

SPREADSHEET INSTRUCTION AND THEIR USE FOR TEACHING
MATHEMATICS IN THE BUSINESS COMPUTER APPLICATIONS COURSE
IN VIRGINIA

by


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(ABSTRACT)

This study describes the use of spreadsheets in business computer applications (BCA) courses and identifies and evaluates the use of spreadsheets for emphasizing and teaching mathematics in BCA courses.

Survey instruments in the form of questionnaires were sent to all of the Virginia high schools with the BCA course to attain the BCA teachers' perceptions of spreadsheet use. Responses were received from 257 teachers, or 70% of the total assumed population.

Findings reveal that 95% of the Virginia BCA teachers include spreadsheet instruction in their BCA courses. The mean number of class periods used for spreadsheet instruction is 27; however, the standard deviation is relatively high. The basic mathematics operations received extensive emphasis. The more complex operations only some emphasis. Accounting and Payroll computation receive the most amount of spreadsheet instructional time.

Over half of the BCA teachers who teach spreadsheets include increasing their students' mathematics skills as one of the course objectives. At the same time, however, only 22% of the respondents evaluate their students' mathematics skills independently from spreadsheet application evaluation. Although this independent mathematics evaluation seldom occurs, 72% of the respondents believe that teaching spreadsheets enhances students' mathematics skills to some extent, and 42% believe that teaching spreadsheets enhances students' mathematics skills extensively.

Considering the amount of material to be taught in spreadsheet instruction, not enough of the BCA class time is devoted to spreadsheet instruction. Much spreadsheet instruction precedes emphasis on mathematics as part of the instruction. Also, considering that students emphasize in their learning what they are evaluated on, the importance the BCA teachers placed on mathematics appears to be minimal.

Dedicated to
My Aunt Patsy

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION AND BACKGROUND INFORMATION

Spreadsheet use is increasing in business and accounting firms today (Collins, 1986; Davies & Ikin, 1987). With this increased use of spreadsheets, firms are beginning to expect office employees to know the basics of spreadsheets before the employees reach their door. This expectation places the responsibility of teaching spreadsheets in the schools as opposed to on-the-job training. Spreadsheets have become an integral part of computer literacy and business courses, allowing students to see the power of such utility software and use of it to solve problems. The spreadsheet can also be an effective tool in the mathematics classroom. There, the spreadsheet can be used to help solve real-world problems and, at the same time, promote students' understanding of important mathematical concepts and principles (McDonald, 1988).

A renewed interest in the fundamental academic skills, of which mathematics is a part, is being dubbed the "back-to-basics movement (Unger, 1989)." This movement concentrates instruction in the basic skill areas of reading, language, and mathematics. The back-to-basics movement is a direct result of the recurring concern about education shown by the public, mass media, governmental

agencies, and special commissions that have recently assessed the status of education. The decline in performance and test scores are both evidence of the difficulty students are having with basic skills (Rosenfeld & Holsey, 1985).

To improve students' academic competence, educators can provide instruction in the basic skills, including communication, mathematics, and science as a part of courses across the curriculum. Vocational education courses are no exception. In fact, vocational education courses have the potential to strengthen basic skills and at the same time provide opportunities to apply those basic skills to real-life situations. The focus of this study is on a particular vocational education course called business computer applications (BCA). BCA is a one-year, single-period course offered throughout Virginia. It is designed to introduce students to microcomputer concepts and business applications using spreadsheets, databases, graphics, and beginning-level word processing. This course also includes an introduction to the BASIC programming language and telecommunications. Eleventh- and 12th-grade students taking BCA may participate in cooperative office education. This program places the student in a local business to gain on-the-job experience while simultaneously attending school. The suggested grade level for the course is 10, 11, and 12. Eighteen weeks of

keyboarding is the only prerequisite (Business Education ..., 1989).

Instruction in the BCA course was examined for this study to discover the extent to which mathematics, a basic skill, is emphasized as part of spreadsheet instruction. In the BCA course, students learn to manipulate spreadsheet software as one of the course competencies. Spreadsheets require extensive use of mathematics. Thus, the emphasis placed on general mathematics concepts, specific mathematics operations, and mathematics applications in teaching spreadsheets in BCA courses was researched.

There are 41 competencies for the BCA course (Business Education ..., 1989), one of which states that the student will deal with the "storage, retrieval, and manipulation of business records using a spreadsheet software package (p. BCA-7)." This competency and its objectives serve as the basis for this study. The five performance objectives stated for the competency follow:

- (a) Given access to a microcomputer, an electronic spreadsheet program disk, and appropriate reference manuals, load the program and enter data and formulas at desired locations on the spreadsheet, using correct operating procedures.
- (b) Given access to a microcomputer, an electronic spreadsheet program, and appropriate reference manuals,

retrieve, update, save, and print data with complete accuracy.

- (c) Given access to a microcomputer and a spreadsheet format on which information has been entered, move and edit the information in the spreadsheet program without destroying or modifying the material that is to be retained for further use.
- (d) Given a familiar or student-written spreadsheet format, write a formal documentation of the spreadsheet, explaining each part of the documentation according to the predetermined guidelines.
- (e) Given a familiar, established spreadsheet, answer "What if?" questions (such as "What if advertising were increased 10%?" and "What if cost of goods sold increased 5%?") without assistance from the instructor or from the reference materials and with complete accuracy (pp. BCA-7-8).

Background of the Problem

A trend of the back-to-the-basics movement has been for schools to eliminate vocational education programs (Rehm, 1989). Policy makers and administrators have tended to adopt the conventional wisdom that the best way to prepare all youth for the emerging world of work is to mandate a common-core program emphasizing basic skills, increasing

academic graduation requirements, and de-emphasizing vocational education. Educational reformers say that the single-focus curriculum they recommend for college-bound students is also best for those who do not go to college. They feel that marketable job skills are no longer necessary for high school graduates since job skills will be taught on the job (Unger, 1989). In reality, only one-third of the total labor force receives any formal on-the-job training (Gray, 1989). Many youth lack the skills needed for available skilled jobs in nonbaccalaureate career fields, thus a sizable discrepancy exists between labor market supply and demand (Gray, 1989).

Historically vocational education has delivered to students the job-specific skills they need for entry-level jobs and in the process emphasized and applied basic skills related to those jobs (Wenrich, 1990). Reformers have overlooked the many opportunities that vocational education courses provide to strengthen the students' basic skills (Unger, 1989). As fewer students are able to participate in vocational education courses because of the demands of increased academic graduation requirements and increased core-curriculum courses, fewer job-specific skills can be taught (Bishop, 1989). Businesses which face a serious problem finding qualified workers are beginning to realize that the shortage of skilled workers could seriously affect

our nation's ability to compete in the global market (Repetto, 1989).

Still, when budgets need to be cut, it is often the vocational education programs and teachers that are sustaining the most sizable cuts. However, without access to vocational education programs, students will not get the training they need to function effectively in the work force after high school. What good is it for a student to learn how to subtract one number from another if when placed in the job situation where this skill is used, the student cannot give correct change. Benson reports that 20 out of 40 students who begin college-prep programs in high school will never enroll in college and of those 20 who do enroll in college only 10 will receive a degree (Benson, 1990). That leaves a large majority of high school graduates and college drop-outs without needed job skills.

Knowledge of mathematics is a skill essential for optimum efficiency in carrying out social, consumer, economic, and occupational responsibilities. Yet, many students have a general fear of mathematics and most students do not take a mathematics course after the 10th grade (Long, 1980). The Educational Commission of the States (cited in Secondary Vocational Education's Mathematics and Science Contribution, 1982) states in its report, Education for a High Technology Economy, "that to

achieve educational excellence, the emphasis on improvement of mathematics ... must be at all levels and in all programs in the educational system." The Commission further argues that "it is essential that more opportunities be provided for acquiring in-depth information and 'hands-on' experience with the problems and the possible solutions (p.2)." In fact, it would seem that the appeal of mathematics may be increased, and fear or apathy may be reduced by demonstrating the relevance of mathematics subject matter to practical, everyday applications in the marketplace and world of work (Long, 1980; Truxal, 1984). In BCA, the opportunity exists for mathematics to be taught, emphasized, and applied in many competencies, especially the competency related to spreadsheet instruction.

Learning the basics is a never ending process. Vocational courses can be utilized to enhance the process. When looking at students who are not academically inclined and who do not learn well in abstract situations, vocational education courses can provide a lifeline for the future.

Purposes of the Study

The purposes of the study were to (a) describe the use of spreadsheets in business computer applications (BCA) courses and (b) to identify and evaluate the use of

spreadsheets for emphasizing and teaching mathematics in BCA courses.

Statement of the Problem

The study was undertaken to determine the extent and nature of the use of spreadsheets in the BCA course. Perceptions of BCA teachers from Virginia high schools teaching the course were obtained through survey procedures. Specific research questions answered were:

1. What amount of class time is spent teaching spreadsheets and what grade level students are taught?
2. What amount and what type of computer equipment (hardware and software) is used to teach spreadsheets?
3. What instructional materials are used to teach spreadsheets?
4. Are the objectives for the BCA course met as recommended by the Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives(1989)?
5. What basic mathematics operations are emphasized as part of the spreadsheet instruction?

6. What importance does the BCA teacher place on enhancing the student's mathematics skills in the BCA course?

Significance of the Study

This study is significant in that it attempts to discover if opportunities to strengthen basic mathematics skills in the BCA course are being taken advantage of in planning instruction. It is also significant in seeking to document evidence of mathematics instruction in a vocational education course.

Results of the study may be used to provide BCA teachers across the state with information about spreadsheets. Further, they can demonstrate how spreadsheets can be used to strengthen students' mathematics skills. Outcomes will also indicate the extent that a basic skill, mathematics, is and can be taught through the BCA course.

Definition of Terms

The following terms may have special use or meaning in this study.

Competency--the ability to perform a job or task.

Computer Software--a set of instructions telling the computer which functions to perform to solve a problem (Weatherwax & Weatherwax, 1991, p. 638).

Electronic Spreadsheet--used to record, manage, and project the financial information of a business. A computer application that performs calculations; information is arranged in tabular format (Weatherwax & Weatherwax, 1991, p. 640).

Formulas--mathematical equations used to make calculations in spreadsheets (Weatherwax & Weatherwax, 1991, p. 641).

Hardware--the computer and all the associated physical equipment that make up the entire computer system (Weatherwax & Weatherwax, 1991, p. 642).

Network System--a system of computers connected together for the purpose of sharing information and peripherals (Weatherwax & Weatherwax, 1991, p. 645).

Objective--task or knowledge to be mastered or acquired.

Peripherals--all the physical equipment and parts of a computer system except the central processing unit (Weatherwax & Weatherwax, 1991, p. 646).

Software--a set of instructions telling the computer which functions to perform to solve a problem (Weatherwax & Weatherwax, 1991, p. 638).

Stand Alone Computer--computers which are not connected to other computers (Weatherwax & Weatherwax, 1991, p. 649).

"What if" Projections--estimates of the effects of various courses of action, computed on a spreadsheet (Weatherwax & Weatherwax, 1991, p. 651).

Substantive Assumption

The study had one underlying assumption--that spreadsheet instruction is included in BCA courses in Virginia.

Delimitations

This study examines spreadsheet instruction in BCA for extent and emphasis of instruction, particularly as related to the basic skill of mathematics. It is delimited to the responses from Virginia BCA teachers.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter reviews selected literature and research to establish a foundation for the study. It includes a discussion of the BCA course, spreadsheet use, and basic skills instruction. It also includes a summary.

The Business Computer Applications Course

BCA, recommended by a curriculum study group in Virginia in 1981 (J. Stewart, personal communication, July 17, 1991), is a core curriculum course that is interesting for students to take and interesting for teachers to teach. "This exciting course allows the teacher to set higher expectations of the student than any other core sequence before (Mlyniec & Schornstein, 1989, p.15)." High schools in Virginia started incorporating BCA into their business education curriculums in the Fall of 1983 (J. Stewart, personal communication, July 17, 1991).

Through BCA instruction, the student gains "a working literacy in computer systems, technological impact(s) on business systems, ethics and issues." In addition, the instruction includes use of the "four basic tools for computer applications: word processing, database, spreadsheet, and graphics. Students learn to use (these

tools) together to produce an interrelated project and use them as analysis tools for management (Mlyniec & Schornstein, 1989, p. 16)."

Spreadsheet Use

Electronic spreadsheets are computer software programs for microcomputers developed for the business world to take the place of the large paper spreadsheets that were used for financial planning (Dubitsky, 1988, p. 18). The screen images physically resemble paper ledger sheets, with cells organized in rows and columns. However, in an electronic spreadsheet, one can place a label, number, calculation, or a formula in any spreadsheet cell, which can subsequently be edited, copied, or moved. The results of calculations in the formula area appear as the content of the cell. The most dramatic difference from static paper spreadsheets is that one can change cell entries and see the repercussions of that change recalculated immediately throughout the spreadsheet (Levy, 1984).

In Dubitsky's study (1988), researchers found that, given the right tools, encouragement, and admiration for unique ways of thinking, students were able to find their own techniques and solutions using the spreadsheet. Students in grades 4-7, some poor mathematics students, others quite accomplished, quickly learned to enter, change,

and delete numbers and to move from problem to problem. The students not only learned about division, but began to understand more about numbers in general. They were also learning to form and trust their own theories about mathematics. All of the students had learned fine problem-solving skills.

Buergermeister (1990), in his study, discusses the important issues surrounding the use of computer spreadsheets for the teaching of undergraduate cost control concepts. To summarize his findings, the instructional use of spreadsheets can improve educational outcomes in undergraduate cost control curriculum in three ways:

(1) The Tool Metaphor provides the learner with a powerful tool that allows for increased practice opportunities, serves as a contemporary tool to apply cost control concepts and offer "what-if" testing scenarios. (2) The Medium and Method serve as an efficient vehicle to transport education concepts from teacher to students via special technology allowing for the demonstration of cost control concepts using real data. The computer spreadsheet medium allows the instructor to use a variety of methods to present material to students--increasing the chances of identifying the optimum method. (3) Teaching Valuable Technical Skills by exposing the student to the

technical skills associated with personal computers and application software, teaching them how to use computer technology in the work environment they plan to pursue as a career. (p. 159)

Weida (1991) stresses that "a spreadsheet is seen as a tool to understanding decisionmaking and not as an end in itself (p. 284)." The basic message is to urge the students to first carefully consider the mathematical model they are using, which happens to be in the form of a spreadsheet. Weida notes that more than computer proficiency is required of the students; the underlying model must also be understood. In spreadsheet software instruction, educators must avoid the temptation to take the easy route by emphasizing the more mechanical and technical aspects of spreadsheet software use.

Basic Skills Instruction

In a study by Weber, Puleo, and Kurth (1989), 2,251 teachers in 120 secondary schools in 24 states were asked to complete a questionnaire covering several variables related to basic skills instruction in vocational and nonvocational education courses. There were 893 nonvocational and vocational classes observed to determine who was doing what to whom and how. Results showed that basic academic skills are an inherent part of most vocational skills/tasks.

Research also revealed that vocational education courses offer frequent and varied opportunities for reinforcing and enhancing students' basic skills, yet vocational teachers did not take full advantage of the naturally occurring opportunities in their courses to strengthen their students' basic skills.

In a study done by Halasz (1984) from the National Center for Research in Vocational Education, researchers observed 152 students in minute by minute activities of almost 200 hours of classroom time in 9 typical secondary courses in comprehensive high schools and area vocational schools. Observers reported the amount of time students spent on-task and off-task, and what teachers were doing. Results showed that of the 71% of class time spent on-task, only 2.8% of the class time was spent specifically on basic skills instruction and that 29% of class time was spent off-task of any kind. Further, evidence existed of students applying basic skills to other tasks rather than studying them in isolation. The researcher noted that while a few teachers emphasized some aspect of basic skills, most did not.

In another study carried out by Ladewig, Robertson, Boschung, and Strickland (1987), a pilot group of 399 eighth and ninth graders were exposed to "Home and Personal Management" integrating basic competencies in reading,

language, and mathematics and employing the microcomputer as a teaching tool. There were 611 students in the control group enrolled in the same course taught in the traditional fashion. The results showed that the pilot group made significantly greater gains in their knowledge of the basic competencies than the control group. The researchers suggest that what may be needed is improved teacher preparation and in-service training that will help teachers locate basic skills content embedded in vocational tasks.

As evidenced in a study by Ristau and Allison (1989), some school districts have been successful in getting vocational courses to count toward graduation as required courses in mathematics, English, or social studies. From reviewing the results of the aforementioned research however, if this type of movement is to occur, it will be necessary to carefully assess the commitment to and success in delivering improved basic skills instruction in the vocational curriculum. The substitution of vocational courses for required academic courses requires careful study to insure that students attain the same levels of achievement, that the competencies are covered, and that the student is challenged.

Summary

Study of the literature revealed the following.

1. Many opportunities exist in vocational courses for basic skills instruction.
2. Although many opportunities exist for basic skills instruction in vocational classes, many teachers do not take advantage of these opportunities.
3. When basic skills are integrated into vocational courses, the opportunity exists to learn more basic skills than in traditional academic courses.
4. Spreadsheets are an effective tool for teaching mathematics.

The review of literature also provided the bases for the research design and methodology of this study.

CHAPTER 3

METHODOLOGY

This chapter includes (a) research design; (b) identification of the BCA spreadsheet competency and objectives; (c) development of the survey instrument used with the BCA teachers; (d) the study participants; (e) data collection and recording; (f) data analysis; and (g) summary.

Research Design

A descriptive research design was used for this study. Based on a review of research studies and textbooks appropriate for use in BCA courses, the survey instrument in the format of a questionnaire was developed. The survey instrument developed includes items to secure the information needed to answer the six research questions. It contains 18 items, some of which are open ended. Thus the BCA teachers were able to provide detailed responses to selected items.

The items for the survey instrument were developed by deciding how to answer the research questions. Some of the items were devised from looking through textbooks which are recommended for the course and selecting the mathematics operations that are covered in the texts. In addition,

mathematics books were consulted so that other mathematics operations could be identified. A listing of the books appears in Appendix A. The items developed for each research question follow.

Research Question 1. What amount of class time is spent teaching spreadsheets and what grade level students are taught? The items from the survey instrument developed for answering this research question follow.

1. How many BCA classes do you teach?
2. On the average, how many students are in each of your BCA classes?
3. What is the grade level of the students?
4. Do you teach spreadsheets as part of the BCA class?
5. On the average, how many class periods are used for teaching spreadsheets?
6. What is the length (in time) of each class?
14. In teaching spreadsheets, how many periods are included in your instruction for the following applications? Payroll computation, Commission report, Sales report, Tax report, Compute hourly wage, Finding tax on purchase, Depreciation schedules, Monthly expenses, Budgets, Accounting, and Other.

Research Question 2. What amount and type of computer equipment (hardware and software) is used to teach spreadsheets? The items from the instrument developed for answering this research question follow.

7. What type of computer do you use for teaching spreadsheets in BCA? IBM or compatible, Apple, Macintosh, Other.
8. Do you teach spreadsheets on a network system or stand alone computers?
9. Average number of students per computer?
10. What software do you use for teaching spreadsheets in BCA? Lotus 1-2-3, Supercalc, PC Calc+, AppleWorks, MicroTools, Other.

Research Question 3. What instructional materials are used to teach spreadsheets? The item from the instrument developed for answering this research question is:

11. What instructional materials do you use for teaching spreadsheets in BCA?

Research Question 4. Are the objectives for the BCA course met as recommended by the Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives(1989)? The item from the survey instrument developed for answering this research question is

12. Do you meet the objectives for BCA as recommended by the Virginia Business Education Service in

Business Education Suggested Course Competencies and Performance Objectives? (Followed by a list of the five objectives).

Research Question 5. What basic mathematics operations are emphasized as part of the spreadsheet instruction? The item from the survey instrument developed for answering this research question is

13. To what degree are basic math operations emphasized as a part of the spreadsheet instruction? Addition, Subtraction, Multiplication, Division, Totals, Sums, Order of operations, Percentages, Decimals, Rounding, Averaging, Other.

Research Question 6. What importance does the BCA teacher place on enhancing the student's mathematics skills in the BCA course? The items from the survey instrument developed for answering this research question follow.

15. To what extent do you, as a BCA teacher, believe that teaching spreadsheets enhances students' mathematics skills? Why?
16. Is one of your objectives for the BCA class to increase the students' math skills? Why or why not?

17. Do you evaluate your students' math skills independently from spreadsheet application evaluation? If yes, how?

BCA Spreadsheet Competency and Performance Objectives

The Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives (1989) lists as BCA course competency number 31 "Store, retrieve, and manipulate business records using a spreadsheet software package" (p. BCA-7). The performance objectives for this competency follow:

- (a) Given access to a microcomputer, an electronic spreadsheet program disk, and appropriate reference manuals, load the program and enter data and formulas at desired locations on the spreadsheet, using correct operating procedures,
- (b) Given access to a microcomputer, an electronic spreadsheet program, and appropriate reference manuals, retrieve, update, save, and print data with complete accuracy,
- (c) Given access to a microcomputer and a spreadsheet format on which information has been entered, move and edit the information in the spreadsheet program without destroying or modifying the material that is to be retained for further use,

- (d) Given a familiar or student-written spreadsheet format, write a formal documentation of the spreadsheet, explaining each part of the documentation according to the predetermined guidelines,
- (e) Given a familiar, established spreadsheet, answer "What if?" questions (such as "What if advertising were increased 10%?" and "What if cost of goods sold increased 5%?") without assistance from the instructor or from the reference materials and with complete accuracy. (pp. BCA 7-8)

Validation of the Survey Instrument Used With
BCA Teachers

After several rough draft revisions of the survey instrument were completed, it was sent to be answered and critiqued by a validation committee of seven experts. The members of this panel were selected as (a) having knowledge of what a questionnaire should contain, (b) having taught the BCA course, or (c) both a and b. The validation committee members were asked to answer the questionnaire as if they were survey participants, and also to provide remarks for revisions or improvements on the questionnaire. The validation committee members returned their responses, and revisions were made to reflect their recommended improvements. The questionnaire was again sent to two of

the panel members to review. Their few minor suggestions for change were incorporated into the final copy. The letter sent to the validation committee members and the names of the validation committee members appear in Appendix B.

The Study Participants

The survey instrument was sent to business department chairpersons at all schools with 1990-1991 offerings in BCA in Virginia. The Business Education Service of the Virginia Department of Education provided a list of all the schools in Virginia with BCA offerings and a mailing label addressed to simply "Business Department Chairperson" for these schools. All teachers teaching a BCA course at the 322 schools were requested to complete an instrument. The chart below contains the number of schools returning instruments and the percentage of the total schools from which instruments were received.

	<u>Number</u>	<u>Percent</u>
Schools Returning	225	69.9
Schools Not Returning	97	30.1
Total Number of Schools	322	100.0

Data Collection and Recording

A total of 546 questionnaires were mailed to the 322 Virginia high schools and vocational-technical centers with a BCA course offering. Some of the schools had large and

some small business departments as indicated on the 1990-91 roster of business teachers (Roster of Virginia Business Teachers, 1990-1991). Therefore, the large departments, more than three business teachers, were sent two instruments for their BCA teachers and the small departments one instrument. The number of schools receiving one instrument and two instruments was:

<u>Number of Instruments</u>	<u>Number of Schools</u>	<u>Total</u>
1	98	98
2	224	448
	----	----
Total	322	546

Accompanying the instruments were (1) a letter to the business department chairperson asking that individual to distribute the instrument(s) to the specific BCA teachers and (2) a letter to each BCA teacher explaining the purpose of the study. A copy of these letters is in Appendix C.

Each school mailing was coded from 001 to 322. The survey respondents were not required to include their names or their school names, so this method of tracking respondents was used. Those schools with three or more business teachers were sent two instruments, coded A and B. The business department chairperson was asked in the letter to copy more instruments if necessary. The code numbers

were recorded on a copy of the mailing labels received from the Virginia Department of Education. A stamped return envelope was enclosed with each mailing.

Three weeks after the initial mailing, a follow-up letter was sent to all of those schools from which a response had not been received. Several teachers returned the follow-up letter with a note indicating that they had never received an instrument. A new instrument was mailed to those respondents. The follow-up letter is in Appendix D.

The survey instruments were divided into two categories according to when they were received. This separation was used to determine if there was a difference in the responses of early respondents and late respondents. The reason for comparing the early respondents and late respondents is to show that these two groups do not differ significantly in material respects. The late respondents can then be taken to typify those who do not respond at all (West, 1991). Representativeness of the survey findings can then be assumed (West, 1991).

Of the 322 schools that were sent instruments, responses were received from 225 schools. From most of the schools (199 or 88%) only one completed survey instrument was returned, 21 schools returned two instruments, 4

returned three, and 1 returned four. An explanation of responses mailed and received is provided below:

Number of instruments mailed	546
Number of teachers returning an instrument	257
Number of teachers teaching BCA	207
Number of BCA teachers not teaching spreadsheets	10
Number of teachers not teaching BCA	50
Number of respondents used for the research	197

The 257 teachers who returned an instrument can be considered to be representative of 70% of the BCA teachers in Virginia as their schools represent 70% of the schools in Virginia offering BCA.

Data Analysis

The research questions were answered as the data from the respondents were analyzed. The first part of the survey instrument which includes items 1-6 and 14, deals with establishing the environment in which the BCA course is being taught and the time spent teaching spreadsheets in the BCA course.

Research Question 1. What amount of class time is spent teaching spreadsheets and what grade level students are taught?

The minimum, maximum, average, and standard deviation values were found for the responses to items 1, 2, 5, 6, and 14. For item 3, a count of responses for each grade level was taken. Item 4 was the deciding question as to the usability of the instrument. The study examined the BCA course only when spreadsheet instruction was included, so a total of 197 instruments were usable for the study.

The next part of the survey instrument was designed to learn from teachers specifically the type of equipment and materials that they use to teach the BCA course, especially in teaching spreadsheets. Items 7-11 are included for this purpose on the survey instrument.

Research Question 2. What amount and what type of computer equipment (hardware and software) is used to teach spreadsheets?

This question was used to get an idea of the environment in which spreadsheets were being taught in the BCA course. For item 7 a count of responses was kept for each type of computer listed that a BCA teacher said was used. An "other" category was also included for teachers to add computers that were not included on the list. Item 8 also produced a count of responses for each type of system available for use with computers--network or stand alone. A mean value was obtained from the responses to the number of students per computer in item 9. For item 10, a count of

responses was kept for each type of software listed that a BCA teacher said was used. An "other" category was also included for teachers to add software that was not included on the list.

Research Question 3. What instructional materials are used to teach spreadsheets?

This question examined the environment in which spreadsheets are being taught in the BCA course. For item 11 teachers provided the titles of the materials they used. A list was established for a tally for those materials used by more than one teacher.

The third part of the survey instrument deals with the number of spreadsheet competency objectives the BCA teachers are meeting.

Research Question 4. Are the objectives for the BCA course met as recommended by the Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives (1989)?

Item 12 collected the teachers' responses as to which objectives they believed their students are meeting. A count of responses was kept for the responses to each objective.

The fourth part of the survey instrument gathers information pertaining to the amount of emphasis placed on certain mathematics operations and the amount of time

(expressed in class periods) devoted to certain mathematics applications.

Research Question 5. What basic mathematics operations and mathematics applications are emphasized as part of the spreadsheet instruction?

For item 13, the mean response and standard deviation was calculated for the degree of emphasis placed on each of the listed basic math operations as a part of spreadsheet instruction.

For item 14, the minimum, maximum, average, and standard deviation values were calculated to determine the number of periods included in spreadsheet instruction for each of the listed mathematical applications. The number of teachers including each application in their spreadsheet instruction was counted as well.

The fifth part of the survey instrument turns to the teachers' perception related to the importance of including mathematics instruction during spreadsheet instruction.

Research Question 6. What importance does the BCA teacher place on enhancing the students' mathematics skills in the BCA course?

For each possible response in items 15, 16, and 17, a count of responses was kept and the percentage of answers for each response computed. The answers in the space where the teachers elaborated on why they feel the way they do,

why they answered the way they did and how they do something were also compiled according to topics mentioned.

Summary

This chapter on methodology included the following topics: research design; identification of the BCA spreadsheet competency and objectives; development of the survey instrument used with the BCA teachers; the study participants; data collection and recording; and data analysis.

CHAPTER 4

FINDINGS OF THE STUDY

The purposes of this study were to (a) describe the use of spreadsheets in BCA courses, and (b) identify and evaluate the use of spreadsheets for emphasizing and teaching mathematics in BCA courses. The results of the study are presented in three sections. The first section compares early and late wave responses, the second gives outcomes for the seven research questions posed in the study, and the third gives a summary of the outcomes.

Early and Late Wave Responses

The purpose of separating the early and late wave responses was to determine if the early wave responses differed from the late wave responses. Following up on those who did not respond to the initial inquiry likely increased the number of respondents and, therefore, the response rate. More important is the provision of a basis for inferring whether representativeness may be assumed with the rate of response that was achieved (West, 1991). Although "it is notorious that nonrespondents to surveys often tend to differ from respondents on features significant to the purpose of the study (West, 1991, p. 134)," "those who have to be nagged to respond are taken to

typify those who do not respond at all (West, 1991, p.135)." A two-sample T-test was performed on seven key items according to arrival time of responses. A probability (prob.) of .05 or greater indicates no difference in the responses. The early wave responses and the late wave responses for this study were essentially the same for the key items as shown in Table 1.

Research Question Outcomes

The research questions were answered through the development of a survey instrument that was distributed to all Virginia high schools with a BCA course.

A total of 257 respondents provided responses. The total number of schools in Virginia identified as offering the BCA course was 322. Because teachers from 225 of those schools returned instruments, the percentage of all BCA teachers in Virginia returning instruments is inferred to be approximately the same as the percentage of schools from which instruments were received. The researcher had no other way of determining the population of BCA teachers in Virginia. The population inference means that the respondents represented approximately 70% of the total population. Although 257 instruments were received, only 197 were filled in past item 4. Item 4 asks "Do you teach spreadsheets as part of the BCA course?" and then further

Table 1

Key Items for Early and Late Wave Responses^a

	Response Time				T-Value	Prob.
	Early		Late			
	Mean	SD	Mean	SD		
5. On the average, how many class periods are used for teaching spreadsheets?	26.9	14.9	28.1	14.7	-.41	.68
13. What degree are basic math operations emphasized as a part of the spreadsheet instruction?						
Addition	3.6	.62	3.6	.54	-.66	.51
Totals	3.6	.57	3.7	.52	-.95	.34
Sums	3.6	.55	3.7	.52	-.83	.41
Rounding	3.0	.66	3.0	.62	.28	.78
14. In teaching spreadsheets, how many periods are included in your instruction for the following applications?						
Accounting	4.8	4.0	4.2	3.8	.66	.51
Depreciation schedules	1.9	2.1	1.2	1.6	1.19	.24

^aOut of the 197 responses, 159 were early responses and 38 were late responses.

instructs "If no, please return this survey in the enclosed envelope at this time." The study was designed to discover the number of BCA classes in which spreadsheet instruction occurred and to examine the extent of emphasis of that spreadsheet instruction; therefore, classes not including spreadsheet instruction were not used for analysis. Thus of the total respondents who taught BCA, 4.8% did not include spreadsheet instruction in their BCA course.

Outcomes for the seven research questions follow.

Research Question 1. What amount of class time is spent teaching spreadsheets and what grade level students are taught?

The minimum, maximum, mean, and standard deviation values for the responses to items 1, 2, 5, and 6 appear in Table 2. The mean number of class periods used for spreadsheet instruction is 27; however, the standard deviation is relatively high. Thus a wide range of class period time is devoted to spreadsheet instruction in the BCA courses.

Table 2

BCA Course: Students Enrolled and Spreadsheet Instructional Time

Item	Minimum	Maximum	Mean	Standard Deviation
1. Average number of classes/teacher	1	6	2.0	1.1
2. Average number of students/class	3	28	17.2	5.0
5. Average number of class periods used for spreadsheets	1	75	27.1	14.8
6. Length (in minutes) of each class period	42	150	50.6	10.1

Note: These statistics are calculated from the 197 responses of teachers who taught spreadsheets.

The responses to item 3 show that according to the recommended standards, most of the students are in the 10th, 11th and 12th grades. The responses are as follows:

<u>Grade</u>	<u>Number of responses</u>
7th & 8th	1
9th	28
10th	101
11th	184
12th	191

Item 4, regarding the teaching of spreadsheets in BCA, received 197 yes responses and 10 no responses. The remaining 50 respondents did not teach BCA.

Research Question 2. What amount and what type of computer equipment (hardware and software) is used to teach spreadsheets?

The responses to the type of computer used for teaching spreadsheets in BCA in item 7 showed IBM/Compatible is the equipment most frequently used with 139 responses or 71% of the responding BCA teachers who teach spreadsheets. Apple came in second with 37 responses, "Other brands" had 12 responses, Macintosh had 2 responses, and 7 respondents used more than one type of computer.

For item 8, which examined use of stand-alone or networked equipment, 18 of the teachers responding used

computers on a network system, 173 teachers used stand-alone systems, and 5 teachers used both types of systems. For item 9, the average number of students per computer was 1.2.

Lotus 1-2-3 led the responses for item 10 with 55 (28%) of the respondents using this software package to teach spreadsheets. Other software packages not included on the list ranked second with 52 (26%) of the respondents. Microsoft Works was a software package frequently added to the "other" list. Appleworks came in third with 35 (18%) of the respondents. MicroTools was fourth with 22 (11%) of the respondents. Thirty-three (18%) of the teachers responding used more than one type of software.

Research Question 3. What instructional materials are used to teach spreadsheets?

A wide variety of instructional materials was listed as having been used by the BCA teachers responding. The instructional materials were compiled for each software package and tallied for most frequent use. Microtools, Appleworks Integrated Applications for Microcomputers, and the Student Edition Lotus 1-2-3 were the most popular software packages listed by the respondents. A list according to software packages with the top three instructional materials and the number of BCA teachers who listed them is included in Appendix E.

Research Question 4. Are the objective for the BCA course met as recommended by the Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives?

Table 3 indicates the numbers and percentages of respondents who felt they met each of the five objectives. The five performance objectives listed in this question came from the Virginia Business Education Service's Business Education Suggested Course Competencies and Performance Objectives (1989). The first three objectives were met more than 90% of the time. The last two objectives were met less than 75% of the time.

Research Question 5. What basic mathematics operations and applications are emphasized as part of the spreadsheet instruction?

The listed mathematics operations in Table 4 were derived from examining textbooks suggested for use in the BCA course and extrapolating those mathematics operations emphasized in the books. Table 4 lists the mean and standard deviation for the mathematics operations reported as emphasized by the BCA teachers. The basic mathematics operations of addition, subtraction, multiplication, division, totals, and sums averaged 3.5 or better. Thus, they received extensive emphasis. The more complex operation, including order of operations, percentages, decimals, rounding, and averaging,

Table 3

Number and Percentage of Respondents who Felt They Met the Five Objectives for BCA

Item	Meet		Don't Meet	
	Number	Percent	Number	Percent
Objective 1	193	98	4	2
Objective 2	192	98	5	2
Objective 3	185	94	12	6
Objective 4	102	52	95	48
Objective 5	142	72	55	28

Table 4

The Degree To Which Basic Math Operations are Emphasized^a as a
Part of Spreadsheet Instruction

Operation	Mean	Standard Deviation
Addition	3.6	.60
Totals	3.6	.56
Sums	3.6	.55
Subtraction	3.5	.61
Multiplication	3.5	.60
Division	3.5	.60
Averaging	3.4	.61
Order of operations	3.3	.65
Decimals	3.3	.60
Percentages	3.1	.57
Rounding	3.0	.65

^a 4=Extensive Emphasis 3=Some Emphasis 2=Incidental Emphasis
1=No Emphasis

averaged 3.0 to 3.4 indicating that they received some emphasis. Rounding had the lowest mean, 3.0; while addition, totals, and sums had the highest mean, 3.6.

Table 5 lists mathematics applications as derived from textbooks for the BCA course and from mathematics books of appropriate high school level. The BCA teachers recorded the number of instructional periods they used to teach the listed mathematics applications. Table 5 shows the minimum, maximum, average, and standard deviation values for the number of periods used by the BCA teacher for each application according to the number who taught each application. Table 5 also shows how many teachers include each of the mathematics applications in their instruction. The mean number of class periods used for the applications ranges between 1.8 and 4.7. Accounting and Payroll computation receive the most extensive amount of instructional time. Tax reports and Depreciation schedules receive the least instruction.

Research Question 6. What importance does the BCA teacher place on enhancing the students' mathematics skills in the BCA course?

The number and percent of BCA teachers who perceive to each extent that teaching spreadsheets enhances students'

Table 5

Number of Periods Devoted to Teaching Spreadsheets for the
Listed Mathematics Applications

Application	Number of Teachers	Minimum	Maximum	Mean	Standard Deviation
Accounting	100	0	20	4.7	3.9
Payroll computation	126	0	20	4.0	3.0
Budgets	126	0	15	3.5	2.6
Sales report	131	0	15	3.4	2.6
Monthly expenses	125	0	15	3.2	2.4
Compute hourly wage	124	0	25	3.1	2.8
Commission report	103	0	10	2.7	2.1
Tax report	69	0	5	2.0	1.6
Finding tax on purchase	100	0	10	2.0	1.6
Depreciation schedules	47	0	10	1.8	2.0

mathematics skills follows: Extensively 42 (21%); Some 141 (72%); Not at all 10 (5%); Not Applicable 4 (2%).

Table 6 shows the importance that is placed on mathematics in the BCA course. Over 50% of the BCA teachers responding consider one of their objectives for the BCA course being to increase the students' mathematics skills.

Summary of the Outcomes

A total of 257 respondents provided usable returns from the 322 schools where the survey instruments were distributed. A total of 106 out of 197 or 53.8% of the teachers who teach spreadsheets in their BCA course, include increasing their students' mathematics skills as one of the course objectives. In addition, a total of 141 out of the same 197 teachers, or 71.6%, believe that teaching spreadsheets enhances students' mathematics skills to some extent.

Table 6

Number and Percentage of Teachers Who Answered Yes, No, and
N/A to the Questions Listed

Item	Yes		No	
	No.	%	No.	%
16. Is one of your objectives for the BCA course to increase the students' mathematics skills? N/A=8(4%)	106	54	83	42
17. Do you evaluate your students' mathematics skills independently from spreadsheet application evaluation? N/A=14(7%)	43	22	140	71
18. Are spreadsheets taught in other Business Education courses? N/A=8(4%)	119	60	70	36

CHAPTER 5

SUMMARY, CONCLUSIONS, AND DISCUSSION

The purposes of the study were to (a) describe the use of spreadsheets in BCA courses, and (b) identify and evaluate the use of spreadsheets for emphasizing and teaching mathematics in BCA courses. In this chapter a summary of the study, conclusions, and discussion are presented.

Summary

The review of the literature revealed few studies related to mathematics instruction in business education through computer applications. There was, however, material in the textbooks available for use in the BCA course that could be used for mathematics instruction while teaching spreadsheets. The list of mathematics operations included in the survey instrument was derived from a review of textbooks available for BCA. In addition, mathematics texts of appropriate level were used to gain information for the survey instrument.

The survey instrument was developed and validated by a panel of experts. Once revisions were completed, the finalized survey instrument was distributed to all 322 high

schools, technical schools, and vocational centers in Virginia that offered the BCA course.

The department head from all 322 of these schools with BCA was sent a letter explaining the study and how to distribute the survey instrument. The survey instrument was then passed on to the teachers in the department who taught BCA with a letter attached providing directions for completing and returning the survey instrument. A return-stamped envelope was also included. Responses were received from 257 teachers, or 70% of the total assumed population.

Seven research questions in the study were answered.

Research Question 1. What amount of class time is spent teaching spreadsheets and what grade level students are taught?

An average of 27 class periods were used to teach spreadsheets to mostly 10th, 11th, and 12th graders in the BCA course. The largest number of respondents taught sales reports. The largest number of periods was spent teaching accounting.

Research Question 2. What amount and what type of computer equipment (hardware and software) is used to teach spreadsheets?

IBM/Compatible computers were used most often by the BCA teachers. Almost all students had their own computers to work on in the BCA classroom.

Research Q3. What instructional materials are used to teach spreadsheets?

The BCA respondents provided an extensive list of materials that they used for spreadsheet instruction. Lotus 1-2-3 received the largest number of responses.

Research Question 4. Are the objectives for the BCA course met as intended by the Virginia Business Education Service in Business Education Suggested Course Competencies and Performance Objectives (1989)?

The first two objectives were met by more than 94% of the respondents as the objectives increased in complexity, the number of respondents meeting the objectives decreased. Objective 4, which addresses the preparation of formal documentation for spreadsheets, was met by only 52% of the respondents. Objective 5, which addresses "what-if" uses of spreadsheets, was met by 72% of the respondents.

Research Question 5. What basic mathematics operations are emphasized in part of the spreadsheet instruction?

The very basic mathematics operations of addition, totals, sums, subtraction, multiplication, and division were emphasized extensively. Some emphasis was given to averaging, decimals, order of operations, percentages, and rounding.

Research Question 6. What importance does the BCA teacher place on enhancing the student's mathematics skills in the BCA course?

Over half of the respondents consider "to increase the students' mathematical skills" as one of their objectives for the BCA course. At the same time, however, only 22% of the respondents evaluate their students' mathematics skills independently from spreadsheet application evaluation.

Conclusions

The following conclusions have been drawn from the findings of this study:

1. The mean class size found is appropriate for a class with computer applications subject matter and hands-on use of computers. The mean number of students in BCA classes was 17.

2. BCA is being taught at the recommended grade levels. The majority of the students (94%) enrolled in the BCA course were 10th, 11th and 12th graders, with only a small portion (6%) in lower grades. These are the recommended grade levels for the BCA course, with the only prerequisite being 18 weeks of keyboarding instruction. Thus, many students at lower grade levels can meet the prerequisite, but are not enrolled in the course.

3. The majority of the BCA teachers responding are addressing the competency requirement for the BCA class that spreadsheet instruction be included. The percentage of BCA teachers teaching spreadsheets was 95%. Thus, through BCA students are exposed to this important computer tool so widely used by business.

4. Considering the complexity of spreadsheet use and the information to be taught related to their use, not enough of the BCA class time is devoted to spreadsheet instruction. The mean number of class periods used for spreadsheets was 27, roughly 6 weeks, or 1/6 of total BCA class time. None of the mathematics applications listed on the survey were included in more than half of the respondents' spreadsheet instruction. The mean number of class periods devoted to Accounting was only 4.7, the highest of all the mathematics applications listed. Accounting, payroll computation, budgets, sales reports, monthly expenses, and compute hourly wage received the largest number of periods of instruction, with mean class periods of 3.1 to 4.7. Commission report, tax report, finding tax on purchase, and depreciation schedules received the least number of periods of instruction, with mean class periods of 1.8 to 2.7.

5. Much spreadsheet instruction precedes emphasis on mathematics as part of the instruction. The emphasis placed

on each of the listed basic math operations as part of the spreadsheet instruction supports the notion that there is only time to emphasize the most basic mathematics operations. Addition, totals, sums, subtraction, multiplication, and division received extensive emphasis. Averaging, order of operations, decimals, percentages, and rounding received only some emphasis.

6. Adequate computer equipment is available for BCA students to use in class. Almost all of the students have their own computers. The average number of students per computer is 1.2. IBM/Compatible is the equipment most frequently used to teach spreadsheets.

7. Teachers appear to need more knowledge of spreadsheets so that they include objective 5, which addresses "what-if" uses of spreadsheets, in their instruction. The first three objectives for the spreadsheet competency are met by at least 94% of the respondents. This finding is appropriate in that the first three objectives are very basic to spreadsheet instruction. Only 52% of the respondents felt they met objective 4 and 72% of the respondents felt they met objective 5. Objective 4, which addresses the preparation of formal documentation for spreadsheets, might be considered advanced spreadsheet instruction, but objective 5 is one of the most basic

principles in spreadsheet instruction and should be addressed by all teachers.

8. Considering that students emphasize in their learning what they are evaluated on, the importance the BCA teachers placed on mathematics appears to be minimal. For 54% of the respondents, to increase the students' mathematics skills was included as one of their objectives for the BCA class. However, only 22% of the respondents actually evaluated their students' mathematics skills independently from spreadsheet application evaluation.

Discussion

Of the BCA teachers who responded, 95% teach spreadsheets in their BCA course. This means that mathematics has to be playing some part in the BCA instruction, considering mathematics skills are embedded in spreadsheets. The fact that 141 or 72% of the respondents feel that teaching spreadsheets enhances students' mathematics skills to some extent and 42 or 21% of the respondents feel that spreadsheet instruction enhances students' mathematical skills extensively, helps to support the assumption that basic skills, or at least mathematics, are part of the instruction in vocational education courses.

There appears to be a need for improved teacher preparation and in-service training that will help teachers

locate basic skills content embedded in vocational tasks. Many more opportunities to emphasize and strengthen basic skills could be realized in every class.

A time problem also exists in the BCA class. There are 41 competencies for the BCA teacher to cover in the 36 weeks period. This is a lot of material to cover in this time frame and many opportunities are being lost because of this lack of time. Only superficial instruction in mathematics is possible because more extensive operations take more time.

Thorough examination of the BCA competencies and performance objectives appears warranted to determine those that should be emphasized, those that might be added, and those that need to be dropped. Restructuring the BCA course to place more emphasis on spreadsheet instruction and teaching of mathematics through spreadsheets could prove to be a step in the right direction for the future of the students.

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APPENDIX A

Textbooks Used for Instrument Development

TEXTBOOKS USED FOR INSTRUMENT DEVELOPMENT

- Casady, M. (1988). Word/information processing concepts (3rd ed.). Cincinnati, OH: South-Western.
- Groneman, N., & Jaderstrom, S. (1990). Applications for computer and you. Cincinnati, OH: South-Western.
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APPENDIX B

Letter to Validation Committee Members and
List of Validation Committee Members

VIRGINIA TECH

Division of Vocational &
Technical Education

College of Education
Blacksburg, Virginia 24061-0254

SAMPLE LETTER TO VALIDATION COMMITTEE MEMBERS

November 28, 1990

Dr. Jeffrey Stewart
215 Lane Hall
Blacksburg, VA 24061

Dear Dr. Stewart:

I am in the beginning stages of conducting a study to evaluate the use of spreadsheets and the use of spreadsheets for teaching math in Business Computer Applications classes throughout Virginia high schools. I will be sending a questionnaire to teachers in several high schools in Virginia who teach Business Computer Applications. I expect to derive results from these questionnaires that will show how extensively and in what capacity spreadsheets are utilized in this class.

Attached you will find a copy of the tentative instrument designed for this purpose. I would be most appreciative if you will serve on the validation committee for this study to assist in validating the survey instrument. Please answer the questionnaire as if you were teaching Business Computer Applications, and then assess the instrument. Note any question that is hard to understand, or any improvements/changes that you feel should be made.

If you have any questions, please don't hesitate to call me at work (231-5133) or at home (552-5430). Upon completion, please return the instrument to me with your comments in the enclosed envelope.

Thank you in advance for your help in this study.

Sincerely,

Lynette Gabris (EDVT)

VALIDATION COMMITTEE MEMBERS

Dr. William Camp, Associate Professor, Vocational Education

Ms. Kristi Eaton, Business Teacher

Ms. Mary Hizer, Accountant and Business Teacher

Ms. Susan Kirby, Business Teacher

Ms. Eleanor Stevens, Business Teacher

Dr. Jeffrey Stewart, Professor, Business Education

Mr. Dan Swafford, Business Teacher

APPENDIX C

Letters to Business Department Chairpersons and
Letter to Business Computer Applications Teachers

VIRGINIA TECH

Division of Vocational &
Technical Education

College of Education
Blacksburg, Virginia 24061-0254

SAMPLE LETTER TO BUSINESS DEPARTMENT CHAIRPERSONS WITH FEWER THAN THREE BUSINESS TEACHERS

January 28, 1991

Dear Business Department Chairperson:

We are conducting a study of the use of spreadsheets, including the use of spreadsheets in teaching math, in Business Computer Applications (BCA) classes. The information gathered in this study should prove useful to all BCA teachers in helping to maximize the use of spreadsheets in their classes.

Enclosed you will find a copy of "The Spreadsheet As a Learning Tool" questionnaire. Please pass this questionnaire to the BCA teacher in your department. If you have more than one BCA teacher, please duplicate the questionnaire so all BCA teachers in your department have a copy. A letter explaining the study is attached to the questionnaire. When the questionnaire is completed, return it in the enclosed envelope by February 10, 1991.

Thank you very much for your help in this study.

Sincerely yours,

Lynette Gabris, Graduate Assistant
Business Education

B. June Schmidt, Professor
Business Education

Enclosures

VIRGINIA TECH

Division of Vocational &
Technical Education

College of Education
Blacksburg, Virginia 24061-0254

SAMPLE LETTER TO BUSINESS DEPARTMENT CHAIRPERSONS WITH MORE THAN THREE BUSINESS TEACHERS

January 28, 1991

Dear Business Department Chairperson:

We are conducting a study of the use of spreadsheets, including the use of spreadsheets in teaching math, in Business Computer Applications (BCA) classes. The information gathered in this study should prove useful to all BCA teachers in helping to maximize the use of spreadsheets in their classes.

Enclosed you will find two copies of "The Spreadsheet As a Learning Tool" questionnaire. Please pass these questionnaires to the BCA teachers in your department. If you have more than two BCA teachers, please duplicate the questionnaire so all BCA teachers in your department have a copy. A letter explaining the study is attached to each questionnaire. When the questionnaires are completed, return them in the enclosed envelope by February 10, 1991.

Thank you very much for your help in this study.

Sincerely yours,

Lynette Gabris, Graduate Assistant
Business Education

B. June Schmidt, Professor
Business Education

Enclosures

VIRGINIA TECH

Division of Vocational &
Technical Education

College of Education
Blacksburg, Virginia 24061-0254

SAMPLE LETTER TO BUSINESS COMPUTER APPLICATIONS TEACHERS

January 28, 1991

Dear Business Computer Applications Teacher:

We are conducting a study of the use of spreadsheets, including the use of spreadsheets in teaching math, in Business Computer Applications (BCA) classes. The information gathered in this study should provide useful resources to maximize the use of spreadsheets in your BCA classes.

We are asking for a few minutes of your time to assist us in this study. Attached you will find "The Spreadsheet As a Learning Tool" questionnaire. Please answer each question as completely as possible. If you have any additional comments, include them in the space at the end. Please complete the questionnaire and return it to your department chairperson by February 9, 1991.

The questionnaires have been coded at the bottom for follow-up purposes only. All answers will remain confidential.

Thank you very much for your help in this study.

Sincerely,

Lynette Gabris, Graduate Assistant
Business Education

B. June Schmidt, Professor
Business Education

Enclosures

APPENDIX D

Follow-up Letter to Business Department Chairpersons

VIRGINIA TECH

Division of Vocational &
Technical Education

College of Education
Blacksburg, Virginia 24061-0251

SAMPLE FOLLOW-UP LETTER TO BUSINESS DEPARTMENT CHAIRPERSONS

February 22, 1991

Dear Business Department Chairperson:

Several weeks ago you should have received a questionnaire, "The Spreadsheet as a Learning Tool," to distribute to the Business Computer Applications (BCA) teacher(s) in your department. The deadline for returning the questionnaire was February 10, 1991 and we have not yet received a response from the BCA teacher(s) in your school.

We ask that you again remind the BCA teacher(s) to complete and return the questionnaire in the stamped, self-addressed envelope provided. If BCA is not taught in your school, please note that on the questionnaire and return it.

If you have misplaced the questionnaire or if you never received the questionnaire, please let us know and we will send an additional one.

Thank you for your help.

Sincerely,

Lynette Gabris
Graduate Assistant
Business Education

B. June Schmidt
Professor
Business Education

APPENDIX E

Instructional Materials Listed by BCA Teachers and
Number of Teachers Listing Each Material

INSTRUCTIONAL MATERIALS LISTED BY BCA TEACHERS AND
NUMBER OF TEACHERS LISTING EACH MATERIAL

LOTUS 1 2 3

STUDENT EDITION LOTUS 1 2 3 v. 2.2 BY ADDISON/WESLEY 15
101 SPREADSHEET EXERCISES BY MCGRAW HILL (GREGG) 11
DDC SPREADSHEETS 8
LOTUS 1 2 3 VERSION 2.2 BY SHELLEY & CASHMAN 8
APPLICATIONS USING THE PERSONAL COMPUTER

33 teachers gave other suggestions for materials and self-developed ideas. Some of the suggestions follow:

RESOURCE BOOKS
OVERHEADS, REF. GUIDES, WORKSHEETS
MANUAL OF TEACHER DEVELOPED SPREADSHEETS
HANDOUTS
WHEELS FOR RENT SIMULATION

APPLEWORKS

APPLEWORKS INTEGRATED APPLICATIONS FOR MICROCOMPUTERS 20
LEARNING TO USE APPLEWORKS 4
COMPUTER AND INFORMATION PROCESSING OF APPLEWORKS 4

14 teachers gave other suggestions for materials and self-developed ideas. Some of the suggestions follow:

SIDESPREAD AND GRAPHS
WHEELS FOR RENT SIMULATION
MECC MATERIALS AND TEMPLATE
FUNDAMENTALS OF DATA PROCESSING - REFERENCE
THE POWER OF APPLEWORKS - REFERENCE
PAYROLL APPLICATIONS
INVOICES AND FINANCIAL REPORTS FROM VARIOUS SOURCES

MICROTOOLS

MICROTOOLS BY SOUTHWESTERN 25
COMPUTERS & INFORMATION PROCESSING CONCEPTS & APPLICATIONS 6
APPLICATIONS USING THE PERSONAL COMPUTER 3

5 teachers gave other suggestions for materials and self-developed ideas. Some of the suggestions follow:

WHEELS FOR RENT SIMULATION
ADDITIONAL APPLICATION PROBLEMS

The following software packages were added to the list under the other category.

ON TO COMPUTING USING MS WORKS BY LAWRENCEVILLE PRESS 8
MS WORKS TUTORIAL AND APPLICATIONS 7
COMPUTERS TODAY
APPLICATIONS USING PERSONAL COMPUTERS
ELECTRONIC SPREADSHEETS APPLICATIONS IN PRACTICE

9 teachers gave other suggestions for materials and self-developed ideas. Some of the suggestions follow:
 SOFTWARE TUTORIAL SUPPLEMENTARY EXERCISES
 INDIVIDUAL PROBLEMS CREATED BY TEACHER

IBM PLANNING ASSISTANT SERIES
 PLANNING ASSISTANT TUTORIAL AND ASSIGNMENTS PREPARED BY FAIRFAX
 COUNTY TEACHERS 3

9 teachers noted that their materials were self-developed.

Multiplan
 MULTIPLAN

VP Planner
 DDC SPREADSHEETS 2

Deskmate
 DESKMATE 2
 APPLICATIONS USING PERSONAL COMPUTERS

PFS 1st Choice
 USING PFS 1ST CHOICE TUTORIAL AND APPLICATIONS

3 teachers noted their materials were self-developed.

Spreadsheet Starter Package
 THE Course SPREADSHEET STARTER PACKAGE

Visicalc
 MICROSPREADSHEET 1 - INTRODUCTION TO VISICALC BY J. WESTON WALCH
 SPREADSHEET ANALYSIS WITH VISICALC

2 teachers noted their materials were self-developed.

Quattro
 QUATTRO 1
 LEARNING LOTUS 1 2 3

2 teachers noted their materials were self-developed.

McGraw Hill Integrated
 COMPUTERS AND INFORMATION PROCESSING/CONCEPTS AND APPLICATIONS 2
 MICROCOMPUTERS-A PRACTICAL APPROACH
 MCGRAW HILL SPREADSHEETS

2 teachers noted their materials were self-developed.

Open Access Deskmate
 INTRODUCTION TO APPLICATION SOFTWARE 3

4 teachers noted their materials were self-developed. Some sugges-
 tions follow:
 STUDY SHEETS AND APPLICATION PROBLEMS
 HANDOUTS

Twin

2 teachers noted their materials were self-developed.

DBII

2 teachers noted their materials were self-developed.

APPENDIX F
Survey Instrument

- _____ Given a familiar or student-written spreadsheet format, write a formal documentation of the spreadsheet, explaining each part of the documentation according to the predetermined guidelines.
- _____ Given a familiar, established spreadsheet, answer "What if?" questions (such as "What if advertising were increased 10%?" and "What if cost of goods sold increased 5%?" without assistance from the instructor or from the reference materials and with complete accuracy.

If different for each class, please explain. _____

13. To what degree are basic math operations emphasized as a part of the spreadsheet instruction? (Check where applicable.)

	<u>Extensive</u>	<u>Some</u>	<u>Incidental</u>	<u>None</u>
Addition	_____	_____	_____	_____
Subtraction	_____	_____	_____	_____
Multiplication	_____	_____	_____	_____
Division	_____	_____	_____	_____
Totals	_____	_____	_____	_____
Sums	_____	_____	_____	_____
Order of operations	_____	_____	_____	_____
Percentages	_____	_____	_____	_____
Decimals	_____	_____	_____	_____
Rounding	_____	_____	_____	_____
Averaging	_____	_____	_____	_____
Other: _____	_____	_____	_____	_____

(Please identify.)

14. In teaching spreadsheets, how many periods are included in your instruction for the following applications?

	No. of Instructional Periods
Payroll computation	_____
Commission report	_____
Sales report	_____
Tax report	_____
Compute hourly wage	_____
Finding tax on purchase	_____
Depreciation schedules	_____
Monthly expenses	_____
Budgets	_____
Accounting	_____
Other: _____	_____

(Please identify.)

15. To what extent do you, as a BCA teacher, believe that teaching spreadsheets enhances students' math skills? (Circle one.)

Extensively Some Not at all

Why? _____

16. Is one of your objectives for the BCA class to increase the students' math skills?
(Circle one.) Yes No

Why or why not? _____

17. Do you evaluate your students' math skills independently from spreadsheet application evaluation?
(Circle one.) Yes No

If yes, how? _____

18. Are spreadsheets taught in other Business Education classes? (Circle one.) Yes No

If yes, which ones? _____

Optional:

NAME _____

SCHOOL _____

VITA

Patsy Lynette Gabris was born in Salem, Virginia on May 4, 1965. She graduated from Salem High School, Salem, Virginia in 1983. She received her B.S. degree from Virginia Polytechnic Institute and State University, Blacksburg, Virginia in 1987 in business education, specializing in data processing. She completed the M.S. program in vocational and technical education at the same university in 1991.

Her teaching career began at Bay Shore High School, Long Island, New York in Spring 1988. Then for two years, she was a member of the faculty at North Stafford High School, Stafford, Virginia beginning in the Winter, 1988. Here she also served as assistant varsity softball coach, co-sponsor of Future Business Leaders of America, junior class co-sponsor, and editor of the monthly Parent Newsletter. Having implemented a new course, Applied Consumer Economics, in cooperation with Junior Achievement, she was awarded the Regional Check Excellence award for her efforts in this endeavor. For the 1991-92 school year, she has been employed by Chesapeake City Public Schools, Chesapeake, Virginia at Oscar Smith High School.

She is a member of the following professional organizations: National Education Association; Virginia Education Association; National Business Education Association; Virginia Business Education Association; Phi Kappa Phi, nation-

al honorary society; Gamma Beta Phi, national honorary society; and Phi Delta Kappa, national honorary fraternity in education.

She has two sisters, Dawn Gabris Giles and Mary Beth, and one brother, Joseph Leslie. Her parents are Mr. Robert Joseph Gabris and Mrs. Mary Evelyn Sykes Gabris of Salem, Virginia. Her grandmothers are Mrs. H. L. Sykes and Mrs. J. R. Gabris of Bluefield, West Virginia.

Patsy Lynette Gabris