EDUCATIONAL BACKGROUND REQUIREMENTS OF COMPUTER SCIENCE INSTRUCTORS

By

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EDUCATIONAL BACKGROUND REQUIREMENTS

OF COMPUTER SCIENCE INSTRUCTORS

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Thank yous are also extended to my co-workers in the Research and VIEW divisions at the Oklahoma State Department of Vocational and Technical Education, for their assistance, guidance, and encouragement. Their support was greatly appreciated.

A special thanks goes to my family and friends. Who, if it wasn't for their encouragement and support, I would not have made it this far. Thank you.

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CHAPTER I

INTRODUCTION

In recent years, computer science in secondary schools has progressed from a supportive area of study in several disciplines to a separate discipline of its own. The source of teachers who have migrated into this newly evolved discipline come from a variety of other long established secondary school disciplines such as business education, mathematics, physics, and electronics. These teachers have not been specifically prepared to provide instruction in computer science, and the variety of instructional approaches to computer science instruction reflects that diversity in preparation.

Statement of the Problem

There is little evidence that specific efforts have been made to qualify and certify teachers for a primary role as secondary school teachers of computer science. Furthermore, there has been no provision for certification standards, or for teacher education curriculum for this growing discipline. The problem is that students are getting a "hit-or-miss" education in the area of computer science, depending on the background of their instructors.

Many areas of computer science may not be adequately covered.

Purpose of the Study

This research addresses the lack of information concerning content areas of computer science education curriculum. It provides an empirical basis upon which computer science teacher education curriculum could evolve.

Research Questions

The questions which this study was intended to answer were:

1. What are the most important cognitive skills and knowledge needed in the area of computer science?
2. What teaching methodologies are most appropriate for computer science instructors?

Assumptions

The study reflected the following assumptions:

1. All questionnaires were answered in an honest manner.
2. The Delphi Technique is useful for assessing present problems and concerns and in predicting future needs.
3. The design of the research instrument will yield data reflecting a measure of consensus on the

cognative skills and knowledge needed in the area of computer science.

CHAPTER II

REVIEW OF LITERATURE

The literature related to this study was surveyed in four main categories, which were expansion of computer science, implications, teaching methodologies, and research methodology.

Expansion of Computer Science

About twelve years ago, the mention of a computer brought about a feeling of mystery. The few people who were familiar with the uses of computers and some of their abilities, worked with them in large organizations. Today almost everyone deals with a computer in some aspect.

Within the last five to seven years, computers have become a part of the public educational system. Many of the first computers used in the classroom were purchased by teachers with their own money and then brought into the classroom. Other means of schools getting computers in their classrooms were through donations of money and/or computers from industries, civic groups, parent groups, grants, and/or donations from individual parents (Lent, 1983).

There were basically four main uses of computers

in the school system. One of the first of these uses was in the administrative area. Computers were used for business management, where records of the payroll, accounting, employee and student records, and numerous other projects were tracked. The next use for computers was by teachers for instructional management. Computers kept track of how well each student performed an individualized project on the computer. The third way computers were used was for instruction. Computers were further integrated into the classroom by the use of demonstration, drill and practice, tutorials, or by any way that complimented the curriculum being taught. The final use of computers was as the main curriculum being taught (Watts, 1981).

Implications

The implications for computer science have a large range. According to Wheatley (1983, p. 52), "students in a vocational curriculum must learn to use computers as tools for work--as word processors and data-base managers."

These are just two uses in some classrooms. Other uses were tutorials, spread sheets, programming, drill and practice, demonstrations, and simulations (Lent, 1983).

Teaching Methodologies

According to Verduim (1977, p. 125), "learning will be as good as the methodology is effective in achieving objectives." No one method would suffice; all were needed,

and frequently several were used together in the same learning period. Some of the more important methods were explanations, demonstrations, questioning, drills, and tutoring.

When choosing which teaching method(s) should be used during a learning period, the instructor should kept in mind the goals that were to be achieved, the content to be taught, and the size of audience being taught. These were a few of the many things which influence the teaching methodologies being used and when they are to be used (Verduim, 1977).

Delphi Technique

The Delphi Technique was selected as the method for obtaining a consensus of opinions from persons who were knowledgeable in these specific areas. This technique was developed by the Rand Corporation as a reliable method of achieving consensus goals. According to Parker (1980, p. 2),

> The Delphi technique was originally used as a forecasting tool, that is, to predict events and their probable times of occurrence. But the technique has since been broadened and used as a way to arrive at a consensus as the desirability of certain events or outcomes.
>
> The procedures of the technique have three features:
>
> 1. Anonymity - opinions of members of the group are obtained by formal questionnaires which reduce the effect of dominant individuals.

2. Controlled feedback - interaction is effected by a systematic exercise conducted in several iterations with carefully controlled feedback between rounds.
3. Statistical group response - reduces group pressure for conformity and assures that the opinion of every member of the group is represented in the final response.

CHAPTER III

METHODOLOGY

The purpose of this study was to provide an empirical base upon which computer science teacher education could evolve. This chapter outlines the methodology used in the study presenting a description of the sample, method of collecting data, and development of the instrument.

Description of the Sample

It was determined that the population being sampled needed to be practicing teachers in the field of computer science. For reasons of practicality, this population was limited to the instructors of information/data processing of secondary students in the area vocational and technical education schools of Oklahoma. 38 individuals were surveyed.

Method of Collecting Data

The method used for the collection of data was a variation of the Delphi Technique. According to Hopkins (1972, p. 1), "this technique procures individual and group ideas which the researchers or consultants may use in the most appropriate manner." This manner is usually part of a planning process.

The Delphi Technique, used here as the consensus model, was modified by the researcher supplying the beginning lists of the computer science subject areas and teaching methods. It was also modified by not mailing out a third questionnaire as the result of so few recommended rerankings in the return of Questionnaire No. 2.

Development of the Instrument

Using literature sources, input of professionals in computer science, and this researcher's own experience, a list of cognitive skills and knowledge needed in the area of computer science and a list of teaching methodologies was developed. The participants of the Delphi process received a copy of these lists and were asked to rate the statements in each list on a nine-point continuum ranging from the most important (1) to the least important (9) and to add to each list anything they felt was important and relevant to this study.

Questionnaire No. 2 was structured by taking the ratings from Questionnaire No. 1 and calculating the mode and mean for each statement. The statements were then ranked by mode and within each mode they were ranked by mean. These ranked factors were then sent to each of the participants asking them to review the rankings, raising or lowering the ranking of any statement they felt was incorrectly ranked. This step completed the involvement of the participants in the Delphi Technique.

CHAPTER IV

RESULTS

The purpose of this study was to address the lack of computer science teacher education curriculum and to provide an empirical basis upon which it could evolve. The Delphi Technique was used to obtain the consensus from the instructors of information/data processing of area vocational and technical education schools in Oklahoma on topics relevant to the content of computer science teacher education curriculum. This chapter presents the results of this study in two areas, return results and data collection and analysis.

Return Results

Questionnaire No. 1 was mailed to 38 participants. 19 or 50.0% of those questionnaires were returned by the date Questionnaire No. 2 was compiled. Eight additional questionnaires were returned at a later date, however, these could not be used in structuring Questionnaire No. 2. This represents a total response of 27 or 71.1% for Questionnaire No. 1.

Questionnaire No. 2 was mailed to each of the 27 participants who returned Questionnaire No. 1. A total

of 20 responses of Questionnaire No. 2 were returned. This was a 74.0% response for Questionnaire No. 2 or 52.6% of the original population. Two of these returned questionnaires were not usable in the analysis of the returned Questionnaire No. 2's. Table I shows the results of the number of responses for each questionnaire in this study.

TABLE I

NUMBER AND PERCENTAGES OF RETURNS FOR EACH QUESTIONNAIRE

	Number Sent	Total Return	Percent Return
Questionnaire No. 1	38	27	71.1%
Questionnaire No. 2	27	20	74.0%

Data Collection and Analysis

Questionnaire No. 1 and a cover letter (Appendix A) was mailed to each of the participants along with a postage paid return envelope to encourage the return of the completed questionnaire. Two weeks after the mail-out date the participants who had not responded

were contacted by telephone. Additional questionnaires were mailed to the participants who had misplaced their original questionnaire.

The mode and mean was calculated for each statement of the first questionnaire. The statements were then ranked by mode and subranked by mean within each mode. Table II and III shows the results of the rankings. After Questionnaire No. 2 was compiled and mailed to the original 19 respondents, the researcher received eight additional questionnaires from the first mailing. Table IV and V shows the results of the rankings with the results of the late questionnaires calculated in. There was very little difference in the rankings of the computer science subject area statements. In the teaching method statements, however, there were several changes and it did not seem possible to define them.

The researcher ranked the responses of Questionnaire No. 1 by mode and then by mean, because it was felt that the mode better represented the responses of the participants. After the data was collected, it was discovered that several responses to items were in fact bimodal, and that the program used in processing the raw data identified only the highest rank mode. This error in data manipulation occurred beyond the time at which adjustments could be implimented, and the resulting corrections in the rankings were recognized as an error in design which produced minimal variation in modal rankings and no changes at

TABLE II

COMPUTER SCIENCE SUBJECT AREA RANKINGS

Rank	Subject Area	Mode	Mean
1	Diskette Care	1	1.316
2	Computer Terminology	1	1.684
3	Data Bases	1	1.947
5	Keyboarding	1	2.053
5	Word Processing	1	2.053
5	Spread Sheets	1	2.053
7	Computer Components	1	2.263
8	Experience with more than one brand of computer or computer system	1	3.211
9	Operating Systems	2	2.316
10	File Structures	2	2.684
11	Data Structures	2	2.737
12	Integrating Software	2	2.789
13	Copywriting, Copyright Laws, Copy Protection	2	3.747
14	Hardware Interfacing	2	3.684
15	BASIC Language	2	3.947
16	Flowcharting	2	4.053
17	Computer Peripherals	3	2.526
18	Computer Systems	3	2.842
19	Math	3	3.842
20	Telecommunications	3	3.947
21	Networking	3	4.263
22	Maintenance/Upkeep/Safety	4	3.105
23	Accounting	4	3.263
24	Graphics	4	3.895
25	Use of Public Domain Software	4	4.105
26	Binary Numbering System	4	5.000
27	COBOL Language	4	5.158
28	Hexadecimal Numbering System	4	5.368

TABLE II (CONTINUED)

Rank	Subject Area	Mode	Mean
29	Interactive Video	5	4.789
30	Science	5	6.421
31	FORTRAN Language	8	6.895
32	Assembler Programming	8	7.211
33.5	Job Control Language (JCL)	9	5.579
33.5	PASCAL Language	9	5.579
35	Authoring Systems	9	6.316
36	LOGO Language	9	6.368
37.5	Another computer language not mentioned	not rated	
37.5	Knowledge of more than one language	not rated	

TABLE III

TEACHING METHODOLOGY RANKINGS

Rank	Teaching Method	Mode	Mean
1	Demonstration - Small Group (1-10)	1	2.000
2	Drills	1	2.526
3	Individualized Instruction	1	2.579
4	Students Teaching Students	1	2.632
5	LAP's	1	3.211
6	Assignments/Homework	1	3.263
7	Questions - Written	2	2.158
8.5	Lecture - Small Group (1-10)	2	3.053
8.5	Small Groups (1-10) - Tutorial	2	3.053
10	Teaching Forum (guest speakers, industrial experts...)	2	3.947
11	Open Entry/Open Exit	2	4.789
12	Small Groups (1-10) - Discussion	3	2.684
13	Questions - Oral	3	3.158
14	Lecture - Large Group (> 10)	3	3.947
15	Tutoring	4	3.158
16	Discussion	4	3.263
17	Small Groups (1-10) - Brainstorming	4	3.316
18	Demonstration - Large Group (> 10)	4	4.632
19	Large Groups (> 10) - Brainstorming	5	3.526
20	Large Groups (> 10) - Tutorial	5	4.474
21	Student Debate	5	5.579
22	Games	5	6.053

TABLE IV

COMPUTER SCIENCE SUBJECT AREA RERANKINGS

Rank	Subject Area	Mode	Mean
1	Diskette Care	1	1.407
2	Computer Terminology	1	1.630
3	Data Bases	1	1.889
4	Spread Sheets	1	2.037
5	Word Processing	1	2.074
6	Computer Components	1	2.370
- 7	Keyboarding	1	2.444
8	Experience with more than one brand of computer or computer system	1	3.333
9	Operating Systems	2	2.074
+10	Integrating Software	2	2.704
11	File Structures	2	2.741
12	Data Structures	2	2.778
13	Copywriting, Copyright Laws, Copy Protection	2	3.407
14.5	Hardware Interfacing	2	3.481
+14.5	Knowledge of more than one language	2	3.481
16	BASIC Language	2	3.630
17	Flowcharting	2	3.667
+18	Networking	2	3.852
19	Computer Peripherals	3	2.407
20	Computer Systems	3	2.519
21	Telecommunications	3	3.778
+22	Graphics	3	3.815
23	Maintenance/Upkeep/Safety	4	2.963
24	Accounting	4	3.259
-25	Math	4	3.778
26	Binary Numbering System	4	4.630
27	COBOL Language	4	4.667
28	Hexadecimal Numbering System	4	4.926

TABLE IV (CONTINUED)

Rank	Subject Area	Mode	Mean
-29	Use of Public Domain Software	5	4.037
30	Interactive Video	5	4.556
31	Science	5	6.296
+32	PASCAL Language	8	5.741
33	FORTRAN Lauguage	8	6.889
34	Assembler Programming	8	7.111
35	Job Control Language (JCL)	9	4.963
36	Authoring Systems	9	5.444
37	LOGO Language	9	6.296
38	Another computer language not mentioned	not rated	

- indicates movement down in ranking.
+ indicates movement up in ranking.

TABLE V

TEACHING METHODOLOGY RERANKINGS

Rank	Teaching Method	Mode	Mean
1	Demonstration - Small Group (1-10)	1	1.852
2.5	Small Groups (1-10) - Discussion	1	2.444
2.5	Students Teaching Students	1	2.444
4	Individualized Instruction	1	2.630
5	Lecture - Small Group (1-10)	1	2.704
6	Assignments/Homework	1	3.185
7	LAP's	1	3.222
8	Open Entry/Open Exit	1	4.593
9	Questions - Written	2	2.148
10	Drills	2	2.407
11	Small Groups (1-10) - Tutorial	2	2.778
12	Large Groups (> 10) - Discussion	2	3.111
13	Large Groups (> 10) - Brainstorming	2	3.481
14	Teaching Forum (guest speakers, industrial experts...)	2	3.519
15	Large Groups (> 10) - Tutorial	2	4.037
16	Tutoring	3	2.889
17	Questions - Oral	3	3.074
18	Small Groups (1-10) - Brainstorming	3	3.185
19	Lecture - Large Group (> 10)	3	3.667
20	Demonstration - Large Group (> 10)	3	4.481
21	Student Debate	5	5.185
22	Games	7	5.815

all in calculation of means. Revision of Tables II and III are presented in Appendix C, indicating items where there was a bimode.

Each respondent of Questionnaire No. 1 was mailed a cover letter and Questionnaire No. 2 (Appendix B) along with a postage paid envelope. Two weeks from the mail-out date of Questionnaire No. 2, the participants who had not yet responded were contacted by telephone. Table VI and VII shows the statements which the participants felt should be reranked and the position of rerank. Because there were so few rerankings indicated, it was concluded that there was no need to send out another questionnaire.

For the computer science subject area portion of the questionnaire, there were ten statements in which only one respondent indicated a change. Seven of those were changed by a magnitude of more than five. Six items were recommended for change by two respondents each. Seven of those changes would exceed a magnitude of five. There were two items in which three respondents recommend ranking change but none of those changes were of magnitude greater than five.

On the teaching methodologies portion of the questionnaire, there was one statement that only one respondent indicated a change. It had a magnitude of five. There were three items in which there was a recommended change by two respondents. Each of the recommendations was

TABLE VI

COMPUTER SCIENCE SUBJECT AREA
RECOMMENDED RERANK

Rank	Recommended Rerank	Subject Area
1	6	Diskette Care
2		Computer Terminology
3	4.3	Data Bases
5	3, 3	Keyboarding
5	4	Word Processing
5		Spread Sheets
7	2.3, 3, 3	Computer Components
8	23	Experience with more than one brand of computer or computer system
9	2.3, 3, 4	Operating Systems
10		File Structures
11		Data Structures
12	4	Integrating Software
13		Copywriting, Copyright Laws, Copy Protection
14		Hardware Interfacing
15	16, 37.5	BASIC Language
16	10,15	Flowcharting
17		Computer Peripherals
18		Computer Systems
19		Math
20		Telecommunications
21	13	Networking
22	1.5, 9	Maintenance/Upkeep/Safety
23	5, 8	Accounting
24		Graphics
25		Use of Public Domain Software
26		Binary Numbering System
27		COBOL Language

TABLE VI (CONTINUED)

Rank	Recommended Rerank	Subject Area
28		Hexadecimal Numbering System
29		Interactive Video
30		Science
31	38	FORTRAN Language
32		Assembler Programming
33.5	12	Job Control Language (JCL)
33.5	14.5, 31	PASCAL Language
35		Authoring Systems
36	15	LOGO Language
37.5		Another computer language not mentioned
37.5		Knowledge of more than one language

TABLE VII

TEACHING METHODOLOGY
RECOMMENDED RERANK

Rank	Recommended Rerank	Teaching Method
1		Demonstration - Small Group (1-10)
2		Drills
3		Individualized Instruction
4	9	Students Teaching Students
5	low, 2	LAP's
6		Assignments/Homework
7		Questions - Written
8.5		Lecture - Small Group (1-10)
8.5		Small Groups (1-10) - Tutorial
10		Teaching Forum (guest speakers, industrial experts...)
11	21.1, 23	Open Entry/Open Exit
12		Small Groups (1-10) - Discussion
13		Questions - Oral
14		Lecture - Large Group (> 10)
15	2-3, 3.5-4	Tutoring
16		Discussion
17		Small Groups (1-10) - Brainstorming
18		Demonstration - Large Group (> 10)
19		Large Groups (> 10) - Brainstorming
20		Large Groups (> 10) - Tutorial
21		Student Debate
22		Games

for a magnitude of greater than five except one did not have a specific magnitude. It was just reranked as "low".

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to address the lack of a defined computer science teacher education curriculum and to provide an empirical basis upon which it could evolve. This was accomplished by using the Delphi Technique and seeking information from instructors of information/data processing of area vocational and technical education schools in Oklahoma what they perceived to be the most important cognitive skills and knowledge needed in the area of computer science and what teaching methodologies were most appropriate for computer science instructors. This chapter presents a summary of the findings of this study, along with conclusions and recommendations based on these findings.

Summary of the Study

Computer Science Subject Areas

As indicated in Table IV, Chapter IV, there was a major break in rankings. This break indicates that those ranked lower than the break would definitely be a lower priority and curriculum developers should reflect

this finding in developing curriculum priorities.

Teaching Methodologies

As reflected by Table V, Chapter IV, those statements ranked lower than the break in rankings were considered to be the least appropriate teaching methods to be used by the teachers who were surveyed and should also be considered a lower priority to curriculum developers when developing curriculum priorities.

Conclusions

1. Based on the data analyzed for this study, the statements which fell below a major break in rankings were considered to be the least appropriate computer science subject areas and teaching methodologies.
2. Because of the diversity of equipment, teacher background, and local program needs, it may not be possible to achieve full consensus with this population and this topic. It is assumed that the variations expressed in the first response, and are incorporated in the rankings developed at that stage of development.

Recommendations

1. The findings and conclusions of this study should be distributed to planners, decision makers,

and others who play a part in the making of decisions of what teacher education courses should encompass.

2. Parallel studies should be done using a similar questionnaire as used in this study to survey the computer science instructors of the comprehensive high schools, and trainers of computer users in business and industry.
3. It is recommended that if a parallel study is done, the rankings should be done using the means of responses to each item, disreguarding the modes.
4. The findings and conclusions of this study should be distributed to teacher educators so that they will be better able to advise students who desire to pursue a program preparing them to teach the subject of computer science at the secondary level.
5. With the field of computer science changing rapidly, a person entering this field must be willing to constantly keep abreast of these changes.
6. It is recommended that curriculum for teacher education in computer science take into account the topics and rankings as identified in this study, and that it be modified to take into consideration special local needs or unusal

constraints that may be found to exist.

7. It should be reiterated that the information found in this study should be used as a guide which is appropriate at the time of this research, and that curriculum developers should strive to incorporate subsequent changes in technology and improve instructional methodologies as they evolve.

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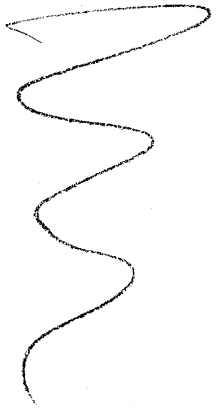
APPENDIXES



APPENDIX A

ROUND 1 INSTRUMENT

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

ROY PETERS, DIRECTOR • 1500 WEST SEVENTH AVE., • STILLWATER, OKLAHOMA 74074-4364 • A.C. (405) 377-2000

MEMORANDUM

TO: Information/Data Processing Instructors

FROM: Nancy Kimbrell, Research Assistant

DATE: February 10, 1987

SUBJECT: Computer Science Education Curriculum

With the use of computers becoming more apparent in our everyday lives, we need to become more computer literate. But, where will we acquire this knowledge more effectively? There is presently no set curriculum in Oklahoma colleges for a Computer Science Education student desiring to become a certified Computer Instructor at the elementary or secondary level. I am trying to compile a list of subject areas that should possibly be made a part of such a curriculum and I need your help.

I will be using a modified version of the **Delphi Technique** to gather information. This technique is useful for gathering opinions from persons like yourself who are knowledgeable in specific areas. However, this technique does not require individuals to get together and meet face-to-face. Successive questionnaires and feedback are necessary with each one designed to produce more of a group consensus. Two questionnaires will be used to gather and finalize your opinions.

Questionnaire No. 1	Lists of possible computer science subject areas and teaching methodologies have been compiled. In order for me to determine which subject areas and teaching methods are of more importance, I am asking you to evaluate or rate them according to your perception of their importance through your teaching experience.
Questionnaire No. 2	A list of priority factors will be compiled from the consensus obtained in Questionnaire No. 1. You will be asked to either revise your opinion to be in line with the priority list of specify your reasons for remaining outside the consensus.

From the responses obtained in Questionnaire No. 2, a final list will be compiled and distributed to you and to Dr. Betty Fry. The results of this study will be used to recommend a curriculum guide for future Computer Science Instructors.

In order to keep within the time frame allowed, I am asking that the attached questionnaire be returned by **February 27, 1987.** I hope that you will participate in this effort to set up a possible curriculum guide for students desiring to become Computer Science Instructors.

Thank you. Your assistance will be appreciated.

82-000704

QUESTIONNAIRE NO. 1 - PART I

NAME: _____

SCHOOL: _____

Below is a list of potential computer science education subject areas. In order for me to determine which of the subject areas are of utmost importance, I am asking you to rate each of them on a 9-point continuum, ranging from those having the most importance (1) to those having the least importance (9).

Please be selective in choosing those factors you consider as most important according to your own teaching experience.

EXAMPLE:

		Circle the rating: Most Important								Least Important
1.	Computer History	1	2	3	4	(5)	6	7	8	9
2.	Vacuum Tubes	1	2	3	4	5	6	(7)	8	9

1.	Computer Terminology	1	2	3	4	5	6	7	8	9
2.	Computer Components	1	2	3	4	5	6	7	8	9
3.	Math	1	2	3	4	5	6	7	8	9
4.	Keyboarding	1	2	3	4	5	6	7	8	9
5.	Accounting	1	2	3	4	5	6	7	8	9
6.	Science	1	2	3	4	5	6	7	8	9
7.	Maintenance/Upkeep/Safety	1	2	3	4	5	6	7	8	9
8.	Computer Systems	1	2	3	4	5	6	7	8	9
9.	Computer Peripherals	1	2	3	4	5	6	7	8	9
10.	Hardware Interfacing	1	2	3	4	5	6	7	8	9
11.	Networking	1	2	3	4	5	6	7	8	9
12.	Binary Numbering System	1	2	3	4	5	6	7	8	9
12.	Hexadecimal numbering System/ Representation.	1	2	3	4	5	6	7	8	9
14.	Operating Systems	1	2	3	4	5	6	7	8	9
15.	Job Control Language (JCL)	1	2	3	4	5	6	7	8	9
16.	Assembler Programming	1	2	3	4	5	6	7	8	9

		Most Important								Least Important
18.	COBOL Language	1	2	3	4	5	6	7	8	9
19.	FORTRAN Language	1	2	3	4	5	6	7	8	9
20.	PASCAL Language	1	2	3	4	5	6	7	8	9
21.	LOGO Language	1	2	3	4	5	6	7	8	9
22.	Authoring Systems	1	2	3	4	5	6	7	8	9
23.	Another computer language not mentioned	1	2	3	4	5	6	7	8	9
24.	Knowledge of more than one language	1	2	3	4	5	6	7	8	9
25.	Flowcharting	1	2	3	4	5	6	7	8	9
26.	File Structures	1	2	3	4	5	6	7	8	9
27.	Data Structures	1	2	3	4	5	6	7	8	9
28.	Word Processing	1	2	3	4	5	6	7	8	9
29.	Spread Sheets	1	2	3	4	5	6	7	8	9
30.	Data Bases	1	2	3	4	5	6	7	8	9
31.	Graphics	1	2	3	4	5	6	7	8	9
32.	Telecomunications	1	2	3	4	5	6	7	8	9
33.	Interactive Video	1	2	3	4	5	6	7	8	9
34.	Copywriting, Copyright Laws, Copy Protection	1	2	3	4	5	6	7	8	9
35.	Use of Public Domain Software	1	2	3	4	5	6	7	8	9
36.	Integrating Software	1	2	3	4	5	6	7	8	9
37.	Diskette Care	1	2	3	4	5	6	7	8	9
38.	Experience with more than one brand of computer or computer system	1	2	3	4	5	6	7	8	9

If I have somehow missed a subject area that you consider important, please write it in the space provided, circle the proper ranking, and state your reason for including it as a subject area.

---

1. 1 2 3 4 5 6 7 8 9

REASON:

---

2. 1 2 3 4 5 6 7 8 9

REASON:

---

3. 1 2 3 4 5 6 7 8 9

REASON:

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4. 1 2 3 4 5 6 7 8 9

REASON:

COMMENTS:

QUESTIONNAIRE NO. 1 - PART II

NAME: _____

SCHOOL: _____

Below is a list of teaching methodologies. In order for me to determine which of the methods have the greatest impact in teaching computer science, I am asking you to rate each of them on a 9-point continuum, ranging from those having the most importance (1) to those having the least importance (9).

Please be selective in choosing those factors you consider as most important according to your own teaching experience.

EXAMPLE:	Circle the rating: Most Important								Least Important
1. Examinations	1	(2)	3	4	5	6	7	8	9
2. Homework	1	2	(3)	4	5	6	7	8	9

---

1. Lecture -									
a. Small Group (1-10)	1	2	3	4	5	6	7	8	9
b. Large Group (> 10)	1	2	3	4	5	6	7	8	9
2. Demonstration -									
a. Small Group (1-10)	1	2	3	4	5	6	7	8	9
b. Large Group (> 10)	1	2	3	4	5	6	7	8	9
3. Questions -									
a. Oral	1	2	3	4	5	6	7	8	9
b. Written	1	2	3	4	5	6	7	8	9
4. Small Groups (1-10) -									
a. Brainstroming	1	2	3	4	5	6	7	8	9
b. Discussion	1	2	3	4	5	6	7	8	9
c. Tutorial	1	2	3	4	5	6	7	8	9
5. Large Groups (> 10) -									
a. Brainstorming	1	2	3	4	5	6	7	8	9
b. Discussion	1	2	3	4	5	6	7	8	9
c. Tutorial	1	2	3	4	5	6	7	8	9

		Most Important								Least Important
6	Individualized Instruction	1	2	3	4	5	6	7	8	9
7.	Students Teaching Students	1	2	3	4	5	6	7	8	9
8.	Assignments/Homework	1	2	3	4	5	6	7	8	9
9.	Drills	1	2	3	4	5	6	7	8	9
10.	Games	1	2	3	4	5	6	7	8	9
11.	Tutoring	1	2	3	4	5	6	7	8	9
12.	Teaching Forum (guest speakers, industrial experts...)	1	2	3	4	5	6	7	8	9
13.	Open Entry/Open Exit	1	2	3	4	5	6	7	8	9
14.	LAP's	1	2	3	4	5	6	7	8	9
15.	Student Debate	1	2	3	4	5	6	7	8	9

If I have somehow missed a teaching methodology that you consider important, please write it in the space provided, circle the proper ranking, and state your reason for including it as a teaching method.

---

1. 1 2 3 4 5 6 7 8 9

REASON:

---

2. 1 2 3 4 5 6 7 8 9

REASON:

---

3. 1 2 3 4 5 6 7 8 9

REASON:

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4. 1 2 3 4 5 6 7 8 9

REASON:

COMMENTS:

APPENDIX B

ROUND 2 INSTRUMENT

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

ROY PETERS, DIRECTOR • 1500 WEST SEVENTH AVE., • STILLWATER, OKLAHOMA 74074-4364 • A.C. (405) 377-2000

MEMORANDUM

TO: Information/Data Processing Instructors

FROM: Nancy Kimbrell, Research Assistant

DATE: March 4, 1987

SUBJECT: Computer Science Education Curriculum - Questionnaire #2

Thank you for your participation in the Delphi study to determine the most important subject areas and teaching methodologies needed by a Computer Science Education student. In this phase of the study I am asking that you review the rankings of each subject area and teaching methodology as listed on the attached questionnaires. Each area and method was rated on a nine-point continuum ranging from the most important (1) to the least important (9). Therefore, those subject areas and teaching methodologies considered as potentially having the greatest amount of impact on a Computer Science Education curriculum appear first in rank order.

If, after examing the ranked lists of subject areas and teaching methods, you feel that any of them should be placed significantly higher or lower on the list, please indicate your changes at the end of the questionnaire and state you reasons for the changes.

Please return the questionnaire by **March 20, 1987.** Upon completion of the study, a copy will be sent to you. If you have any questions concerning the study, please feel free to call.

Thank you for your assistance.

QUESTIONNAIRE NO. 2 - PART I
(Rankings derived from Questionnaire #1-Part I)

NAME: _____

SCHOOL: _____

Examine these ranked subject areas and, if you feel that they should be placed significantly higher or lower, use the space provided at the end of this questionnaire to indicate which factors and your justification as to why they should be placed higher or lower on our list of priorities. Please **return** this questionnaire.

Rank	Subject Area	Mode	Mean
1	Diskette Care	1	1.316
2	Computer Terminology	1	1.684
3	Data Bases	1	1.947
5	Keyboarding	1	2.053
5	Word Processing	1	2.053
5	Spread Sheets	1	2.053
7	Computer Components	1	2.263
8	Experience with more than one brand of computer or computer system	1	3.211
9	Operating Systems	2	2.316
10	File Structures	2	2.684
11	Data Structures	2	2.737
12	Integrating Software	2	2.789
13	Copywriting, Copyright Laws, Copy Protection	2	3.747
14	Hardware Interfacing	2	3.684
15	BASIC Language	2	3.947
16	Flowcharting	2	4.053
17	Computer Peripherals	3	2.526
18	Computer Systems	3	2.842
19	Math	3	3.842
20	Telecommunications	3	3.947

Rank	Subject Area	Mode	Mean
21	Networking	3	4.263
22	Maintenance/Upkeep/Safety	4	3.105
23	Accounting	4	3.263
24	Graphics	4	3.895
25	Use of Public Domain Software	4	4.105
26	Binary Numbering System	4	5.000
27	COBOL Language	4	5.158
28	Hexadecimal Numbering System	4	5.368
29	Interactive Video	5	4.789
30	Science	5	6.421
31	FORTRAN Language	8	6.895
32	Assembler Programming	8	7.211
33.5	Job Control Language (JCL)	9	5.579
33.5	PASCAL Language	9	5.579
35	Authoring Systems	9	6.316
36	LOGO Language	9	6.368
37.5	Another computer language not mentioned	not rated	
37.5	Knowledge of more than one language	not rated	

Write the rank number and the justification as to why you feel this factor should receive a lower or higher ranking. (Use back of pages for extra space.)

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

QUESTIONNAIRE NO. 2 - PART II
(Rankings derived from Questionnaire #1-Part II)

NAME: _____

SCHOOL: _____

Examine these ranked teaching methods and, if you feel that they should be placed significantly higher or lower, use the space provided at the end of this questionnaire to indicate which factors and your justification as to why they should be placed higher or lower on our list of priorities. Please **return** this questionnaire.

Rank	Teaching Method	Mode	Mean
1	Demonstration - Small Group (1-10)	1	2.000
2	Drills	1	2.526
3	Individualized Instruction	1	2.579
4	Students Teaching Students	1	2.632
5	LAP's	1	3.211
6	Assignments/Homework	1	3.263
7	Questions - Written	2	2.158
8.5	Lecture - Small Group (1-10)	2	3.053
8.5	Small Groups (1-10) - Tutorial	2	3.053
10	Teaching Forum (guest speakers, industrial experts...)	2	3.947
11	Open Entry/Open Exit	2	4.789
12	Small Groups (1-10) - Discussion	3	2.684
13	Questions - Oral	3	3.158
14	Lecture - Large Group (> 10)	3	3.947
15	Tutoring	4	3.158
16	Discussion	4	3.263
17	Small Groups (1-10) - Brainstorming	4	3.316
18	Demonstration - Large Group (> 10)	4	4.632
19	Large Groups (> 10) - Brainstorming	5	3.526
20	Large Groups (> 10) - Tutorial	5	4.474
21	Student Debate	5	5.579
22	Games	5	6.053

Write the rank number and the justification as to why you feel this factor should receive a lower or higher ranking. (Use back of pages for extra space.)

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____

PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

PRESENT RANK NO.: _____
PREFERRED RANKING: _____

REASON FOR RANKING CHANGE:

APPENDIX C

BIMODE LISTINGS

COMPUTER SCIENCE SUBJECT AREA
RANKINGS AND BIMODES

Rank	Subject Area	Mode	Mean
1	Diskette Care	1	1.316
2	Computer Terminology	1	1.684
3	Data Bases	1,2*	1.947
5	Keyboarding	1	2.053
5	Word Processing	1,2*	2.053
5	Spread Sheets	1,2*	2.053
7	Computer Components	1	2.263
8	Experience with more than one brand of computer or computer system	1,2*	3.211
9	Operating Systems	2	2.316
10	File Structures	2	2.684
11	Data Structures	2	2.737
12	Integrating Software	2	2.789
13	Copywriting, Copyright Laws, Copy Protection	2	3.747
14	Hardware Interfacing	2	3.684
15	BASIC Language	2	3.947
16	Flowcharting	2	4.053
17	Computer Peripherals	3	2.526
18	Computer Systems	3	2.842
19	Math	3	3.842
20	Telecommunications	3	3.947
21	Networking	3,6*	4.263
22	Maintenance/Upkeep/Safety	4	3.105
23	Accounting	4	3.263
24	Graphics	4	3.895
25	Use of Public Domain Software	4	4.105
26	Binary Numbering System	4	5.000
27	COBOL Language	4	5.158
28	Hexadecimal Numbering System	4	5.368
29	Interactive Video	5	4.789

COMPUTER SCIENCE SUBJECT AREA
RANKINGS AND BIMODES
(CONTINUED)

Rank	Subject Area	Mode	Mean
30	Science	5	6.421
31	FORTRAN Language	8	6.895
32	Assembler Programming	8	7.211
33.5	Job Control Language (JCL)	9	5.579
33.5	PASCAL Language	9	5.579
35	Authoring Systems	9	6.316
36	LOGO Language	9	6.368
37.5	Another computer language not mentioned	not rated	
37.5	Knowledge of more than one language	not rated	

* indicates a bimode.

TEACHING METHODOLOGY
RANKINGS AND BIMODES

Rank	Teaching Method	Mode	Mean
1	Demonstration - Small Group (1-10)	1,2*	2.000
2	Drills	1,2*	2.526
3	Individualized Instruction	1	2.579
4	Students Teaching Students	1	2.632
5	LAP's	1,2*	3.211
6	Assignments/Homework	1	3.263
7	Questions - Written	2	2.158
8.5	Lecture - Small Group (1-10)	2,3*	3.053
8.5	Small Groups (1-10) - Tutorial	2	3.053
10	Teaching Forum (guest speakers, industrial experts...)	2,4*	3.947
11	Open Entry/Open Exit	2,9*	4.789
12	Small Groups (1-10) - Discussion	3,4*	2.684
13	Questions - Oral	3	3.158
14	Lecture - Large Group (> 10)	3	3.947
15	Tutoring	4	3.158
16	Discussion	4	3.263
17	Small Groups (1-10) - Brainstorming	4	3.316
18	Demonstration - Large Group (> 10)	4	4.632
19	Large Groups (> 10) - Brainstorming	5	3.526
20	Large Groups (> 10) - Tutorial	5	4.474
21	Student Debate	5	5.579
22	Games	5,7*	6.053

* indicates a bimode.

VITA

Nancy Kay Kimbrell

Candidate for the Degree of

Master of Science

Thesis: EDUCATIONAL BACKGROUND REQUIREMENTS OF COMPUTER SCIENCE INSTRUCTORS

Major Field: Technical Education

Bibographical:

Personal Data: Born in Nowata, Oklahoma, February 6, 1964, the daughter of Billy R. and Wanda L. Kimbrell.

Education: Graduated from Oaks High School, Oaks, Oklahoma, in May, 1982; received Associate in Technology Degree in Computer Science from Northeastern Oklahoma A&M College in May, 1984; received Bachelor of Science Degree in Technical Education from Oklahoma State University in May, 1986; completed requirements for the Master of Science degree at Oklahoma State University in May, 1987.

Professional Experience: Lab Assistant, Computer Science Department, Northeastern Oklahoma A&M College, August, 1982, to May, 1984; Microcomputer Programer, Oklahoma State Department of Vocational and Technical Education, VIEW Division, March, 1985, to May, 1986; Graduate Research Assistant, Oklahoma State Department of Vocational and Technical Education, Research Division, May, 1986, to present.