maintained and **externally controlled** by Computer Services.

A method of determining who has **access** to the lab was needed. The microcomputer lab was booked through a contact person in the office of the Dean of Agricultural and Food Sciences. These bookings were based on a 'first come, first served' basis for course use. A schedule was placed on the Microcomputer Lab door showing regularly scheduled classes

and free time. However, this free time could have been booked for other activities by teaching staff. Students could gain access to the microcomputer lab during the evening and weekends by agreeing to take responsibility for the room when they borrowed the key. A temporary code would be set up on the alarm system and this person would be given the code so that the alarm could be set when they left the lab.

Although the equipment used for the demonstration was different between the two periods, the result was that the instructor could project the computer output onto a large screen for demonstrations. In the Microcomputer Period, the instructor demonstrated the process of using the software with a microcomputer hooked up to a Liquid Crystal Display (LCD) panel set on an overhead projector which projected the monitor output onto the large screen at the front of the classroom. During the Mainframe Period the display consisted of large monitors hooked up to the computer instead of the LCD unit.

To recap, although the hardware changed from a mainframe to a microcomputer network, the power of the hardware was sufficient in both Periods. The access to this hardware improved during the Microcomputer Period. One major advantage of the change to microcomputers was that students were able to learn farm business management using similar microcomputer hardware which they could have in their own farm offices.

10. Software

The **software** available to the students and taught during the two Periods changed. At the start of the Mainframe Period there was **one** very large program used, called the Crop Simulator. One professor indicated that the "Simulator" - was:

previously used for evaluation of farm diversification program in Interlake - Kradok's study for Education Council in early 70's re funding for lands/grants/training. The computer program was used to evaluate the success of the farm diversification program.

This Simulator used linear programming models to "let you play farm on the mainframe". By the end of the Mainframe Period two programs, the Crop Simulation and another program for enterprise budgeting, were used. These produced similar results to most of the spreadsheet templates used on the microcomputers.

The students in the Microcomputer Period were taught to use **more** software. **Farm business management spreadsheet templates were taught.** First Lotus and then Quattro Pro spreadsheet commands were learned by doing a cashflow exercise. Students then used spreadsheet templates to complete a projected balance sheet and income statement. A module was added which allowed historical statements to be produced.

There was some **general purpose software** available during the Microcomputer Period which students used. The students were starting to use a word processor on the microcomputers to prepare assignments. The spreadsheet software was used by a few advanced students to prepare their

own calculators to consider different alternatives in their farm plans. Other software was available for use in the lab, such as WordPerfect, PC File, Windows, SAS, and EXSTAT. Although, none of this software was formally taught in the Farm Business Management courses, students did choose to use some of these available packages to complete assignments, especially the word processor.

There were also some Microcomputer programs for which no equivalent product existed during the Mainframe Period. There wasn't a mainframe program for developing the historical financial statements. Another difference was the use of a Computer Assisted Learning (CAL) program on the microcomputer to review concepts in the marketing course. Four other CAL programs were being developed about farm business management concepts which the teaching staff had started to use in the degree program and were considering for use in the microcomputer labs.

The program used during the Mainframe Period was comprehensive. That was one of the problems with the program. **During the Microcomputer Period the templates were simplified.** Other major difference between the simulation program and the spreadsheet templates were that **the templates replicated the student work more precisely** and were more modular. The staff decided to develop the Microcomputer software in-house because none of the commercially available software matched what

the students were required to do by hand. During the Mainframe Period this difference between the software and the manually developed records and statements had confused students during the learning process.

In the move from the mainframe to microcomputers, the use of the software increased. The farm business management software changed from a very comprehensive program, which was complicated to use, to very modular and less detailed spreadsheet templates, which were simpler to use. The students became more familiar with using computers because they used them more frequently for both farm business management subject related tasks as well as for more general purpose tasks such as preparing reports. The students received formal instruction in the use of the farm business management software.

11. Location and Layout of Computer Lab

The location of instruction and layout of the computer lab had an impact on the use of computers. **During the Mainframe Period the instruction lesson occurred in a different room from the terminals** where the students completed their assignments. There were a few occasions during the Microcomputer Period where the instruction occurred in a different room from the computer lab. In these situations a portable microcomputer and viewer were taken to a regular classroom for instruction. **In the Microcomputer Period most of the instruction occurred in the microcomputer room where the students completed their assignments.**

The **microcomputer lab was planned for instruction** to occur in the same room as the microcomputers were located. A copy of this plan is found in Appendix 15. The mainframe terminals were placed in space which was available at the time. During the Mainframe Period the terminals were placed in a rounded room, in an area referred to as the "silo", with no blackboard or screen. However, the microcomputer room layout was planned before the computers were ordered.

To restate, the opportunity to do some preplanning for the layout of the microcomputer classroom facilities made this room more useable as a teaching facility than the terminal room used during the Mainframe Period.

C. **Changes in the Farm Business Curriculum**

1. **Curriculum Goals**

The curriculum goals for using the computer **did not change** between the two Periods, although there was some indication of changes coming in the future. During both Periods, the purpose of using the computer was to teach students to produce more accurate financial statements. As more students were using computers effectively to achieve this goal, the teaching staff were beginning to consider other areas where computers could be used effectively. The interviews and records of staff meetings revealed that the staff were beginning to discuss the need for more analysis of the farm plan using the microcomputers.

2. **Conceptions of Curriculum Content**

A comparison of course outlines confirmed that the teaching staffs' **conceptions of curriculum content did not change very much during the two periods.** To illustrate this Appendix 16 is the Proposal for Undergraduate Course Change sent to Senate for the Advanced Farm Business Management course. Appendix 17 includes the actual course outlines handed out in class for the Advanced Farm Business Management course in September, 1990 and in September, 1988. However, as one administrator noted "professors, under academic freedom, tend to retain the right to change" courses, though professors are "quite cooperative and open to suggestions from the school and other members of the department."

A major outcome of the two year program is a Farm Planning Project. An outline of the sections in this project provides an overview of the farm business management topics covered in the courses. These topics are: a) the personal and business objectives of the farm, b) the available resources and constraints (assets, liabilities, current business arrangements and uniqueness of the farm); c) a report on last year (financial statements, ratio analysis, cash flow analysis, fixed cash cost analysis, historical enterprise analysis); d) a basic analysis of alternative enterprises (alternative enterprises, projected enterprise budgets, proposed operational plans); e) a financial analysis of proposed plans (financial statements, ratio analysis, cash flow analysis, fixed cash cost analysis, loan repayment schedule, use of surplus/uncommitted cash) e) marketing plans, f) basic risk analysis h) business organization i) conclusions. By the end of the Mainframe Period **programs used on the computer were similar** to the Microcomputer Period except for the historical statements and the use of CAL programs to review concepts. A review of the formal curriculums sent to the Senate for approval did not indicate that computers and software were a very big part of the course during either period.

However, during the Microcomputer Period, the computer use was **integrated into the curriculum** to a much greater extent than during the Mainframe Period. A farm simulation program was used to produce financial statements on the mainframe computer. These were developed

during the Advanced Farm Business course and accompanied the Farm Planning Project assignment. During the Mainframe Period these computer-generated financial statements were an optional part of the Project, although lab time was used to teach and to generate these statements. During the Microcomputer Period the various reports generated by the computer were a required part of all the Farm Business Management courses taught and of the Farm Planning Project.

The microcomputer was used to develop both historical and projected financial statements--Income, Cash Flow and Balance Sheet. The programs also calculated liquidity, profitability, solvency and efficiency ratios. These reports and ratios were required for the report on last year and the financial analysis of proposed plans. The computerized generation of budgets was used to analyze alternative enterprises. These budgets also were used in considering potential markets. The budgets and revised projected financial statements were used in the section about risk analysis. One instructor, describing the primary microcomputer activities in the courses, said:

Once you've done the budgets [on the microcomputer] we've got the financial statements that you can develop from a set of budgets and there's also the historical ledger that can be used now and the historical statements so we've sort of got the whole basis covered now. It's just streamlining and tying them together so it works like an easier package.

In summary, the use of the computer did not result in significant changes in the curriculum between the Mainframe and Microcomputer Periods. The microcomputer was used as a tool in teaching students to produce accurate financial statements in all the farm business management courses in the latter Period. Computer literacy was simply a bi-product of using the computer to do farm business management tasks. The microcomputer applications were integrated into the curriculum work because there was greater recognition by the staff that the computer could be used as a "quick calculator" to reduce the amount of calculations students would have to do by hand and to improve the accuracy of the results. This change occurred as simpler programs were developed and more staff became familiar with the microcomputers.

3. **Sequencing of Curriculum Content**

The **sequencing of curriculum content did not change** very much due to the use of computers since farm business management topics build on previously learned concepts. The few changes which occurred related to the fact that the curriculum was rewritten during this period. One instructor summed these few changes up when he said:

I think we changed the sequence more to suit the curriculum and the forced changes by lab structure...it's more just trying to coordinate a flow within the curriculum changes and when the deadlines were put in place for certain portions of the planning project.

Both the professors and lab instructors during the microcomputer period made a concerted effort to cover material during the scheduled time so that when students went into the microcomputer lab they had covered the material sufficiently to take advantage of the microcomputer lab time to complete assignments.

At the start of the Mainframe Period the computer was not used until the Advanced Farm Business Management course which all students took. The use of the microcomputer started in the first term of first year.

In summary, the computer use did not significantly change the planned sequence of the curriculum. The only recognizable change observed was the plan was more important as the material had to be covered in the planned time or the students would not be able to use the scheduled microcomputer lab time effectively.

4. Curriculum Knowledge

During the Mainframe Period, the majority of staff did not feel that the students would learn much about farm business management using a computer. The computer assignment was introduced as an option only because a few staff felt that students could potentially produce more accurate statements using a computer. As the hardware and software became easier to use during the Microcomputer Period, more staff agreed that the students could produce more accurate statements faster by using a

computer. By producing more accurate statements students would be able to produce more practical and reliable farm business plans.

To use the mainframe program the students had to collect considerable detailed information which they entered into the program by answering Yes/No questions. Many of the values required by the program were already in the program as default values, some of which could not be changed by the user. This program also calculated the farm plan based on selling the farm rather than as an ongoing operation. As a result of these factors some students had difficulties understanding what the computer reports meant as they were different than those they had developed by hand.

During the Microcomputer Period there were occasions when the teaching staff expressed concerns about whether the students would understand how the statements were constructed and the relationships between statements as much of this work was done by the software. To ensure that the students did learn the concepts the statements were actually covered three times--first in lecture; secondly the students did the work by hand in a regular lab; and then the students went into the Microcomputer Lab to do it again on the computer.

During the Microcomputer Period, the teaching staff started to focus on concerns about students understanding of advanced farm business management concepts. One of the purposes for using the computer during

the Microcomputer Period was to reduce the amount of time it took to cover more basic information so that there would be more time available to cover the advanced concepts in greater depth. Although the students produced much more accurate statements faster once they learned the software, valuable time was used to teach students how to use the computer and how to use the programs.

Since no prerequisite computer literacy course was required, much time was spent in the first classes teaching the basics of how to use the computer. Students were producing more accurate statements, but as one instructor said:

We've given up lab time to teach use of the micro rather than to discuss some of these concepts. Things like partial budgeting, analysis of ratios and financial statements and overall financial performance. We're missing some risk analysis ... we would discuss options more by looking at different enterprises, and fiddling with that. We would use them as a discussion topic, rather than just ask for the student to do it, the statements, on the computer. We actually would do more talking about that. We wouldn't do as many calculations of it.

In summary, the change between the Mainframe and Microcomputer Periods was that most diploma students were producing more accurate records using the microcomputers. However, the teaching staff felt that all students did not have the opportunity to learn the advanced farm business management topics as thoroughly as previously. This can be partially explained because of the implementation of 'majors', which meant that not all students were required to take advanced farm business man-

agement. Those students taking the advanced class used the computer extensively and effectively in producing their farm business plans. However, the remaining students did not have that opportunity because time gained in using the computers as "quick calculators" was lost in teaching students how to use the microcomputers in the required farm business management courses. Secondly, the inclusion of microcomputer lab periods in the lab schedule reduced the amount of time which formerly was used for note taking and discussion.

D. Why Changes Took Place

1. Overview

The reasons for the changes in "teaching" and "farm business management curriculum" resulting from the move from the mainframe computer to the microcomputer can be grouped into five areas. The following information was provided during a staff meeting discussion on February 4, 1991 and reconfirmed during individual interviews with staff.

The five groups of reasons for the changes in "teaching" and "curriculum" include:

- a. Change in administrative policies
- b. Greater integration of computer use in the courses
- c. Greater experience using and teaching with computers and computer software
- d. Advances in computer technology and software technology
- e. Administration and teaching staff identified needs for change

2. Why changes occurred in teaching

a. Change in administrative policies

Administrative support for the computer use in the diploma program changed from being mainly a Department of Agriculture and Farm Management initiative during the Mainframe Period to include not only the Department, but also the School and Faculty of Agriculture during the Microcomputer Period. The need for the

teaching staff to be able to use a computer was recognized through provision of funds and the implementation of policies to support microcomputer use.

The need to be able to use a microcomputer was included in the job descriptions of the lab instructors in the School. Furthermore, the School and Faculty administration provided support for the teaching staff by funding a Microcomputer Lab Coordinator and by clearly defining this person's job. A portable microcomputer was also purchased for the lab instructors office use. The professors in the Department of Agricultural Economics also purchased microcomputers for their offices. The School of Agriculture and the Faculty identified funds to establish a Microcomputer Lab in the Agriculture Building. The faculty provided annual funding to support the lab. A Faculty Committee was given the responsibility for managing the funds for the Microcomputer Lab and for identifying staff computer needs. Weekly staff meeting of all professors, lab instructors and the administration of the school were established to encourage greater communication among the staff teaching farm business management.

b. Greater integration of computer use in the courses

The microcomputer lab was established at the request of the teaching staff. Once confirmed that it would be established, the

Farm Business Management professors and lab instructors planned how to integrate the use of the microcomputers into the courses in order to take advantage of the facility. One advantage they had was the fact that the courses were formally being revised at the same time as the microcomputer lab facility was added.

In the weekly staff meetings the staff determined how to integrate the software use into the courses. During these meetings staff planned where the computer use would be appropriate in order to achieve the goal of having students produce more accurate statements.

Because the curriculum was being rewritten during the Microcomputer Period, the lab manuals were rewritten. The microcomputer lab periods were planned and manuals written by the lab instructors to meet the course objectives as identified by the professors. During the year the manuals were being revised, the materials were tested in the classroom and further revisions made before the lab manuals were printed.

c. **Greater experience planning, using and teaching with computers and computer software**

Changes occurred between Periods because more staff had greater experience planning, using and teaching with computers and computer software during the Microcomputer Period. This meant

that more teaching staff could help students use the microcomputers in farm business management courses.

During the weekly staff meetings between professors, lab instructors and school administrators, ways to learn the software were identified. These included using the teaching software to enter personal farm records, developing and entering a case farm to be used in teaching, and learning about potential problems by intentionally entering incorrect information to determine what students could do wrong and figuring out how to solve the problems before classes.

The teaching staff accepted the computers more as they became more familiar with them and as they participated in the design of the microcomputer software to be used in the teaching situation. The original mainframe program was used because one professor decided to include it in a course. The mainframe farm simulation was revised by a Research Assistant in the Department of Agricultural Economics and Farm Management as specified by this professor.

During the Microcomputer Period, the microcomputer spreadsheets were developed as a cooperative effort between all the teaching staff in the School of Agriculture and the Department of Agricultural Economics and Farm Managements to meet the specific

needs identified in the teaching situation. Both the professors and lab instructors had input into the design and the revisions of the spreadsheet templates. The result was that all the teaching staff were more satisfied with the software. All the lab instructors used the programs in teaching.

3. The Farm Business Management Curriculum

a. Greater experience using and teaching with computers and computer software

Greater experience using and teaching with computers and computer software did not lead to great changes in curriculum goals, conception of curriculum content, sequencing of the curriculum content, or expectations about students' curricular knowledge because the reason for using the computers did not change between Periods. However, this experience did lead to greater teamwork among the staff using the computers.

The mainframe computer was introduced to enable students to prepare more accurate financial statements. This goal remained the same in the Microcomputer Period. However, as the students were producing more accurate financial statements, the teaching staff were beginning to focus more on the need for more analysis using computers. This need could lead to changes in the curriculum goals involving the use of computers.

The content and the order in which the content was covered in courses did not change when computers were used. However, in the Microcomputer Period, the teaching staff followed the lesson plans closely as the students needed to cover required material before they went to the scheduled microcomputer labs.

As all the farm business management teaching staff were involved in designing the programs to be used in the classroom and in planning how to learn to use these programs in teaching, a sense of teamwork developed. The opportunity to discuss concerns during the weekly staff meetings contributed to this cooperative atmosphere. The teaching staff provided each other with support as they learned to use the microcomputers for teaching.

b. **Advances in computer technology and software technology**

Advances in computer technology and software technology made it easier to use the computer to teach farm business management. The microcomputer software used complemented what the students were doing by hand. The original mainframe program simulated a total sell-out of the farm with contingent tax. This meant that the tax structure in the program was based on selling the operation. The books prepared by hand by the students were for ongoing operations. However, by the end of the Mainframe Period

much of the software used also complemented what the students were doing by hand.

The students had more control over the information used in the microcomputer programs. Many default items and values were built into the mainframe program. The entry process consisted largely of answering a series of yes/no questions. With the microcomputer programs the students could select their accounts or create their own names for the accounts and the students provided all the values.

Using the microcomputer programs, the level of detail used could increase as the students knowledge of farm business management increased. The mainframe simulation program required extremely detailed information in order to use it at all. For example, detailed information was maintained on every piece of machinery, including attachments, for depreciation purposes. This collection of detailed information required considerable time, a valuable commodity in the School of Agriculture's shortened school year.

The students could produce results much faster using the microcomputer programs than the mainframe because each spreadsheet was complete in itself; a separate report could be produced from each spreadsheet; the amount of detail required was less; and

the entry process was simpler. The students could complete one activity, such as a budget, and produce a report in one class period.

The use of the microcomputer hardware simulated more closely the farm office in set up, access and control. The microcomputer, floppy disk drives and printer were all located in one place, whereas previously the printer and the computer were in a different location from the terminals. The printer was in the Engineering Building, requiring a walk of two blocks from the terminals to pick up the output. This involved going outside during the winter. The control of the hardware and of access resided with computer services, not the Faculty of Agriculture. Decisions such as backing up, taking files off the system, shutting down the system for repairs, were made after warnings were given but with limited ways of dealing with individual instructor's or student's situations at the time.

The smaller spreadsheet templates were easier to modify than the mainframe program. Examples of modifications included linking different templates together such as the historic records with the enterprise analysis and the projected statements, and the addition of the GST tax. The first mainframe program could also be modified in-house. However, because of its size and the computer

language used, the mainframe program was not as easily modified to meet changing needs.

The user interface was simpler on the microcomputer running spreadsheet templates than it had been using mainframe terminals and interfacing with a program stored on the mainframe. The microcomputer software and hardware were much more user friendly and required less time to learn and to use.

The need to develop a simpler program user interface developed during the Mainframe Period. At that time, the Department of Agricultural Economics and Farm Management had a farm simulation program for developing budgets that could be and was modified for total farm planning. Access to microcomputers was not available at the time.

During the Mainframe Period the availability of the mainframe crop simulator and a research assistant who could revise the program for teaching facilitated the original implementation. However, the mainframe program was too complete and too complicated operationally. As one professor said:

It wasn't suitable to those who needed it most; i.e. those with bad records and limited knowledge.

c. **Administration and teaching staff identified needs for change to microcomputers.**

Among the reasons given for the move to the microcomputer was the need to keep up with what farmers were doing and with other universities which had already moved to using the microcomputer in their courses. The Universities of Alberta and Guelph were two examples given.

Another reason given for moving from the mainframe to the microcomputer was that students would be able to use the microcomputer when they returned to the farm. A microcomputer could be purchased at a reasonable price whereas they would have limited access to a mainframe. Since the students even had access to the software used in the courses, they potentially could carry on with the same files if they had used their own farm records for the Farm Planning Project. The difficulty with that at the time was that there were slight differences between the LAN version, due to problems with the printer access, and the version that students could get for home use. Until the problem of accessing the printer was solved the students couldn't use the same data file as the network version.

Finally, the main reason why the computers were used during both Periods was the need to have the students produce more accurate financial statements. As a "quick calculator" the computer

could calculate and recalculate the financial information quickly and accurately as numbers changed throughout the year.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

A. Introduction

The conclusions are based on findings about computer use during the transition from the Mainframe Period to the Microcomputer Period in the School of Agriculture at the University of Manitoba. The conclusions are discussed under three subsections: effects on the teaching practices; effects on the Farm Business Management curriculum; and the reasons for these changes.

Conclusions about the effects of changes in computer use on teaching practices and on the Farm Business Management curriculum are relevant to the specific contexts within which use of the computer occurred in the School of Agriculture courses. The integration of computers into the teaching of Farm Business Management has allowed the teaching staff to reach their goal of teaching students to develop more accurate statements. There have been very minor effects on the Farm Business Management curriculum to date, largely because the purpose for using the computers remained the same in both Periods.

The various reasons why change occurred are clarified in the discussion about the process of change. The causal conditions, the intervening conditions and the consequences of actions taken all influenced the phenomenon of using computers to teach Farm Business Management. The reasons for change are also highlighted by the process of learning to teach using computers. Lastly, the reasons for change are discussed in terms of the organizational levels affecting and effected by the changes. The computer use has influenced and, in turn, has

been influenced by individuals, the sub-organizations of the Department and School, the Faculty as a whole and the community.

The study ends with recommendations for further research and some concluding comments.

B. **Conclusions About Effects on Teaching**

A number of conclusions were reached about teaching practices by comparing the contexts of the Mainframe and Microcomputer Periods.

1. **Staff Numbers**

Compared to the Mainframe Period, the **administrative steps taken during the Microcomputer Period to require or to encourage more teaching staff to use computers were successful.** All the lab instructors used computers during the Microcomputer Period but not during the Mainframe Period. The lab instructors' job descriptions were modified to require microcomputer skills. The professors in the Department of Agricultural Economics and Farm Management were all encouraged to purchase microcomputers and become familiar with their use. In redesigning the Farm Business Management courses, these professors required that the students use the microcomputer to complete assignments. Weekly staff meetings of lab instructors, professors and School administrators provided a time when staff could plan the classroom use of the microcomputers. The lab instructors were provided with one portable microcomputer which they could use either in their offices or take home evenings. When the adminis-

tration agreed to provide the microcomputer lab facility they required that the Farm Business Management professors and instructors use the microcomputers in the courses since this group requested that the lab be established. As the teaching staff knew they would have a microcomputer lab in agriculture at least a year prior to using the lab, they were able to plan how they would use the facility.

Many levels of support were developed. A new position was created--Microcomputer Lab Coordinator--with responsibilities to support the teaching staff in software development, in solving technical problems, in maintaining the lab facility and in teaching instructional methods, largely through role modelling. A Faculty Committee was given the responsibilities of planning the budget for the computer facilities, determining the faculties computer needs and making recommendations about appropriate uses of the microcomputer lab facility. Final responsibility for the lab facility rested with an Associate Dean. Faculty funds were identified for yearly support of the microcomputer lab facility.

2. Staff Computer Training

The methods selected by the teaching staff to learn how to use computers during the Microcomputer Period proved successful. In the Mainframe Period only one professor and a research assistant used the computer to teach farm business management. By 1991 a cultural transition had occurred since all the teaching staff saw microcomputers as

valuable tools in teaching farm business management. In the Mainframe Period there had been general disagreement about the value of the mainframe for teaching the diploma students. Considerable experience had been gained by all lab instructors in using the microcomputer software to teach farm business management topics. Efforts taken to learn how to teach with the farm business management software included entering the case farm used in classes, entering their own farm records, purposefully entering probable student errors and determining how to correct these prior to classroom use, observing the Lab Coordinator teaching in the microcomputer lab, observing each other teaching in the microcomputer lab and considerable discussion with each other in order to plan how to use and to solve problems related to using microcomputers. Designing and testing the spreadsheet templates to be used in class was another component of the learning done by the professors and instructors. By using the office microcomputer to prepare classroom materials and maintain marks the staff developed word processing and spreadsheet skills.

Although there were still concerns expressed about the personal usefulness of the computer because of lack of typing skills or because the software was not directly applicable to their own farming situation, all staff saw the value of the microcomputer use for farm management. For some the key to using it themselves was the addition of the historical records. Others were still looking for a package tailored to their type of farm

operation, which differed from a typical grain or livestock operation.

There was general recognition about the usefulness of the computer in teaching farm business management because of the accuracy and speed of the computer in doing calculations and producing reports. There was also recognition about the value of the microcomputer for preparing and revising teaching materials and in maintaining marks.

3. **Instructional Methods**

The instructional methods used in the Microcomputer Period were effective for meeting the goal of teaching students to produce accurate financial statements. In the Mainframe Period many of the same instructional methods were used, but the results were not as successful because the computer-related assignment was optional, fewer people used the computers for teaching Farm Business Management and there were difficulties using the mainframe program. The mainframe program was not "user-friendly" to operate. It did not replicate exactly what the students did by hand. The program could not be learned in stages and very detailed information was needed before the program worked.

Many of these problems were overcome by using the spreadsheet templates in the Microcomputer Period. In both Periods the students learned the steps in maintaining records and developing financial statements sequentially. However, the microcomputer was used as each step was taught. At the end of the first year and throughout the final year a

more holistic instructional method was used when the students considered a farm plan. The microcomputers were used to develop the farm plans and to consider alternative scenarios. The instructional methods used with the microcomputer resulted in students moving beyond experiencing to actually utilizing microcomputers in producing accurate financial records.

Successful instructional methods in both Periods included verbal directions, written handouts and demonstrations using a viewer connected to the computer. Rote learning of basic principles of farm business management was reinforced by doing each step by hand and on the microcomputer. Learning advanced planning skills was made more meaningful by using the microcomputer to consider options. Reception learning, where the students were told and shown exactly what they were to do, proved successful in learning how to use the computer. In the Microcomputer Period, once the students had learned the basics of how to produce financial statements, knew how to utilize the computer and were familiar with the software, some discovery learning was encouraged in creating the farm plans. In both Periods, considerable individualized help was provided during and after formal lab periods, but more lab instructors knew how to use the microcomputers for farm business management so the students had access to more help.

The reason for using the computers, the course content and the sequencing of course material did not change extensively between both

periods with the result that the computer assignments remained individualized assignments. However, this meant that during the Microcomputer Period each successful student did learn the programs sufficiently to produce the enterprise plans and the historical and projected financial statements.

Although most computer assignments remained individualized, there was a move to group work in the advanced classes. With the addition of group activities during the Microcomputer Period the students were encouraged to learn from each other's experience and knowledge. One potential effect of this was to help push the individual past their own limitations by considering alternatives and using methods of supporting their positions which they might not have considered on their own. It also had the potential to help students become more critical thinkers as they considered the alternative arguments and the validity of the assumptions behind these arguments. Some groups were much more active and effective than others. The discussions in the staff meetings about group work indicated some interest in learning more about group dynamics and how to create and use groups effectively in a teaching situation.

The microcomputer was not being used extensively in the regular classroom to model expertise in planning, to build problem-solving skills by developing the ability to recognize problem types or to foster students abilities to recognize meaningful relationships between farm business

management concepts. With few exceptions, the computer was not used during the regular classroom lectures. Some computer printouts were used as examples during lectures. Also, the microcomputer was used a few times in the regular labs to personalize the instruction where students provided the lab instructor with input information about crops and prices during a demonstration. The fact that the computer was not used much in the classroom can be attributed to the identified purpose for using the computer. The purpose was to use the computer as a tool to enable students to improve their abilities to produce accurate financial statements. However, as discussed in the following section under curriculum, the staff were identifying new purposes for using the computer in teaching.

Because calculations can be done so quickly on the computer and because there are portable microcomputers and viewers available, professors could illustrate the various concepts taught during the classroom lecture. By tracing the effects of various management decisions on the financial statements, the professors could demonstrate the relationships between concepts. Professors and lab instructors could simulate farm business planning and problem-solving processes with the use of case examples during regular class or lab periods.

When teaching occurs in the same room as the computers, instructional methods which encourage students to listen carefully need to be used. Some students were distracted by the technology in the Microcom-

puter Lab. The fact that the instruction and computers were in the same room meant that in the Microcomputer Period there should have been less intervening activities to interfere with students memory of the lesson.

However, it also meant that students may not have heard the lesson as they had already started to use the microcomputer to complete the assignment or just to experiment before listening to all the instructions.

4. **Student Questions**

Findings in both Periods confirmed that **when teaching Farm Business Management with computers, instructors need to be prepared for students to ask many varied questions.** When learning to use the computer hardware and software, the students required specific facts. Many of these initial questions related to the technical concerns about how to operate the equipment or run the programs. As the comfort level with the machines increased, the questions changed to specifics about farm business management. In the advanced courses questions asked indicated that the students were thinking critically about farm business management when using the microcomputer as a problem-solving tool. Since students entered the course with varying expertise using computers and varying backgrounds in doing Farm Business Management, instructors needed to be prepared to answer many, varied technical and subject related questions about the particular assignment. One reason why the lab instructors felt the need to

team teach was because of the variety and number of questions asked in any one microcomputer lab period.

Compared to the Mainframe Period, during the Microcomputer Period the students had greater access to authorities who could answer their technical questions and subject specific questions related to computer use. More teaching staff were knowledgeable about and comfortable with the computer and the programs used by the students during the Microcomputer Period than during the Mainframe Period. The fact that students addressed many different types of questions to the lab instructors indicated a show of confidence in being able to get the questions answered by their own lab instructors. Students also supported each other during microcomputer labs. This was generally considered useful by the lab instructors as they frequently had a large number of questions in a computer lab period and had difficulty reaching all the students quickly. In fact there were frequently two lab instructors in each lab in order to deal with all the questions.

5. Assignments

In the Microcomputer Period when students used computers to complete many short, required assignments which built on previous learning, they gained confidence and competence in using the computer as a farm business management tool. In the Mainframe Period few students

were successfully able to use the computer to complete the Farm Business Management assignment in the time provided. During the Microcomputer Period, students' confidence in their ability to use the microcomputer was built by integrating the computer use into each step of the learning process. The students were not graded on their use of computers. Therefore the positive reinforcement came from the grades received for the successful completion of the computerized farm business management assignments. These assignments were short, specific and built on previously covered concepts. Also, during the Microcomputer Period students received more feedback on assignments as instructors marked more computer-related, individual assignments as the year progressed.

When using computers, students need to be required to use critical thinking skills in all assignments, including the early assignments. In the Mainframe Period students only used the computer in the advanced courses where students used the printouts to support their farm plans. In the Microcomputer Period students were frequently asked to apply their knowledge of how to produce accurate statements when they used the microcomputers at all levels. However, in most assignments where computers were used the students were not asked to explain what the information on the statements meant and how this information could be useful. Only in the later courses were students asked to explain their decisions when they used the programs to produce alternate farm plans.

As the Advanced course was only a requirement for the Farm Business Management majors during the Microcomputer Period, a number of students had very little experience in really utilizing the microcomputer-generated information in the planning process. The inability of a number of students to use the information on the financial statements to support their farm plans during the oral presentation of their farm planning project highlights this need to develop critical thinking skills throughout the courses.

6. Evaluation Practices

In the Microcomputer Period the computer was a valuable tool in evaluation. During the Mainframe Period the computer was valuable only for the central administration to maintain final grades. In the Microcomputer Period, professors and lab instructors took less time to mark computer-generated assignment reports because the extensive calculations in financial statements were correct if the information was entered correctly in the spreadsheet templates. The result was that the assignments took less time to mark or the markers had more time to provide feedback on the assignments. The neat, organized printouts were easier to mark. The marking scheme could be very detailed as the microcomputer was used to calculate the final grade. The teaching staff agreed on the marking scheme in advance. This detailed marking scheme meant that the instructors could show the students more precisely how they could improve. The detailed

marking scheme also meant that the instructors could easily justify marks given if students questioned their grades. Although the marks were extensive, the actual recording and calculating of marks took less time using the computer. The lab instructors, professors and the office staff used the computer for recording marks during the Microcomputer Period.

The marking scheme used in the Microcomputer Period needs further refinement. In the Mainframe Period the computer assignment was optional whereas there were many short microcomputer printouts required as assignments during the Microcomputer Period. Individual small deadlines created by the marking structure used in the Microcomputer Period had the potential of helping students to manage their time as the year progressed. However, these marks were small and were not given if the student was late handing in assignment, including the computer-related assignments. The instructors felt that one of the reasons that some students did not hand in all the reports by the deadline was that these small marks reduced the importance of the assignments. This created a problem since the subject matter built on previous knowledge and each step provided input for the next step. The teaching staff indicated that the students who did not complete each step generally appeared to have more difficulty completing assignments as the year progressed.

7. Classroom Management

When computers were used, classroom management was complex in both Periods. In the Microcomputer Period, the complexity of classroom management was reduced by the fact that the teaching staff supported each other in preparing for and using the microcomputer labs. In both Periods there was much advanced preparation, much in-class preparation, many time management issues and many classroom interruptions when computers were used. The major difference in the Microcomputer Period was the support the teaching staff provided each other both in and out of the classroom. Teamwork developed for a variety of reasons. In the short weekly staff meetings each staff member reported on the past week's activities and their plans for the next week. Specific problems were discussed and solved during these meetings. The instructors coauthored the lab manual; shared and tested the teaching materials; reviewed software and then designed and tested the spreadsheet templates for use in the lab; and observed in each other's classrooms and in the professors lectures. The microcomputer lab scheduling provided the opportunity to team teach microcomputer labs, making classroom management easier.

During the Microcomputer Period the way many students chose to use the assigned lab time created a time management problem for students and staff. Instruction occurred in the same lab period as the assignment was to be done during the Microcomputer Period. Therefore the students should have had less time between the instruction and completing the

assignment. This should have meant that there would have been less time to forget what they had learned before doing the assignment. However, a large number of students chose to leave the microcomputer lab immediately after the instruction and to complete the assignment on their own time. Later, when these students experienced difficulties using the programs, they approached the lab instructors in their offices for assistance at any time during the day. This created a time management problem for the instructors who were always available to students throughout the day even though they had other tasks to complete. Instructors commented that students who did not complete the work during the allocated labs more easily fell behind in their assignments.

A certain amount of routine was created by the fact that the lesson plan format varied very little in each microcomputer lab, with a short introduction about the objective of the lab, a demonstration and then the students completing their assignment. This element of routine should have been useful as students would know what was expected. However, because students knew the routine, some students chose to leave the lab as soon as the demonstration was finished, not using the allocated time to complete their work.

8. Resources and Support

During the Microcomputer Period the separation of responsibilities for maintaining the hardware and software from those of teaching made it

possible for more staff to use computers for teaching. It was possible to teach using the computers without extensive technical background. Having the Lab Coordinator located in an office attached to the lab meant that the instructors had ready access to assistance if they did experience difficulties with the hardware and software during the lab session. The Lab Coordinator also had direct control over the computers. Since he was aware of what was happening in the lab he could schedule work on the hardware without seriously disrupting classroom and student activities.

A major reason for the success of the microcomputers versus the mainframe computer use in farm business management was the fact that the administration provided more substantial financial, administrative and technical supports during the Microcomputer Period. Because a budget for maintaining the microcomputer lab facility was available, a means to book the lab facility was put in place, technical support for the lab was established and a decision-making faculty body was formalized during the Microcomputer Period, the microcomputer lab functioned well. The result was a facility which met the needs of the School and the Faculty more completely. However, the microcomputer lab use was growing rapidly and the need appeared to be quickly outgrowing the space available.

9. Equipment

The available hardware was meeting the present needs for teaching Farm Business Management in the diploma program. However, the need

for more microcomputer hardware was increasing because more Faculty of Agriculture staff required the use of the microcomputer lab for instructional purposes. More work is required to clearly identify the hardware needs for the faculty. Based on the number of students who wanted the "shareware" templates, a number of students were purchasing their own hardware. More departments were purchasing portable microcomputers and viewers which meant that more instruction could occur away from the microcomputer labs. There was some discussion in staff meetings about placing a few microcomputers in another area so that group work could be done using a microcomputer without needing to book the microcomputer lab facilities.

10. Software

Short, simplified programs were more effective for teaching than a comprehensive program. The comprehensive mainframe software package was used during the final course in Farm Business Management during the Mainframe Period. When comparing the spreadsheet templates to the mainframe program, the staff found that simplified, tailored programs were more useful for teaching Farm Business Management curriculum concepts than a large, detailed program, described by one person as a "cadillac". Using the spreadsheet templates, students could complete each assignment in the given lab period with only the related information for that specific topic in the farm business management course. In the Mainframe Period,

because the program was comprehensive, the students required very detailed and complete farm data to produce any reports. Difficulties in using the mainframe program resulted in the printouts being made an optional part of the assignment. The microcomputer reports were a required part of the assignments during the Microcomputer Period. One measure of the success of the simplified packages was the fact that a number of the students wanted the "shareware" compiled spreadsheet templates used in the courses for their own personal use on the farm. Very few former diploma graduates had ever come back to use the mainframe farm business management program after graduation.

11. **Location and Layout of Lab**

The microcomputer lab was conveniently located for the School of Agriculture. However, the location may not have been as convenient for other Departments within the Faculty of Agriculture.

The microcomputer lab layout was a great improvement over the facility provided for the mainframe computer terminals. The instructor could quickly see what was on half the students' computer screens at any one time because the screens faced inwards on both sides of the aisle. Another advantage was the availability of the display panel connected to a microcomputer for demonstration purposes and the presence of a second overhead projector for transparencies.

The lab layout had two noticeable drawbacks. First, to reach a student at the back in either aisle, the instructor had to come to the front and then move down the second aisle. This meant that the instructor either had to group students with difficulties together or the instructor did a considerable amount of walking around the classroom during any one lab period. A second drawback was the fact that there wasn't a way to subdivide the lab room when only a portion was required for any one lab group. This meant that either the instructor accepted interruptions by having students not in the class come and go or that the machines were not used to capacity because students not in the class in session were not allowed in even though machines were available.

C. Conclusions about Effects on the Farm Business Management Curriculum

1. The farm business management curriculum goals, content and sequencing were not substantially changed by the incorporation of computers in either period.

In both the Mainframe and the Microcomputer Periods the purpose for using the computer remained unchanged. The purpose was that by using the computer students would be able to produce more accurate financial statements. The one obvious change in the course results was that students developed computer skills, but learning to use computers was not an end in itself in the program. Rather this computer literacy and skill development was more a side-effect of using computers as a tool to do

farm business management tasks. The curriculum and lab manuals were revised during the Microcomputer Period, which made it easier to incorporate the microcomputer labs into the plan. The schedule became more rigid as planned topics had to be covered before microcomputer labs, since the labs could not easily be rebooked for another date.

2. **Using computers did not result in a gain of time to teach more advanced farm business management topics. Most beginning students had to learn the very basic microcomputer skills before they were able to use the computers to do the many calculations required in Farm Business Management.**

One of the reasons why the teaching staff decided to use computers was the recognized need to spend more time teaching students to use the financial information for planning. If students could produce more accurate statements quickly, then there should be more time to teach the advanced subject matter in the courses. However, no significant time was gained because students did not have the entry level skills in using microcomputers and much time was lost teaching these skills. However, in the Microcomputer Period the mark allocation for the Farm Planning Project was partially shifted away from the preparation of reports, which used to be done by hand and were now done by the microcomputer, to the explanation of the reports. The instructors and professors noted that the students were able to prepare more accurate reports but used the reports

and analysis of reports less in their supporting arguments for their farm plan. Financial statements were much more reconcilable and students were much more organized in responding to questions about reconciliation during the Microcomputer Period than previously.

Several factors may help explain why the analyses of reports were not used as well to support the farm plan. In the first year farm management courses the marks were allocated for preparing reports on the microcomputer without emphasis on demonstrating understanding by explaining the results. Also the change in emphasis to completing the assignments on the microcomputer meant that less lab time was used to consider the results and less instructions were given about the meaning of the reports. Time limitations restricted extensive considerations of partial budgeting, analysis of ratios and financial statements, overall financial performance and some risk analysis. Another reason was that since students now specialized in second year there were fewer students taking the Advanced Farm Business Management where students did more analysis and comparisons of alternative enterprises.

3. Learning to use computer technology involves considerable time and needs to be recognized in the curriculum plan.

Although time is potentially saved because the computer can complete calculations so quickly, more time is needed to learn how to use the technology. Some teaching staff suggested that there should be a short

course for students to learn the basics of spreadsheets and word processors before taking the farm business management courses. Also, because the machines do calculations so quickly, there may be a tendency to ask students to consider more alternatives as was done in the advanced farm business management classes. Perhaps a solution would be to ask students to do more revisions to assignments to improve the quality of their work. Also, time may be lost when there are problems with machines.

During both periods students had to learn about computers and about computer programs. However, during the Microcomputer Period, instruction using microcomputers occurred in more courses with the result that more time was spent instructing students about computers and computer programs than previously. The time available for the majority of students to consider advanced farm business management topics was reduced. During the Microcomputer Period the lab time used for note taking on more advanced topics, including partial budgeting, analysis of ratios, analysis of financial statements, and risk analysis, was reduced as students were working on the computer completing assignments. The students may have had fewer notes to refer back to when writing up their explanations for their results in the Farm Planning Project. Secondly, all the students in the Mainframe Period took the Advanced Farm Business Management whereas this was only required for majors in Farm Business Management during the Microcomputer Period.

In the Microcomputer Period students had to learn about computers and computer software in order to complete the farm business management assignments. The students in the Microcomputer Period had more responsibility for their computer files and more assignments which had to be completed on the computer. This meant that they spent more time using and learning about the hardware and software.

During the Microcomputer Period, this learning about computers was intended to be more of an extra benefit of taking the farm business management courses. During the Mainframe Period the computer use was not considered by the students to be of great benefit to them as they did not expect to use a mainframe computer on their farm. By 1991, the professors, instructors and administrators all identified that this experience with microcomputers was considered important to students when they applied for jobs after graduation.

4. **More work needs to be done to confirm whether students' knowledge of the curriculum content changed with the introduction of computers.**

Not all students completed the statements using the computer during the Mainframe Period as this requirement was optional. During the Microcomputer Period all were required to complete their financial statements and plan using the microcomputer. Certainly, the staff confirmed that more students produced more accurate financial statements

using the computer. There was a screen which helped students identify problems with reconciling statements in the microcomputer program. Also, since the financial statements were easier to mark because the marker did not need to be as concerned about the accuracy of the calculations, more time could be spent on comments about the assignment. However, the students were generally required only to hand in the statements without a discussion of what the statements meant. The staff were now beginning to focus on the need for students to be able to more effectively explain how to use the financial statements for planning.

D. Why Changes Occurred

1. The Process of Change

The reasons for the changes become apparent as the process of change from the Mainframe to Microcomputer Periods is considered in light of the grounded theory paradigm. The causal conditions are the basic reasons for using the computer. However, the intervening conditions, the actions and interactions and the consequences of using the computers during each Period help to explain why the use of the computers led to changes in the teaching and the Farm Business Management curriculum.

During Phase I, the Mainframe Period, the faculty in the Department of Agricultural Economics and Farm Management were faced with the challenge of teaching students in the School of Agriculture to produce

accurate farm financial statements. This need was the **causal condition** which led to the **phenomenon** of using computers.

Several **intervening conditions** affected this situation. In 1983, the one professor teaching the farm business management course was using a crop simulation program on the mainframe computer for research and for projects with graduate students. This professor was able to arrange for a research assistant, familiar with this program, to make revisions to the Crop Simulator, according to the professor's specifications, so that it could be used for teaching the Diploma students to produce a set of projected farm financial statements. Terminals for accessing the campus mainframe computer were available in the Agriculture Building. The resulting **action** taken was that the same research assistant taught the computer labs.

At this stage, the **consequences** of using the computer were varied. The computer was only used in one Farm Management course, 41.283, the Farm Planning Project. These computer-generated statements were considered an optional supplement to the Farm Planning Project. The students experienced considerable frustration using the program due to its lack of a "user-friendly" interface; the need to use extremely detailed information; the use of many default values which differed from values used by students in their manually prepared reports; the lack of a livestock component in the program; and the difficulty in understanding how the results were calculated. The computer-generated reports differed from

what students had done by hand as the farm plan produced by the computer was based on selling out the operation, whereas they were dealing with on-going farm operations. The students also objected to having to walk outside for two blocks (even in Manitoba's cold winters) each time they printed out a report. Finally, this diploma program was intended to be a very applied program. Students objected to using the program on the mainframe because they did not expect to be able to do so after graduation.

Intervening conditions changed from 1983 to 1987. The mainframe crop simulator program was revised each year in order to improve it. Weekly staff meetings with the Department of Agricultural Economics and Farm Business Management professors teaching farm business management in the diploma courses, the School of Agriculture lab instructors and the administrators in the School were established to improve communications between the three groups. However, the lab instructors, who had used the program as former students, and the other professors, who were teaching farm business management and who were familiar with the program because they used it in research, continued to express concerns about using the crop simulator program for teaching. The crop simulator never reached a stage where it completely replicated what the students were doing by hand using the Manitoba Farm Records II book and it lacked the livestock component.

In 1987, the move to the microcomputers began. This period from 1987 to 1991 is referred to as the Microcomputer Period. The need or **causal condition** leading to the **phenomenon** of using computers remained unchanged. There was still the need to teach students to produce more accurate farm financial statements. However, the **intervening conditions** changed. A second professor teaching farm business management decided that there was a need to find a simpler way to teach students to produce more accurate financial statements using computers. During this period the weekly staff meetings continued. The mainframe program continued to be used. However, a microcomputer lab was now available in the University of Manitoba student union building. Students were taught how to use the spreadsheet, Lotus 1-2-3, to develop some planning tools. In addition, a series of templates, referred to as the Market Oriented Decision Making Modules (MODMM), were available to be used for enterprise planning. The **action** taken was that the research assistant, who worked on the mainframe crop simulator program, also developed the spreadsheet templates and was in charge of the microcomputer lab sessions. However, this second professor attended and assisted the lab instructor with the microcomputer lab sessions. The enterprise templates were specified and used by a third professor teaching the marketing courses, but were also applicable to the farm management courses. The computer programmer in the Department of Agricultural Economics had completed the programming of

the MODMM series and assisted this third professor with the microcomputer labs in his marketing classes. The outcome or consequences of this move to microcomputers were many. The use of the computer was now a requirement for some farm business management assignments. Students were experiencing less frustration with the hardware and the software. Among other things discussed at the weekly meetings, all the staff heard about what worked and didn't work well in the computer labs, shared their own observations and students' comments about the computer use and had opportunities to provide suggestions for improvement.

Staff interest reached a level that the School started to make plans for and requested that a microcomputer lab be established in the Faculty of Agriculture for use in teaching farm business management to the diploma students. Scheduling access to the microcomputer lab in the University Student Union Building (UMSU) was becoming more difficult as more faculties on campus wanted to use the microcomputer in teaching their courses.

During the time when the School of Agriculture was planning to establish a microcomputer lab, an external review was done in the Faculty of Agriculture. One external reviewer pointed out the need for graduates to have experience with microcomputers and the need for further steps to be taken to increase exposure of students to microcomputer uses. A survey of prospective diploma graduate employers also indicated that knowing

how to use microcomputers was an important skill. Student feedback was now much more positive towards computer use and students were now asking for more. In 1989 funding was confirmed and a microcomputer lab was established by the Faculty of Agriculture in the Agriculture Building.

The goal of teaching diploma students to produce accurate financial statements using computers continued but again the **intervening conditions** had changed. Now there was a microcomputer lab available within the faculty. The job description of the research assistant from the Department of Agricultural Economic (who had done all the programming for the farm management courses to this point) was now rewritten and title changed to Microcomputer Lab Coordinator. This person's salary was now partially financed by the Department, the School and the Faculty as a whole. The research role continued in the Department of Agricultural Economics. The Lab Coordinator's commitment to the School involved developing a series of compiled spreadsheet templates to replace the mainframe crop simulator program, to provide guidance in teaching and technical assistance to the lab instructors in the School who would all now teach the microcomputer labs. The commitment to the Faculty of Agriculture was for the maintenance of the microcomputer lab and support to all the faculty using the lab. The four professors/
instructors lecturing in the five diploma courses felt that the microcomputer should be used in these classes.

During this period, the curriculum guides and the lab manuals for the School of Agriculture courses, including 61.042 (formerly 41.149), Introduction to Farm Business Management; 61.043 (formerly 41.150), Economics of Farm Business Management; 61.066 (formerly 41.277), Advanced Farm Business Management; 65.062 (formerly 41.283), Farm Planning Project and a marketing course, were rewritten. The students were now allowed to major. This meant smaller class sizes in the Advanced Farm Business Management course.

The Lab Coordinator developed microcomputer modules to replace the mainframe crop simulator program. These templates more accurately reflected what the students were doing by hand using the Farm Records II manual. A template for developing historical financial statements was developed. All the staff who met at the regular weekly staff meetings had direct input into the specifications for these modules. The lab instructors went through a series of learning exercises to become familiar with the programs. A computer assisted learning program developed by the Solomon Sinclair Farm Management Institute within the Faculty of Agriculture was also used in the marketing course.

The resulting **action** taken was that all five of the lab instructors now taught the microcomputer labs. The **consequences** were that by 1990-91, there were microcomputer labs in all courses related to farm business management and the marketing course. The assignments completed on the

microcomputer were a requirement in all the courses. The student evaluations indicated greater satisfaction with using the microcomputer compared to the Mainframe Period. The marking of assignments in various classes, including the students' farm plan, indicated that the students were now producing much more accurate financial statements using the microcomputer.

The process of change was continuing. A change in the **causal condition** was now occurring. Since the students were producing more accurate statements, the staff felt that more emphasis needed to be given to analysis of the farm plan. A number of **intervening conditions** were developing at this stage. Staff were considering how to focus on more analysis, given the time constraints of a short class year in the diploma program. Group work was being used in the advanced courses. Consideration was being given to a means of teaching the students the basics of spreadsheets at the beginning of the class year and outside the farm business management classes. This way less time would have to be spent familiarizing the students with the hardware and software during scheduled class time. The year runs from late September to the end of March so that students from the farm are able to harvest and to seed their crops. Another time-saving measure which the teaching staff were considering was linking all the templates together so that the students would not have to reenter numbers at various stages. The Solomon Sinclair Farm Manage-

ment Institute was developing a microcomputers program for the Manitoba Department of Agriculture. The provincial farm business management staff planned to use this program when consulting with farmers. Some of the teaching staff at the university were considering using the provincial program in the Advanced Farm Business Management diploma course. The students had started to use the lab for word processing. Other departments were now starting to use the microcomputer lab and scheduling lab time was beginning to be a concern.

2. **The Process of Learning to Teach with Computers**

Another way to conceptualize the **process of change** is in terms of **learning how to teach with computers**. This may be related to the ways of teaching discussed in the literature review. It may be worthwhile to consider the alternative ways of teaching as stages which one moves through as you grow in your understanding of how to teach using computer technology. In this light these professors and instructors appear to have progressed through three stages of change and are moving into a fourth level.

A **cultural change** was encouraged by asking the lab instructors to enter their own farm records on the computer. This provided a means for them to learn more without great involvement. Until this time the teaching staff were not interested in using computers to teach. They knew little about computer use in farm business management at the beginning of the

Mainframe Period. At this stage one professor and one research assistant were involved in using computers for teaching.

When the individual teaching staff gained access to microcomputers for their own use outside of class they started to progress through the **second stage** where they wanted **training** using specific software. They wanted to learn more about the computer and the software as they identified specific applications related to what they were doing--developing lessons, maintaining marks, doing research. They wanted this training in specific software which they planned to use in order to solve a specific problem.

The third stage of evolution in using computers involved **enabling the teaching staff expand their use of the computer in teaching farm business management**. Because students and businesses saw computer use as important for grads, the administration of the School supported expansion of computer use in the Microcomputer Period. The competitive factor entered in here. Other teaching centres were using microcomputers. A microcomputer lab was established in the faculty. Funding and other supports were put in place for decision-making about microcomputer applications. Through influencing the environment, greater sharing of information began to occur and this encouraged expansion. Individual teaching staff broadened their use of the computer to other areas. All the instructors became involved in teaching with computers. More professors

included the use of the computer in their courses. Access to computers was easier.

A fourth stage of change, a **conceptual change**, was beginning. The staff felt that their initial goal for using the computers was being reached. Students were developing more accurate financial statements using the computers. A new goal was evolving. The microcomputer was being used as a problem-solving tool in the advanced farm business management course. Students were encouraged to consider alternative scenarios. Discussion among staff now centred around how to include more analysis and problem-solving for students not in the major. Time was at a premium in the short school year. More ways to use microcomputers effectively were being considered. These included discussions about how to improve the students' entry skill levels by providing some specific training in software prior to taking the farm management courses. If less time was required initially to teach students the basics of computer use, then more time could be spent using the computer's calculation abilities to consider alternative farm scenarios. The speed with which alternative farm scenarios can be developed could potentially help expand the use of the computer as a vehicle to make students think about issues beyond computing. Another alternative to help students become familiar with computers faster would be to integrate the use of the computer in more courses in the School such as the communications course. Perhaps by using computers to

write critical essays, such as comparing different farm management software, could help students clarify where computers could be of value on the farm. Based on such an evaluation students could develop exercises in farm business management to exemplify their position about the software of their choice. Advanced planning would be required so that the basics of using the computer were not repeated in all the courses. Using alternative software such as simulations and case studies to create discussion among small groups may be another way. Computer-assisted learning software which is already being used in the degree courses, could help students not only learn more about farm business management topics, but also help students to become familiar with computer use in an enjoyable way.

3. **The Conditional Matrix Highlights the Levels of Effects**

A conditional matrix is a means of looking at a phenomenon in relation to different groups. A conditional matrix helps one focus on **how different levels within the organization and outside--individuals, suborganizations, the organization as a whole, and the community--affected and were effected by the computer use.**

The staff influenced the implementation of computers in the diploma program and in turn were effected by how the computer was used.

The staff went through a cultural change. During the start of the Main-frame Period there was little motivation to use computers because staff as a whole had little knowledge about computers. Initially there was very

little interest in computer use. Even with all the problems with the mainframe computer program, using the mainframe helped people see the potential.

A period of staff training began with the introduction of microcomputers. The problem at this time was linking skills to purposes. Most staff received some training in using word processors and spreadsheets. Further, each person's natural development was fostered by personal use of computers for preparation and maintenance of marks. The staff then used the software for developing farm plans for the student assignments and for their own farms. The lab instructors then learned instructional methods using the microcomputers. By sharing their concerns about computers and software use, the staff were encouraged to increase their level of competence with the computer. As the staff used computers, they provided more and more input into the design of the programs used in teaching.

The beginnings of a conceptual change appeared evident. The teaching staff were beginning to ask what they could do so that students would think further about how to use the financial information for planning. This potentially could change their perspective from learning being a cumulative process to one of transformation. Certainly the goal was that students who came in the door at the beginning of the two years would be changed from people who had little input into decision-making

on the farm to people who would be able to take on the responsibility of managing a farm operation.

This process requires a dialectical process of teaching through which students' knowledge and beliefs undergo change. The central problem of this type of teaching is that the teacher must somehow get inside the student's mind and make contact with what is there. Certainly the size of the group and the continuous contact over a two year period makes it possible to develop a more accurate student profile. Discussions during the group interaction on the computer in the *Advanced Farm Business Management* course provided one means to better understand what the students were thinking. Another problem of trying to encourage conceptual change is that people can acquire new knowledge without displacing old knowledge. People need to examine their beliefs if real change is to occur. That, in turn, is one of the core problems of teaching farm business management. Many students are far more interested in the production aspects of farming than in the financial aspects of managing the farm.

The goal of using computers to teach farm business management to diploma students originated in the **Department of Agricultural Economics and Farm Management**. By 1991, the professors saw computer use as a very important part of teaching farm business management concepts. In fact, professors within this department were involved in various microcomputer developments for financial management in addition to the spread-

sheet templates being developed for the diploma school. These included a farm business planning program for the Manitoba Department of Agriculture and a series of computer assisted learning programs covering farm business management concepts.

The computer use directly **impacted the School of Agriculture**. As early as 1987 a request for renovations for the microcomputer lab was made by the diploma office. The microcomputer is used in other diploma courses. One person mention both the dairy cattle production course, 35.062 where a feeding and milk production economic evaluator type of program is used. The approach used in the class is:

really an integrated farm management approach ...but from an animal scientist. He's using it to show students that your nutritional program affects the bottom line as far as returns go, whereas an agricultural economist teaching farm business management might be looking at things from the opposite perspective, but overall in both courses, they're trying to show the linkage between production, plan and the economic outcome.

One person summed up the perspective of the school about using computers:

One of the nice features about using the microcomputer lab that we have now, is that students upon their graduation are much more likely to encounter that technology within their workplace, whether it's a farm office or working for an agricultural business. They're much more likely to encounter a microcomputer. Now to those of us who are academics that might not seem like a big difference. You know, we have all sorts of packages that are available in a mainframe version or a personal computer version, but to the students and to our graduates it makes quite a difference to have the sort of technology in place that they might be using afterwards. I

think it's more important for the Diploma program than even the degree because of the applied orientation of the Diploma program.

The Faculty of Agriculture as a whole has been affected by the introduction of microcomputers. The Faculty has provided the maintenance budget. A Faculty Committee now has the responsibility of determining how a faculty budget for computers should be spent to maintain both the mainframe and microcomputer facilities. Various departments are now using the microcomputer for teaching and research. The microcomputer lab, although partially funded by the School, was established as a facility for the whole faculty. Any department can book the facility for use in teaching. The Faculty has also taken on some responsibility for funding the Lab Coordinator.

The development of the microcomputer facilities was partially in response to the identified community needs. Prospective students and agribusinesses had indicated that knowledge of how to use a microcomputer was an important skill to graduates. The templates developed for teaching farm business management have been made available to the community through the concept of shareware so that those who learned to use the software as students could continue using it when they returned to their farms. It was always important to the teaching staff that anything used in the labs would be available to the graduates.

F. Recommendations for Further Research

Based on the findings, four major areas for further research were identified. These include:

- a. Further identification and confirmation of instructional methods using computers to develop "expertise" in farm business planning;
- b. Develop Students Profiles of the diploma students based on demographics and learning styles;
- c. Further confirm the research findings about effects of computer on teaching and curriculum through comparative studies with the degree program, other agriculture departments extension and/or community college courses;
- d. Further research about the influence of using the computer on curriculum, especially as educators learn to teach with computers and begin to adopt new technologies such as multimedia.

First, further research should be done to identify and confirm the classroom effectiveness of microcomputer instructional methods which could be used to model and promote the development of Farm Business Management expertise in the two year diploma program. The teaching staff's new goal goes beyond using computers to teach students to produce accurate financial statements. Now staff want to determine more ways to use computers to teach students how to analyze and evaluate alternative farm financial plans. Since students now have access to more complete financial records using the software, the microcomputer may be useful as a tool in teaching students to develop the complex skills of exerting voluntary, strategic control over parts of the farm planning process in order to meet identified goals and to solve problems. The microcomputer may

also be useful in teaching students the multilevel knowledge structures and many connections between the concepts found in Farm Business Management.

Referring to the grounded theory paradigm, consideration of the context and the intervening conditions which could be changed provides a means to identify what potential actions can be taken to reach this new goal. The context could be influenced by determining what specific properties of teaching and curriculum could be modified. The literature review identified alternative uses of computers for teaching and a taxonomy of educational purposes which could be considered. Some of the specific properties of teaching which are controlled by the teaching staff are instructional methods, assignments, evaluation practices and feedback. Those factors which influence classroom management, resources, support, equipment, software and location and layout of the computers should also be considered.

For example, one potential way to achieve analytical and evaluative learning outcomes is to use small group discussions. One way to structure this would be to have small groups use the computer to manipulate financial information while considering case studies. This is already being done in the Advanced Farm Business Management course, but may also be useful in beginning courses. However, a change in the physical location may be required. Suggestions have been made that group work may be more easily done away from the microcomputer lab with the use of a few small rooms with computers in the library so that students can work without interrupting others. Group work might also mean that

the professors and lab instructors could influence learning more through a mentoring process.

Ongoing data collection would be necessary to confirm the success or failure of actions taken so that the plan could be adjusted as needed to meet the changing classroom situation. Areas where it would be useful to collect data include the type of questions students ask and students' success rates in supporting their conclusions reached on assignments.

Since the professors and instructors in the School of Agriculture already meet on a weekly basis, a format could be established where each person could focus on an area of individual concern about what is occurring in his/her classes. In this type of situation each person would complete small research projects to clarify their question, identify methods to improve their teaching practices and then follow through with these methods, collecting data to confirm the success or failure. Throughout this process the group of teaching professionals could report progress in staff meeting and in this way receive direction and feedback from their peers on a regular basis. They could also receive assistance from people within the campus structure who have specific expertise in areas of concern.

Second, research should be done to develop student profiles for the diploma school program so that instructional methods can be planned to meet the needs of these learners. This data should include both demographics and learning styles. Student profiles which include information about learning styles would be useful to those people teaching farmers to use microcomputers in farm

business management. A database about the demographics of the farmer/student population in Manitoba and clarifying which instructional practices using a microcomputer are most effective with different learning styles would be useful to develop. Some data collection has already begun as far as demographics of the whole student population in the Faculty of Agriculture at the University of Manitoba. A comparison could be made between subsets of this data. For example, a comparison could be made between those students who are taking farm business management in the degree and diploma courses and those taking farm business management courses from the various other agencies within the province. This could help to clarify the characteristics of people interested in using microcomputers for farm business management, thus helping to identify the potential learning needs of this group. Such research could also help to identify what could be done to motivate others to learn more about using microcomputers for farm business management. Further follow-up studies could clarify who benefits, why and in what ways. Research, in which learning styles and related instructional methods which include the microcomputer use are compared, could provide key information about which instructional methods are effective with different post-secondary learners.

Third, further confirmation of the properties of teaching and curriculum and the dimensions or range of potential actions needs to be done through other comparative studies. Such studies could include a comparison to other subject areas within the Faculty of Agriculture or to other groups teaching farm business

management, such as the degree program, provincial extension agencies and community colleges. In terms of research, there is a need to clarify which effects of the use of computers in teaching and curriculum are universal and which are local to the specific situation studied. This could be done by a comparative study of instructional methods used by the School to those used in Farm Business Management courses in the Degree program and the community college system and provincial Department of Agriculture extension offerings within Manitoba. This could be broadened to include the three prairie provinces. Another way of developing this research is a comparative study of the instruction methods used to teach farm business management in the diploma program to those used to teach the degree students. Another comparative study could be done between methods used for teaching farm business management and methods used to teach the other areas of agriculture within the diploma program. This could then be expanded to the other Faculty of Agriculture courses.

Fourth, further research should be done to determine if there are ways that the computer can be used which would directly influence the curriculum in new ways. There were very few effects on curriculum identified in this thesis, largely because the original reason for using the computers was to produce accurate financial statements. Now that the original need has been met, new uses for the computer in teaching farm business management are being considered. Questions about how the curriculum will be affected by further change in the use of the computer need to be answered. Perhaps there are stages that teachers move

through in learning to teach with computers before they reach the stage where they conceptualize new ways of doing things which could not be done before the advent of computer technology. Also, the use of new computer software such as graphical user interfaces, computer assisted learning modules, knowledge-based systems or the use of interactive video discs or CDROMS or the use of multimedia technology may have noticeable effects on the curriculum goals, concepts and sequencing of topics taught.

G. Concluding Comments

This study used grounded theory methods to identify what changes occurred in teaching and curriculum as computers were integrated into the teaching of Farm Business Management in the University of Manitoba diploma program. The reasons why changes took place were clarified by identifying the causal conditions for the phenomenon of using computers to teach the curriculum, the context, the intervening conditions, the actions and interactions and the consequences.

By comparing the findings in the Mainframe Period (1983-87) to the Microcomputer Period (1987-91), changes to teaching were identified in the following areas: the number of staff teaching with computers, the staff computer training, instructional methods used, student questions, assignments, evaluation practices, classroom management, resources and support required, equipment, software, and classroom layout. Conclusions were also drawn about the effects of computer use on the curriculum goals, curriculum content, sequencing of curricu-

lum content and development of curriculum knowledge. The reasons why changes occurred in teaching and the Farm Business Management curriculum fall into five groups: changes in administrative policies; greater integration of computer use in the courses; greater experience using and teaching with computers and computer software; advances in computer technology and software technology; and administration and teaching staff identified needs for change.

Recommendations for research included further comparative studies about the changes in teaching and curriculum as computers are introduced in order to determine which findings can be generalized. More research was recommended in this specific situation in order to determine the effectiveness of using the microcomputer to meet new educational goals which go beyond the present goal of using the microcomputer as a teaching tool to help students produce more accurate financial statements.

In conclusion, this research paper is intended to be used as an example for others planning to use the microcomputer in teaching Farm Business Management courses. There is a need for staff involved in classroom instruction to share ideas and concerns about alternative curriculum and teaching issues in agriculture. This sharing is potentially beneficial to both university faculty and extension personnel in agriculture. Agricultural instructors in post secondary and extension are drawn from experienced and knowledgeable people in the subject area. The educational approach of these professors and instructors has largely been developed through personal experience rather than formal courses in education. The

exchange of information about instructional methods can provide these professionals with opportunities to reflect on their instructional practices. This is important since computers can be programmed to serve an almost unlimited range of purposes. Educators with varying educational approaches find that the computer can play an effective role in their classroom.

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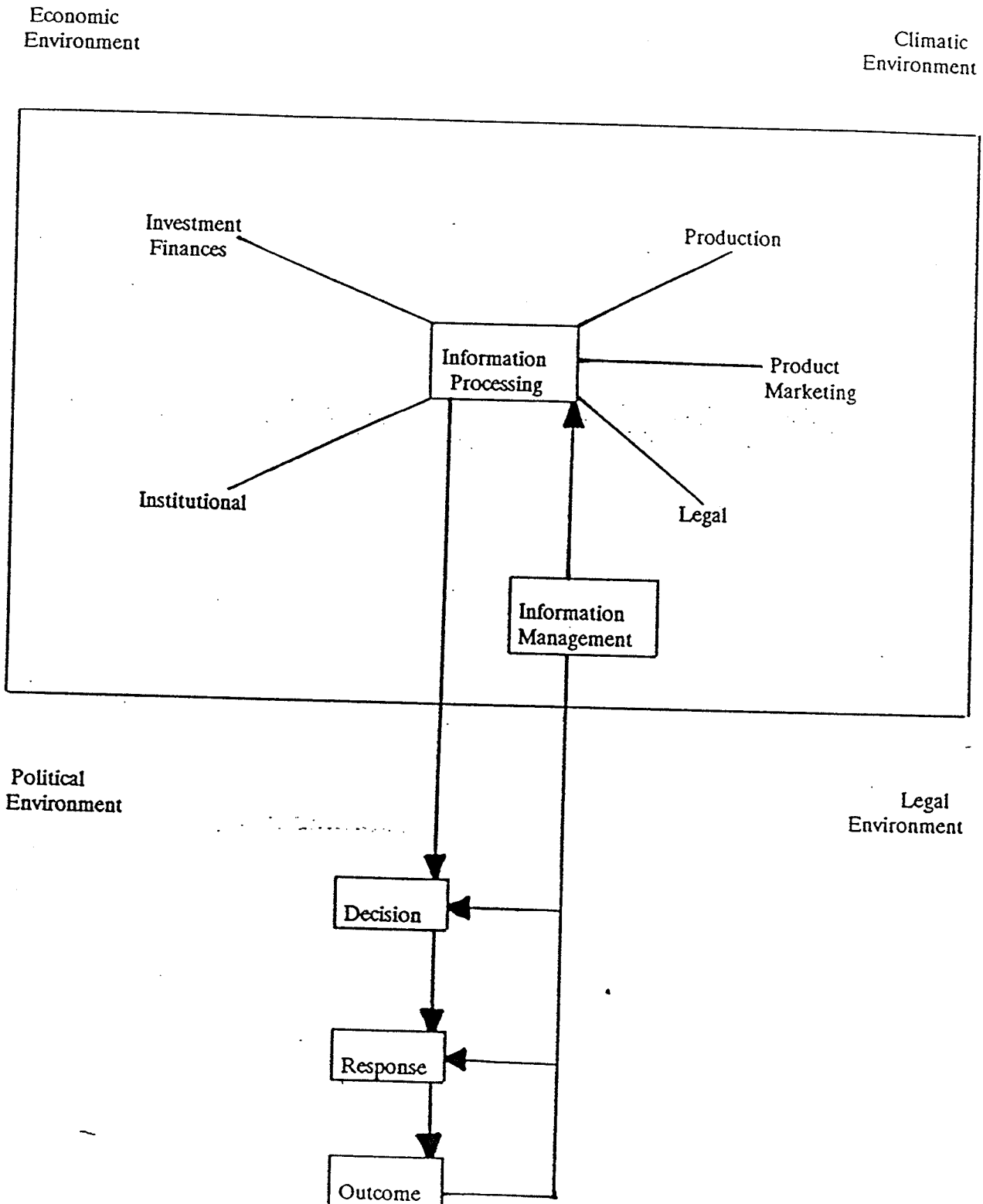
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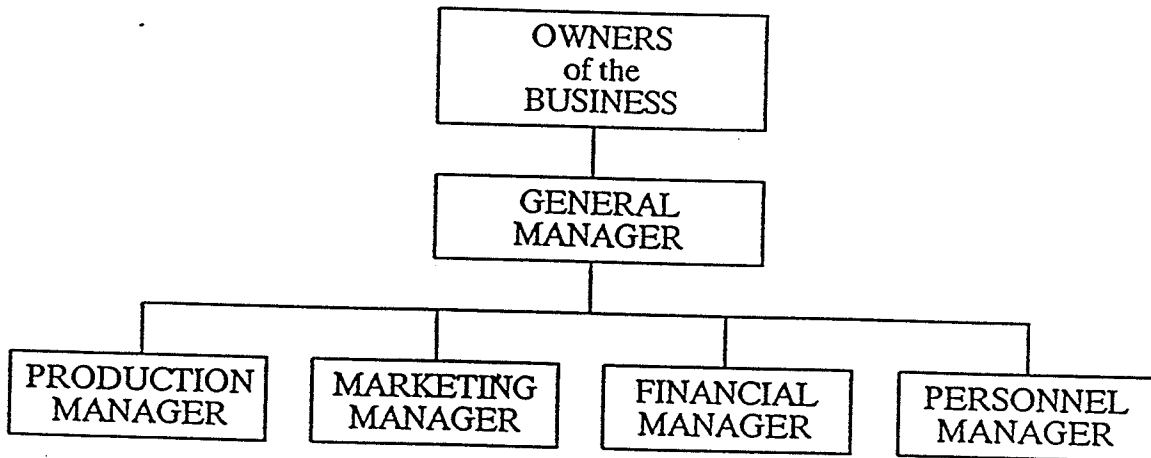
APPENDIX 1

FARM MANAGEMENT DECISION MAKING PROCESS



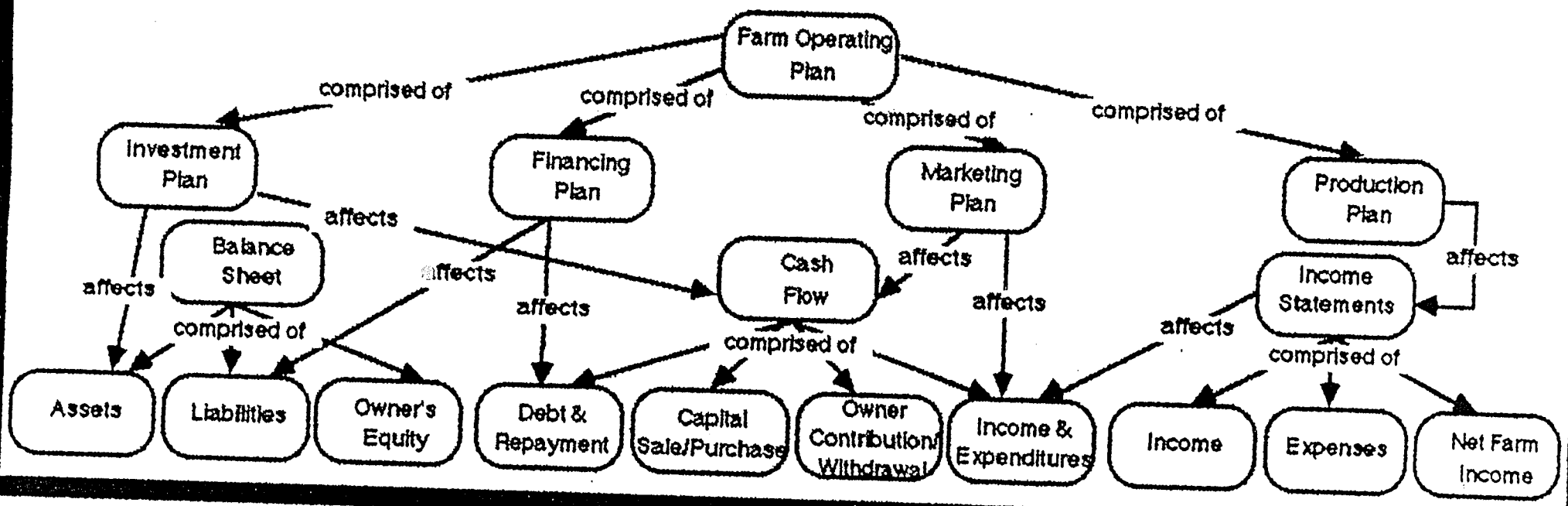
APPENDIX 2

An Organizational Chart of the Farm Business

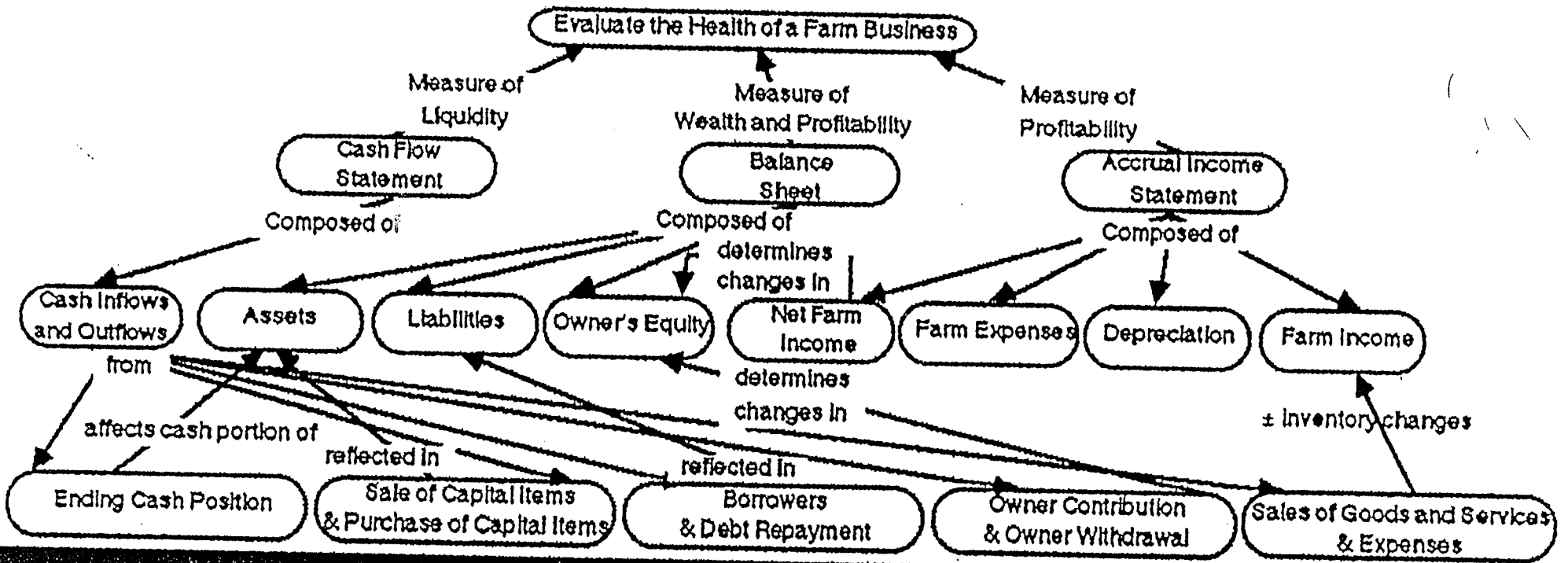


APPENDIX 3

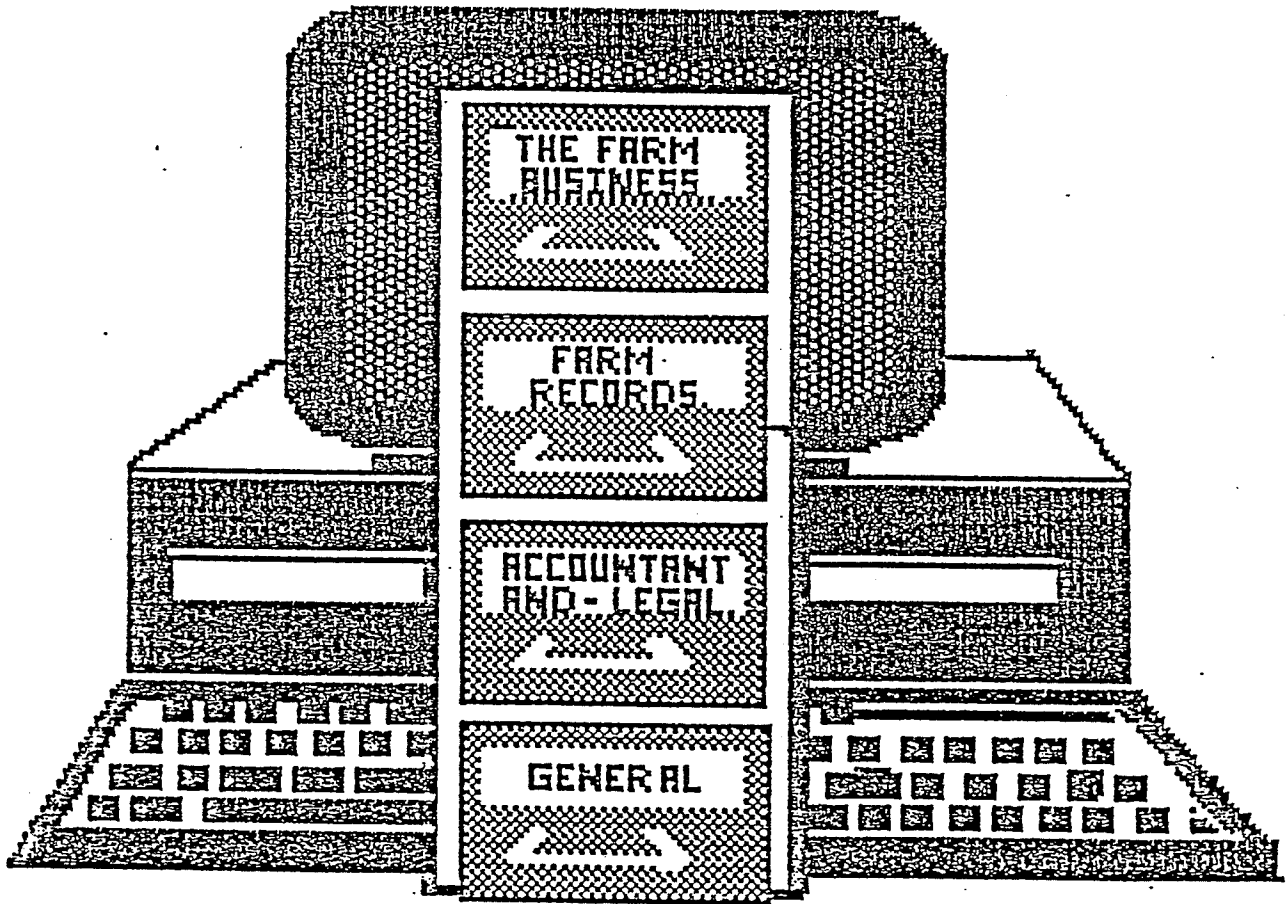
Four Areas of Farm Operations and Their Effect on Financial Statements



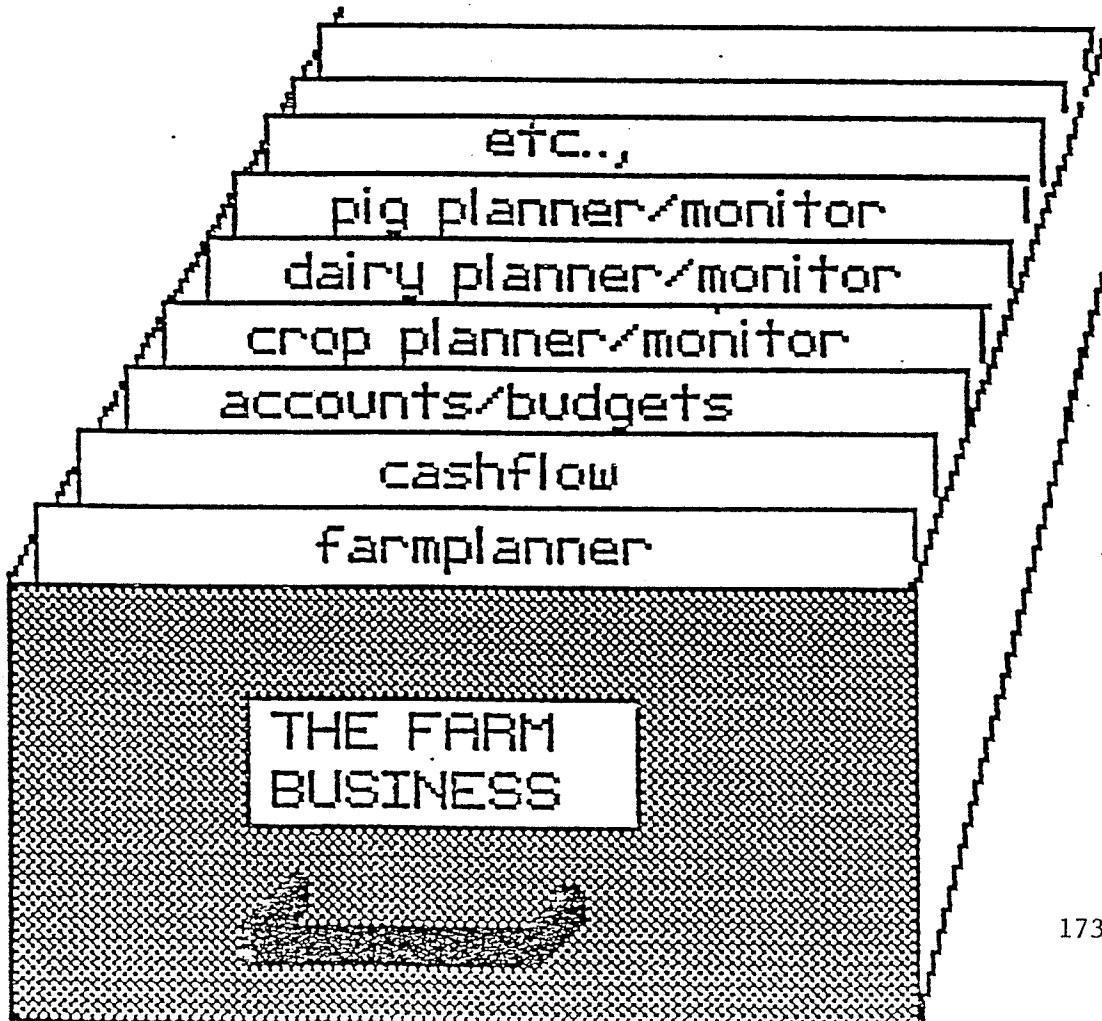
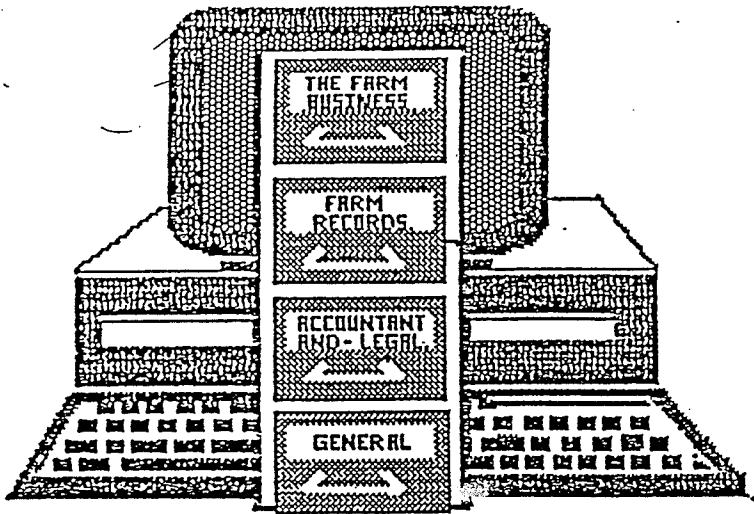
How Financial Statements Can Be Used to Evaluate a Farm Business

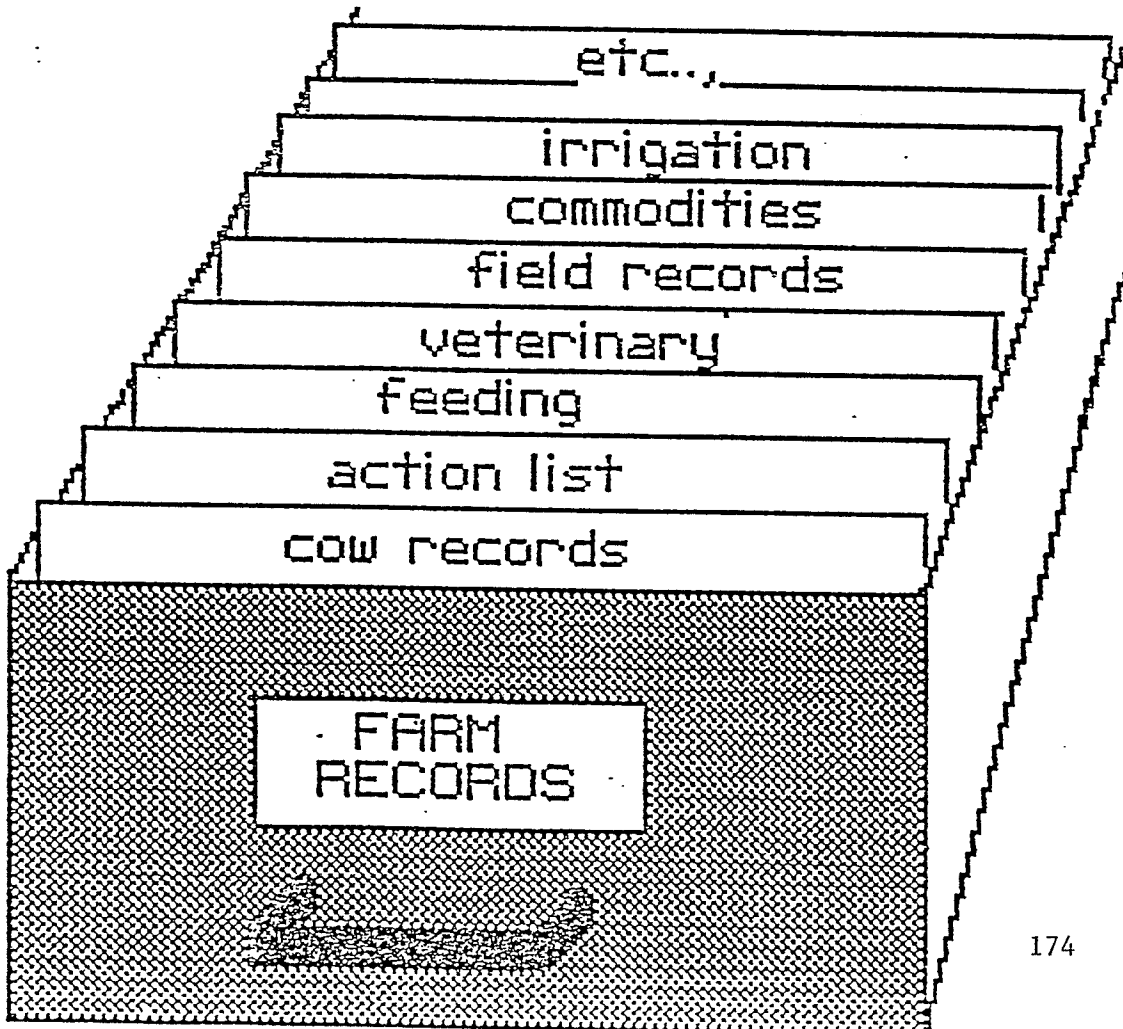
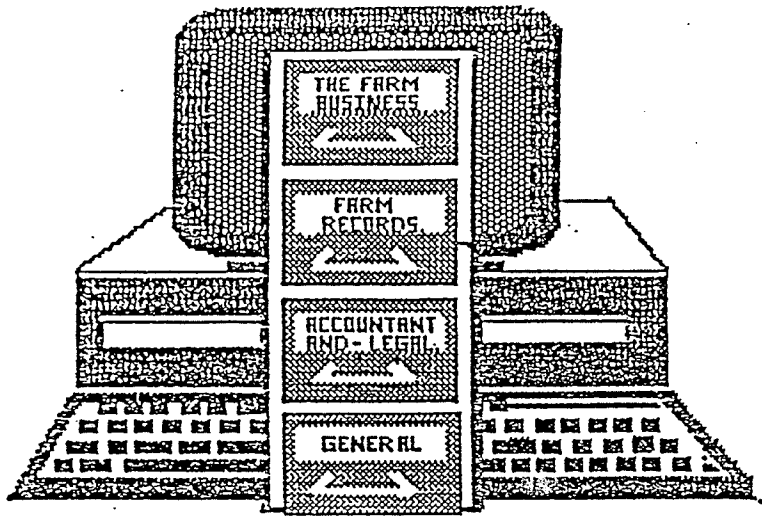


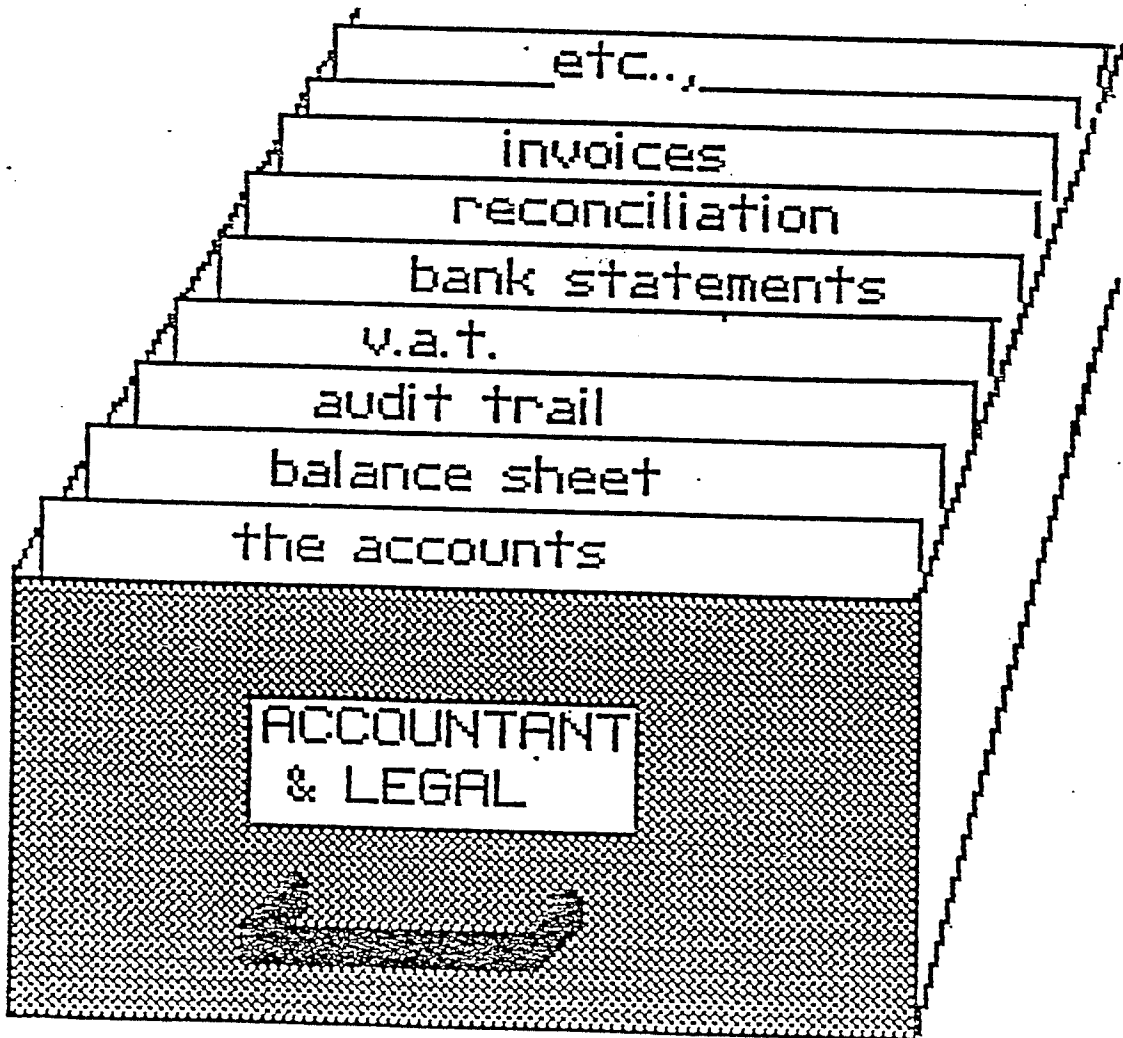
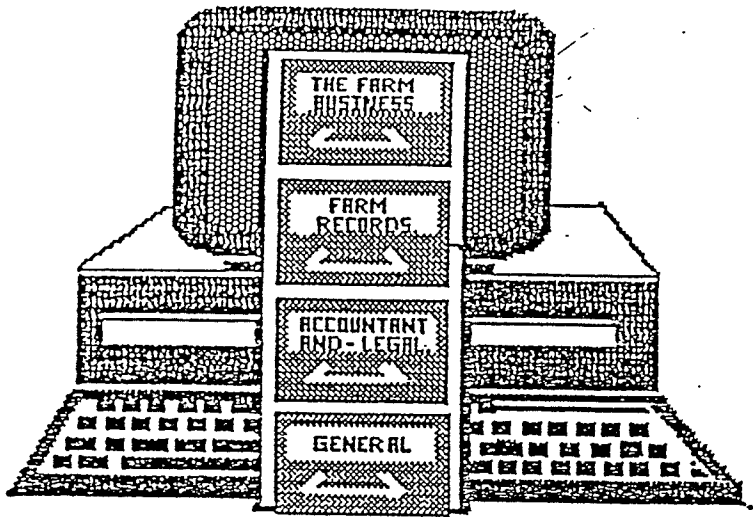
APPENDIX 4

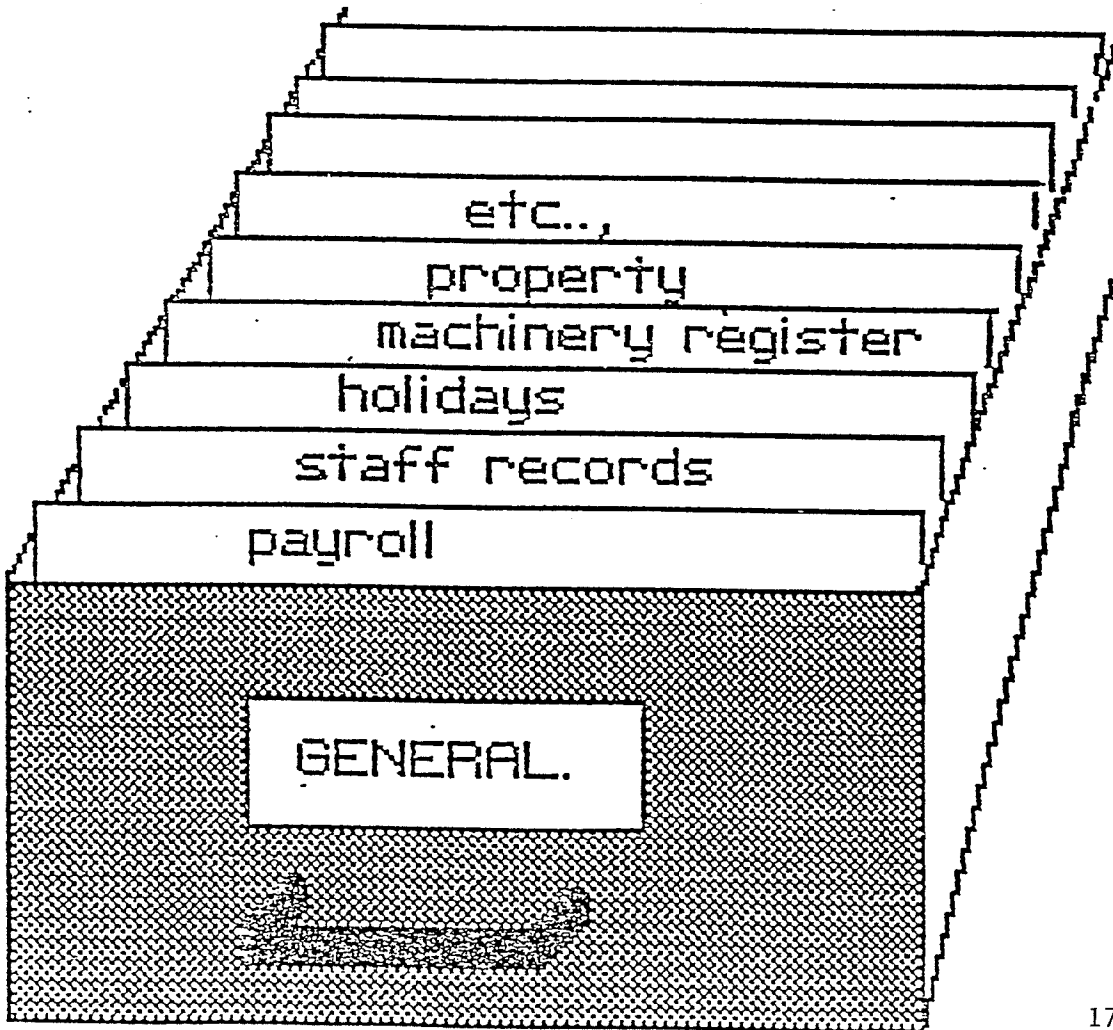
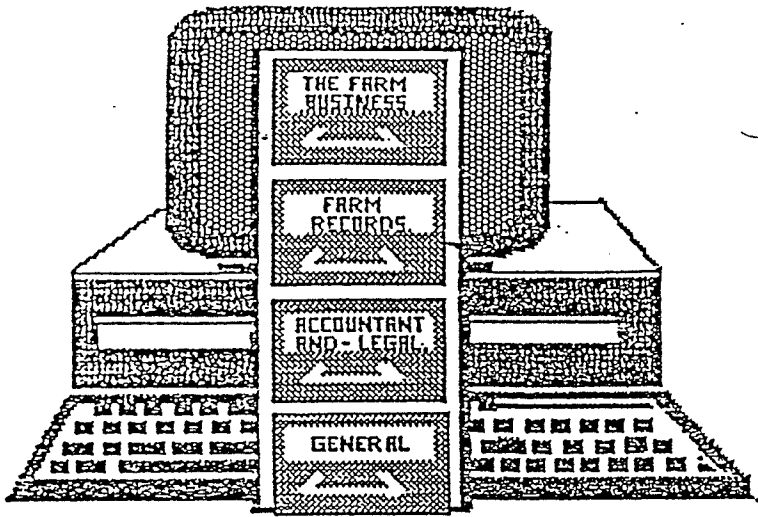


Now let us look inside each drawer.









APPENDIX 5

Appendix 5

CHARACTERISTICS OF LEARNERS by Brundage and Mackeracher, 1980.

Adults, in general

Adults have extensive pragmatic life experiences which tend to structure and limit new learnings. Learning focuses largely on transforming or extending the meanings, values, skills, and strategies acquired in previous experience.

Major pressures for change come from factors related to social and work roles and expectations, and to personal need for continuing productivity and self-definition.

Learning needs are related to current life situations.

Adults are more likely to use generalized, abstract thought.

Adults are likely to express their own needs and describe their own learning processes through verbal activities which allow them to negotiate and collaborate in planning their own learning programs.

Adults have an organized and consistent self-concept and self-esteem which allows them to participate as a self separate from other selves and capable of acting independently of others.

Adults are assigned a responsible status in society, and are expected to be productive.

Children, in general:

Children have few pragmatic life experiences. Learning focuses largely on forming basic meanings, values, skills, and strategies.

Major pressures for change come from factors related to physical growth, to demands for socialization, and to preparation for future social and work roles.

Learning needs are related to developing organized patterns for understanding future experience.

Children are more likely to use specific, concrete thought

Children are likely to express their own needs and learning processes through non-verbal activities, which leads to planning by "expert" observers and interpreters.

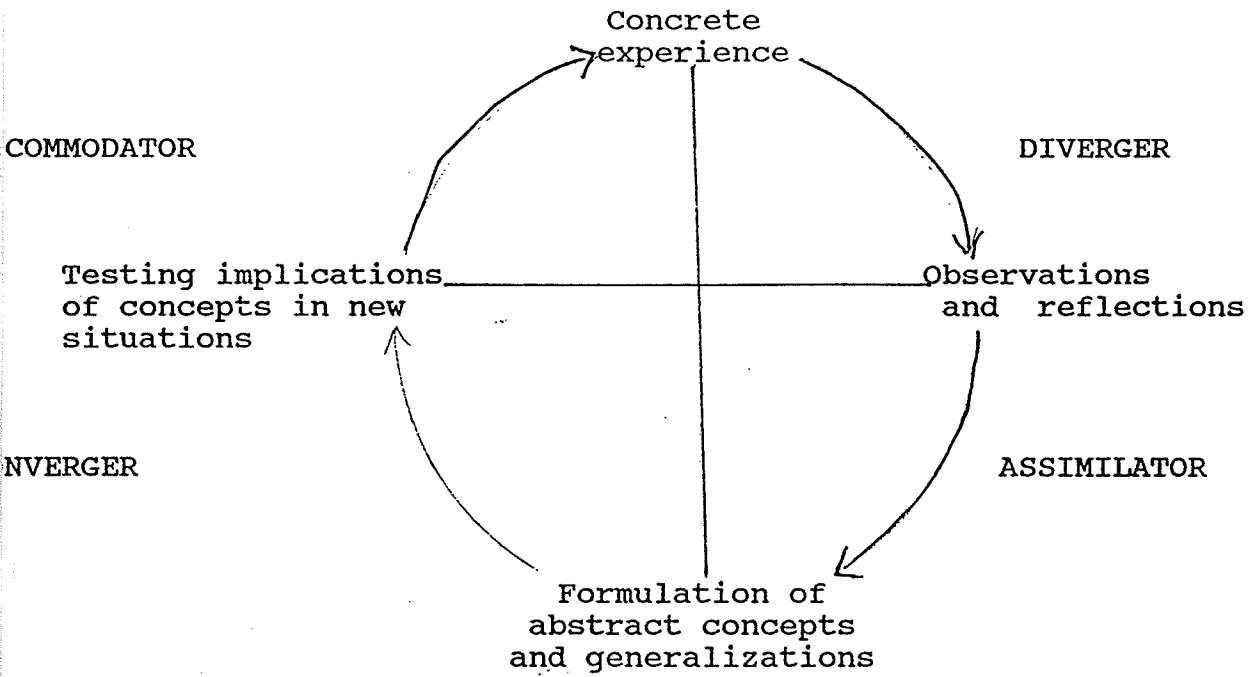
Children have a relatively unorganized and inconsistent self-concept which allows them to perceive themselves as a self separate from, but dependent on, others.

Children are assigned a non-responsible status in society, and are expected to play and learn.

APPENDIX 6

Appendix 6

Learning Cycle
by Kolb and Fry, (1975).



APPENDIX 7

Grounded Theory Research Method

1. Purpose

According to Hutchinson (1986, p. 51), grounded theory method offers "a systematic approach for generating substantive theories". Substantive or middle-range theories originate in and help explain the real world. Grounded theory is a form of social criticism since judgments and recommendations are made about a documented social phenomena based on identified patterns of social interaction.

2. Need

Grounded theory methods are advocated by Richer (1975) in his paper "School Effects: The Case for Grounded Theory" in which he argues that relevant conceptual frameworks to guide and focus educational research must come from inductive, concept-generating research conducted in naturalistic school settings. Grounded theory research is advocated by Martin (1978) in "Neglected Aspects in the Sociology of Education in Canada" in which he indicates that the merits of a theory for predicting, explaining, and being relevant are inseparable from the methods used to generate the theory.

3. Foundation

Grounded theory can be classified as applied research since the resulting theory has practical implications for understanding the nature and sources of human and societal problems. The desired result of applied research is to make "contributions to theories that can be used to formulate problem-solving programs and interventions" (Patton, 1990, p. 160). The key assumption of applied research is that knowledge provides a means to understand and solve human and societal problems.

The philosophical foundation for grounded theory is provided by the work of George Herbert Mead and American pragmatism. Patton (1990) notes the practical side to qualitative methods. This involves solving problems by asking open-ended questions of people and observing matters of

interest in real-world settings. This problem-solving function may or may not require that the study be placed in a theoretical framework. This particular research paper has a practical application as it focuses identifying changes and the reasons for the changes in how computer hardware and software products are used to teach farm business management in a particular situation. This study will end with recommendations.

This study draws from several theoretical traditions. One perspective taken in grounded theory studies is that of symbolic interactionism, which is based on the work of Herbert Blumer (Lewis and Smith, 1980). This has disciplinary roots in social psychology. The central questions of symbolic interactionism are "What common set of symbols and understandings have emerged to give meaning to people's interactions?" (Patton, 1990, p. 88). Hutchinson (1986) describes the belief of symbolic interactionists, that people use meaningful symbols to interact with each other. Meaning evolves through social interactions over a period of time. Symbolic interactionists believe that the human reality is not simply 'out there' awaiting scientific study; rather, it is socially and symbolically constructed and always emerging and relative to other facts of social life.

An ecological psychology perspective is also present in this study since the classroom situation is considered. The disciplinary roots are ecology and psychology. The central questions of this theoretical base are "How do individuals attempt to accomplish their goals through specific behaviours in specific environments?" (Patton, 1990, p. 88).

There is also an heuristics perspective to this research study. Heuristic studies are drawn from the disciplinary roots of humanistic psychology. The Solomon Sinclair Farm Management Institute (SSFMI) has a mandate which includes developing software for use in farm management educational settings. Since one of the professor's observed and interviewed and myself, as the participant observer, are also personnel within this Institute and another of the professors interviewed participates on the Advisory Council for SSFMI, our personnel experience forms part of this study. The central questions of the theoretical tradition of heuristics are "what is my experience of this phenomenon and the essential experience of others

who also experience this phenomenon intensely?" (Patton, 1990, p. 88).

4. Grounded Theory and Qualitative Research

Grounded Theory research uses qualitative research methodology. According to Sherman, Webb, and Andrews (1984) criteria for qualitative research include focusing on context, 'lived' experience, patterns of experience and judging or appraising. Questions are asked about people in specific contexts and data is gathered and analyzed about the participants in a naturalistic setting through observation. Naturalist inquiry refers to "studying real-world situations as they unfold naturally; non-manipulative, unobtrusive, and non-controlling; openness to whatever emerges--lack of predetermined constraints on outcomes" (Patton, 1990, p. 40). The initial observations are intended to understand and describe the social structure and patterns of behaviour. Since the presence of the researchers may alter the context in undetermined ways, the researchers collect and analyze data about how people react to them and how they themselves react to the people and the setting. Through interviews, researchers verify, clarify, or alter their record of what they thought happened, in order to achieve a full understanding of an incident, and to take into account the "lived" experience of participants (Hutchinson, 1986, p. 52).

5. Assumptions of qualitative research

Qualitative research assumes that people have patterns of experience. They order and make sense of their environment and this order or pattern is derived from their shared social and symbolic interactions. This social construction of reality is described by Berger and Luckman (1966, pp. 19-20):

Everyday life presents itself as a reality interpreted by men and subjectively meaningful to them as a coherent world. ... The world of everyday life is not only taken for granted as reality by the ordinary members of society in the subjectively meaningful conduct of their lives. It is a world

that originates in their thoughts and actions, and is maintained as real by these.

Another assumption is that social reality is communally constructed and thus subject to change. The assumption is made that all people who share common circumstances also share social psychological 'problems' that are not necessarily articulated or conscious but which grow out of their shared life. The resolution of these problems is through social psychological processes, referred to as core variables in grounded theory research (Glaser, 1978; Hutchinson, 1986).

6. Reliability and Validity

Reliability is enhanced through triangulation which involves combining methodologies in the study of the same phenomena or programs (Patton, 1990). One method is investigator triangulation which involves using several observers/data collectors or evaluators (Richer, 1975; Denzin, 1978). This provides a check against observational bias and the interchange at the interpretive stage adds reliability. According to Denzin (1978) other forms of triangulation include: data triangulation - or the use of a variety of data sources in a study; theory triangulation or the use of multiple perspectives to interpret a single set of data; methodological triangulation or the use of multiple methods to study a single problem or program. It is also possible to achieve triangulation through cutting across inquiry approaches and by combining qualitative and quantitative methods. Patton (1990) indicates that studies that using multiple methods are less vulnerable to errors linked to a particular method (such loaded interview questions or biased or untrue responses). Cross-data validity checks are provided by the different types of data collected using the various methods.

Field work is conducted over a period of time. Hypotheses are formulated and discarded if not confirmed by data. Validity is checked by searching out contradictory data, investigating unusual circumstances and negative cases and through comparing and contrasting data. Bias is reduced through the multiple data collection methods of direct observation, interviews and

document analysis.

Since grounded theory depends on the interaction between the data and the creative processes of the researcher, it is unlikely that it can be replicated. However, one of the intentions of qualitative research is to generate theories which offer a new perspective on a given situation. Through other methods, including quantitative research methods, these theories can then be tested further.

One criticism of quantitative research relates to potential changes in the situation due to the presence of the observer. However, any initial influence on the setting by the presence of a participant observer is usually neutralized by the social and organization constraints. According to Becker, (1970), participants will become more concerned with meeting the demands of their own situation than with paying attention to, pleasing, or playing games with the researcher.

Although a substantive theory can be said to be valid only for the studied population, the theory "will inevitably identify a basic social process relevant to people in similar situations" (Hutchinson, 1986, p. 59). Only through further studies can this be verified.

7. Method

Denzin (1970) stated that data serves four functions for theory: they initiate new theory or reformulate, refocus and clarify existing theory. Grounded theory provides data for all four functions of theory. Hutchinson (1986) states that grounded theory is useful when there is little known about a topic and there are few adequate theories available to explain or predict a group's behaviour. Also, grounded theory provides a new approach to an old problem and suggests interventions that may result in programmatic, curricular and administrative changes.

Grounded theory data-collection methods include participant observation and interviewing.

The strategy is to go to the site of the "participants" (called "subjects" in experimental research) in an attempt at

understanding their perspective within a given situation. The notion of discovery, so fundamental to grounded theory, includes discovering first the world as seen through the eyes of the participants and then the basic social processes or structures that organize that world." (Hutchinson, 1986, p.*).

Through inquiry and analysis the researcher discovers and conceptualizes the essence of specific interactional processes. The resulting theory is intended to provide "a new way of understanding the social situations from which the theory was generated." (Ibid.).

The Grounded Theory Method is described by Glaser (1978) in his book entitled Theoretical Sensitivity. Once a researchable problem has been identified, the researcher makes observations in the field which allow the researcher to describe the social structure, observe patterns of behaviour, and begin to understand the environment. The researcher also observes his own behaviour in order to become aware of his own preconceptions and to "bracket" his own values and beliefs. "Bracketing" means becoming aware of one's personal values and preconceptions in order to go beyond them during the research in order to view the situation from a new perspective. The importance of bracketing is explained by Berger and Kellner (1981): "If such bracketing is not done, the scientific enterprise collapses, and what the sociologist then believes to perceive is nothing but a mirror image of his own hopes and fears, wishes, resentments or other psychic needs; what he will then not perceive is anything that can reasonably be called social reality."

Interviews augment observations. Through formal and informal interviews the meanings which participants attribute to a given situation are clarified. Four Additional data is collected from other sources such as documentation about students and policy, in order to expand and further clarify the data base. Data recording is through taped interviews and hand-written field notes.

Through continuous reference to the data and through rigorous analytical thinking, the researcher identifies a core variable which illuminates the "main theme" of the actors

behaviour and explicates "what is going on in the data" (Glaser, 1978). The characteristics of the core variable include the fact the it reoccurs frequently in the data, it links the data together and it explains much of the variation in the data. A theory is generated from the core variables and theory is related to the core variables in its categories, properties, phases and dimensions.

Glaser (1978) states that basic social psychological processes (BSPs) are one type of core variable that illustrate social processes as they are repeated over time. As a BSP emerges, it is verified. Other data that relates to it is selectively coded. In this way, the BSP guides further data collection and analysis.

Level I coding uses meaningful words that describe the action in the setting and are frequently exact words of the participants in the situation. These codes are referred to as substantive codes. Substantive coding is based only on the data. In this way the researcher is prevented from imposing preconceived impressions. "Open coding refers to the coding of each sentence and each incident into as many codes as possible to ensure full theoretical coverage" (Hutchinson, 1986). These code words are written in the margins and break the data into small pieces.

Level II codes condense the Level I codes into categories. By asking what the incident indicates and by comparing the incident with others in the field notes, categories are identified and incidents grouped into these categories. The categories are compared to each other to ensure that they are mutually exclusive and cover all behavioral variations.

Level III codes are theoretical constructs derived from a combination of academic and clinical knowledge. Glaser (1978) states that these constructs contribute theoretical meaning and scope to the theory. These codes may or may not be BSPs depending on the variation of behaviour accounted for by the codes. The relationship among the three levels of codes is conceptualized by the theoretical constructs, as Glaser (1978) metaphorically states, "weaving the fractured data back together again". Abstract theorizing is precluded by the fact that these theoretical constructs are grounded in substantive or

categorical codes.

Inductive analysis provides the starting point. This means "immersion in the details and specific of the data to discover important categories, dimensions, and interrelationships; [and begins] by exploring genuinely open questions rather than testing theoretically derived (deductive) hypotheses" (Patton, 1990).

Comparison is the fundamental method of data analysis. Through comparing incident with incident the basic properties of a category or construct are defined. Differences between incidents establish coding boundaries, and relationships among categories are gradually clarified. The properties of a category emerges through searching for its "structure, temporality, cause, context, dimensions, consequences, and relationships to other categories" (Hutchinson, 1986). Through comparing incidents with category, and category with category or construct with construct, the analyst distinguishes similarities and differences among incidents. In this way a dense theory, one that "possess a few key theoretical constructs and a substantial number of properties and categories" (Hutchinson, 1986), is constructed. The richness of the theory is also supported through comparison of the behavioral patterns of different groups within the substantive area.

Memoing is a method for conceptualizing the ideas so that the descriptions of empirical events can be elevated to a theoretical level. Memoing is a means by which the researcher quickly and spontaneously records his ideas in order to capture the initially illusive and shifting connections within the data. The code or codes the memo describes are used as headers so that the ideas are retrievable and reorganized to check the relationship with other codes. To establish relationships between codes, during memoing the researcher asks questions such as: "Are they separate codes? Is one code a property or a phase of another? Is one event the cause or consequence of another? What conditions influence the codes?" (Hutchinson, 1986).

Throughout the entire research process sampling decisions are made as the researcher looks for relevant data to support evolving categories and theoretical codes. Through diverse sampling,

supportive data that covers the wide ranges of behaviour in varied situations is gathered and comparison of data maximized.

When a core variable which explains most of the behaviour variation in the data is identified, sorting begins. In order to discover relationships between the different levels of codes, schematic diagrams may be drawn and redrawn. Through the sorting process an outline emerges. Saturation is achieved when further data collection only serves to support the research, but nothing new is revealed.

APPENDIX 8

Evaluation Frameworks
by Aoki, 1986

<u>Orientation</u>	<u>Interest</u>	<u>Form of Knowing</u>	<u>Mode of Evaluation</u>
ends-Means	<ul style="list-style-type: none"> ♦ Ethos of Control ♦ Values Reflected <ul style="list-style-type: none"> -Efficiency, -Effectiveness, -Certainty, -Predictability 	<ul style="list-style-type: none"> ♦ Empirical nomological ♦ Terms of Understanding <ul style="list-style-type: none"> -Facts -Generalizations 	<ul style="list-style-type: none"> ♦ Achievement oriented, ♦ Goal Based, ♦ Criterion Referenced, ♦ Cost Benefit Oriented.
situational interpretive	<ul style="list-style-type: none"> ♦ Meaning Structures of Intersubjective Communication between and among people who dwell in a situation 	<ul style="list-style-type: none"> ♦ Situational Knowing ♦ Terms of Understanding <ul style="list-style-type: none"> -structure of meaning -to explain is to strike a resonant chord by clarifying motives and common understanding 	<ul style="list-style-type: none"> ♦ Situational Evaluation ♦ Seeks quality of meanings people living in a situation give to their lived situations.
critical theoretical	<ul style="list-style-type: none"> ♦ Emancipation from hidden assumptions or underlying human conditions. 	<ul style="list-style-type: none"> ♦ Critical Knowing ♦ Terms of Understanding <ul style="list-style-type: none"> -hidden assumptions -perspectives -motives -rationalizations -ideologies -to explain is to trace down and bring into fuller view underlying unreflected aspects 	<ul style="list-style-type: none"> ♦ Critical Theoretic Evaluation, involving: <ul style="list-style-type: none"> (1) discovering through critical reflection, underlying human conditions, assumptions and intentions, and (2) acting upon self and world to improve the human conditions or to trace down the underlying assumptions and intentions.

APPENDIX 9

Substantive Codes Example

Setting:

Diploma Microcomputer Lab Observation
October 2, 1992
Lab Coordinator instructing
One Professor, assisting
15 Students

Properties:

CM Classroom Management
SQ Student Questions
IM Instructional Method
E Equipment

Substantive Code

Observations

CM: Beginning Activities	<ul style="list-style-type: none">• Students pay for diskettes and sign book that they have paid and received diskettes.
CM: Preclass Preparation	<ul style="list-style-type: none">• Diskettes had been preformatted prior to class and the spreadsheet templates copied onto them.
CM: Preclass Preparation	<ul style="list-style-type: none">• Students walked into class with forms from previous lab. Students were to have completed forms and use the information to input into computer.
CM: Interruptions	<ul style="list-style-type: none">• Majority of students turned on computers as soon as they sat down, but they were not able to do anything other than read the screen. (They did not know what the passwords were.)
CM: Interruptions	<ul style="list-style-type: none">• A lab instructor came into lab. The

- Coordinator and lab instructor left lab and went into adjoining Lab Coordinator's office.
- SQ: Authorities
- Professor talking to one student. Class has not started yet.
- SQ: Authorities
- Another student approaches professor with question. Refers to input sheet.
- CM: Interruptions
- No students talking in lab. Class has not yet begun. Quiet.
- CM: Preclass Preparation
- Two handouts prepared for this class; Student Profile Questionnaire; Budget Input Form.
- IM: Oral
- CM: Beginning Activities
- Lab Coordinator asks if everyone brought their completed budgets. Hands out Budget Input Form to two people who forgot their copies.
- CM: Interruptions
- Lab Coordinator has to talk over noise of computers.
- IM: Visual
- E: Instructional Display
- Lab Coordinator uses LCD Display pane connected to computer
- CM: Preclass Preparation
- IM: Visual
- Handout entitled "Notes on Using Budgets Program" handed out to students.
- CM: Beginning Activities
- Lab Coordinator uses hand held adjuster to focus LCD panel projection on large screen.
- CM: Beginning Activities
- Professor adjusts room lights.
- IM: Verbal Directions
- Lab Coordinator tells

students how to turn on
microcomputers, how to
log into the system, how
to switch between
printers, how to insert
diskettes into drives.

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.

APPENDIX 10

Data Collection Methods and Interview Questions

Category	Question	Method
Background	<ul style="list-style-type: none"> · What courses do you teach? What labs? You use(d) the mainframe in which courses? For how long? You use microcomputers in which courses? Since when? · What computer facilities do you use? · What microcomputer software is used in which courses? · What mainframe software was used in which courses? · What are the primary microcomputer activities in these courses? 	<ul style="list-style-type: none"> · Interview Guide

Category	Question	Method
Needs/Goals	<ul style="list-style-type: none"> • What are the goals of the farm business management courses? • What needs or problems prompted the use of the mainframe computer in these courses? When was this? • Why were microcomputers introduced and mainframe use phased out? When was this? • What concerns or problems have you encountered while incorporating the microcomputer into the courses? • What did you do about these problems? What was the outcome in your opinion? • What personal {unformalized} expectations do you have about using the microcomputer in teaching farm business management? • In what ways have you been able realize these? 	<ul style="list-style-type: none"> • indiv. written response to questions • course outlines and handouts • Informal conversational interviews • record of group discussion(s); • Interview Guide for interviews with individual instructors and professors; • administrative documents- -applic. for funds for lab • course evaluations

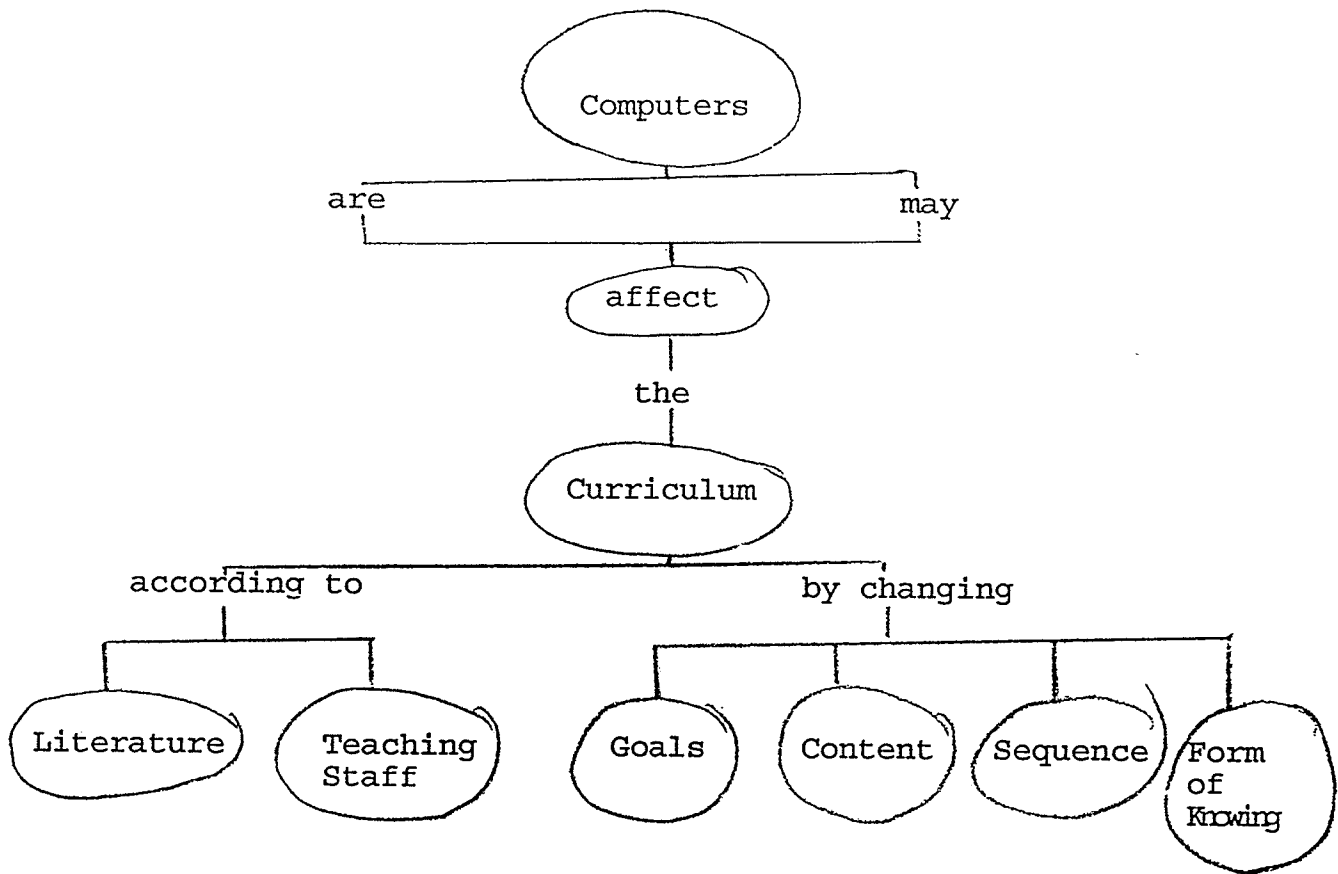
Category	Question	Method
Conception of Curriculum content.	<ul style="list-style-type: none"> • What subject matter is taught using microcomputers? • How is this a change from what was taught before? • Is there other subject matter that you would like to teach using the microcomputer? 	<ul style="list-style-type: none"> • course outlines-old and new • lab manuals • sample assignments • concept maps • interview with instructors using Interview Guide
Sequencing of the curriculum.	<ul style="list-style-type: none"> • What changes in the order in which the content is presented have occurred because of incorporating microcomputer usage? 	<ul style="list-style-type: none"> • Interview Guide
Form of Knowing the Curriculum	<ul style="list-style-type: none"> • In what ways have your concerns about students' comprehension of concepts and abilities to apply these concepts changed since incorporating microcomputer usage into the classroom. 	<ul style="list-style-type: none"> • recording of discussion based on Interview Guide • participant observer's field notes and memos of observations in classes, microcomputer labs and in weekly meetings • informal conversational interviews

Category	Question	Method
Preferred Teaching Approaches	<ul style="list-style-type: none"> • What instructional methods do you use with the microcomputer? Would you give examples? • How is this different from before when the microcomputer was not used? When the mainframe was used? (How do you feel that using the microcomputers has changed your teaching methods?) • What other ways would you like to use the microcomputer in your teaching? • What do consider positive about your teaching methods with the computer? What would you like to change or improve? 	<ul style="list-style-type: none"> • Interview with instructors based on Interview Guide
Preferred Evaluation Methods	<ul style="list-style-type: none"> • How has the incorporation of microcomputers changed the methods of evaluation? (What did you do before vs what you do now) • In what ways to you consider these successful? Unsuccessful? • How would you revise this? 	<ul style="list-style-type: none"> • Interview Guide • Student course outlines • Student Assignment handouts

Category	Question	Method
Classroom Management	<ul style="list-style-type: none"> · In what ways has classroom management changed now that you use a microcomputer? How is it different in the micro lab than in other labs? · In what ways do you structure of the microlab time different than other labs? 	<ul style="list-style-type: none"> · Interview guide
Resources and support required	<ul style="list-style-type: none"> · What support is required for you to use the microcomputers? How is this different from when you used the mainframe? · What resources are required in order to use the microlab? · Do you have any concerns about these resources and support? 	<ul style="list-style-type: none"> · Interview guide
<p>Students:</p> <ul style="list-style-type: none"> - Responsibility for learning - leadership roles in the classroom - authority and responsibility related to the social structure of the classroom <p>Learning</p>	<ul style="list-style-type: none"> · What changes have you observed in students which you consider are related to using the microcomputers. (How is this different from when you used the mainframe?) (In what ways do students act differently in the micro lab than in other labs?) 	<ul style="list-style-type: none"> · Interview Guide

Category	Question	Method
Planning, Coordinating and Administering	<ul style="list-style-type: none"> · How are you using the microcomputer for preparation for class? · How are you using the microcomputer for administration? · In what ways has the use of the micro affected your time: <ul style="list-style-type: none"> -for prep.? -in the classroom? -after class? 	<ul style="list-style-type: none"> · Interview Guide
General	<ul style="list-style-type: none"> · What changes would you like to make in respect to using microcomputers in these courses? · What concerns do you have about using microcomputers? (· What do you like about using microcomputers in teaching? · What do you dislike about using microcomputers in teaching?) · How do you feel about using micros? (How has it affected you?) Has this changed over the time you have been using them? · Is there anything more that you would like to add about using microcomputers for teaching? 	<ul style="list-style-type: none"> · Interview Guide

APPENDIX 11









APPENDIX 12

CONTEXT

Properties	M/F	Micro
Staff Numbers	1/1	4/5/1
Staff Training	None	Extensive
Resources & Support	Dept. Funds Limited	Faculty Funds Many Levels of Support
Software	Compreh. Subject	Simple Subj/Gen.P.

CONTEXT

Properties	M/F	Micro
Instructional Methods	Sequential	 Seq./Holistic
	Experience	 Utilize
	Oral /Visual	 Oral /Visual
	Rote Learning	 Rote /Mngful Learning
	Reception Learning	 Rec./Disc. Learning
	Individual	 Individ./Grp.

CONTEXT

Properties	M/F	Micro
Classroom Management	Much Adv. Prep.	➔ Much Adv. Prep.
	Much In-class prep.	➔ Much In-class prep.
	Many Time Mgmt. Issues	➔ Many Time Mgmt. I.
	Individual	➔ Teamwork
	Many Interruptions	➔ Many Interrupt.

CONTEXT

Properties

M/F

Micro

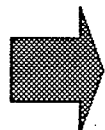
Evaluation
Practices

Little Imm.
Feedback



Much Opp.
Feedback

Gross
Record



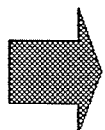
Detailed
Record

Manual
Records



Computer
Records

Opt. few
Marks



Many Req.
Marks

CONTEXT

Properties	M/F	Micro
Assignments	Individual	Indiv./ Group
	Optional	Required
	One	Many

CONTEXT

Properties	M/F		Micro
Student Questions	Factual	➔	Fact/Critical Thinking
	Many	➔	Many
	Tech./Subj. Related	➔	Tech./Subj. Related
	One	➔	Many
	Authority		Authorities

APPENDIX 13

APPENDIX 13

fixed
lab manual
6/10/23

61.043 LABORATORY SCHEDULE

SPRING 1991

<u>Lab</u>	<u>DATE</u>	<u>Topics</u>
#1	JANUARY 7 - JANUARY 11	OBJECTIVES, RESOURCES, CONSTRAINTS
#2	JANUARY 14 - JANUARY 18	PHYSICAL RECORDS, ALTERNATIVES
#3	JANUARY 21 - JANUARY 25	CROP BUDGETS
#4	JANUARY 28 - FEBRUARY 1	LIVESTOCK BUDGETS
#5	FEBRUARY 4 - FEBRUARY 8	BUDGETS (COMPUTER LAB)
	FEBRUARY 11 - FEBRUARY 15	MIDTERM BREAK
#6	FEBRUARY 18 - 22	PROJECTED CASH FLOW
#7	FEBRUARY 25 - MARCH 1	PROJECTED INCOME STATEMENT PROJECTED BALANCE SHEET
#8	MARCH 4 - MARCH 8	FINANCIAL STATEMENTS (COMPUTER LAB)
#9	MARCH 11 - MARCH 15	ANALYSIS OF PRODUCTION AND FINANCIAL STATEMENTS
#10	MARCH 18 - MARCH 22	RISK ANALYSIS

- 2 budgets
- what do
- what do

MONDAY - ROIS
TUESDAY - CHARLES
WEDNESDAY - TIA
FRIDAY - KNEWL
ALL LABS 12:30 - 2:30

LABORATORY FIVE

BUDGETING USING A COMPUTER

Supplies Needed

1. Lab Manual for 61.043. Have pages 50 and 51 completed by the beginning of your lab session so you are able to enter the data into the computer during the session.

Presentation Outline (1 hour)

1. The computer as a budgeting and planning tool.
2. Instructions on the two budgeting programs.

Work Session (1 hour)

Students will complete the following assignment during the work session.

1. Students will enter the data from their 2 worksheets for the quick budget calculator computer program for the 2 crops they budgeted for.
2. Students will save this data on a floppy diskette.
3. Students will print the 2 crops budgets and hand them into their lab instructor.

The computer printout of the 2 budgets are due at the beginning of your next scheduled lab.

Worksheet for Quick Budget Calculator Computer Program

Crop Name: _____ Acres or Hectares Grown: _____

Expected Price: High _____	Expected Yield: High _____
(\$/bu) Medium _____	(bu/acre) Medium _____
or Low _____	or (tonnes/ hectare) Low _____
(\$/tonne) Budget _____	Budget _____

VARIABLE COSTS (\$/acre) or (\$/hectare)

Fertilizer	\$ _____
Herbicide	\$ _____
Pesticides	\$ _____
Seed-purchased	\$ _____
-home grown	\$ _____
Fuel	\$ _____
Repairs Machinery	\$ _____
Repairs Buildings	\$ _____
Custom Work	\$ _____
Hired Labour	\$ _____
Insurance Premiums	\$ _____
Other (specify)	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
Interest Paid on Operating	\$ _____
TOTAL VARIABLE OPERATING COSTS	\$ _____

FIXED COSTS (\$/acre) or (\$/hectare)

Land Taxes	\$ _____
Land Rental	\$ _____
Depreciation	
- machinery	\$ _____
- buildings	\$ _____
Interest Paid	
- machinery	\$ _____
- buildings	\$ _____
- land	\$ _____
Other fixed costs	
(hydro, phone, administration, etc)	\$ _____
TOTAL FIXED COSTS	\$ _____
TOTAL COSTS	\$ _____

NET INCOME/ACRE \$ _____

LESS INVESTMENT COST ON EQUITY IN:

Operating Capital	\$ _____
Machinery	\$ _____
Buildings	\$ _____
Land	\$ _____
TOTAL INVESTMENT COSTS/ACRE	\$ _____
RET. TO LABOUR & MANAGEMENT	\$ _____
BREAKEVEN YIELD/ACRE	\$ _____
BREAKEVEN PRICE/TONNE	\$ _____

Worksheet for Quick Budget Calculator Computer Program

Crop Name: _____ Acres or Hectares Grown: _____

Expected Price: High _____	Expected Yield: High _____
(\$/bu) Medium _____	(bu/acre) Medium _____
or Low _____	or (tonnes/ hectare) Low _____
(\$/tonne) Budget _____	Budget _____

VARIABLE COSTS (\$/acre) or (\$/hectare)

Fertilizer	\$ _____
Herbicide	\$ _____
Pesticides	\$ _____
Seed-purchased	\$ _____
-home grown	\$ _____
Fuel	\$ _____
Repairs Machinery	\$ _____
Repairs Buildings	\$ _____
Custom Work	\$ _____
Hired Labour	\$ _____
Insurance Premiums	\$ _____
Other (specify)	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
Interest Paid on Operating	\$ _____
TOTAL VARIABLE	
OPERATING COSTS	\$ _____

FIXED COSTS (\$/acre) or (\$/hectare)

Land Taxes	\$ _____
Land Rental	\$ _____
Depreciation	
- machinery	\$ _____
- buildings	\$ _____
Interest Paid	
- machinery	\$ _____
- buildings	\$ _____
- land	\$ _____
Other fixed costs	
(hydro, phone,	
administration, etc)	\$ _____
TOTAL FIXED COSTS	\$ _____
TOTAL COSTS	\$ _____

NET INCOME/ACRE \$ _____

LESS INVESTMENT COST ON EQUITY IN:

Operating Capital	\$ _____
Machinery	\$ _____
Buildings	\$ _____
Land	\$ _____
TOTAL INVESTMENT COSTS/ACRE	\$ _____
RET. TO LABOUR & MANAGEMENT	\$ _____
BREAKEVEN YIELD/ACRE	\$ _____
BREAKEVEN PRICE/TONNE	\$ _____

Notes on Using Budgets Program

1. Turn on machine.
2. Login to the network
LOGIN id
where id is on the machine (on a white sticker) eg. AG01
NOTE: the number is a zero, not a letter 'O'
3. To select a printer, say printer #1, type PRINTER1 and press return key.
4. To access spreadsheet program QUATTRO and press return key.
5. To access template (budget program)
/ File Retrieve
Select BUDGETS and Press Return.
6. To use budgets program
PgDn
PgDn
Enter your name (first time only)

Alt M brings the following menu:

- | | | |
|----------|---|--|
| Budgets | - | Enter budgets (up to 14) |
| Acres | - | Enter acres grown and calculate summaries |
| Save | - | Save your budgets as follows:
Insert your diskette in drive A.
Press "Esc" as many times as required until you
get "Enter
file name:"
Type a:filename and press return |
| Retrieve | - | Retrieve your budgets as follows:
Insert your diskette in Drive A.
Press "Esc" as many times as required until you
get "Enter
name of file to retrieve:"
Type a: and Press Return
Select your own filename and Press Return. |
| Print | - | Print your results |
| Quit | - | Quit |

When you are finished and have Quit the program, type LOGOUT to get off the network.

LABORATORY EIGHT

COMPUTER LAB FOR PROJECTED FINANCIAL STATEMENTS

Supplies Needed:

- 1) Completed income statement, balance sheet and cashflow statement are required to do this assignment.

Work Session:

- 1) Students will input the data from their completed, "by hand" financial statements into the STMT 19__ program. The program will then generate the financial statements. Cells within the program which have a zero do not require a number to be entered, this will be done automatically.
- 2) Students will attempt to correct any errors they have made on the by hand projected statements by using the computers reconciliation options.
- 3) Students will hand in a print out of their financial statements, as well as their "by hand" financial statements at the end of the lab.

This assignment is due at the end of this lab.

Marks allocated for this assignment:

1 mark will be allocated for this assignment. Full marks will be obtained if the financial statements are complete and reconcile.

1. Turn on machine.
2. Login to the network

LOGIN id

where id is on the machine (on a white sticker) eg. AG01
NOTE: the number is a zero, not a letter 'O'

3. To select a printer , say printer #1, type
PRINTER1 and press return key.

4. To enter spreadsheet program

QUATTRO and press return key.

5. To access template (Financial Statements program)

/ File Retrieve

Select STMT199 and Press Return

6. To use financial statements program

PgDn

PgDn

PgDn

Enter your name.

Fill in all the underlined cells.

7. TO SAVE YOUR DATA ON A DISKETTE

Insert your diskette in Drive A.

/File Save

esc } as many times as required until you get

esc } "Enter file name: "

Type a:filename for example a:HIST1

Press Return

8. TO RETRIEVE YOUR DATA FROM DISKETTE

Insert your diskette in Drive A.

/File Retrieve

esc } as many times as required until you get

esc } "Enter name of file to retrieve: "

Type a: and Press Return

Select your own filename and press return

9. TO PRINT YOUR FINANCIAL STATEMENTS

(Be sure printer is lined up before you print.)

ALT P to print Financial Statements

ALT Q to print Crop Inventory Worksheets

ALT X to print Reconciliation Screens

10. TO QUIT (Be sure to save before you quit)

/Quit

Yes

LOGOUT to get off the network.

NOTES ON USING HISTORICAL FINANCIAL STATEMENTS + BUDGETS
PROGRAM ON COMPUTERS IN W306 AGRICULTURE BUILDING

General Instructions

- A. See attached diagram for review of Quattro Control keys.
- B. Please Note:
When you are typing commands on the computer screen, copy them exactly as they appear in this set of instructions. For example, if your ID is AG07, (see 2. below), do not put any spaces between any of the characters and use the number zero as opposed to the letter O. However, in the case of letter keys, it does not matter if the letters are capitalized or small casement.

Login Instructions

1. Turn on the machine.
2. You will now have to enter the network. To do so, when "F>" appears on the screen (called the F-prompt), type in the word "LOGIN", then one space (using the space bar) and then type in your ID number, which you will find on the machine - example:
LOGIN AG13.

Printer Selection

3. A listing of the programs that you can access will then appear, followed by a second "F>" or F-prompt. It is at this point that you should indicate which printer you will use to print your results. There are three printers: if you opt for the first one, type "PRINTER1". Then press the "ENTER" key.

Using Floppy Disk

4. You will now see on the screen that it is time to place your floppy diskette in the slot that is labelled A-Drive on your machine. Once the diskette is placed in the slot, lower the "gate" or lever above the slot and strike any key to continue into the program. Please note: make sure that the disk that you are using is formatted. If it is not, it will have to be before you can continue.

To FORMAT the disk, after you "LOGIN" you will see the prompt F:\USERS\AGID> with the floppy in drive A gate closed enter
FORMAT A:

Program Selection

5. Another F-prompt will appear. It is at this point that you will access the program that you will be using for your historical financial statements. Type "QUATTRO" and then press the "ENTER" key.

Quattro Spreadsheet

6. You will now come to the spreadsheet program. The spreadsheet, if you wish to visualize it, is like a huge page of graph paper with letters on the horizontal axis (top of the screen) and numbers on the vertical axis (left-hand side of the screen). Each square or block, be it A6 or B14, is a cell where numbers or lettered headings can be entered. Cells which appear in the dull green print are protected - you can not change the headings or alter the numbers in these cells. The unprotected cells are the ones that you will be completing with the information from your account books. Please remember that when using the spreadsheet program, the cursor (that is, the bright green block, with the flashing black line within it, that you can move around on the screen with the cursor buttons or arrow keys) must be moved fully into the cell in which you want to enter information. "Then" you type the numbers and letters that you wish to enter: they will appear on the top left-hand corner of the screen. When you move the cursor to another cell, the letters or numbers that you have typed will appear automatically to the cell for which they were intended.

Accessing Budgets Program

The budgets program that you will be using is set out on this type of spreadsheet - but so are other programs. Therefore, to access the budgets program (called BUDGETS), you will have to call up a menu and choose this program. To do so, press the "/" or slash key (number 5 on the attached diagram). A box will appear on the top right-hand corner of the screen, containing a list of terms. By either typing the letter "F" or by pressing the "ENTER" key once you have made certain that the cursor is on the word "File", you will bring a second box of terms to the screen. This time, you are to either type the letter "R" or press the "ENTER" key once you are sure that the cursor is on the word "Retrieve". This process, in order to abbreviate future instructions, will be referred to as "Slash, File, Retrieve" or "/FR". This will bring you to a final box of terms - among this menu of items, you will select "BUDGETS" by pressing "ENTER" once you are sure that the cursor is on this term.

Projected Budgets

7. The next screen to appear will be an introductory page to the budgets program. Once it has appeared, press the "PgDn" key twice. This will take you to the screen where you are to enter your name (you need only enter it once). Move the cursor to the middle of the series of X's and enter your name. As the command in the long rectangular box that you will find below your name indicates, pressing the "ALT-M" keys (both at the same time), will bring up another menu. Make sure the cursor is on the term "BUDGETS" and press "ENTER". A screen will appear that closely resembles the Worksheet for Quick Budget Calculator program that you will have completed previously. Enter all of the information for each of the budgets that you have prepared. After you have completed the first budget, cursor or tab over to the right where you will find the second budget. Make sure that the expense headings of the second budget are right against the left-hand side of the screen so as to have only 1 budget on the screen at a time.

Allocation of Acres

8. Once you have finished entering the budget information, you must press the "ALT-M" keys. The same menu will again appear but this time, you will cursor down to "ACRES" and press "ENTER", thus bringing you to the screen where you can allocate the total number of acres that you have to the various crops that you will be growing. You do not have to allocate acres to all of the crops that you have budgetted and the total amount of acres must be exactly equal to the amount of land that you are cropping on your farm.

Save

9. When you have entered all the data which you intend to enter during this session, it is time for you to save your information. First, press the "ALT-M" keys. Once the menu has appeared, cursor down to "SAVE" and press "ENTER". You will then need to press the "ESCAPE" key twice (or as many times as it takes) so as to obtain the following command on the top left-hand corner of the screen: "ENTER FILE NAME". At this point, type the entry "A:" followed by whichever name you decide to assign to this file - for example "A: BUDG1". Please note that there are no spaces in this command. Then, press the "ENTER" key. Your data is now saved under your chosen file name.

Print

10. Once the data is saved, you are ready to print. By pressing "Alt-M", you will again access the menu of commands. Cursor down to "PRINT" and press "ENTER". Another menu will appear on the top right-hand corner of the screen - you will be able to choose between three items "BUDGETS", "SUMMARY" and "COMBINED". If you only wish to print 1 individual budget, cursor to "BUDGETS" and press "ENTER". Another menu will appear, allowing you to select which budget it is that you wish to print. Ordinarily, however, you will wish to print all of your budgets as well as the acres-allocation screen so as to obtain the total farm summary that you will require for your financial statement projections. If this is the case, cursor down to the "COMBINED" command and press "ENTER". Another menu will appear, requiring you to select the number of budgets that you wish to print: if you wish to print budgets 1 through 4, cursor down to "4" and press "ENTER". If you wish to print budgets 1 through 7, then cursor down to "8" and press "ENTER". The printing process will then begin on the printer that you have selected.

Retrieve

11. If at a later date, you wish to reaccess the data that you have previously saved, you will need to repeat steps 1 through 6, except that you will stop after having gone through the "/FR" process. Instead of cursoring down to "BUDGETS", you will need to press the "Escape" key twice (or as many times as it takes) so as to obtain the following command on the top left-hand corner of the screen: "Enter name of file to retrieve:". At this point, type the entry "a:" and press the "ENTER" key. A box will appear on the top right-hand corner of the screen, containing a list of all the files that you have saved on your diskette. Cursor to the file that you wish to access and press the "ENTER" key again. Your file will soon appear on the screen.

If you are simply examining the data, you may simply "quit" (see step 12) once your examination is completed.

Saving

On the other hand, if you have revised your data, it will be necessary to save your changes. You do so by repeating step 9 - the screen will then ask you if you wish to "Cancel, Replace or Backup" the file that already exists - that is, if you decide to use the same file name. You will normally cursor to "Replace" and then press the "ENTER" key.

Quit

12. To quit the program, you must press the "ALT-M" keys to access the menu. Either press the "Q" key or cursor down to the "QUIT" command and press "ENTER". You will then see an F-Prompt appearing on the screen - you will type "LOGOUT" and then turn off the machine.

① Escape

Cursor Keys

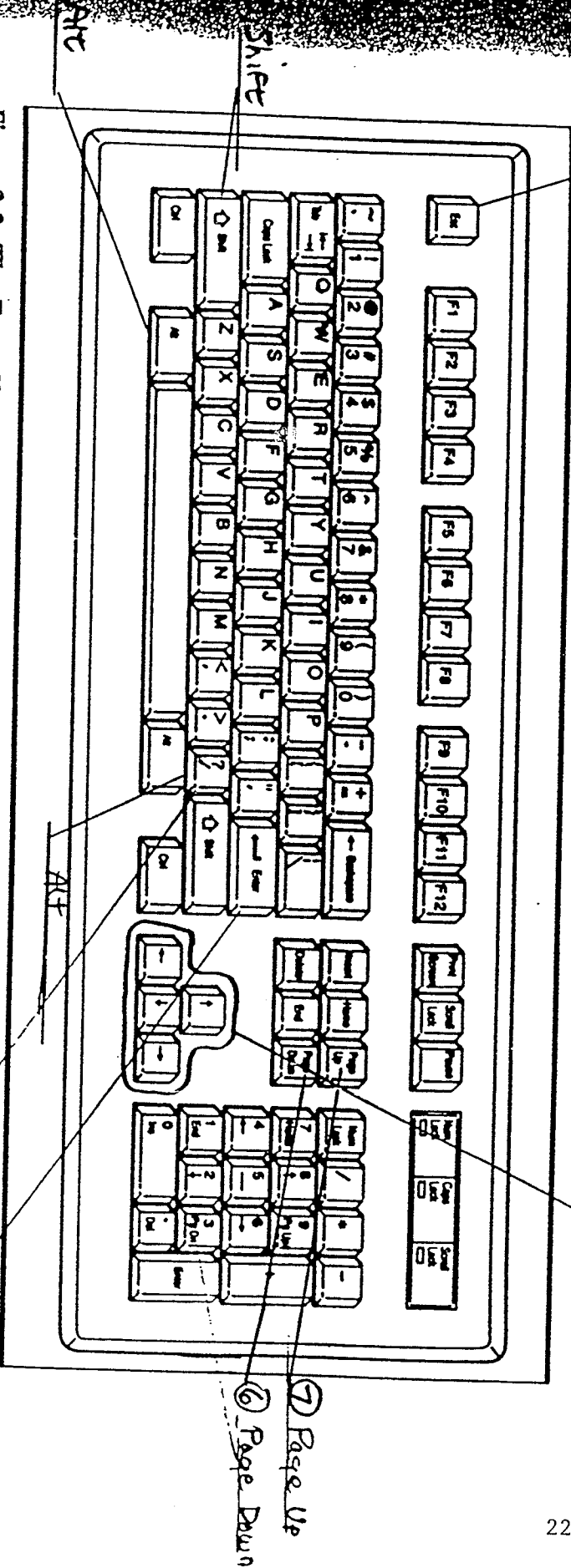


Figure 2.2: The Enter Key (↵)

4. Type the time after Enter new time:. For example,

Enter new time: 15:30:00

⑤ Slash

④ Enter

5. If you typed the time corre v. press ↵ to enter it

APPENDIX 14

+ Crop Inv. sheet -
H10.2 - Proj. Plan 3/89
hapt
Oct 26/90

Farm Financial Program for Microcomputers
(Projected Statements Generator)

By

Sylvio Sabourin
Neil Longmuir

Developed from MDA's "Farm Records Two" System
in consultation with

Ernie Steeves
Lesley Clark
Charles Gilson
Curtis Penner

Department of Agricultural Economics
University of Manitoba

October 1989

Name : _____

1994 CROPS ENTERPRISE PROJECTIONS

(From Computer Crop Budgets Program)

	Totals	\$/unit
Total Acres/Hectares	_____	
Fertilizer	_____	0.00
Chemicals	_____	0.00
Seed - purchased	_____	0.00
Seed - home grown	_____	0.00
Fuel	_____	0.00
Repairs - machinery & bldgs.	_____	0.00
Custom Work	_____	0.00
Hired Labour	_____	0.00
Insurance premiums	_____	0.00
Other _____	_____	0.00
Other _____	_____	0.00
Other _____	_____	0.00
Other _____	_____	0.00
Interest on operating capital	_____	0.00
TOTAL OPERATING COSTS	0.00	0.00
Land taxes	_____	0.00
Land rental costs	_____	0.00
Depreciation : machinery	_____	0.00
buildings	_____	0.00
Interest paid : machinery	_____	0.00
buildings	_____	0.00
land	_____	0.00
Other fixed overhead & utilities	_____	0.00
TOTAL FIXED COSTS	0.00	0.00
TOTAL COSTS	0.00	0.00
TOTAL RETURNS	_____	0.00
RETURNS ABOVE OPERATING	0.00	0.00
NET RETURNS	0.00	0.00

Enterprise Name (hogs, dairy, etc.)	Totals	Per Unit
Number of units (heads, cows, etc)		
Repairs and Maintenance		0.00
Feed - purchased		0.00
Feed - home-grown		0.00
Pasture cash costs (Crown Land, etc)		0.00
Insurance		0.00
Custom work and machine rental		0.00
Utilities (hydro, etc) & misc overhead		0.00
Marketing & Transportation		0.00
Bedding - purchased		0.00
Bedding - home-grown		0.00
Health and A.I. costs and vet costs		0.00
Hired labour		0.00
Other _____		0.00
Other _____		0.00
Other _____		0.00
Other _____		0.00
Interest on operating capital		0.00
Subtotal	0.00	0.00
Purchase of growing animal (fdr, wean.)		0.00
TOTAL OPERATING COSTS	0.00	0.00
Depreciation on machinery & equip.		0.00
Depreciation on Buildings		0.00
Interest paid on fixed investments		0.00
Other fixed costs		0.00
TOTAL FIXED COSTS	0.00	0.00
TOTAL COSTS	0.00	0.00
TOTAL EXPECTED RETURNS		0.00
NET INCOME	0.00	0.00

Enterprise Name (hogs, dairy, etc.)	Totals	Per Unit
Number of units (heads, cows, etc)		
Repairs and Maintenance		0.00
Feed - purchased		0.00
Feed - home-grown		0.00
Pasture cash costs (Crown Land, etc)		0.00
Insurance		0.00
Custom work and machine rental		0.00
Utilities(hydro, etc) & misc overhead		0.00
Marketing & Transportation		0.00
Bedding - purchased		0.00
Bedding - home-grown		0.00
Health and A.I. costs and vet costs		0.00
Hired labour		0.00
Other		0.00
Other		0.00
Other		0.00
Other		0.00
Interest on operating capital		0.00
	Subtotal	0.00
Purchase of growing animal (fdr, wean.)		0.00
TOTAL OPERATING COSTS	0.00	0.00
Depreciation on machinery & equip.		0.00
Depreciation on Buildings		0.00
Interest paid on fixed investments		0.00
Other fixed costs		0.00
TOTAL FIXED COSTS	0.00	0.00
TOTAL COSTS	0.00	0.00
TOTAL EXPECTED RETURNS		0.00
NET INCOME	0.00	0.00

BALANCE SHEET

End of Year : Dec. 31, 1991 Name: _____
 Start of Year: Jan. 1, 1991 StudNo: _____

ASSETS	End of Year	Start of Year
CURRENT		
Cash on Hand	0.00	_____
Cash on Deposit in Bank	_____	_____
Notes and Accounts Receivable	_____	_____
Crops and Feed (From Worksheet)	0.00	0.00
Farm Supplies	_____	_____
Market Livestock	_____	_____
Other Farm Assets	_____	_____
TOTAL CURRENT ASSETS	0.00	0.00
INTERMEDIATE		
Machinery and equipment	_____	_____
Breeding Livestock	_____	_____
Other Farm Assets	_____	_____
TOTAL INTERMEDIATE ASSETS	0.00	0.00
FIXED		
Buildings and Improvements	_____	_____
Farm Land	_____	_____
Other Fixed Farm Assets	_____	_____
TOTAL FIXED ASSETS	0.00	0.00
TOTAL FARM ASSETS	0.00	0.00

LIABILITIES	End of Year	Start of Year
CURRENT		
Current Accounts Payable - 1	_____	_____
Current Accounts Payable - 2	_____	_____
Cash Advance Payable	_____	_____
Accrued Int. On Loans & Arrear Int.	_____	_____
Short-Term Loans (12 months or less)	_____	_____
Intermediate Principal Due This Year	_____	_____
Long-Term Principal Due This Year	_____	_____
Other Farm Liabilities	_____	_____
TOTAL CURRENT LIABILITIES	0.00	0.00
INTERMEDIATE (1-10 Years)		
Mach. Loans Principal Not Due This Yr.	_____	_____
Lstk. Loans Principal Not Due This Yr.	_____	_____
Other	_____	_____
TOTAL INTERMEDIATE LIABILITIES	0.00	0.00
LONG-TERM (OVER 10 YEARS)		
Farm Bldg. Loan Princ. Not Due This Yr	_____	_____
Farm Land Mort. Princ. Not Due This Yr	_____	_____
Other Farm Liabilities	_____	_____
TOTAL LONG-TERM LIABILITIES	0.00	0.00
TOTAL FARM LIABILITIES	0.00	0.00
TOTAL FARM EQUITY	0.00	0.00
TOTAL FARM LIABILITIES AND EQUITY	0.00	0.00

PROJECTED CASHFLOW

(From January 1, 1991 to December 31, 1991)

	YEAR TOTAL	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
CASH INFLOW					
Crops Receipts-1	0.00				
Crops Receipts-2	0.00				
Crops Receipts-3	0.00				
Livestock Receipts - 1	0.00				
Livestock Receipts - 2	0.00				
Cash Advances	0.00				
Government Payments	0.00				
Other Receipts - 1	0.00				
Other Receipts - 2	0.00				
TOTAL OPERATING RECEIPTS	0.00				
MONEY BORROWED FOR CAPITAL EXP.	0.00				
MONEY BORROWED FOR OPERATING	0.00				
CAPITAL SALES	0.00				
PERSONAL CONTRIBUTIONS	0.00				
TOTAL CASH INFLOW X	0.00	0.00	0.00	0.00	0.00
CASH OUTFLOW					
Seed & Grain Purchases	0.00				
Feed	0.00				
Livestock	0.00				
Fertilizer	0.00				
Chemicals	0.00				
Hired Labor	0.00				
Fuel and Lubrication	0.00				
Repairs	0.00				
Custom Work	0.00				
Land Taxes	0.00				
Land Rent	0.00				
Health (Vet, Vitamins, etc) & A.I.	0.00				
Others - cropping enterprise	0.00				
Others - livestock enterprise # 1	0.00				
Others - livestock enterprise # 2	0.00				
Other	0.00				
Interest on Term Loans	0.00				
Int. on Oper. Loans & Service Charges	0.00				
TOTAL CASH OPERATING EXPENSES	0.00	0.00	0.00	0.00	0.00
LOANS PAID(PRINC.ONLY)TERM	0.00				
OPERATING LOANS(PRINC.ONLY)	0.00				
CAPITAL PURCHASES	0.00				
PERSONAL WITHDRAWALS & INCOME TAX	0.00				
OTHER	0.00				
TOTAL CASH OUTFLOW S	0.00	0.00	0.00	0.00	0.00

SUMMARY

SURPLUS(DEFICIT)FOR PERIOD (TOTALS X-S)	0.00	0.00	0.00	0.00	0.00
PLUS OPENING CASH POSITION	0.00	0.00	0.00	0.00	0.00
EQUALS CLOSING CASH POSITION	0.00	0.00	0.00	0.00	0.00

PROJECTED INCOME STATEMENT (Accrual)

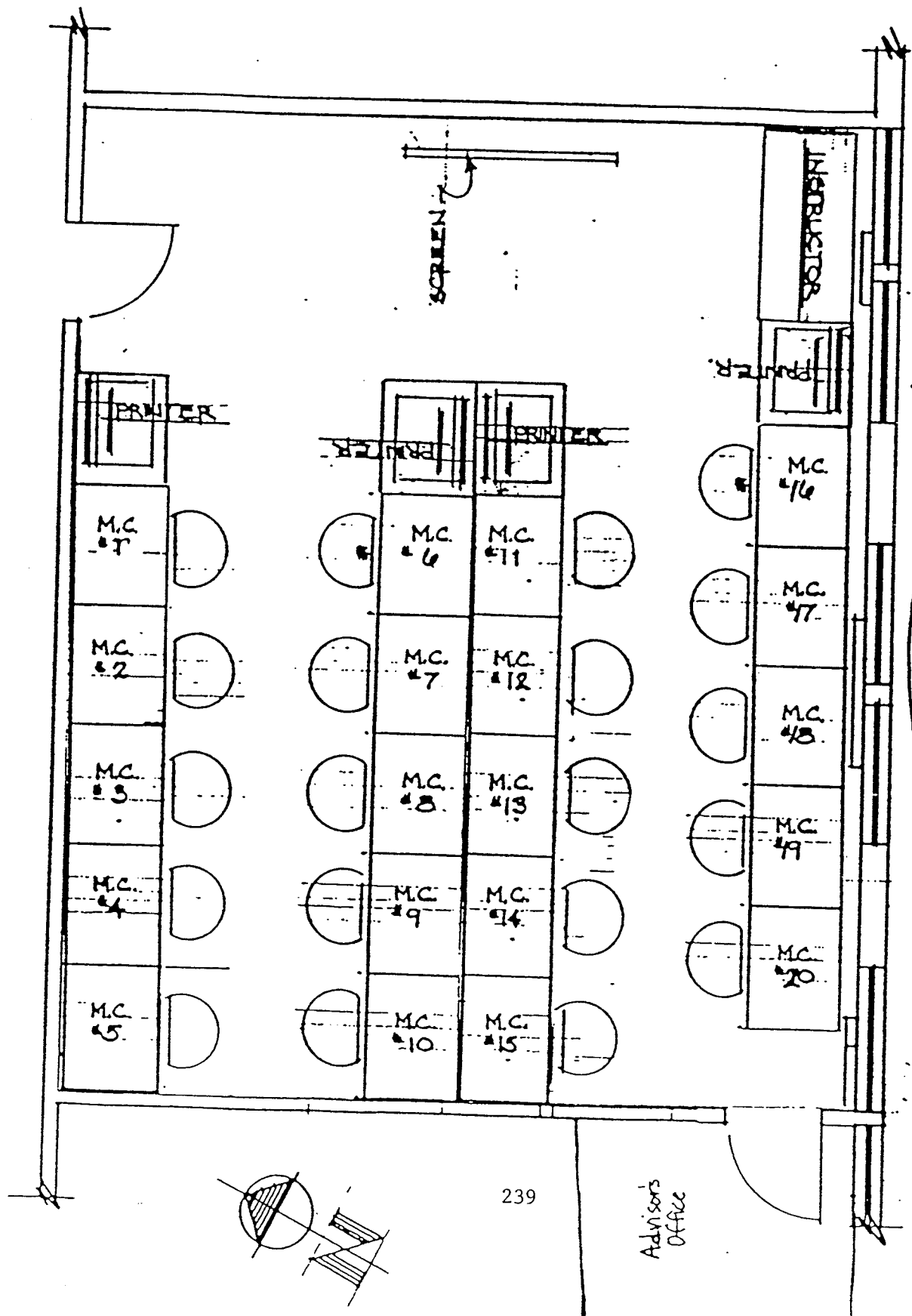
For The Period From January 1, 1971 To December 31, 1971

Crops Receipts-1	0.00		
Crops Receipts-2	0.00		
Crops Receipts-3	0.00		
Livestock Receipts - 1	0.00		
Livestock Receipts - 2	0.00		
Cash Advances	0.00		
Government Payments	0.00		
Other Receipts - 1	0.00		
Other Receipts - 2	0.00		
Total Operating Receipts	0.00	->A	0.00
Cash Advance Adjustment: (Only those repaid by deductions from deliveries)			
Cash Advances Payable Start of Year(+)	0.00		
Cash Advances Payable End of Year (-)	0.00		
Accounts Receivable Start of Year (-)	0.00		
Accounts Receivable End of Year (+)	0.00		
Starting Inventories:			
Crops (-)	0.00		
Livestock (-)	0.00		
Livestock Products (-)	0.00		
Ending Inventories:			
Crops (+)	0.00		
Livestock (+)	0.00		
Livestock Products (+)	0.00		
Purchases:(incl. items bought on acct) (obtained from cash flow)			
Seed (-)	0.00		
Feed (-)	0.00		
Livestock (-)	0.00		
Value of Produce Used in Home (+)			
Revenue Adjustments	0.00	->B	0.00
GROSS VALUE OF FARM PRODUCTION (A) Plus (B)		->C	0.00

GROSS VALUE OF FARM PRODUCTION		-->C	0.00
Operating Expenses		0.00	
Interest & Service Charges	(-)	0.00	
Crops	(-)	0.00	
Feed	(-)	0.00	
Livestock	(-)	0.00	
Accounts Payable Start of Year	(-)	0.00	
Accounts Payable End of Year	(+)	0.00	
Inventory Farm Supplies Start Year	(+)	0.00	
Inventory Farm Supplies End of Year	(-)	0.00	
Adjusted Operating Expenses		0.00	-->D 0.00
Margin of Income Over Operating Expenses (C) Minus (D) (Before Interest)		-->E	0.00
Interest Paid on Operating Loans		0.00	
Interest Paid on Term Loans	(+)	0.00	
Interest Outstanding Start of Year	(-)	0.00	
Interest Outstanding End of Year	(+)	0.00	
Depreciation Machinery and Equip.	(+)	0.00	(From Budgets)
Depreciation Buildings & Impr.	(+)	0.00	(From Budgets)
Total		0.00	-->F 0.00
Net Farm Operating Income (E) Minus (F)		-->G	0.00
Gain on Asset Disposal	(-)		
Loss on Asset Disposal	(+)		
Total		0.00	-->H 0.00
NET FARM INCOME (G) Minus (H)		-->I	0.00

APPENDIX 15

APPENDIX D



ROOM W306 AGRICULTURE
 SKETCHED BY SCHOOL OF ARCH.
 (USING ARCH. AND ENG. SERVICES
 DEC. 10/87 & K A-4 AS
 TEMPLATE)

ROOM LAYOUT: PROPOSAL
 SCALE: 1/4" = 1'-0"

Flaten Penner + Sabowin
 March 15/88

239

Advisor's
 Office

APPENDIX 16

UNIVERSITY OF MANITOBA

PROPOSAL FOR UNDERGRADUATE COURSE CHANGE

FACULTY: Agriculture

DEPARTMENT: School of Agriculture/Dept. of Agric. Economics

PROPOSAL

61.0GG Advanced Farm Business Management (2-2:0-0)3

(Include department number, course number, course name and credit hours)

This course is to be:

Deleted Introduced Modified
 Not Currently Offered Reactivated

To become effective in the 1990/1991 R session.

To be included in the 19 90 / 19 91 General Calendar.

Is this course listed as a required or a formal elective course in any University program?

YES () NO ()

REASON(S) FOR CHANGE

The School of Agriculture proposes to reorganize and update the content of its various courses and allocate new course numbers, according to department. This course is similar to the former course 41.277, but has been modified slightly and assigned a different course number.

PROPOSED CALENDAR ENTRY

61.0GG Advanced Farm Business Management (3)I - Application and refinement of management principles to farm accounts and financial information for the purpose of planning an actual farm enterprise. Students may not hold credit for 61.0GG and the former 41.277. Prerequisite: 61.0ED.

(Exactly as it will appear in the Calendar, See Guidelines)

FREQUENCY OF OFFERING (See Guidelines)

Will this course be offered every year? YES () NO ()

PROPOSAL FOR UNDERGRADUATE COURSE CHANGE

61.0GG Advanced Farm Business Management (2-2:0-0)3
 (Course number, name and credit hours)

SUPPORTING DOCUMENTATION (See Guidelines)

The following items are attached to and form part of this proposal:

- Course outline
- Bibliography
- * Statement from subject librarian(s) as to library resources
- * Statement of additional costs, workload, and/or supplies
- * Statement(s) from other Departments, Faculties or Schools as regards possible overlap
- * Revised Program Descriptions for all programs utilizing this course in your Faculty/School
- *See covering memorandum

TO BE COMPLETED FOR COURSES BEING INTRODUCED (See Guidelines)

Dept. No.	Suggested Course No.	Abbreviated Course Title (15 characters or less)	Credit Hours
61	066	Advanced FEM	3

SIGNATURES

Proposed by: Dr. J. MacMillan, _____
 Head, Ag. Economics

Departmental Approval: Don Flaten, Director _____
 School of Agriculture

Faculty/School Approval: R.C. McGinnis, Dean _____
 Faculty of Agriculture
 (Print Name) (Signature) (Date)

UNIVERSITY OF MANITOBA
DEPARTMENT OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

COURSE OUTLINE

61.0GG Advanced Farm Business Management
(suggested course number 61.066)

Objective

To provide an approach for an illustrative example of farm plan formulation together with discussion of the related considerations in order to equip each student with the skills and understanding needed to complete her or his own Farm Plan in detail with particular emphasis on economic feasibility and practical management. In that context the course will provide:

1. An approach to farm plan formulation.
2. The specified approach will be illustrated through application to an example to the class.
3. Each student will develop several alternative farm plans from which one plan will be selected for refinement for Final Presentation.

Lecture

Two hours of lectures and one laboratory per week in fall term.

1. The key parts of An Approach to Farm Planning (seven lectures)
 - 1.1 Objectives
 - 1.2 Resources and constraints
 - 1.3 Options and selecting real ones
 - 1.4 Tools for analysis - economic and technical
2. Illustrated Plan Presented (four lectures)
 - 2.1 Situation appraisal
 - 2.2 Technical requirements
 - 2.3 Budgets
 - 2.4 Investment analysis
 - 2.5 Cash flow
 - 2.6 Balance sheet
 - 2.7 Tax implications
 - 2.8 Evaluation (annual)
3. Relating the Plan to Off-Farm Institutions (ten lectures)
 - 3.1 Business organization
 - 3.2 Insurance
 - 3.3 Taxation
 - 3.4 Marketing
 - 3.5 Financing
 - 3.6 Leasing
 - 3.7 Contracting - e.g., income sharing

BIBLIOGRAPHY

Textbook

Ronald D. Kay, Farm Management, 2nd ed., Toronto: 1986, McGraw-Hill.

Appendix 17

COURSE OUTLINE

61.066--Advanced Farm Business Management
September 24, 1990

- Instructors: C.F. Framingham and R.M. Josephson
Tim Groening and Rheal Cenerini
- Purpose: The purpose of this course is to develop, through lectures and laboratory exercises, student capability to (a) develop detailed plan alternatives for a farm business over a minimum of three years into the future and (b) acquire an in-depth understanding of those alternatives and factors affecting them.
- The Approach: The approach will focus on:
- I. Development of:
 1. Alternative future projections for a case farm by students working together in groups, to be maintained as originally struck, throughout the course.
 2. Alternative future projections for each student's home farm (or case farm) developed by each student.
 - II. Student rationale for plans and projections made including basic operating decisions and longer term decisions in the context of price and cost scenarios provided by course lecture and laboratory instructors for:
 - (a) The Case Farm
 - (b) Each Student's Own Farm Situation
- Basis of Evaluation: Mid-Term: One Hour Fifteen Minutes, 25 percent of Final Grade
Final Exam: Two Hours, 35 percent of Final Grade
Lab Work: 40 percent of Final Grade

41.277--Farm Business Planning I
Course Outline

September 27, 1988

Objective

To provide an approach for and illustrative example of farm plan formulation together with discussion of related considerations in order to equip each student with the skills and understanding needed to complete her or his own Farm Plan in second term.

Approach

1. An approach to farm plan formulation will be presented.
2. The specified approach will be illustrated through application of examples in class.

Content

1. The Key Parts of An Approach to Farm Planning
 - (a) Objectives
 - (b) Resources and Constraints
 - (c) Options and Selecting Real Ones
 - (d) Tools for Analysis - Economic and Technical
2. Illustrative Plan Presented
 - (a) Situation Appraisal
 - (b) Technical Requirements
 - (c) Budgets
 - (d) Investment Analysis
 - (e) Cash Flow
 - (f) Balance Sheet
 - (g) Tax Implications
 - (h) Evaluation (Annual)
3. Relating the Plan to Off-Farm Institutions
 - (a) Business organization
 - (b) Insurance
 - (c) Taxation
 - (d) Marketing
 - (e) Financing
 - (f) Leasing
 - (g) Contracting (e.g., Income Sharing)

Requirements

- Mid-Term: One hour - Oct 31, 1989 (25 percent of final grade)
- Final Exam: Two hours (35 percent of final grade)
- Labs: 40 percent of final grade (10 labs each worth 2 to 5 percent; written presentation of Operating Loan-Cash Flow Projection 5 to 10 percent).

NOTE: Lab assignments will be due at the beginning of the following week's lab. Your letter grade on each lab assignment will be reduced by one increment for each day or part day that it is late. (For example, B+ will become a B if lab assignment is turned in one day or part-day late).

LECTURE AND LAB CONTENT OF FARM BUSINESS PLANNING I September 25 - December 8, 1989.

A. LECTURES

(Minor revisions may be necessary)

<u>Date</u>	<u>Topics</u>
Sept. 26	Discussion of Course Outline & Final Presentation
Sept. 28	Objectives of and Constraints on Farm Planning
Oct. 3	The Components and Process of Farm Planning
Oct. 5	Computers in Farm Planning and Operation
Oct. 10	The Numbers in Farm Planning
Oct. 12	Use of Capital and Credit
Oct. 17	Use of Capital and Credit
Oct. 19	The Economics in Your Farm Plan
Oct. 24	The Economics in Your Farm Plan (continued)
Oct. 26	An Illustrative Example of a Farm Plan
Oct. 31	MID-TERM
Nov. 2	IBM Microcomputer Budget Analysis MODMM
Nov. 7	and Apple Microcomputer Demos
Nov. 9	Income Sharing
Nov. 14	Insurance
Nov. 16	Taxation
Nov. 21	Taxation
Nov. 23	The Central Importance of Market Decisions
Nov. 28	Leasing Arrangements
Nov. 30	Farm Planning - What Can Happen
Dec. 5	Outstanding Material Wrap-up and Review
Dec. 7	Evaluation

B. IABS

(Tentative or may be revised. Revisions made will be provided in the form of a revised schedule for labs)

Dates

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|----------------|--|
| Sept. 25-29 | 1) (a) Introduction
(b) Time Management On and Off the Farm |
| Oct. 2-6 | 2) (a) Present Cropping Workbook Assignment
(b) Mini Presentation - Hindsight |
| Oct. 9-13 | 3) Financial Analysis Review of Mini Presentation |
| Oct. 16-20 | 4) MODMM Preparation & Livestock Budgets Assignment (Short Case Study) |
| Oct. 23-27 | 5) Prepare 1988 Operating Loan Application - Cash Flow Projection |
| Oct. 30-Nov. 3 | 6) Budget Analyses Using Computer - MODMM |
| Nov. 6-9 | 7) Insurance |
| Nov. 13-17 | 8) Tax Planning and Management |
| Nov. 20-24 | 9) Loan Applications Interview & Livestock Budgets Due |
| Nov. 27-Dec. 1 | 10) Alternatives to be Analyzed for Final Presentation |
| Dec. 4-8 | 11) Overflow and Final Presentation Information |