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AUTHOR Kloosterman, Peter; And Others
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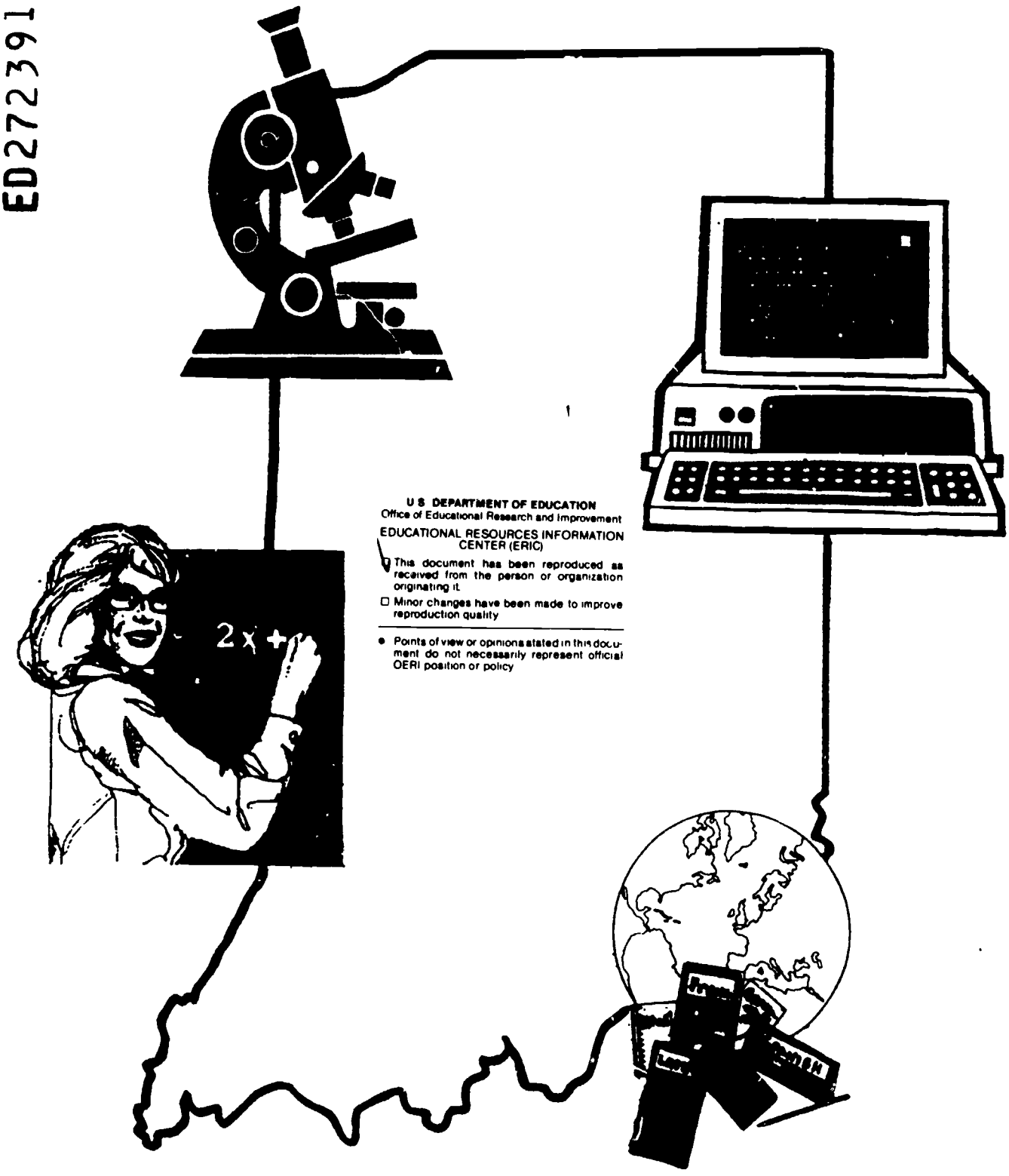
ABSTRACT

The purpose, design, and results of a study of teacher certification and qualifications for the subjects of science, mathematics, foreign language, and computer learning in Indiana are presented in this document. Sections of the report include: (1) contextual setting (explaining the federal regulations of needs assessments); (2) needs identification in public high schools (discussing the revision, administration, and results of a survey of teacher certification in science, mathematics, and foreign language and assessing the current state of computer learning as well as addressing issues of teacher quality); (3) needs identification in other areas of concern (presenting data for non-public high schools, public elementary and junior high schools, and higher education institutions); (4) assessment of needs for related groups (highlighting information on programs to increase participation of underserved student populations); and (5) implications for enhancement (summarizing and synthesizing data results into conclusions, projections, and recommendations). The document also contains a reference list, 13 appendices and 58 tables. The study concluded that most high school teachers were certified in their subject areas, but the major issue in Indiana is the quality of instruction not the process of certification. (ML)

Indiana Needs Analysis Project



Department of Curriculum and Instruction
School of Education
Indiana University
Bloomington, Indiana 47405

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Final Report

NEED SENSING, ASSESSING, AND VALIDATION FOR SCIENCE, MATHEMATICS, COMPUTER, AND FOREIGN LANGUAGE EDUCATION IN THE STATE OF INDIANA

Project Co-Investigators

Peter Kloosterman
Harold Harty

Project Assistants

Jack Matkin
Phyllis Campbell Ault

Gerald R. Smith, Chairperson
Department of Curriculum & Instruction

School of Education
Indiana University
Bloomington, Indiana

May, 1986

Howard Mehlinger, Dean

Preface

When reading this document, one should begin by noting that the study reported here was intended to give a picture of teacher certification and qualifications in the subjects of science, mathematics, foreign language, and computer learning. Additional portions of the study dealt with issues such as access to these subjects by underrepresented populations along with five year projections of change in all of these areas. The intent with respect to the design and production of this document has been to give readers a full picture of the purpose, design, and results of this study as well as to give policy makers our interpretations of the implications of the results. We have made every effort to make this Report very complete yet to keep it as non-technical as possible. Forthcoming revisions of this Report will be designed for more specific audiences, and therefore, include more information on a few selected topics and less on the substantial array of issues covered here.

To help readers understand the background and framework of this needs assessment, the section labeled "Contextual Setting" includes information on the federal regulations which were the initial impetus for this study. Included in the sections entitled "Needs Identification in Public High Schools" is a discussion of the revision, administration, and results of a survey of teacher certification in science, mathematics, and foreign language. The subsection labeled "Validation of Collected Needs Assessment Data" compares the data collected in this study to data on certification available from two other sources.

As Indiana has no certification standards for computing teachers, it was not possible to collect certification data for computing teachers using the methods employed for the other subject areas. In the subsection "Computer Education," an attempt was made to give some general information on the current state of computer learning in Indiana as well as a picture of where computer learning is headed and the problems that are likely to surface. The subsection entitled "Supplementary Teacher Quality/ Availability Survey" evolved from the concern that data showing that teachers were certified did not necessarily show that they were highly qualified. Results of this supplementary survey address the issue of teacher quality although one must be cautioned that the current study was too limited in scope and resources to provide a truly reliable assessment of teacher quality from a statewide perspective.

In the section called "Needs Identification in Other Areas of Concern," various data are presented for non-public high schools, public elementary and junior high schools, and higher education institutions. Although these educational agencies were not the major focus of this study, some of the findings with respect to these levels of education should be of interest to policy makers.

The section referred to as "Assessment of Needs for Related Groups" presents information on programs to increase participation in science, mathematics, foreign language, and computing by underserved student populations. The final section of text entitled "Implications for Enhancement" attempts to summarize and synthesize the voluminous data reported by making a series of conclusions and projections based on those

conclusions. Recommendations to policy makers are also included in this section. For individuals interested in many of the specific procedures and instruments used in data collection, a series of appendices has also been provided.

Overview of Process-Product

The first major task to be completed by the needs analysis project staff was the fine tuning and mailing of a survey instrument to all superintendents in the state of Indiana. The major focus of this instrument was to ascertain the number of uncertified teachers of science, mathematics, and foreign language in the State. While the Chief State School Officers' final draft of this instrument was expected in August, it was not received until late September. It also took longer than expected to get approval for a letter from Indiana officials (State Education Department and Higher Education Commission) encouraging superintendents to fill out the survey questionnaire. While these delays put mailing of the five-page survey behind schedule, it was still sent out by late October with a deadline for return of November 15. A second mailing and a number of phone calls produced a 95% return rate from public schools by January 15, 1986. By far the most surprising finding from this general survey was the high rate of certification of Indiana teachers of science, mathematics, and foreign language. As outlined in other parts of this Report, certification rates varied from 89% in physics to 99% in mathematics. While there was doubt about the accuracy of these findings at first, subsequent investigations of two other data bases lead us to the conclusion that these figures were valid. The reader should be cautioned, however, that the high rates of certification reported in this document should not be interpreted as meaning that instruction in science, mathematics, and foreign language in Indiana high schools is adequate. It is quite possible that many of the certified teachers in these subject areas are doing a less than adequate job. Also, note that while this assessment was to include data on computer learning, Indiana does not have specific certification requirements for computer learning teachers; and thus, qualitative data on computer learning have been substituted for certification rates in this subject area.

In addition to the certification data obtained through the master survey, the original timetable had proposed a series of interviews with school, state education department, and higher education officials to gather qualitative data on the issues of teacher quality, special programs for underserved groups, needs for instructional materials, etc. While these interviews were a little behind schedule, they were all completed by April 1, 1986. The collected data are too numerous to try to summarize here; however, two points deserve mention. The first involves the validity of data collected on teacher quality in science, mathematics, and foreign language. To assess teacher quality, project staff interviewed school administrators as this was the only feasible method of obtaining data on quality that was within the budget of the project. It is entirely possible that having content experts in science, mathematics, and foreign language observe and evaluate teachers in these subjects might have resulted in very different findings about teacher quality than was obtained from administrators. Unfortunately, it would require an extensive research study costing several hundred thousand dollars to

obtain a clearer picture of teacher quality in the sciences, mathematics, and foreign languages. The second point that should be mentioned involves the lack of minority teachers in the State of Indiana. Details of findings on this point are explained later in this Report, but it is clear that the percentage of minority teachers in Indiana is substantially smaller than the percentage of minority students. In addition, it appears that the situation may get worse in the near future. Recommendations concerning this finding, as well as all other findings of the needs analysis, are detailed in the "Implications for Enhancement" section of this Report.

Acknowledgments:

Seldom is an effort of this nature and magnitude successful without help and encouragement from many people. The completion of this needs assessment effort would not have been possible without the generous assistance of numerous individuals. While many individuals are listed here, highest praise goes to Jack Matkin and Phyllis Campbell Ault who, as project assistants, worked on every aspect of the study from initial revisions of instruments through writing and revising of this Report. Each of them took responsibility for pieces of the study and developed instruments, collected data, and drafted reports on those pieces. In addition, they were invaluable in the day to day organization and implementation of the project as a whole. Without their efforts, this document and the data reported would have been much less complete and of much less value.

Also included high on the list of those who deserve thanks and recognitions are volunteers who served as members of the Project Advisory Committee and as Project Associates. These individuals made suggestions on project design and implementation, and thus provided context validation of the study and its results from an external perspective. The individuals are:

Project Advisory Committee

Dr. Larry Campbell, Director
Office of School Programs, Indiana University
Ms. Mary Carr, President
Indiana Foreign Language Association
Dr. Neyland Clark, Assistant Superintendent
Brown County Schools, Nashville, IN
Dr. Charles Dilk, Principal
Parkside Elementary School, Columbus, IN
Mr. David Flowers, President
Indiana Computer Educators
Ms. Jennifer Grossman, Teacher
Lakeview Elementary School, Bloomington, IN
Dr. John Harris, Director
Center for Urban and Multicultural Education, IUPUI
Ms. Bettye Lou Jerrel, Member
Indiana State Board of Education
Mr. Mike Kasper, President
Indiana Council of Mathematics Teachers

Dr. George Swafford, President
Indiana Association for Teacher Educators
Mr. Lee E. Williford, President
Hoosier Science Teachers Association
Mr. Donald Winslow
Coordinator of School Science, Indiana University
Mr. Jerry Colglazier, Indiana Department of Education
(ex officio)
Dr. Earl Francq, Indiana Department of Education
(ex officio)
Dr. Karen Rasmussen, Indiana Commission for Higher Education
(ex officio)

Project Associates

Dr. Hans Andersen, Science Education
Indiana University
Dr. J. Marvin Ebbert, Associate Dean of the Faculties for Learning Resources, IUPUI
Dr. Tom Gregory, Director
Office of Instructional Computing
Indiana University
Dr. Frank Lester, Mathematics Education
Indiana University
Ms. Lorraine Strasheim, Foreign Language Education
Indiana University

As this study required input and expertise on a wide variety of topics, it was necessary to call on many individuals throughout the State of Indiana for information, contacts, and access to data. While the total list of such individuals is probably in the hundreds, the following people were particularly helpful. From the Indiana Department of Education, Earl Francq, Jerry Colglazier, John Harrold, and Martha Hegg provided data on needs in elementary and middle schools, and gave us guidance on feedback from the Department's perspective throughout the project. Pat Stafford provided suggestions and data on gifted and talented programs in the State. Dallas Daniels and Daryle Mason provided contacts and data on programs for underserved populations in Indiana. Kim Powers and Jim Biddle offered their insights and provided contacts on vocational education. Dixie Whitney and Ann Patterson were very helpful in getting us information on certification questions. In addition, we had numerous contacts with staff of the Division of Educational Information and Research of the Indiana Department of Education. These individuals were very helpful in providing us with data collected throughout the State on a variety of topics.

Representatives of a variety of other organizations were also very helpful in the data collection process. Karen Rasmussen and the staff of Indiana Higher Education Commission provided guidance on the project as well as data on higher education institutions in Indiana. Stanley Warren of DePauw University shared his data on black faculty and black students enrolled in teacher education programs with us. Camilla Heid of the Center for Urban and Multicultural Education spoke with us on special math and science programs for women and minorities. Data collection for the computer learning section of this Report involved a series of lengthy

interviews. Mike Olds of the Indiana Clearinghouse for Computer Education was instrumental in providing us with data and contacts in this area. Other individuals interviewed for the computer learning section were Nancy Miller of Clinton Prairie Schools, B.J. Eib of Linton-Stockton Schools, and Margaruite Hart of Washington Township Schools, and regional computer training directors John Soudah, Nancy Miller, James Pershing, and Charles Price.

As deadlines approached for preparing this document, some data collection and much writing of the Report had fallen behind schedule. Several Indiana University doctoral level graduate students helped us catch up by doing interviews and drafting sections of this Report, often on a very tight schedule. We would like to thank Jeff Woods, who drafted portions of the Report on the public and non-public school core results. Beatriz D'Ambrosio, Jackie Gorman, and Diana Krcll did most of the interviews and original writing for the section on the supplementary teacher quality/availability survey and on the section dealing with materials and equipment needs. Patty Haynes-Gainey worked on the section concerning minority students and teachers. Gayle Reiten did data tabulation for parts of the core validation results; Howard Kalman completed the interviews and drafted a working document on the concerns of the business and industry.

Another time consuming aspect of this project involved the clerical chores of typing notes and tables as well as the many drafts of this Report. Ann Fischer worked diligently all year in this regard, and was helped by Valerie Matkin during the final push to complete the Report. Valerie is also responsible for the cover of the document. Debbie Woodward was helpful in many respects but particularly in her ability to speed requisitions through the bureaucratic channels.

Finally, we would like to thank the numerous school system personnel who filled out our questionnaires and responded to our phone queries for data on a variety of issues. Their cooperation lead to an exceptionally high rate of response on all of our instruments which made our findings more valid in terms of the entire State of Indiana.

In short, this study was a major undertaking which required cooperation from numerous individuals. To all those mentioned above, and to those others too numerous to mention, we extend a whole hearted thank you.

P.K.
H.H.
Bloomington, Indiana
May, 1986

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CONTEXTUAL SETTING

During the spring of 1985, federal regulations were passed for states to obtain Title II funds which required that each state wishing funds undertake a needs assessment. The regulations required states to assess the status of mathematics, science, foreign languages, and computer learning within the state's public and private secondary schools. As part of the assessment in these content areas, each state was to assess and make five-year projections on the availability of teachers, instructional materials, and equipment, and on the degree of access to instruction by historically underrepresented and underserved groups and of the gifted and talented.

The assessment was also required to include a description of programs and initiatives within each state to improve teacher availability and qualifications, and to increase access by underrepresented groups to these content areas. Each state's assessment was to be developed in consultation with legislative bodies, public and private elementary and secondary schools, vocational schools, institutions of higher education, private industry, and other interested groups. Finally, the assessment was to be submitted jointly by each state's department of education and higher education agency. What follows is that assessment Report for Indiana.

Within the State of Indiana, the Indiana Commission for Higher Education assumed the task of overseeing the needs assessment outlined above. During June of 1985, the Commission sent out a request for proposals to do the assessment for Indiana. By that time, a survey instrument dealing with the issues outlined in the assessment regulations was being developed by the Council of Chief State Schools Officers with a grant from the National Science Foundation. The Commission asked that organizations seeking to undertake the Indiana assessment to use the Chief State School Officers' instrument to the extent that it was applicable to the specific assessment requirements of Indiana. A proposal from Indiana University to undertake the Indiana needs assessment was submitted on July 31, 1985 by the School of Education's Department of Curriculum and Instruction (APPENDIX A - "Original Project Design and Timetable"). Late in August, tentative notification was sent that the Indiana University proposal had been accepted, and thus work on the project began.

Backdrop for Needs Assessment

One of the first activities to be undertaken by the staff of the "Indiana Needs Analysis Project" was to invite participation on a Project Advisory Committee by teacher groups and content experts involved with science, mathematics, foreign language, and computer learning in Indiana (APPENDIX B - "Composition and Minutes of Project Advisory Committee"). At the same time that the Project Advisory Committee was being formed, the project staff was working with the latest drafts of the survey instrument from the Council of Chief State School Officers. In its final and extensively field tested form, that instrument consisted of two parts. The first part, known as the "core" instrument involved questions on teacher certification and was intended for use by all states. The second

part of the instrument, known as the "models" instrument, involved the much less quantifiable questions of teacher quality and retention, special programs for underrepresented groups, etc. On the advice of the Project Advisory Committee, only the core instrument was sent to school systems in Indiana (APPENDIX B). Data on issues in the models instruments were gathered from existing data bases and from an extensive set of in-person and telephone interviews. Once final approval of Indiana University as the contractor for the Indiana needs analysis took place on September 13, 1986, work progressed as planned in the timetable of the original proposal (APPENDIX A).

* * * * *

NEEDS IDENTIFICATION IN PUBLIC HIGH SCHOOLS

To help states carry out the needs assessment mandated by federal Title II legislation, the Council of Chief State School Officers (CCSSO) in Washington, D.C. compiled an instrument (APPENDIX C - "Survey of Public School Teachers of Science, Mathematics, and Foreign Languages") for surveying certification of teachers of science, mathematics, computer learning, and foreign languages with funding from the National Science Foundation. This instrument was disseminated to all states for use in their assessments with the intention that it would be copied and sent to all school systems in each state. The instrument was composed of six inquiry sections dealing with: (1) number of uncertified teachers, (2) number of class sections taught by uncertified teachers, (3) quality of new hires, (4) number of initial teaching certificates issued, (5) number of retirees through 1990, and (6) state standards for certification. Note that this instrument has commonly been referred to as the Chief State School Officers' "core" instrument to distinguish it from a "models" instrument package which was also developed but which was only to be used by states that felt it was appropriate. The national core instrument (APPENDIX C) was modified slightly for the purpose of ascertaining the most pertinent information from the Indiana school districts. The modified Indiana core instrument contained four sections rather than the original six as it was felt that points 4 and 6 (above) required data that were most readily available from State agencies rather than individual school districts. The "models" instrument package was not used.

The version of the "Survey of Public School Teachers of Science, Mathematics, and Foreign Languages" (APPENDIX C) in Indiana contained four sections seeking information regarding number of uncertified teachers, number of sections taught by uncertified teachers, number of retirees through 1990, and quality of new hires in the 1985-86 school year. The survey also asked the respondents to indicate the size of their school districts. For each of the four sections, table shells were given. Subjects only had to respond by writing numbers in the appropriate boxes. The total time required to fill out the questionnaire was estimated at 30 minutes. The questionnaire probed for information in the subject areas of science, mathematics, and foreign language. Since there are currently no certification requirements for computer learning in Indiana, this subject area was not included in the survey. Rather, this information was gathered qualitatively using interviews.

Part I of the Indiana core instrument asked for the number of persons teaching each subject area, and the number teaching in each area without certification in that subject. In order to assess the total number of persons teaching in areas without certification, respondents were asked to count persons more than once who taught in more than one area. Part II of the core instrument dealt with the number of class sections taught by uncertified teachers. Respondents were asked to indicate the number of class sections taught in each area, and the number of class sections taught by uncertified persons. If several persons were counted as teaching in more than one subject area in Part I, this would also show up in Part II. Part III of the core instrument asked for the number of retirees in grades 7-12 of each subject area from 1985-86 through

1989-90. Unfortunately, retirements are often optional or tentative so these data are somewhat subjective. However, this information is critical in predicting the future needs of Indiana schools so the question was included in the core instrument. Part IV of the core instrument dealt with the certification of persons hired in 1984-85. Respondents were asked to indicate: (a) the number of new teachers in each subject area, (b) the number teaching without certification, (c) the number coming directly from a teacher training program, (d) the number coming directly from a teaching position in another state, and (e) the number with prior teaching experience who did not teach the previous year. Respondents were to indicate these totals in FTE units (full-time equivalents). Several examples of how to calculate FTE were included with the instrument.

Results from a Statewide Survey

A copy of the core instrument (APPENDIX C) was mailed to each public school system in Indiana. Each survey was mailed with a letter from H. Dean Evans, Indiana State Superintendent of Schools, and Clyde R. Ingle, Commissioner of Higher Education in Indiana. This letter (APPENDIX C) emphasized the improvement of teacher education in Indiana and the importance of meeting requirements of Title II of the Federal Education for Economic Security Act. A very detailed and precise instructional cover letter (APPENDIX C) was also included to insure a high response rate and accurate completion of the survey form.

The survey of public school teachers of science, mathematics, and foreign languages was mailed to each of the 305 superintendents of public school systems in Indiana. Ten school corporations were later dropped from the sample because it was found that they did not have high schools. After a second mailing and a set of confirmatory and exploratory telephone interviews, only ten surveys were left unreturned. Four additional surveys were so poorly filled out that even phone contacts did not make them comprehendable. Thus, data were analyzed on 281 out of a possible 295 or 95.25% of the school corporations with high schools in Indiana. In short, data pertaining to the public schools give a very complete picture of Indiana public school corporations. Because Indiana data are so complete, there is a strong possibility that data from Indiana will be cited as representative of an area much larger than the boundaries of the Hoosier State. While the public schools survey was mailed to the superintendent of each corporation, in some cases the task of responding to the survey was delegated to another individual. This occurred mainly in large school corporations where someone other than the superintendent was best qualified to supply the data requested.

One should be cautioned while examining the data on the subject areas, that the data relate only to certification rather than "quality" of teaching. The data from the core instrument give no information about the quality of instruction taking place in Indiana schools. Also, students now entering high school are required to have two credits of science and mathematics to graduate instead of one. A substantial majority of students graduating under old requirements had taken at least two years of science and math, but the potential for this new requirement causing greater teacher shortages should be considered in relation to the following data.

As each subject area is discussed, two tables will be presented for each high school subject. The tables will reveal figures regarding teacher certification for: (a) current and, (b) newly hired teachers in Indiana's public high schools.

Overview

The most surprising finding of the study is that there appears to be very few uncertified science, mathematics, and foreign language teachers in Indiana high schools. As pointed out in the preface, this finding should not be interpreted as meaning that quality of instruction in these areas is satisfactory. Teacher shortages are most severe in the areas of physics and general science, although only 10.8% of physics class sections and 7.3% of general science class sections are taught by uncertified teachers. Of science, mathematics, and foreign language, the lowest percent of classes taught by uncertified teachers was found in mathematics (0.6%). This is true even though there are the most teachers in this subject. Compared to other subject areas, French classes have the lowest actual percent of uncertified teachers (0.8%) with mathematics also very low (1%). In looking at specific subject areas, it appears that concern may arise in physics, general science, German, and Latin. Biology and French on the other hand seem to currently be matching the need for teachers with the supply. In reviewing the data, note that questions on newly hired teachers referred to the 1984-85 school year whereas other data were for the 1985-86 school year. Also note that data on retiring teachers are for grades 7-12 while all other data are for grades 9-12. This variation in grade levels was done at the request of the Council of Chief State School Officers.

Science

The shortage of certified science teachers is the greatest in the physical sciences. Data are reported separately for each science area.

Biology: Overall, the greatest number of fully certified teachers in any science area were found in biology. Compared to other subjects, a rather low proportion of retiring teachers were found (about 11%). Compared to the other sciences, biology had the lowest percentage of class sections taught by uncertified teachers (1.4%). TABLE 1 reveals these data. Seven percent of all biology teachers were hired in 1984-85. Of the new hires, only 4% were uncertified (TABLE 2).

Chemistry: Compared to other subjects, the number of uncertified chemistry teachers was relatively low. Also, the proportion of teachers expected to retire in the next four years was fairly low (TABLE 3). Relative to the total number of chemistry teachers in the State, few new teachers were hired in this field (5%). Most of those had taught the previous year (TABLE 4). A fairly high proportion (14%) of the newly hired chemistry teachers were uncertified in chemistry although the actual numbers were small (3.44 out of 24.94 full time equivalents of teachers). About half (12.32 out of 24.94 full time equivalents) of the newly hired teachers came directly from a teacher training program (TABLE 4).

TABLE 1

BIOLOGY TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	35	1	2.9	43	4	9.3	4
10,000-49,999 (n=17)	263	8	3.8	930	31	3.3	37
4,000-9,999 (n=34)	193	2	1.0	715	3	0.4	19
500-3,999 (n=215)	440	3	0.7	1569	9	0.6	45
1-499 (n=14)	19	0	0	39	0	0	3
Total: 1-100,000+ (n= 281)	954	14	1.5	3296	47	1.4	108

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 2

NEW BIOLOGY TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	14.60	2.2	4.60	3.40	0.80
4,000-9,999 (n=34)	16.40	0.40	5.10	0	4.00
500-3,999 (n=215)	33.96	0 17	18.09	4.85	4.60
1-499 (n=14)	0.68	0	0.34	0	1.00
Total: 1-100,000+ (n=281)	65.64	2.77	28.13	8.25	10.40

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 3

CHEMISTRY TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers	
50,000-99,999 (n=1)	12	0	0	31	0	0	4
10,000-49,999 (n=17)	90	4	4.4	306	14	4.6	21
4,000-9,999 (n=34)	88	2	2.3	334	4	1.2	12
500-3,999 (n=215)	256	8	3.1	742	19	2.6	26
1-499 (n=14)	13	1	7.7	20	1	5.0	1
Total: 1-100,000+ (n= 281)	459	15	3.3	1433	38	2.7	64

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 4

NEW CHEMISTRY TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	1.00	0	1.00	0	0
10,000-49,999 (n=17)	6.30	0.60	3.30	2.00	0
4,000-9,999 (n=34)	6.70	0.70	2.80	1.60	0
500-3,999 (n=215)	10.60	1.87	5.05	1.51	1.28
1-499 (n=14)	0.34	0.17	0.17	0.17	0
Total: 1-100,000+ (n=281)	24.94	3.44	12.32	4.68	1.28

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

Earth Science: Of all the sciences, earth science contained the least number of current teachers and the fewest number of expected retirees. The percent of teachers without certification (5.1%) was about two percent higher than the percent of class sections (3.3%) taught by uncertified teachers (TABLE 5). This indicates that teachers from other subjects were teaching earth science as part of their teaching assignment. Very few new teachers (9.39) were hired in earth science during the 1984-85 school year (TABLE 6). A large proportion of new hires came directly from a teacher training program (6.74 out of 10.93). Compared to the other sciences (TABLE 6), earth science had the least number of teachers hired from outside Indiana (only 0.44 of 10.93).

General Science: In the public schools, the number of uncertified teachers in general science was fairly high (TABLE 7) when compared to the other subject areas (general science 5.9%, only physics was higher). It should be noted in the State's largest school system, 88% (44 out of 50) of sections of general science were taught by uncertified teachers (10 of the 18 teachers were uncertified) indicating a severe problem in that school system. In all the school size categories, a fairly large number of general science teachers are expected to retire by 1990 (TABLE 7). This made general science the subject area with the greatest percentage of anticipated retirements (100 out of 555 or about 18%). A fairly large number of teachers (TABLE 8) were newly hired in 1984-85 in general science (55.77). Of those new hires, 4.31 of the 55.77 were uncertified. More than half of those (26.39) came directly from a teacher training program (TABLE 8).

Physics: The number of uncertified teachers (38) was higher in the area of physics than in other subject areas (TABLE 9). This trend seems likely to continue as about 1/3 of all newly hired teachers in physics were uncertified, although there were only 9.38 newly hired physics teachers in 1984-85 (TABLE 10). A fairly high proportion of physics teachers (TABLE 10) are expected to retire by 1990 (59 of 360 or about 16%). Except for general science, this ratio is the highest in the sciences.

Mathematics

The greatest number of teachers in any subject area was found in mathematics (TABLE 11). The greatest actual number of expected retirees was also in this area. In perspective, the number of expected retires as a percentage of the total was not particularly high in this area (10%). Certification of incoming teachers in mathematics was not a significant problem. The percent of uncertified teachers in mathematics was lower than any of the sciences (1.0%). The number of newly hired teachers without certification (TABLE 12) was also very low (7.73 out of 211.54 or about 4%). As in other subject areas (chemistry, general science, and French), about half of the newly hired mathematics teachers came directly from a teacher training institution. Mathematics (along with general science) had a relatively high number of new teachers in the 1984-85 school year (211.54 or about 10%). Of all subject areas surveyed, mathematics has the lowest percent of class sections with uncertified teachers (0.6%). TABLES 11 and 12 summarize data on mathematics teachers.

TABLE 5

EARTH SCIENCE TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	12	1	8.3	42	3	7.1	2
10,000-49,999 (n=17)	40	4	10.0	108	5	4.6	10
4,000-9,999 (n=34)	49	1	2.0	162	2	1.2	4
500-3,999 (n=215)	148	7	4.7	349	12	3.4	31
1-499 (n=14)	5	0	0	9	0	0	2
Total: 1-100,000+ (n= 281)	254	13	5.1	670	22	3.3	27

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 6

NEW EARTH SCIENCE TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	2.00	0.40	0.40	0	0
4,000-9,999 (n=34)	3.00	0	3.00	0	0
500-3,999 (n=215)	5.76	0.76	3.17	0.14	1.28
1-499 (n=14)	0.17	0	0.17	0	0
Total 1-100,000+ (n=281)	10.93	1.16	6.74	0.14	1.28

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 7

GENERAL SCIENCE TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	18	10	55.6	50	44	88.0	5
10,000-49,999 (n=17)	132	4	3.0	362	10	2.8	45
4,000-9,999 (n=34)	100	4	4.0	276	14	5.1	18
500-3,999 (n=215)	293	14	4.8	748	37	4.9	31
1-499 (n=14)	12	1	8.3	14	1	7.1	2
Total: 1-100,000+ (n= 281)	555	33	5.9	1450	106	7.3	100

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 8

NEW GENERAL SCIENCE TEACHER CERTIFICATION IN PUBLIC SCHOOLS

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	11.70	0	2.60	1.60	6.30
4,000-9,999 (n=34)	14.30	0.50	7.40	0	0
500-3,999 (n=215)	28.86	3.81	16.22	3.21	2.68
1-499 (n=14)	0.91	0	0.17	0.34	0.40
Total: 1-100,000+ (n=281)	55.77	4.31	26.39	5.15	9.38

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 9

PHYSICS TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	8	1	12.5	14	3	21.4	3
10,000-49,999 (n=17)	57	4	0.7	156	8	5.1	20
4,000-9,999 (n=34)	46	5	10.9	124	13	10.5	4
500-3,999 (n=215)	227	27	11.9	317	42	13.2	30
1-499 (n=14)	12	1	8.3	12	1	8.3	2
Total: 1-100,000+ (n= 281)	360	38	10.6	623	67	10.8	59

[a] 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 10

NEW PHYSICS TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	2.00	1.00	1.00	0	0
10,000-49,999 (n=17)	1.20	1.00	0.20	1.00	0
4,000-9,999 (n=34)	0.20	0	0.20	0	0
500-3,999 (n=215)	5.99	1.28	2.50	1.34	0.88
1-499 (n=14)	0	0	0	0	0
Total: 1-100,000+ (n=281)	9.39	3.28	3.90	2.34	0.88

[a] 1984-85 school year; grades 9-12

[b] "Number" refers to F.T.E. (full time equivalent)

TABLE 11

MATHEMATICS TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	78	0	0	337	0	0	23
10,000-49,999 (n=17)	576	4	0.7	3001	11	0.4	91
4,000-9,999 (n=34)	465	2	0.4	2174	3	0.1	36
500-3,999 (n=215)	1045	16	1.5	4449	46	1.0	74
1-499 (n=14)	38	0	0	116	0	0	2
Total: 1-100,000+ (n= 281)	2202	22	1.0	10077	60	0.6	226

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 12

NEW MATHEMATICS TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	16.00	2.00	5.00	0	0
10,000-49,999 (n=17)	40.95	0.20	18.70	5.40	3.50
4,000-9,999 (n=34)	43.70	1.00	16.40	4.00	6.50
500-3,999 (n=215)	107.44	4.53	58.02	9.39	15.50
1-499 (n=14)	3.45	0	3.00	0	1.28
Total: 1-100,000+ (n=281)	211.54	7.73	101.12	18.79	26.78

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

Foreign Languages

In the public schools, the percentage of uncertified teachers was lower in the foreign languages than in mathematics or the sciences. These trends continue with newly hired teachers in the foreign languages.

French: In the public schools, the percentage of uncertified teachers in French was the lowest (TABLE 13) when compared to other languages (0.8%). This trend seems likely to continue in light of the data concerning newly hired teachers. Of the 17.61 FTE of new teachers in French, not one newly hired teacher in the public schools was uncertified (TABLE 14). Added to this high certification record are the data on retirees. Of all subject areas surveyed, French had the lowest proportion expected to retire by 1990 (26 out of 374). Most newly hired French teachers came directly from a teacher training program (TABLE 14).

German: In the public schools, 3.1% of all German teachers were uncertified (TABLE 15). The number of expected retirements before 1990 is high relative to the other foreign languages as 17 out of 106 (about 16%) are expected to retire (TABLE 16). As a percentage, the number of newly hired teachers in 1984-85 was higher than in any other foreign language (11.88 out of about 106 teachers or approximately 11%). General science and mathematics had similar levels of new hires although there were five to ten times more teachers in those subjects. About half of the newly hired German teachers did not teach the previous year (TABLE 16).

Latin: Of the four principle languages surveyed (TABLE 17), Latin had the greatest percent of uncertified teachers (4%). Although only 2.5% of class sections were taught by uncertified teachers, a relatively high percentage of Latin teachers are expected to retire over the next five years (21 out of 126 or about 17%). The percentage of newly hired Latin teachers in 1984-85 (8.58 out of 126 or about 7%) was similar to percentages in many other subject areas. All newly hired Latin teachers were certified (TABLE 18). Similar to German but unlike other subjects, about half of the new hires did not teach the previous year. No newly hired Latin teachers came directly from a teacher training program (TABLE 18).

Spanish: The highest number of foreign language teachers was found in Spanish (527). Of these, few were uncertified (1.5%). An estimated 21 out of 527 Spanish teachers are expected to retire before 1990 (TABLE 19). This is similar to the proportion of retirements in French but low compared to other subject areas. A typical proportion of new teachers were hired in Spanish (44.08 teachers or about 8%). Most of the newly hired teachers came directly from a teacher training program (TABLE 20).

Other Foreign Languages: There were only ten foreign language teachers outside the areas of French, German, Latin, and Spanish in the public schools, and three of them were uncertified (TABLE 21). Of the 2.0 newly

TABLE 13

FRENCH TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	10	0	0	41	0	0	0
10,000-49,999 (n=17)	89	1	1.1	309	2	0.6	14
4,000-9,999 (n=34)	81	0	0	316	0	0	4
500-3,999 (n=215)	186	2	1.1	633	7	1.1	8
1-499 (n=14)	8	0	0	20	0	0	0
Total: 1-100,000+ (n= 281)	374	3	0.8	1319	9	0.7	26

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 14

NEW FRENCH TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	4.98	0	3.40	0.68	0.50
4,000-9,999 (n=34)	3.00	0	2.00	0	0.60
500-3,999 (n=215)	9.29	0	3.59	0.17	1.51
1-499 (n=14)	0.34	0	0	0	1.00
Total: 1-100,000+ (n=281)	17.61	0	8.99	0.85	3.61

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 15

GERMAN TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	6	0	0	16	0	0	0
10,000-49,999 (n=17)	52	2	3.8	198	6	3.0	8
4,000-9,999 (n=34)	50	0	0	182	0	0	4
500-3,999 (n=215)	85	3	3.5	290	9	3.1	5
1-499 (n=14)	3	1	33.3	8	2	25.0	0
Total: 1-100,000+ (n= 281)	196	6	3.1	694	17	2.4	17

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 16

NEW GERMAN TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	5.80	0	0.60	1.00	2.60
4,000-9,999 (n=34)	1.77	0	0	0	1.77
500-3,999 (n=215)	4.31	1.00	1.00	0	1.31
1-499 (n=14)	0	0	0	0	0
Total: 1-100,000+ (n=281)	11.88	1.00	1.60	1.00	5.68

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 17

LATIN TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	6	0	0	10	0	0	1
10,000-49,999 (n=17)	46	3	6.5	125	6	4.8	9
4,000-9,999 (n=34)	29	2	6.9	80	2	2.5	3
500-3,999 (n=215)	45	0	0	108	0	0	8
1-499 (n=14)	0	0	0	0	0	0	0
Total: 1-100,000+ (n= 281)	126	5	4.0	323	8	2.5	21

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 18

NEW LATIN TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	0	0	0	0	0
10,000-49,999 (n=17)	5.01	0	0	2.00	3.01
4,000-9,999 (n=34)	1.00	0	0	0	0
500-3,999 (n=215)	2.57	0	0	0	1.00
1-499 (n=14)	0	0	0	0	0
Total: 1-100,000+ (n=281)	8.58	0	0	2.00	4.01

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

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TABLE 19

SPANISH TEACHER CERTIFICATION IN PUBLIC SCHOOLS [a]

School System Size	Teachers [b]			Class Sections [b]			Number of Teachers Expected to Retire 1985-1990 [c]
Number of Students K-12	Number in Subject Area	Number without Certification [d]	Percent without Certification [d]	Number in Subject Area	Number in Subject Area without Certified Teachers [d]	Percent in Subject Area without Certified Teachers [d]	
50,000-99,999 (n=1)	10	0	0	41	0	0	3
10,000-49,999 (n=17)	123	1	0.8	486	3	0.6	19
4,000-9,999 (n=34)	113	1	0.9	470	4	0.9	5
500-3,999 (n=215)	269	5	1.0	1111	19	1.7	22
1-499 (n=14)	12	1	8.3	30	2	6.7	2
Total: 1-100,000+ (n= 281)	527	8	1.5	2138	28	1.3	51

[a] 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] without certification in this subject area; teachers with temporary or limited certification were considered not certified

TABLE 20

NEW SPANISH TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	3.00	0	0	0	0
10,000-49,999 (n=17)	7.37	0.60	2.60	1.00	0.67
4,000-9,999 (n=34)	7.60	0.80	3.20	0	1.10
500-3,999 (n=215)	25.43	1.40	11.05	2.17	3.94
1-499 (n=14)	0.68	0	0	0	1.00
Total: 1-100,000+ (n=281)	44.08	2.80	16.85	3.17	6.71

[a]1984-85 school year; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 21

OTHER FOREIGN LANGUAGES TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size	Teachers[b]			Class Sections[b]			Number of Teachers Expected to Retire 1986-1990[c]
Number of Students K-12	Number in Subject Area	Number without Certification[d]	Percent without Certification[d]	Number in Subject Area	Number in Subject Area without Certified Teachers[d]	Percent in Subject Area without Certified Teachers[d]	
50,000-99,999 (n=1)	4	0	0	4	0	0	0
10,000-49,999 (n=17)	2	1	50.0	4	1	25.0	0
4,000-9,999 (n=34)	3	2	66.7	5	4	80.0	1
500-3,999 (n=215)	1	0	0	1	0	0	0
1-499 (n=14)	0	0	0	0	0	0	0
Total: 1-100,000+ (n= 281)	10	3	30.0	14	5	35.7	1

[a]1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]without certification in this subject area; teachers with temporary or limited certification were considered not certified

hired FTE teachers in 1984-85, 1.8 FTE were uncertified (TABLE 22). Thus, there continues to be a potential certification problem outside the four main foreign language areas. However, the sample is currently so small that any predictions would be difficult to make.

Validation of Collected Needs Assessment Data

Two attempts were made to validate the data received by way of the public high school survey (APPENDIX C). With respect to the first check, a random sample of school corporations was chosen and data from the current study were compared to reports from the Indiana Department of Education (Indiana Department of Education, 1986) and the North Central Association for School Accredation (North Central Association for School Accredation, 1986). As a second check, the total number of uncertified teachers ascertained from the present study were compared to the total number of uncertified teachers in each subject area as reported by the Indiana Department of Education (Indiana Department of Education, 1986).

As a further explanation of the first data validity, a random sample of 20 of the 295 Indiana school districts with high schools was chosen. The number of uncertified teachers in the areas of biology, chemistry, earth science, general science, physics, mathematics, French, German, Latin, Spanish, and other foreign languages was tabulated for the 20 school districts. TABLE 23 shows the comparison of data obtained from the three sources: the present Needs Analysis Survey, the North Central Association, and the State Education Department. The present study reported the greatest number of uncertified teachers. Reports to the North Central Association revealed a lesser number, and data from reports to the State Education Department represented an even lesser total number. Five of the school districts chosen at random contained unaccredited schools. Data from these unaccredited schools were not sent to the North Central Association (NCA). Thus, the total sample available for comparison between the present survey and the NCA was reduced from 20 to 15. Of these 15 schools there was exact agreement between the present study, and the North Central Association data in 12 of the 15 schools. Of the three discrepancies, the present study reported one extra uncertified school teacher in District #9, and one less uncertified teacher in Districts #8 and #11.

The agreement between the present study and the State Education Department information was not as great. Only 11 of 20 school districts matched exactly. In every case but one (in District #1), the present study reported more uncertified teachers than the State Education Department data. In comparing data from the State Education Department and the North Central Association, there was agreement in 11 of 15 school districts. In 3 of the 4 disagreements, the North Central Association data showed one more uncertified teacher.

As a second check on the validity of the results of the present study, data from the current study were compared with data on the total number of teachers teaching without regular certification in Indiana. These data were obtained from the Educational Information and Research Division of the Indiana Department of Education (Indiana Department of Education, 1986). These results appear in TABLE 24. Each subject area

TABLE 22

NEW ALL OTHER LANGUAGES TEACHER CERTIFICATION IN PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position Outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year Within or Outside of Indiana
50,000-99,999 (n=1)	1.00	1.00	0	0	0
10,000-49,999 (n=17)	0	0	0	0	0
4,000-9,999 (n=34)	0.80	0.80	0	0	0
500-3,999 (n=215)	0.20	0	0	0	0
1-499 (n=14)	0	0	0	0	0
Total: 1-100,000+ (n=281)	2.00	1.80	0	0	0

[a] 1984-85 school year; grades 9-12

[b] "Number" refers to F.T.E. (full time equivalent)

TABLE 23

COMPARISON OF NUMBER OF UNCERTIFIED TEACHERS AMONG TWENTY RANDOMLY SELECTED SCHOOL DISTRICTS FROM THREE SOURCES OF DATA

School District	Source[a]	Biology	Chemistry	Earth Science	General Science	Physics	Mathematics	French	German	Latin	Spanish	Other Languages
1	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
2	N.A.	-	-	1	1	2	-	-	-	-	-	-
	N.C.A.	Unaccredited School										
	S.D.	-	-	-	-	-	-	-	-	-	-	-
3	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	Unaccredited School										
	S.D.	-	-	-	-	-	-	-	-	-	-	-
4	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
5	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
6	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
7	N.A.	-	-	1	-	1	-	-	-	-	-	-
	N.C.A.	Unaccredited School										
	S.D.	-	-	-	-	-	-	-	-	-	-	-
8	N.A.	-	-	-	-	-	1	-	-	-	-	-
	N.C.A.	-	-	-	-	1	1	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
9	N.A.	-	-	-	-	1	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
10	N.A.	-	-	-	-	-	-	-	-	2	-	-
	N.C.A.	-	-	-	-	-	-	-	-	2	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-

[a] N.A. = Needs Analysis
N.C.A. = North Central Association
S.D. = State Department

TABLE 23 (Cont'd)

COMPARISON OF NUMBER OF UNCERTIFIED TEACHERS AMONG TWENTY RANDOMLY SELECTED SCHOOL DISTRICTS FROM THREE SOURCES OF DATA

School District	Source[a]	Biology	Chemistry	Earth Science	General Science	Physics	Mathematics	French	German	Latin	Spanish	Other Languages
11	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	1	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
12	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
13	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
14	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
15	N.A.	-	1	-	-	1	-	1	-	-	-	-
	N.C.A.	Unaccredited School										
	S.D.	-	-	-	-	-	-	-	1	-	-	-
16	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
17	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
18	N.A.	-	-	1	1	-	-	-	-	-	-	-
	N.C.A.	Unaccredited School										
	S.D.	-	-	-	1	-	-	-	-	-	-	-
19	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-
20	N.A.	-	-	-	-	-	-	-	-	-	-	-
	N.C.A.	-	-	-	-	-	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-	-	-	-	-	-

[a]N.A. = Needs Analysis
N.C.A. = North Central Association
S.D. = State Department

TABLE 24

COMPARISON OF PRESENT STUDY WITH STATE DEPARTMENT DATA ON TOTAL NUMBER OF UNCERTIFIED TEACHERS

Subject Areas / Data Sources	Number of Uncertified Teachers	
	Present Needs Assessment Study	State Department Information
French	3	1
German	6	2
Latin	5	1
Spanish	8	6
Other Languages	3	5
Mathematics	22	22
Biology	14	8
Chemistry	12	6
Earth Science	13	1
General Science	33	4
Physics	38	6

was compared. Total agreement was found in only the area of mathematics, with each study reporting 22 uncertified teachers. In all other areas except one, the present study reported more uncertified teachers than were reported by the State Education Department. An interesting point to note is that in foreign language, the largest discrepancy between the present data and State Education Department data was 4 teachers. In science, however, discrepancies between the two sources ranged from 6 to 32 teachers. It is unclear why State Education Department data for foreign language were so much closer to present study data than were data for science.

An interesting side note to the issue of uncertified teachers is the question of what sort of qualifications uncertified personnel posessed. Included in the data obtained from the State Department of Education (Indiana Department of Education, 1986) was a listing of college degrees held by non-certified teachers. All non-certified science, mathematics, and foreign language teachers on that listing had at least a bachelor's degree and many had master's degrees. While no information was available on how closely these degrees corresponded with the subject the individual was teaching, the data do show that non-certified teachers in Indiana all have at least four years of college training.

Getting back to task, it is necessary to consider possible reasons for the discrepancies which did occur between the three data sources of: (a) the present Needs Analysis survey, (b) the North Central Association data, and (c) the State Education Department information. The explanations are generated from a deep sense of familiarity with the subject at hand. The speculations include, but should be limited to the following:

* It is possible that school districts have been reporting exactly the same information but differences occur because of various lag times in the different bureaucratical structures.

* Changes in staff may have occurred between reporting deadlines to the different agencies.

* There may have been confusion when a person teaches in 2 or 3 areas, but is certified in only one. Attempts were made to alleviate some of this confusion in the wording of the questions, but one can rarely remove all ambiguity.

* It is possible that some school corporations were trying to hide the fact that they have uncertified teachers, and thus did not report them on the questionnaire.

Computer Education

The State of Indiana requires that students receive computer instruction. How schools do that is left to the discretion of each district. Indiana does not currently have certification program for computer teachers. There is a new program at Indiana University for the "computer endorsement" which education students or teachers may choose to complete. This is currently a small program with fewer than a dozen

students on the Bloomington campus. This endorsement is not currently required to teach computer classes. Thus, as computer "certification" is not a viable means of assessing computer instructors, other methods of evaluating computer instruction in Indiana were used by the Needs Analysis Project Staff.

The use of computers in classrooms in Indiana as well as the nation continues to grow rapidly. This continued rapid change in the status of school computers makes quantitative data quickly outdated. The Indiana Clearinghouse for Computer Education (ICCE) completed a survey in the spring of 1985 which gathered data on several pertinent questions. (APPENDIX D - "Indiana Clearinghouse for Computer Education's Computer Utilization Survey Results"). Although the data are probably outdated, the survey does indicate general trends. By far the most used microcomputer in Indiana schools is the Apple. Of 22,593 microcomputers listed in the ICCE survey, about half (11,335) were Apples. Computer Literacy is most frequently taught during the middle school years, although across the state it was taught at all grade levels in various schools. Finally, the ICCE survey indicated that the most frequently reported instructional applications of computers in Indiana were: Computer Literacy Instruction, BASIC Programming, Computer Assisted Instruction, and Word Processing.

Methodology

Rather than replicate the ICCE survey a year later, it was decided to review recent national surveys, (Becker, 1986; Reinhold & Corkett, 1985), interview experts in the field, and use a case study approach to examine in depth several schools with model computer curricula. By selecting schools with outstanding computer programs a perspective was gained on the "cutting edge" of school computer use and a glimpse at the future as more and more schools use computers on a similar level.

After interviewing the Field Services Coordinator for the ICCE (APPENDIX E - "Computer Education Information Interview Outlines"), and receiving suggestions from the Project Advisory Board, four schools were selected to look at "up-close". The case study schools were:

School	Grades	Enrollment
Clinton-Prarie Corporation	K-12	1,000
Linton-Stockton Corporation	K-12	1,400
MSD Washington Township Northview	6-8	870
MSD Washington Township North Central	9-12	3,500

Also interviewed (APPENDIX F - "Computer Education Trends or Directions Interview Schedule") were four of nine directors of regional computer training centers for teachers in Indiana. These directors were:

Training Director	Region
John Soudah	I
Nancy Miller	IV
James Pershing	VII
Charles Price	VIII

State of Computer Learning in Indiana

Indiana has an extensive program for training teachers in using computers. An estimated 2/3 of the school professional staffs in the State have had some training. This year the nine regional training centers around the State are offering what is called "Level II Training" which builds on initial exposure. Although State funds are no longer available for "Basic Training" sessions, some centers are continuing to offer these introductory workshops as well. It was noted that a second crop of teachers have come along who have seen the usefulness of computers in the classroom. They now view them as an integral part of a classroom, and have requested the basic training which had previously been offered.

A State loan program has made computer acquisitions affordable to almost any school with interest. However, it was mentioned it is often difficult to convince school administrators to invest additional funds for sufficient software. Currently many schools need greater access for more students to broaden their programs. Schools are struggling with how to best broaden their scope with some looking for additional hardware, others adding networks, and some purchasing multiple copies of software.

There is great diversity in the degree to which schools have become involved with computers. Many schools began their computer programs with an interested teacher in the math or science department and a limited number of computers. Many schools are still at that level. It was noted that "we still haven't gotten to the meaningful stage" with computer programs in most schools. Many schools have computers but not the supporting framework necessary for effectively using them. Some schools are in a "transition" period; using a lab, tied to the math or science departments but are not integrating computer use into the curriculum. Still others have lab space which can be scheduled and additional computers which circulate to classrooms as teaching tools.

Computer use in many schools often begins with a cadre of teachers who are motivated and enthusiastic about the potential of computer use. These teachers initiate original acquisition of materials and build administrative commitment to a computer program. Interest is then sparked in other teachers who also become involved. Typically, some training occurs to encourage hesitant teachers. Soon frustration develops as the demand for computers exceeds resources, at which time more hardware and software are obtained. Finally, an atmosphere evolves where teachers are expected to use computers (and often required to do so) as part of the curriculum, with a computer coordinator to manage the program. At this stage there is administrative as well as peer support for integrating computers into each subject area or grade level. Eventually even reluctant teachers begin to recognize that their students would benefit from various computer uses. Ideally these schools then reach a level where computers are used as a tool. Although highly appropriate, the use of computers in libraries has been very slow but is catching on as computer use becomes more widespread. The use of data bases, spread sheets, word-processing, drill and practice, and computer assisted instruction (CAI) make computers a versatile tool with innumerable applications to subject areas. Even the most "computer-wise" schools are still working at getting teachers to recognize situations where computer use would be effective and make their teaching more efficient.

The Division of Educational Information and Research (EIR) of the Indiana Department of Education (1985b) provided some interesting data on enrollments for the State. By far the greatest number of students in grades 9-12 taking a computer course were in the category of "Computer Programming I" (10,449 during the 1st semester 1985-1986). This number was on a level with enrollments in beginning French, level II biology, or basic art. The data were at first puzzling. Although a high percent of teachers have been trained in computer use, and schools report increasing use, the actual percent of students in computer classes is low. The problem may be that many computer uses don't fit into a convenient course title. It is anticipated that computers will be integrated into the classroom more and more as a tool. When this is occurring, those classes aren't listed as specific computer classes. Also special programs which don't fit into defined categories may be missed, such as computer-augmented-algebra classes. Additionally, teacher uses like gradebooks and record keeping are not apparent in course enrollment data. It is the hope of experts in the field that these applications which are outside the bounds of a course offering will be increasing steadily. This means that although computer use in Indiana schools continues to rise, it may not show up as increasing enrollments in computer classes per se. Once again, it is evident that quantitative measures of computer classes may not reflect a clear picture of the field.

Trends in Computer Use

Based on the case studies and interviews, several trends seem to be emerging. These are general directions that "state of the art" schools seem to be headed in.

* INTEGRATING COMPUTERS INTO CLASSROOMS OR SUBJECT AREAS

Schools with model computer curricula are providing support and opportunities for teachers to integrate computers into their classes. School coordinators work with teachers to incorporate computer use where it will benefit students. Educators are viewing computers as tools rather than a passing fad or a piece of equipment which students can learn about in isolation. Schools are beginning to realize computers are not an "add-on" but a real contribution. It has been noted that teachers "are using computers to do things they can't really do very easily without a computer" such as printer-based uses like class newspapers.

* PARTICIPATION IN REGIONAL MEETINGS, WORKSHOPS, AND CONFERENCES

This is an opportunity for teachers to keep up to date, discuss problems, issues and programs, share information and resources and get feedback from peers. Teachers in the forefront of computer use in the schools are finding the top a lonely place. Different regions are trying to meet their needs in various ways. Coordinators hold meetings, regional training centers offer courses, and teachers within buildings share experiences. However, they are in need of college or relevant university course work. Teachers in Boston, Massachusetts can enroll in three degree programs designed specifically for them. In Indiana classes tailored to

teachers' needs are seldom offered. Teachers are often self-taught, but unable to "test-out" of prerequisite classes. Applicable classes are often taught during the day when teachers are unavailable. The result is a turning away from traditional institutions toward professional organizations for training and new ideas. It was mentioned that some school districts in a region are considering the possibility of sharing a person to provide inservice training, oversee purchases, and rotate software.

* LAB SET-UP WITH PORTABLES FOR USE IN INDIVIDUAL CLASSROOMS

All of the schools visited had two or more labs set up. These labs were used for computer classes (literacy, programming, etc.) as well as for subject area or grade level classes. Labs tend to be used a high percentage of time. Schedules are maintained to block out times for various classes and to keep in use at an optimal level. In addition, portable computer units are available for teachers to use in their own rooms. All of the schools visited also had a computer coordinator to oversee the program and equipment, support teachers, and schedule computer use. This position is crucial to the smooth operation of a computer lab.

* USE OF NETWORKS LIKE CORVUS OR WICAT IN AREAS WHERE THERE IS ENOUGH SIMILARITY IN HARDWARE

A computer network is a set of computers in one school that are wired together so that a single piece of software can be used on all the computers at once. This approach enables an entire class to access the same software program. If a school is using a series of software like MECC (Minnesota Educational Computing Consortium) this is particularly useful. Unfortunately, networks can be slow to "boot-up" and are limited to material on the network. Many companies also charge three to ten times the single copy price for software that is to be used on a network. Thus, software for networks can be almost as expensive as buying single copies. Some of the schools interviewed are negotiating with software companies to obtain more economical arrangements.

* CONCERN OVER SOFTWARE QUALITY

Concern was expressed by several people over the quality of software on the market. Principles of instructional design or efforts to use the full capability of computers are not always considered. In addition software may not address specific needs of a teacher. Companies are also slow in responding to the need for "lab packs" or "site licenses" for schools. Many schools make extensive use of MECC software because it is very inexpensive and covers many subject areas.

* BUSINESS APPLICATIONS OF COMPUTER TECHNOLOGY ARE SEPARATE FROM OTHER PROGRAMS

Business classes tend to have their own labs with computers restricted for use by their students. Vocational areas have been more

involved in computer use than other subject areas as they have a greater focus on employee readiness for the job market. Often IBM compatibles are used so that current business application software can also be used.

* EVOLVING PROGRAMS

All the case-study schools have plans for acquiring more computers next year and expanding or revising their computer usage. Many schools are struggling with hardware and software problems as well as program questions. The middle school is becoming the time when computer literacy is most often taught. Elementary schools are finding relevant applications in the early grades. The technology and versatility of computers has grown so rapidly, that schools are struggling to keep up.

Limitations/Common Problems in Computer Usage

* INVOLVING RELUCTANT TEACHERS

Everyone involved in the study commented on the problem of how to encourage teachers with low interest in computers to use computers with their classes. Computer coordinators in a school play a critical role in this involvement process. They can demonstrate relevant applications, and provide the assistance necessary for lagging teachers to attempt to use computers. Leaders need to continuously show how computer use can make teachers more effective and efficient.

* EFFECTIVE USE OF COMPUTERS

As teachers become more comfortable with computer use, they are looking for effective ways to integrate computers into their curricula. Making teachers aware of available and appropriate software is critical to their using it, yet is a time-consuming endeavor.

* ORGANIZING SOFTWARE

The Dewey Decimal System is not practical for filing software. As a result each school has devised its own method of organizing software. For schools with extensive computer programs some software may "fall between the cracks" because it does not fall into any one particular category.

* TEACHER SUPPORT

Teachers who are involved in computer use need:
- adequate resources which are maintained,
- a coordinator or teacher with release time to spend on organizing the computer program, not an "add-on" responsibility,
- administrative commitment and planning.

Coordinators' Recommendations

In each of the case study schools, the coordinators spent time with Needs Analysis Project staff explaining their programs and reviewing their facilities. They have a unique perspective on their whole school. Coordinators interact and observe teachers throughout the school and across disciplines. This has given them insight into what makes for successful teaching using computers.

The following is a list of recommendations from coordinators to teacher training institutions. The coordinators felt experience in these areas would enhance a new teacher's ability to use computers in the classroom.

* A course in instructional development focusing on integrating materials like software and activities with their subject area. Also experience in planning units of study which use computers effectively as tools.

* Word processing experience on at least two different word processors, as well as data base experience.

* Teaching methods classes with a problem-solving emphasis, training in "thinking skills". Less focus on drill and practice or "right-answer" orientation.

* Exposure to different types of software and evaluation of use with emphasis on applications.

* Opportunities to attend at conferences on a regular basis to learn-how-to-learn in an informal setting, and get acquainted with professional organizations.

* Models for the use of innovation and creativity ir teaching.

Coordinators have often been in the position of being the first person in their school to fill the coordinator's job. They have defined it as they went along. They are close to this evolving process and recognize strengths which they've used as coordinators. Computer coordinators need:

* Management skills - with an ability to organize people, programs, resources, budgets, and time.

* Social skills - must like people, be able to support, push, encourage, and teach staff as well as children.

* Appreciation for all subject areas, keeping a "whole-school" focus.

* Programming and maintenance skills especially at the high school level.

Summary

The need for computer teachers in Indiana is an unresolved issue. The extensive and continuing training program for Indinana's teachers has made a great number of them "computer literate" although there is currently no certification requirement. Although the "endorsement" for computer teachers is available, it is not necessary to teach computer classes. There is presently an adequate pool of teachers for programming classes. However, it is difficult to evaluate the quality of instruction in many such classes statewide..

While there is diversity across the State with regard to the status of computer use, there is also similarity. As schools move toward accepting computers as a teaching tool and integrating them into the curriculum, there are several considerations. Administrators need to recognize that developing a program and supporting teachers in computer use is not a job which can be added on to most teaching loads. Computers are not tools which can be placed in a room and be effectively used without back-up software, maintentance, and teacher support. The new positions of computer "coordinators" or "coaches" are evolving as critical roles in successful programs. To make a program work, schools need to make an investment in supporting hardware and software. In addition, as technology advances and schools become more comfortable with computers, school personnel and parents need to plan the development of programs to best meet the needs of their students.

Supplementary Teacher Quality-Availability Survey

While results from the core instrument (APPENDIX C) indicate the extent to which uncertified teachers are teaching in Indiana, they give no indication about the quality of instruction in science, mathematics, and foreign language. In an attempt to get a feeling for quality of instruction, twenty school systems were selected for additional study. These districts were chosen using a stratified random sampling technique designed to make sure several large districts were studied. This was done because, while 80% of the school systems in the State have fewer than 4,000 students in grades K thru 12, the large districts in the State are big enough to represent a substantial proportion of the school-age population.

In addition to needing information on teacher quality, data were also sought on teacher availability and turnover so that projections on teacher shortages from 1986-1990 could be made. It was felt that administrators in charge of personnel would usually be able to answer questions about both teacher quality and availability so the questions from these areas were combined into one survey (APPENDIX G - "Teacher Quality/Availability Interview Schedule"). Because quality, availability, and certification are all related, it seemed logical that the individuals who had completed the core survey (APPENDIX C) would be appropriate contacts for these additional questions so they were the people who were asked to respond to the telephone survey (APPENDIX G). This proved to be appropriate as the superintendents, high school principals, or personnel directors who had filled out the core instrument were able to provide the quality and availability information that was requested.

To gather data on the issues of teacher quality and availability, a 10 minute telephone survey instrument was developed (APPENDIX G). Briefly, the "quality" questions on the instrument included queries on: (1) teachers' content knowledge of the subject area where they were teaching, and (2) teachers' ability to communicate their knowledge. The "availability" portion of the instrument (APPENDIX G) included questions about whether administrators had experienced or expected to experience difficulty in hiring qualified applicants in science, math, and foreign language, and questions on turnover of teachers in these subjects.

While the major purpose of the phone interviews outlined here was to gather data on the quality of instruction in science, math, and foreign language, it must be pointed out that the data collected were from school administrators who were not content experts in these subjects. If it were possible, for example, to have experts in mathematics instruction observe math teachers' classes, the following conclusions about the effectiveness of the math teachers in the State of Indiana might have been quite different. Observations by content experts probably would have been a much more valid measure of teacher quality. Unfortunately, such an investigation was far beyond the resources available for this study, and thus the project was forced to rely on administrator comments as a proxy for teacher quality. In short, because administrators often have a different view of "quality" teaching than content experts, the results reported here on teacher quality might be viewed with some skepticism.

Teacher Quality

In the first part of the interviews the administrator contacted was asked about the quality of his or her teachers with respect to two issues. The first issue was teachers' mastery of their subject area, and the second was the teachers' ability to effectively communicate their knowledge.

Content Knowledge

The interviewees were asked to place their science, math, and foreign language teachers into one of three categories: (1) those who knew the subject area very well (probably majored or had a strong minor in it), (2) those who knew the subject area adequately (knowledge weak or somewhat out of date), and (3) those who really didn't know the subject area very well or sometimes provided incorrect information. Thirty percent of the corporations indicated that 100% of their teachers in each of the three subject areas fell into the (best) first category. TABLE 25 summarizes the data on this question. Note that numbers in TABLE 25 indicate frequency of response by administrators. For example, the 8 in the upper left of the TABLE 25 indicates that 8 of the 20 administrators (40%) surveyed felt that 100% of their high school science teachers possessed excellent content knowledge in science, 11 of the 20 (55%) felt that 100% of their math teachers possessed excellent content knowledge in math, and 13 of the 20 (65%) felt that 100% of their foreign language teachers had excellent content knowledge in foreign language. In general, the high frequencies in the upper left portions of TABLE 25 and the low frequencies in "poor" sections of TABLE 25 reflect that while administrators were not

TABLE 25

KNOWLEDGE IN SUBJECT AREAS OF SCIENCE, MATH,
AND FOREIGN LANGUAGE TEACHERS

Percent of Teachers in Category	Frequency of Administrator Ratings[a]								
	Strong Content Knowledge			Adequate Content Knowledge			Poor Content Knowledge		
	Science	Math	Foreign Language	Science	Math	Foreign Language	Science	Math	Foreign Language
100	8	11	13			2			
80 - 99	7	5	2						
60 - 79	3	1	2	1					
40 - 59	-	3	1	2	3	1			
20 - 39	2			4	2	2	1		
0 - 19				5	5	2		2	1

[a]based on a stratified random sample of 20 Indiana School Corporations

completely satisfied with the content knowledge of their science, math, and foreign language teachers, most were at least generally pleased with their teachers in these subjects.

When administrators were asked to make suggestions about ways in which their teachers could increase their subject area knowledge, three general categories of responses emerged. The first method commonly cited for improving subject area expertise was inservice programs. Some administrators suggested these programs as an effective way to enhance teachers' knowledge of the subject matter. Others felt that this strategy can be good if it is planned as an on-going program but that it is usually ineffective if done once as a workshop, and then not followed up in the near future. A few of the respondents indicated that their teachers react negatively to such programs because participation is usually required. One respondent suggested motivating teachers by making inservice programs financially rewarding.

A second suggestion for improving teachers' knowledge of subject areas was to encourage the teachers to take course work at a college or university. Many teachers do this only until they acquire a master's degree. Some respondents felt that teachers should return to colleges or universities more often for continual updating of their knowledge. One administrator suggested that the emphasis in the university training of professionals is geared too much toward content. He would like to see more work on issues such as development of human relations.

Participation in professional organizations and attendance at national meetings were suggested as a third important method of professional development for teachers. Such activities allow teachers to keep active and updated with the developments in their fields. One respondent mentioned that teachers need to read professional journals and publications as a means of updating knowledge. In addition to the above comments, some respondents suggested visiting other teachers or schools for observation, development of independent research or field work, and improvement of teachers' undergraduate college preparation as ways of increasing teachers' content knowledge.

Communication Skills

The interviewees were asked to rate the communication skills of their science, math, and foreign language teachers by placing them into one of three categories: (1) those who teach effectively and who motivate high achievement on the part of most students, (2) those who teach adequately and acceptably, and (3) those who do not communicate well. As shown in TABLE 26, eight of the 20 administrators (40%) felt 80% to 100% of their high school science teachers were excellent communicators. In comparison, 13 of 20 of the administrators (65%) felt 80% to 100% of their foreign language teachers were excellent communicators. Only 6 of 20 of the administrators (30%) placed 80% or more of their math teachers in the category of excellent communicators. Only a few administrators noted any of their teachers in science, math, or foreign language as poor communicators (TABLE 26). Thus, in terms of both content knowledge and ability to communicate knowledge, most administrators were fairly positive about their teachers. There were, however, some instances where teachers were rated as inadequate on these measures.

TABLE 26

COMMUNICATION SKILLS OF SCIENCE, MATH, AND FOREIGN LANGUAGE TEACHERS

Percent of Teachers in Category	Frequency of Administrator Ratings[a]								
	Strong Communication Skills			Adequate Communication Skills			Poor Communication Skills		
	Science	Math	Foreign Language	Science	Math	Foreign Language	Science	Math	Foreign Language
100	4	3	7						
80 - 99	4	3	6	1	1	1			
60 - 79	6	10	4	1					
40 - 59	2	3		5	4	1			1
20 - 39	4	1	1	5	6	6	2	1	
0 - 19				4	6	3	1	4	2

[a] based on a stratified random sample of 20 Indiana School corporations

The respondents were then asked for suggestions of ways to improve their teachers' communication skills. Although inservice programs were mentioned once again, the administrators had mixed feelings about their effectiveness. As before, some suggested that the teachers be financially rewarded for their participation in inservice programs and others mentioned teachers' resistance to the mandatory nature of many such programs. Respondents again stressed that inservice programs must be ongoing in order to be effective. Various methods of evaluation of teacher effectiveness were also suggested as possible methods of improving teachers' communications skills. These included peer evaluation, administrative evaluation, and regular self evaluation and monitoring. The most common suggestion posed by the respondents was to expose the teachers to effective teaching by model teachers. Administrators suggested that the teachers visit other programs, interact with other professionals, observe master teachers, and participate in teacher exchanges. One of the suggestions to encourage this kind of interaction among professionals was through university laboratory schools.

Another suggestion made by a number of school system administrators was to encourage teachers to enroll in university courses. Some respondents believed that this would keep the teachers updated in terms of new teaching methods and skills, although a few respondents were adamantly opposed to this as a form of updating teaching methodology and skills. A further important suggestion was to improve the college preparation of the future teachers in the State. To improve the preservice program the following suggestions were made: (1) require longer periods of student teaching, (2) teach communication skills, (3) create an awareness of different learning styles that can be present in a classroom, (4) increase study of child development, and (5) increase emphasis on psychology and group dynamics.

Replacement of Teachers

As an final measure of administrators' judgment of teacher quality, a hypothetical question was posed to the interviewees (APPENDIX G). The question involved the number of science, mathematics, and foreign language teachers the administrator would replace if he or she could replace any of his or her current faculty with well qualified teachers. When offered this hypothetical possibility, most administrators indicated considerable satisfaction with their foreign language teachers, less satisfaction with their science teachers, and least satisfaction with teachers of mathematics (TABLE 27). Although 85% said that they would replace fewer than 20% of their foreign language teachers, only 65% felt this positively about science teachers, and only 55% about mathematics teachers.

The extent of dissatisfaction is further reflected in the fact that administrators in 5 of the 20 school systems surveyed would replace between 20% and 40% of their math teachers, and 5 would replace between 40% and 60% of their science teachers (TABLE 27). Only 2 administrators felt negatively enough to want to replace more than 60% of their teachers in any of the three subjects surveyed (both of these would choose to replace this large percentage of their mathematics teachers only).

TABLE 27

PERCENTAGES OF TEACHERS IN SCIENCE, MATH, AND FOREIGN LANGUAGE THAT ADMINISTRATORS WOULD "REPLACE"

Percent of Teachers in Category	Frequency of Administrator Responses[a]		
	Science	Math	Foreign Language
None	5	6	10
1 - 20	6	5	7
21 - 40	4	5	2
41 - 60	5	2	1
61 - 80		2	
Over 80			

[a]based on a stratified random sample of 20 Indiana School corporations

When asked to explain why they would consider replacing present teachers, administrators responded by describing characteristics of their poorer teachers. These included ineffective communication and teaching skills, a lack of effort to remain current and updated, and a lack of desire to improve (teachers have bad attitudes, are not enthusiastic, etc.).

Availability of Teachers

The next question on the interview schedule (APPENDIX G) involved recent availability of qualified applicants for teaching positions in math, science, and foreign languages. A majority of the administrators asked (13 of 20) responded that there is a general shortage. Although not all respondents clearly delineated their responses by subject area, the shortage appears to be perceived differently in the three subject areas. Only a few administrators have had difficulty hiring foreign language teachers. More indicated a problem in science, and many indicated difficulties in mathematics.

In spite of perceived shortages in qualified applicants, a majority of the school systems surveyed (12 of 20) have not resorted to hiring unqualified teachers. Some have simply had no recent vacancies to fill. Others have had good success in attracting qualified applicants for their openings. A few have simply refused to hire unqualified teachers, preferring instead to cover classes by increasing class size. On the other hand, eight of the 20 respondents did admit to having hired unqualified individuals to staff classes because qualified teachers were not available. Most of the administrators who resorted to this practice appear to do it rather frequently, although only to fill last-minute (end-of-summer or mid-term) vacancies. Sometimes substitute teachers are hired for long-term positions. A school district may seek rejected teachers from nearby districts. One administrator justified use of these less-than-optimal teachers by pointing out that such situations are usually temporary--unqualified teachers don't usually last.

The next question asked of administrators was whether finding qualified applicants is more difficult for high school or middle school. Administrators were almost equally divided on this question as 7 noted high school, 9 indicated middle school, and 4 were undecided. Those who thought high school was more difficult to staff pointed out that more highly qualified individuals are required because the content is more advanced, and that discipline may be more of a problem at this level. However, those who perceived middle school as more difficult noted not only that there are far fewer teachers holding middle school certification, but also that most highly qualified college graduates (especially in technical areas such as math and science) may prefer high school teaching because they can use their expertise in advanced classes.

As an additional check on the issue of whether teacher supply was more of a problem at the middle school or high school level, data on limited (temporary) licenses issued by the Indiana Department of Education were examined (Indiana Department of Education, 1986). These data indicated that approximately equal numbers of limited licenses were issued in grades 6 through 9 as in grades 9 through 12 in the areas of science,

mathematics, and foreign language. While there is reason to question the completeness of these data, they do tend to validate the above conclusion that teacher supply is about the same at the middle school and high school levels.

Projections about Teacher Shortages

To aid in the formation of projections of teacher shortages over the next five years, respondents were asked to give their expectations about shortages from 1986-1990. The administrators interviewed were essentially unanimous in their prediction of some shortages of qualified teachers in the near future, although many qualified their answers by predicting shortages in certain areas but not in others. For example, three respondents expected a lack of math and science teachers, but predicted no shortage of foreign language teachers. On the other hand, two respondents predicted the need will be greater in foreign languages than in either math or science.

When administrators were asked why they expected shortage, answers were predictable but varied. Quite a few individuals observed that they had already experienced shortages in some areas: one district needs a physics teacher and 4 chemistry teachers now. Others pointed to their small file of potential applicants and indicated that they are already engaged in active recruitment. One administrator expected a shortage because a new early retirement policy will create an unprecedented number of vacancies on his staff. On the other hand, one respondent knew of several unemployed foreign language teachers in his area, and thus concluded that he would face no shortage of foreign language teachers.

Although most administrators seemed to base their answers on personal experience in their own districts, some responded more on the basis of common wisdom and/or rumors in the profession. These individuals mentioned having read about shortages, having heard that fewer students are majoring in education in colleges and universities, and having read that talented potential mathematics and science teachers are being wooed by higher salaries to business and industry.

When asked whether the new requirement of two years of mathematics and science would create any staffing problems, administrators' answers were mixed (11 said yes, 8 said no, 1 said maybe). Many indicated that most of their students were already taking two years of each of these subjects. A number of school systems will simply reshuffle and cover any new classes with present staff. Some plan to do this by increasing class sizes, by lengthening the school day, and/or by giving current teachers more class preparations. Quite a number of respondents spontaneously interjected their support of the new two-year requirement, in spite of any staffing difficulties it may cause.

Turnover of Teachers

As a final question, interviewees were asked about any problems they were having holding on to good teachers. Sixty percent of the respondents (12 out of 20) indicated that they were not having any difficulties

keeping certified, competent teachers in math, science, or foreign languages. Although they had no big problems with keeping staff, these school systems did mention other problems such as an anticipated increase in turnovers because of early retirement plans.

Those respondents who do have trouble keeping competent teachers primarily blamed low compensation for their difficulties. Some of their good teachers had taken better paying positions in other school districts. Other highly competent teachers (particularly in math and science) were going into industry for better pay and fringe benefits. Family circumstances were mentioned as an additional reason for frequent turnovers. Some teachers were leaving in order to follow their spouses to jobs in other communities. Finally, turnover of teachers because of maternity leaves was also a common problem.

* * * * *

NEEDS IDENTIFICATION IN OTHER AREAS OF CONCERN

In addition to data on teacher quality in public schools, federal guidelines with respect to states' needs assessment called for information from non-public schools, teacher preparation programs, and institutions of higher education. Data were also to be collected on science, math, and foreign language in middle schools/junior high schools and elementary schools. At the outset of this project the middle school/junior high school and the elementary school were not targeted as priority areas, and thus, were not included in the core instrument discussed earlier in the Report. It was not until three months after the commencement of this project that a national priority shift instituted by federal decision makers occurred in the direction of middle schools/junior high schools and elementary schoc Another area of emphasis in the federal guidelines which was not covered in the core survey was the availability of adequate instructional materials and equipment in schools.

Non-Public High Schools

The survey on teacher certification distributed to Indiana Public Schools (APPENDIX C) was modified to make the questions more appropriate for the private schools in Indiana (APPENDIX H - "Survey of Non-Public School Teachers of Science, Mathematics, and Foreign Languages"). The difference between the public and non-public questionnaire occurred in section I. In addition to asking for the number of uncertified teachers, the non-public questionnaire asked for the number teaching without certification who had met the certification requirements. This addition was made in an attempt to remove the confounding variable of uncertified persons teaching in the non-public schools who had actually met certification requirements but because certification was not required in the school where they worked, had not followed through with the formal certification procedures.

Procedures for mailing the private school core instrument (APPENDIX H) were the same as those for public schools. However, because many non-public high schools in Indiana are very small, the survey was only sent to those with enrollments of 100 or more students in grades 9-12. The 36 schools in this category represent 85% of the students enrolled in the State's non-public schools, and thus omitting the smaller non-public schools from the sample does not substantially diminish validity of the non-public school results. Of the 36 schools with enrollments over 100, twenty-seven usable surveys were returned establishing a return rate of 75%. While this rate is somewhat lower than the 95% return rate for the public schools, it is still high (and respectable) enough to allow the results to be generalizable to the population of non-public high schools in Indiana.

In reporting results for non-public schools, common mention is made of the number of "uncertifiable" teachers in those schools. This term has been used to distinguish, as noted above, between teachers who had the qualifications to be certified but did not complete the forms or pay the license fees from those teachers who had not completed teacher certification programs. The number of uncertifiable teachers can be

easily calculated by subtracting the number of those who qualify for certification but have not been certified from the number of uncertified teachers.

Sciences

In biology, three of 53 teachers (6%) were uncertifiable (TABLE 28) although almost half of the newly hired biology teachers (2.60 of 5.75 full time equivalents) did not have biology certification (TABLE 29). Four of 37 chemistry teachers (11%) were uncertifiable (TABLE 30), the highest uncertifiable rate of any of the sciences for non-public schools. Approximately one third of the new hires in chemistry (1.34 of 3.84) were not certified (TABLE 31). In earth science, there were only 13 teachers reported for the entire State. One of these individuals was uncertified although he or she only taught 1 of the 27 sections of the course (TABLE 32). All new earth science teachers hired by non-public schools were certified (TABLE 33), and thus certification of earth science teachers in non-public schools does not appear to be a major problem. As was the case with science, general science was not commonly taught in non-public schools with only 20 teachers and 32 sections reported (TABLE 34). As only one of those 32 sections was taught by an uncertified individual (TABLE 34) and as all new general science teachers were certified (TABLE 35), certification does not appear to be any more of a problem in general science than it is in earth science. In physics, two of 29 of the teachers (7%) were uncertifiable (TABLE 36) and approximately one third of the new hires (1.48 of 4.73) were not certified (TABLE 37). It should also be noted that the rate of retirement during the next 5 years was higher for physics teachers (4 out of 29 or 14%) than for any of the other sciences (TABLE 37).

Mathematics

In mathematics, there was a higher incidence of uncertifiability than in any of the sciences as 19 of 142 teachers (13%) were not certifiable (TABLE 38). It might be noted that while rates of uncertifiability among non-public school science teachers were not that much different that rates of non-certification among public school science teachers, the rates among corresponding populations of mathematics teachers varied substantially. For the public schools, only 1% of mathematics teachers were uncertified (TABLE 11), yet 13% of the non-public school mathematics teachers were uncertifiable (TABLE 38) The rate of non-certification of new hires in mathematics (3.28 of 21.82 or 15%) was lower (TABLE 39) than the rate of non-certification of the sciences taken as a group where 5.42 of 19.42 newly hired teachers (28%) were uncertified in the science they were teaching (TABLES 29, 31, 33, 35, & 37).

Foreign Languages

In French, three of 38 teachers (8%) were uncertifiable and 1.00 of 3.16 (32%) of the newly hired teachers were not certified (TABLES 40 & 41). In German, the highest percentage on uncertifiable teachers in foreign language occurred as 3 of 19 individuals (16%) were not

TABLE 28

BIOLOGY TEACHER CERTIFICATION IN NON PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	37	4	2	2	127	18	6	12	2
1-499 (n=13)	16	1	0	1	47	3	0	3	1
Total: 1-3,999 (n=27)	53	5	2	3	174	21	6	15	3

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 29

NEW BIOLOGY TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	3.00	2.60	2.40	0	0.60
1-499 (n=13)	2.75	0	0	0	0
Total: 1-3,999 (n=27)	5.75	2.60	2.40	0	0.60

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 30

CHEMISTRY TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	26	4	1	3	79	13	1	12	0
1-499 (n=13)	11	2	1	1	24	4	3	1	2
Total: 1-3,999 (n=27)	37	6	2	4	103	17	4	13	2

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey: 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 31

NEW CHEMISTRY TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	2.34	1.34	0.20	0	1.00
1-499 (n=13)	1.50	0	0	0	0.17
Total: 1-3,999 (n=27)	3.84	1.34	0.20	0	1.17

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 32

EARTH SCIENCE TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	8	1	0	1	18	1	0	1	0
1-499 (n=13)	5	0	0	0	9	0	0	0	0
Total: 1-3,999 (n=27)	13	1	0	1	27	1	0	1	0

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 33

EARTH SCIENCE TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	1.40	0	0.40	0	0
1-499 (n=13)	1.50	0	0	0	0
Total: 1-3,999 (n=27)	2.90	0	0.40	0	0

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 34

GENERAL SCIENCE TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	10	1	0	1	17	1	0	1	0
1-499 (n=13)	10	0	0	0	15	0	0	0	1
Total: 1-3,999 (n=27)	20	1	0	1	32	1	0	1	1

[a] survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] meet certification requirements but did not apply for certification

[e] do not meet certification requirements

TABLE 35

GENERAL SCIENCE TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	1.20	0	0	0	0
1-499 (n=13)	1.00	0	0	0	0
Total: 1-3,999 (n=27)	2.20	0	0	0	0

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 36

PHYSICS TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	18	3	1	2	36	6	2	4	3
1-499 (n=13)	11	2	2	0	15	4	4	0	1
Total: 1-3,999 (n=27)	29	5	3	2	51	10	6	4	4

[a] survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] meet certification requirements but did not apply for certification

[e] do not meet certification requirements

TABLE 37

PHYSICS TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	3.48	0.48	2.00	0	1.20
1-499 (n=13)	1.25	1.00	0	0	0.17
Total: 1-3,999 (n=27)	4.73	1.48	2.00	0	1.37

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 38

MATHEMATICS TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	101	16	2	14	413	78	8	70	4
1-499 (n=13)	41	9	4	5	135	21	11	10	2
Total: 1-3,999 (n=27)	142	25	6	19	548	99	19	80	6

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 39

MATHEMATICS TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	14.68	3.28	2.00	2.00	1.80
1-499 (n=13)	7.14	0	4.00	0.14	2.14
Total: 1-3,999 (n=27)	21.82	3.28	6.00	2.14	3.94

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 40

FRENCH TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	24	2	0	2	84	11	0	11	3
1-499 (n=13)	14	6	5	1	36	12	10	2	1
Total: 1-3,999 (n=27)	38	8	5	3	120	23	10	13	4

[a] survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] meet certification requirements but did not apply for certification

[e] do not meet certification requirements

TABLE 41

FRENCH TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	0.60	0	0.60	0	0
1-499 (n=13)	2.56	1.00	0	1.56	0.56
Total: 1-3,999 (n=27)	3.16	1.00	0.60	1.56	0.56

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

certifiable (TABLE 42). One of 2.84 new hires in German (35%) were not certified (TABLE 43). In Latin, two of 13 teachers (15%) were not certifiable and 1.25 of 3.05 new hires (41%) were not certified (TABLES 44 & 45). In Spanish, six of 48 teachers (13%) were not certifiable and 2.40 of 6.88 newly hired teachers (35%) were not certified (TABLES 46 & 47). Suprisingly, there were no reports of any other languages being taught in non-public schools in Indiana (TABLES 48 & 49).

In comparing certifiability of foreign language teachers in public and non-public schools, the results were similar to those of mathematics. With the exception of "other" languages where there were very few teachers in the public schools, the rates of non-certification in the public schools ranged from a low of 1% in French (TABLE 13) to a high of 4% in Latin (TABLE 17). In the non-public schools, non-certifiability rates varied from a low of 8% in French (TABLE 38) to a high of 16% in German (TABLE 42).

Public Middle Schools/Junior High Schools

Each school system in the State of Indiana was asked to respond to a needs assessment questionnaire (APPENDIX I - "Elementary School and Middle School/Junior High School Science, Mathematics, Computer and Foreign Language Education Identified Needs Rating Scale"). The survey, locally developed and validated, asked the superintendent of each school system to indicate the degree of need for assistance for improving mathematics, science, foreign languages, and computer learning. Each superintendent's judgments were to be based upon the needs of children and teachers. Each respondent was asked to indicate the degree of need based on a Likert scale for fourteen previously identified needs of school systems in Indiana. The Likert scale ranged from a five (indicating the greatest degree of need) to a one (indicating the least degree of need). Remaining numbers indicated intermediate degrees of need in descending order of importance. In order to reflect the needs in each of these areas, respondents were asked to indicate the degree of need for each of the fourteen identified needs for grades K-6 and thirteen identified needs for grades 7-8. In an effort to insure the highest return rate possible, superintendents were asked to complete the surveys (APPENDIX I) and return them with the application for Title II funds under P.L. 98-377. Respondents were informed that the rating scale had to be completed in order to receive P.L. 98-377 funds.

While not every respondent answered every question, an average of 252 school systems responded to questions on the degree of need for assistance in improving the areas of mathematics, science, foreign languages, and computer learning in grade level 7-8. At these grade levels, superintendents expressed a greater need for assistance in the areas of mathematics, science, and computer learning, than in the area of foreign language (TABLE 50). Overall, the greatest degree of need was for instructional materials and equipment to be used in mathematics and science education (Item #10). The second highest degree of need was in the area of assisting the gifted and talented students (Item #8). In contrast, the degree of need to assist women, minorities, handicapped, and other underrepresented groups (Item #9) ranked tenth out of the 13 identified needs. Inservice workshops were perceived as being needed

TABLE 42

GERMAN TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	15	2	1	1	46	4	2	2	1
1-499 (n=13)	4	2	0	2	10	6	0	6	1
Total: 1-3,999 (n=27)	19	4	1	3	56	10	2	8	2

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 43

GERMAN TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	1.84	0	0.84	0	1.00
1-499 (n=13)	1.00	1.00	1.00	0	0
Total: 1-3,999 (n=27)	2.84	1.00	1.84	0	1.00

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 44

LATIN TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	9	1	0	1	32	3	0	3	1
1-499 (n=13)	4	2	1	1	8	3	1	2	2
Total: 1-3,999 (n=27)	13	3	1	2	40	6	1	5	3

[a] survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] meet certification requirements but did not apply for certification

[e] do not meet certification requirements

TABLE 45

LATIN TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	1.80	0	1.00	0	0.80
1-499 (n=13)	1.25	1.25	0	1.25	1.00
Total: 1-3,999 (n=27)	3.05	1.25	1.00	1.25	1.80

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 46

SPANISH TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	31	3	1	2	128	10	4	6	4
1-499 (n=13)	17	9	5	4	49	21	13	8	3
Total: 1-3,999 (n=27)	48	12	6	6	177	31	17	14	7

[a]survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b]grades 9-12

[c]grades 7-12

[d]meet certification requirements but did not apply for certification

[e]do not meet certification requirements

TABLE 47

SPANISH TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	3.74	0.40	0.40	0.80	2.14
1-499 (n=13)	3.14	2.00	1.00	0	2.00
Total: 1-3,999 (n=27)	6.88	2.40	1.40	0.80	4.14

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 48

OTHER FOREIGN LANGUAGES TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Teachers[b]				Class Sections[b]				Number of Teachers Expected to Retire 1986-1990[c]
	Total Number	Number Without Certification			Total Number	Number Taught by Teachers Without Certification			
		Total	Certifiable[d]	Not Certifiable[e]		Total	Taught by Certifiable Teachers[d]	Taught by Teachers Who Were Not Certifiable[e]	
500-3,999 (n=14)	0	0	0	0	0	0	0	0	0
1-499 (n=13)	0	0	0	0	0	0	0	0	0
Total: 1-3,999 (n=27)	0	0	0	0	0	0	0	0	0

[a] survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1985-86 school year

[b] grades 9-12

[c] grades 7-12

[d] meet certification requirements but did not apply for certification

[e] do not meet certification requirements

TABLE 49

ALL OTHER LANGUAGES TEACHER CERTIFICATION IN NON-PUBLIC SCHOOLS[a]

School System Size (Number of Students K-12)	Total Number[b] of New Teachers Hired to Teach this Subject	Number[b] Hired to Teach this Subject without Certification in this Subject	New Teacher Background		
			Number[b] Directly from a Teaching Training Program	Number[b] from a Teaching Position outside Indiana	Number[b] with Prior Teaching Experience who did not Teach Last Year within or outside of Indiana
500-3,999 (n=14)	0	0	0	0	0
1-499 (n=13)	0	0	0	0	0
Total: 1-3,999 (n=27)	0	0	0	0	0

[a]Survey sent to all non-public high schools with enrollments of 100 or more; 75% of these schools returned survey; 1984-85 data; grades 9-12

[b]"Number" refers to F.T.E. (full time equivalent)

TABLE 50

DEGREE OF NEED FOR ASSISTANCE IN IMPROVING MATHEMATICS, SCIENCE, FOREIGN LANGUAGES, AND COMPUTER LEARNING IN THE MIDDLE SCHOOL/JUNIOR HIGH SCHOOL[a]

Identified Needs / Measure	Mean[a]	S.D.
Need for:		
1. Inservice for improving teachers' competencies in mathematics, science, and computer learning.	3.09	1.29
2. Inservice for improving teachers' instructional skills in mathematics, science, and computer learning.	3.40	1.36
3. Inservice for improving teachers' competencies in foreign languages.	1.85	1.10
4. Inservice for improving teachers' instructional skills in foreign languages.	1.91	1.14
5. Supply of adequately prepared mathematics, science, and computer learning teachers.	3.07	1.44
6. Supply of adequately prepared foreign language teachers.	2.05	1.27
7. Inservice in use of technology with mathematics, science, and computer learning.	3.40	1.26
8. Mathematics, science, computer learning, and foreign language for the gifted and talented.	3.61	1.20
9. Mathematics, science, computer learning, and foreign language programs for women, minorities, and handicapped.	2.27	1.24
10. Adequate instructional materials and equipment for mathematics and science education.	3.82	1.22
11. School programs and curriculum for nonacademic mathematics students.	3.02	1.22
12. School programs and curriculum for nonacademic science students.	3.12	1.20
13. School programs and curriculum for nonacademic students in computer learning.	3.03	1.21

[a]Not all questionnaires were complete. The average number of responses per item was 252

(TABLE 50) in the areas of mathematics, science, and computer learning, especially for the purposes of improving teachers' instructional skills and use of technology (Items #1, #2, & #7).

As a final note on middle school/junior high school needs, the question of teacher supply at this level is worthy of note. While no certification data were collected for the middle school, this issue was addressed in relation to high school teacher supply as part of the "Teacher Quality/Avaliability Interview Schedule" (APPENDIX G). These data can be found in the subsection of this Report titled "Availability of Teachers."

Public Elementary Schools

Since the needs assessment data at the elementary school level were obtained by way of the same rating scale (APPENDIX I) used to procure information for the middle school/junior high school, the data collection procedures and/or logistics will not be discussed or elaborated upon. An average of 250 school system administrators responded to the degree of need for assistance in improving the areas of mathematics, science, foreign languages, and computer learning in grade level K-6. As was the case for grades 7-8, there was a greater need for assistance in the areas of mathematics, science, and computer learning, than in the area of foreign languages. The greatest need (TABLE 51) of all was the need for materials and equipment for teaching science and mathematics (Item #10). The second highest need was for assistance in teaching the gifted and talented in each of the four subject areas involved (Item #8). The degree of need was much higher in this area than in the area of programs for women, minorities, handicapped, and other underrepresented students (Item #9). Superintendents also felt very strongly that inservice workshops were needed to improve subject matter competencies, instructional skills, and familiarity with technology in the areas of mathematics, science, and computer learning (Items #1, #2, & #7). At the elementary school level the needs in mathematics and science appear to be of the nature and magnitude to warrant further study (APPENDIX J - "Some Thoughts and Reflections on Analyzing and Assessing Needs in Elementary School Mathematics and Science"). It appears that an examination of what science and mathematics is taught and how it is taught, or if any is taught at all in the case of science, is in order and is a priority.

Instructional Materials and Equipment Needs

The previously mentioned and discussed "Elementary School and Middle School/Junior High School Science, Mathematics, Computer and Foreign Language Education Identified Needs' Rating Scale" (APPENDIX I) covered 5 topics: teacher quality, applicant pool, minority access, materials and equipment, and non-academic curriculum. Of these five areas, the one indicating the greatest need in both elementary and middle schools was materials and equipment, with a mean of 3.82 for middle school (TABLE 50) and a mean of 3.76 (TABLE 51) for elementary school. Twenty school systems were chosen for more intensive study of their instructional material needs. These school systems were chosen using a stratified random sampling technique from those districts which stated a moderately

TABLE 51

DEGREE OF NEED FOR ASSISTANCE IN IMPROVING MATHEMATICS, SCIENCE, FOREIGN LANGUAGES, AND COMPUTER LEARNING AT THE ELEMENTARY SCHOOL LEVEL[a]

Identified Needs / Measure	Mean[a]	S.D.
Need for:		
1. Inservice for improving teachers' competencies in mathematics, science, and computer learning.	3.31	1.29
2. Inservice for improving teachers' instructional skills in mathematics, science, and computer learning.	3.49	1.35
3. Inservice for improving teachers' competencies in foreign languages.	1.66	1.09
4. Inservice for improving teachers' instructional skills in foreign languages.	1.67	1.11
5. Supply of adequately prepared mathematics, science, and computer learning teachers.	2.86	1.34
6. Supply of adequately prepared foreign language teachers.	1.76	1.19
7. Inservice in use of technology with mathematics, science, and computer learning.	3.30	1.28
8. Mathematics, science, computer learning, and foreign language for the gifted and talented.	3.60	1.19
9. Mathematics, science, computer learning, and foreign language programs for women, minorities, and handicapped.	2.17	1.15
10. Adequate instructional materials and equipment for mathematics and science education.	3.76	1.24
11. School programs and curriculum for nonacademic mathematics students.	2.83	1.17
12. School programs and curriculum for nonacademic science students.	2.93	1.22
13. School programs and curriculum for nonacademic students in computer learning.	2.85	1.22
14. Curriculum and programs for remediating the lower 15 percent of elementary students in the area of mathematics.	3.30	1.21

[a]Not all questionnaires were complete. The average number of responses per item was 250.

high or very high need for materials and equipment on the survey. The contact person in each school system, either the superintendent or assistant superintendent, was asked to describe the types of materials and equipment most needed in his or her school district.

All contacts were made by phone (APPENDIX K - "Instructional Materials Survey"). Of the school systems contacted, the strongest need spontaneously given was for science laboratory equipment. This response was given by 90% of the schools. Forty-five percent (45%) of the respondents also needed additional laboratory space. Seventy-five percent (75%) of the school districts indicated a need for computer hardware and software (95%); however, most mentioned that this need was not as vital as it was in the past. Administrators indicated that their school districts had computers, but could function more efficiently with more computers. Forty percent (40%) of those asked indicated a need for audiovisual equipment. Five percent (5%) of the respondents (1 person) indicated a need for supplementary textbook materials. It should be noted that many of the other administrators contacted reported they needed texts but they had other sources of income to handle that need.

As part of this survey, school systems were also asked to indicate whether their need for instructional equipment was at the elementary middle school, or high school level. Eighty-five (85%) of the school districts indicated needs for equipment at the high school level, seventy percent (70%) expressed needs at the middle school level, and sixty percent (60%) expressed needs in the elementary grades.

To see whether materials and equipment needs varied by school system size, results of the phone interviews were tabulated by school district size. Results did vary by district size with respect to laboratory space and audiovisual equipment. Four of six (67%) districts with more than 4,000 students needed more laboratory space while only five of fourteen (36%) with less than 4,000 students needed more laboratory space. On the question of audiovisual (AV) equipment, eight of 14 (57%) smaller districts (less than 4,000 students) needed more AV equipment while none of the larger districts (more than 4,000 students) needed AV equipment.

Teacher Preparation Programs and Certification Processes

Information regarding the number of initial teaching certificates issued in Indiana or the State standards for the certification process were not obtained by way of mail questionnaire. Rather, this information was obtained directly from the Indiana State Education Department and by way of interviews with teacher certification officers at the State teacher training institutions.

Indiana Preparation and Certification

The Division of Teacher Education and Certification of the Indiana Department of Education annually tabulates the vital statistics for teacher certification in the State of Indiana (Indiana Department of Education, 1986). Their data base includes total number of original and renewal licenses by subject area, teachers' cognate area of graduation (college, school, department, etc.) and highest degree level attained.

Reviewing these annual summaries provided a wealth of information concerning the state's ability to supply itself with certified teachers.

Teacher certification totals were compared for 1980 through 1985 (TABLE 52). During this time period no less than 70% of the original teaching licenses issued went to individuals who had graduated from Indiana colleges and universities. For the same time period no less than 79% of all teachers certified annually, represented by all licenses issued in a year, graduated from Indiana schools. Although the actual number of teachers receiving certification varies from year to year, graduates from Indiana colleges consistently represent a sizable percentage of these teachers.

Comparing yearly changes in the number of teachers certified in individual subjects did not yield any noticeable patterns except in mathematics (TABLE 52). Issue of original licenses in mathematics has steadily increased from 5.3% of all original licenses issued in 1980 to 7.7% of all original licenses issued in 1985. This percentage change represents an increase of 45% over a six year period. Of all teachers receiving certification, math teachers increased from 4.1% in 1980 to 5.2% in 1985, which represents a positive change of 27%.

The annual report (Indiana State Department of Education, 1986) also indicates the highest degree attained by each licensee - bachelor, master, or doctorate. For the years of 1980 through 1983, teachers holding master's degrees comprised 48-52% of the teachers licensed each year, while teachers whose highest degree attained was a bachelor's represented less than 46% of the licenses issued annually. Subsequent years indicate a dramatic shift in the proportions of licenses issued to the two major groups of degree holders, as master's degree holders decreased and bachelor's degree holders increased. Less than 40% of the teachers licensed in 1985 held a master's degree; however, over 55% of the licensees consisted of teachers whose highest degree attained was a bachelor's.

State Certification Standards

Below in outline format are the State standards for both elementary and secondary certification. Only the program areas of mathematics, science and foreign languages are displayed under secondary education. In addition, changes over the past three years and projected requirements for the next five years are discussed.

Elementary Education

Standard License: 124 Credit Hours (Valid for Teaching Grades 1-6)
- General Education: 70
  - Science
  - Mathematics
  - Language Arts
  - Arts
  - Electives
- Professional Education: 40-42
- Electives: 12-14

TABLE 52

RELEVANT INDIANA TEACHER CERTIFICATION AND DEGREE STATUS PATTERNS[a]

Certification and Status / Years	All Licenses					Original Licenses		
	Number Issued	Highest Degree Attained (%)		Percent of Graduates from Indiana Institutions	Percent of Mathematics Licenses	Number Issued	Percent of Graduates of Indiana Institutions	Percent of Mathematics Licenses
		Masters	Bachelors					
1980	15,462	48	47	80	4.1	6,958	70	5.3
1981	13,773	51	43	81	3.9	5,596	72	5.3
1982	14,564	39	37	82	4.5	5,404	74	6.3
1983	11,631	48	46	83	4.6	4,410	77	7.1
1984	13,781	43	51	82	5.3	6,007	77	7.4
1985	13,745	40	55	79	5.2	6,856	74	7.7

[a]Source: Indiana Department of Education (1986)

Secondary Education

Mathematics

Major: 36 Credit Hours
- Analysis
- Algebra
- History of Mathematics
- Probability and Statistics
- Geometry
- Applied Mathematics
- Electives

Minor: 24 Credit Hours
- Analysis
- Alegbra
- Probability
- Geometry
- Applied Mathematics or Computer Programming
- Electives

Foreign Languages

Major: 36-39 Credit Hours
- Sophomore Level Work
- Language
- Literature
- Culture and Civilization
- Electives

Minor: 24-27 Credit Hours
- Sophomore Level Work
- Language
- Literature
- Culture and Civilization

Science

Major: 51 Credit Hours
- General Requirements
- Primary Area
- Supporting Area

Minor: 24 Credit Hours

Three major changes in certification requirements have occurred over the past three years. In 1984 the State announced requirements for a Computer Education Certificate; however, teachers currently are not required to have a Computer Education Certificate to teach computer education. Teachers holding certification at the elementary or secondary level can receive additional certification for junior high/middle school by completing 15 hours of professional education courses and 18 hours of additional coursework in their certified subject area. The State has eliminated lifetime licenses. A grandfather clause allows teachers who began a master's degree before September 1, 1985 to still be eligible for such a license if their master's degrees are completed by September 1, 1990, and they apply for their license by December 31, 1990.

The lifetime license has been replaced by a "stair-step" process requiring teachers to participate in continuing education. Intitial certification in all subject areas and grade levels requires the completion of the bachelor's degree in the subject area and "successful completion" of the National Teacher Examination. "Successful completion" is defined as a score in the 30th percentile or above. The initial license is valid for 5 years from the time the applicant is eligible for the license. Renewal of this license five years later requires the completion of either: (a) 12 semester hours of approved graduate credits or (b) 6 semester hours and 2 years of teaching experience. The renewed license is also valid for 5 years from the time the applicant is eligible for the license. Teachers may choose to "professionalize" their license. Professional certification requires the completion of a master's degree and 5 years of teaching experience. This type of license is then valid for 10 years from the time the applicant is eligible for the license.

Requirements for recertification (to obtain a certificate in an additional subject area or level) involve additional work. To obtain a

certificate in an additional subject area or level, the state of Indiana requires the following additional course work in mathematics, science, or foreign languages:

> Mathematics: 12 Credit Hours of additional course work which includes a minimum of 6 hours of graduate level work.
> Science: 12 Credit Hours of additional course work, divided into 3 different areas of science. Courses may be undergraduate or graduate level.
> Foreign Languages: 12 Credit Hours of additional course work which includes a minimum of 6 hours of graduate level work.

The State is currently reviewing a possible shortage of junior high/middle school teachers in the near future. In December 1985, school administrators were given the prerogative to assign elementary or secondary school teachers to teach in the intermediate grades. These teachers will not be required to obtain a limited license as long as they have completed at least 9 credit hours in the subjects they are teaching. This special arrangement will continue to be in effect until the end of the 1987-88 school year. Furthermore, the State will probably redefine the grade validity of teaching licenses, moving from one license for Grades 5-9 and one for Grades 9-12 to one license for Grades 7-12.

Minority Students in Higher Education

The Indiana Commission for Higher Education supplied the Indiana Needs Analysis Project with information concerning subject major enrollments for postsecondary institutions in Indiana (Indiana Commission for Higher Education, 1986b). The data were divided into six different population sub-groupings which included white, black, Asian, Hispanic, and female. Students majoring in science, mathematics, foreign languages, and computer science, as well as students earning degrees in those fields were reported. Information in mathematics education and science education was only available for degrees earned.

Black students constitute 6.1% of the student population in Indiana postsecondary institutions (Indiana Commission for Higher Education, 1985). However, it is clear that these students are not pursuing careers in teaching, mathematics, or the sciences in proportionate numbers. The Commission for Higher Education reported 2% of mathematics majors, 3% of science majors, 2% of foreign language majors, and 6% of computer science majors were black (TABLE 53). Apparently, black students are pursuing other fields of study at a much higher rate (TABLE 53).

A more disturbing concern than the lack of black students pursuing degrees in the sciences and education is the even lower percentage of black students actually earning degrees in these fields. The greatest problem appears in computer science, where black students make up 6% of students majoring in the subject; however, black students represent only 2% of the students earning degrees in the subject (TABLE 53). Hispanic, Asian, and white students graduated at a higher rate than their proportion of computer science majors. In three other academic areas--mathematics, science, and foreign language--black students also earned degrees at rates lower than their proportion of the students majoring in those subjects.

TABLE 53

POSTSECONDARY SUBJECT AREA ENROLLMENT
BY POPULATION SUBGROUPS[a]

Subject Area / Sub-groups	Mathematics		Math Ed. Degree	Science		Science Ed. Degree	Foreign Languages		Computer Science	
	Major	Degree		Major	Degree		Major	Degree	Major	Degree
Female	45.0%	44.0%	47.0%	38.0%	36.0%	47.0%	72.0%	70.0%	32.0%	31.0%
Black	2.0	1.0	--	3.0	2.0	6.0	2.0	1.5	6.0	2.0
Hispanic	1.0	0.6	--	1.6	1.5	--	4.0	3.0	1.0	1.2
Asian	1.8	1.5	--	2.3	1.5	--	1.0	1.0	2.0	2.3
White	83.0	81.5	89.0	85.5	87.0	94.0	84.0	85.5	79.0	83.5

[a]Source: Indiana Commission for Higher Education (1986b)

Black students did represent 6% of the degree students in science education, but did not constitute any percentage of the mathematics education degrees. These figures are augmented by a study conducted at DePauw University (Warren, 1986). This survey included data from 31 of the 40 postsecondary, four-year institutions in Indiana. The survey indicated that less than 200 black students were majoring in education in the state of Indiana. This represents 2.2% of the black student population from the colleges and universities which returned the questionnaire.

Minority Faculty in Higher Education

In a survey conducted at DePauw University during the spring of 1985 (Warren, 1986), data on black faculty members and their highest degree attained were collected from 31 of the 40 four-year higher education institutions in Indiana. Respondents included the three public universities which annually produce over 50% of the new teachers in Indiana. Information was collected in the following categories: full-time/part-time faculty, male/female faculty, and faculty rank.

The survey revealed that 157 black men and women serve as full-time faculty members at the 31 institutions of higher education (TABLE 54). Part-time faculty members included 84 blacks. The ratio of black men to black women is equal at the full-time and part-time levels. However, part-time black males hold terminal degrees 3 1/2 times more often than part-time black females, and full-time males hold terminal degrees over 1 1/2 times more often than full-time black females. Although equal in numbers, black males and females are clearly not equal in education level, which in higher education will ultimately relate to job and power levels. Within the 31 colleges and universities, only 20 black faculty members were identified as members of education faculties. Of these 20 faculty members, 15 were full-time faculty. However, only one black held the rank of full professor in education. It should be noted that information relating to education faculty did not include degree levels attained.

Another source of data, the Indiana University Faculty Records Office, provided a faculty count of all Indiana University campuses in the subject areas of mathematics, mathematics education, science, science education, foreign language, foreign language education, and computer science (TABLE 55). The information included full-time faculty only at the University's nine branch campuses, which produce over 30% of the new teachers in Indiana on an annual basis (Indiana University, 1986). The total faculty count of 605 consisted of 86 (or 14.21%) female professors and 519 (or 85.79%) male professors. Of those female faculty members, 79 (or 91.8%) were white (Indiana University, 1986). Of most noticable concern was the presence of only 2 full-time black faculty members in seven subject areas, and representing less than one-half of one percent of the 605 faculty members in those subjects. Asian faculty members were much more prevalent, although their presence was in the arts and sciences departments rather than the education departments. Asian professors represented over 6% of the full-time faculty, a significantly higher proportion than the proportion of Asian students enrolled in these subjects. Hispanic faculty members were present only in foreign language and science; however, they were much more prevalent than black professors.

TABLE 54

BLACK FACULTY IN INDIANA POSTSECONDARY INSTITUTIONS[a]

Faculty-Type	Male	Female	Total
All Faculty			
Full-Time	73	74	157
Full-Time w/ Terminal Degree	44	27	71
Part-Time	43	41	84
Part-Time w/ Terminal Degree	24	7	31
Education Faculty			
Full-Time	6	9	15
Part-Time	2	3	5
Faculty Rank			
Lecturer	2	3	5
Assistant Professor	1	2	3
Associate Professor	4	1	5
Full Professor	1		1

[a]Source: Warren, 1986

TABLE 55

FULL-TIME FACULTY COUNT BY POPULATION-TYPE
FOR THE INDIANA UNIVERSITY SYSTEM[a]

Subject Area	White	Black	Asian	Hispanic	Female	Total
Science	342	2	15	6	48	365
Science Education	17				1	17
Mathematics	73		5		7	88
Mathematics Education	5				1	5
Foreign Language	96		7	5	21	108
Foreign Language Education	1				1	1
Computer Science	21					21
Faculty Total	555	2	37	11	86	605
Percentage of Total	91.73	0.0033	6.12	1.82	14.21	100%

[a] Indiana University system includes the following campuses: Bloomington, East, Fort Wayne, Kokomo, Northwest, South Bend, Southeast, IUPUI, and Columbus.
Source: Indiana University, 1986

ASSESSMENT OF NEEDS FOR RELATED GROUPS

There were several other areas which were deemed as high priority areas for data collection purposes at the federal level. These areas have been targeted as high need over the last decade or so. Information collected in these areas was not obtained by way of a mail survey, but was procured from existing data bases and on-site or telephone interviews. These somewhat classical areas of interest are (1) minorities, (2) gifted/talented, (3) vocational education, and (4) business and industry

Underserved Student Populations

Within Indiana, 27 school districts have high school minority enrollments in excess of 5% (Indiana Department of Education, 1985b). Twenty-four of these school systems were contacted to gather information on student and teacher programs aimed at increasing the enrollments of minorities and/or women in math, science, foreign language, or computer courses. Seven of these 24 were unable to release information for various reasons (public access rules, preference for written rather than verbal contact, unreturned calls, etc.).

Of the 17 school systems who responded to project telephone inquiries (APPENDIX L - "Minority Programs Telephone Survey"), eleven had no formal programs to increase the number of minority teachers they had, although informally some action had been taken. For example, to increase the number of minorities and/or women teachers in math, science, foreign language, or computers, one school system tried to: (1) recruit former minority students as teachers; (2) employ spouses of present minority teachers; and (3) make minority student contacts at colleges. Two other school districts have had a couple of minority awareness programs in the past. One school system mentioned the personnel director's specific minority teacher recruitment effort which is currently taking place at several colleges. Still another school district explained its policy to always send postings on available teaching positions to eight local sources in order to reach minority and/or women teaching applicants. These sources were the: (1) Community Desegregation Advisory Council; (2) Indiana University-Purdue University at Indianapolis School of Education; (3) State Careers and Counseling Organization; (4) Office of the Indianapolis Public Schools' Assistant Superintendent for Communications/Human Relations; (5) National Association for the Advancement of Colored People; (6) Indianapolis Urban League; (7) Martin Center College; and (8) Desegratation Assistance Center.

All districts selected for the minority programs telephone survey were also asked about programs to increase participation by minority and/or women students in math, science, foreign language, or computer education. The 11 school districts noted above reported they had no special programs for underserved student populations although 6 of them noted that their high school guidance couselors monitor minority and women students, encourage advanced education, and plan convocations and other programs on various career possibilities. Two of the school systems had implemented a math program on problem solving with the premise of increasing achievement for all students including minorities and women.

Another school system described career awareness programs beginning in an eighth-grade unit where outside representatives were brought in. This idea was expanded by another school district which had students "shadow" professional workers, work in community projects, and participate in special scholarship and summer employment programs.

In addition to the 11 school districts with no formalized programs to increase participation by minority and/or female students, there were 7 school systems in Marion County which currently participate in a specific program for teachers to encourage minority and/or women students in math, science, foreign language, and computers. Under the leadership of faculty with science backgrounds from Ball State University, the program EQUALS has been implemented now for two years with plans for a third year with two targeted urban sites outside of the Indianapolis area. EQUALS was developed by the Lawrence Hall of Science at the University of California in Berkeley.

> EQUALS is an inservice training program for elementary and secondary educators. . .educators learn to use materials and activities that increase the participation and achievement in math of girls and minority boys. Evaluation of the program has found that most participants continue to use the materials for years after attending the inservice training and that there is indication that increased participation of girls has been associated with EQUALS activity by teachers in some schools.
>
> (Campbell, 1986, p.511.)

The types of "hands-on" activities used in EQUALS workshops include the construction of polyhedrons using newspaper and string, the estimation of the number of beans in a jar, and the solution of logic and detective riddles. The various school systems handle the management of the EQUALS program differently. One district had a 3-day workshop involving an administrator, counselor, central office employee, science teacher, math teacher, student, and parent. Another school district had approximately 30 teachers meet on nine Saturdays and receive continuing education units as incentive for their participation. One-hundred-fifty teachers had 8 school-day meetings throughout the year from 8:30 to 2:30, and were provided with lunch and substitutes. Still another plan for EQUALS implementation was in a school district which involved the entire staff of an elementary school building on a rotating in-house basis. In addition, many of these same school systems had teachers participate in a multicultural education program at Ball State University in previous years.

Minority Teachers with Minority Students

An additional issue with respect to underserved populations is the question of how many minority teachers there are in Indiana schools. As a substantial majority of school systems in the State have few if any minority students, again our primary investigation of numbers of minority teachers was done only in those 27 districts with at least 5% minority enrollments in grades 9-12. TABLE 56 displays, for each of those districts, the total number of students (K-12), the percentage of minority

TABLE 56

PERCENTAGES OF HIGH SCHOOL MINORITY STUDENTS AND TEACHERS IN INDIANA SCHOOL SYSTEMS WITH MINORITY ENROLLMENTS GREATER THAN FIVE PERCENT[a]

School System Code	Number of Students, Grades (K-12)	Percent of Minority Students (K-12)	Percent of Teachers (9-12)			
			Minority Science Teachers	Minority Math Teachers	Minority For. Lang. Teachers	Minority Computer Teachers
A	2,377	5.9	0.0	0.0	0.0	0.0
B	3,794	27.0	6.2	0.0	0.0	0.0
C	3,861	12.0	7.1	0.0	0.0	*
D	5,061	13.2	11.7	5.8	0.0	0.0
E	7,636	91.0	33.3	43.7	77.7	0.0
F	7,777	22.0	4.3	0.0	27.2	0.0
G	7,812	13.2	0.0	0.0	0.0	0.0
H	8,800	24.8	0.0	0.0	7.1	0.0
I	9,017	25.0	0.0	10.3	10.0	0.0
J	9,044	12.5	6.8	3.5	0.0	0.0
K	9,605	22.1	3.2	2.5	0.0	*
L	9,701	8.9	3.8	0.0	8.3	0.0
M	10,042	27.7	2.3	2.0	7.6	*
N	10,817	16.2	3.1	0.0	0.0	*
O	11,130	5.7	0.0	0.0	0.0	0.0
P	11,330	16.2	10.8	0.0	0.0	*
Q	11,397	17.2	2.7	2.3	0.0	0.0
R	11,680	9.9	0.0	5.[illegible]	0.0	0.0
S	12,178	18.3	3.5	2.5	0.0	0.0
T	13,699	27.0	3.0	10.6	11.1	0.0
U	14,215	17.7	5.0	0.0	11.1	0.0
V	17,958	8.0	3.[illegible]	3.6	7.6	0.0
W	21,666	31.9	3.1	5.1	22.2	0.0
X	22,602	12.8	1.6	4.7	7.1	0.0
Y	29,812	96.7	66.[illegible]	71.5	78.5	66.6
Z	32,172	25.6	8.8	4.5	17.3	25.0
AA	53,192	46.9	15.7	21.0	19.4	0.0
Total/ Average	368,325	24.3	7.6	7.4	11.6	3.4

[a]SOURCE: Division of Educational Information and Research, Indiana Department of Education.

* These districts had no computer teachers at all.

students, and the percentage of minority teachers (9-12) in science, math, foreign language, and computers. Data in TABLE 56 came from the Division of Education Information and Research of the Indiana Department of Education (Indiana Department of Education, 1985b).

As can be seen from TABLE 56, twenty-four percent of the students in the school systems surveyed were minorities, yet the percentage of minority teachers in those districts averaged only 7.6% in science, 7.4% in math, 11.6% in foreign language, and 3.4% in computer education. With the single exception of foreign language teachers in School District F, the percentage of minority students in every district exceeded the percentage of minority teachers in science, math, foreign language, or computing education. These statistics clearly indicate an insufficient number of minority role models in Indiana high schools. The problem is sad in foreign language, worse in science and math, and worst in computing education where only two of the 22 school systems which utilized computer teachers had minority computer teachers.

As a final note, it is appropriate to comment on the number of minority teachers in the 275 school systems in Indiana that had less than five percent minority student enrollments. According to data from the Division of Educational Information and Research of the State Department of Education (1985b), twenty of those school systems had minority foreign language teachers. Only one, however, had minority science teachers; two had minority math teachers; and none had minority computing teachers. In short, minority role models in science, math, foreign language, and computing education are almost non-existent in schools with small minority student enrollments in Indiana.

Minority Undergraduates Entering Teaching

During the spring of 1985, a survey of black enrollments in teacher education programs in Indiana was conducted at DePauw University (Warren, 1986). The study, described in greater detail in the higher education subsection of this Report, included responses from 31 of 40 institutions of higher education in Indiana which prepare teachers. This study revealed a total of only 64 black elementary education majors and 86 black secondary education majors in those 31 institutions. From this it was concluded that there are currently less than 200 black education majors in the State of Indiana, and thus the already small percentage of black teachers in Indiana public schools will decrease. There appears to be no reason to question this conclusion. It should also be noted that while data on minority candidates for teaching in high school science, mathematics, foreign language, and computing were not available, the overall lack of black teachers in secondary education programs indicates that there must be very minority candidates few in these content areas.

Gifted and Talented Students

During the spring of 1985, the Gifted and Talented Office of the Indiana Department of Education conducted a survey of school systems in the State (Indiana Department of Education, 1985a). The survey's purpose was to collect data on gifted and talented programs in individual school

districts. The survey included questions in the following areas: (1) program philosophy, (2) program history, (3) exceptional abilities addressed, (4) subject areas addressed, (5) skill areas addressed, (6) types of programs used, (7) enrollment by ethnic category, (8) methods of identifying gifted and talented students, and (9) funding sources. Of the 305 school systems in Indiana, 289 (95%) returned complete surveys. The survey did not ask at which grade levels school districts had functioning gifted and talented programs. Therefore, responses cannot be translated into percentages of gifted and talented programs. However, responses can be ranked by frequencies.

Student Enrollment

A total of 27,804 students participated in gifted and talented programs during 1985 in the State of Indiana. These numbers are not distributed equally among grades 1 through 12. Rather, grades 4 through 8 had the largest number of students participating in programs, ranging from 3,215 in grade 7 to 3,449 in grade 8. Other than grade 3, which had 2,556 students in programs, enrollments in the remaining grades (1 and 2, 9 through 12) were less than 1,600 (TABLE 57). Gifted and talented programs appear to occur most frequently in middle schools and the higher grades of elementary schools, and occur least frequently in high schools.

Minority Enrollment

School corporations reported student enrollment by ethnic category for each grade level. The categories included Asian, black, caucasian, Hispanic, native American, and other, and are displayed in TABLE 57 by numbers of students and percentage of students. Overall, the white population represented 85.34%, black represented 9.24%, other represented 2.42%, and Asian represented 1.27% of the gifted and talented programs. Hispanic and native American each represented less than 1% of gifted and talented population. However, ethnic proportions in the separate levels varied greatly and deserve particular attention.

At the elementary level, black student participation ranged from 5.49% for first grade students up to 3.08% for fifth grade students (TABLE 57). Black students participated in elementary gifted and talented programs at a rate sometimes drastically below the proportion of black students in the overall student population. However, this misrepresentation exhibits a dramatic reversal in middle school and high school, ranging from 11.91% of ninth grade students to 13.36% of tenth grade students. Correspondingly, white student participation in elementary school programs never dropped below 86.5%, but fell continually through junior and senior high with only 75.8% of the gifted and talented enrollment in the twelfth grade.

Program Types

Of the ten types of program formats listed in the Gifted and Talented Survey (Indiana Department of Education, 1985a), by far the most utilized was individualization in the regular classroom. Individualization was the

TABLE 57

GIFTED AND TALENTED ENROLLMENT BY ETHNIC-MINORITY CATEGORY IN THE STATE[a]

Category \ Grade	1		2		3		4		5		6	
	#	%	#	%	#	%	#	%	#	%	#	%
Asian	4	0.37	16	1.13	38	1.49	50	1.48	46	1.34	54	1.57
Black	60	5.49	102	7.21	145	5.67	273	8.07	278	8.08	210	6.11
Caucasian	1008	92.31	1256	88.83	2287	89.48	2937	86.78	2980	86.58	3056	88.94
Hispanic	7	0.64	6	0.43	12	0.46	27	0.80	33	0.96	17	0.49
Native American	1	0.09	3	0.21	17	0.67	43	1.27	37	1.07	49	1.43
Other	12	1.10	31	2.19	57	2.23	54	1.60	68	1.97	50	1.46
Total	1092		1414		2556		3384		3442		3436	

Category \ Grade	7		8		9		10		11		12		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Asian	32	1.00	33	0.96	21	1.34	20	1.53	14	1.10	21	1.81	352	1.27
Black	403	12.53	391	11.34	186	11.91	175	13.36	159	12.52	135	11.63	2,569	9.24
Caucasian	2701	84.01	2880	83.49	1284	82.21	1010	77.10	994	78.21	879	75.80	23,729	85.34
Hispanic	39	1.21	44	1.28	21	1.34	14	1.07	22	1.73	13	1.12	255	0.92
Native American	5	0.16	39	1.13	--	--	1	0.07	--	--	32	2.75	227	0.81
Other	35	1.09	62	1.80	50	3.20	90	6.87	82	6.45	80	6.89	672	2.42
Total	3215		3449		1562		1310		1271		1161		27,804	100%

[a]Source: Indiana Department of Education, Division of Curriculum (1985a)

most prevalent program format in half of the elementary grades and all of the middle school and high school grades. Such dominance by one of ten types of program structures may be the result of its convenience and cost of utilization rather than superior effectiveness. Individualization in the regular classroom requires no extra teacher cost or space allocation.

The second most prevalent form of gifted and talented instruction at the elementary school level was "pull out with resource teacher," meaning that students divided time between their regular classroom and a special classroom for gifted and talented students. This type of program was not prevalent in the upper grade levels. Other dominant forms in the elementary grades were summer school and a resource teacher working with the regular teacher. Summer school was also prevalent in junior high grades. Self-contained rooms for gifted and talented were prevalent in the junior high grades only.

After individualization in the regular classroom, mentorships were the second most prevalent form of instruction in high school. This type of program indicates an awareness of the higher level of responsibility among high school students compared to lower grade levels. Resource teachers working with the regular teacher was also prevalent in grades 9 through 12. Types of programs utilized least by gifted and talented programs included before/after school classes, Saturday classes, and cluster grouping.

Subject Areas

In addition to program type, the Gifted and Talented Survey (Indiana Department of Education, 1985a) included data on gifted and talented programs by subject area and grade level. TABLE 58 reveals the average ranking, out of sixteen subject areas, for science, math, and foreign language programs in grades K-12. As can be viewed from TABLE 58, mathematics was addressed more often in grades 7 through 12 than any other subject area, and ranked second among all subjects in the elementary grades. This prevalence indicates a high level of awareness concerning the importance of mathematics in gifted and talented programs. Science ranked third among all subject areas in grades 8 through 12 and fourth in grades 1 through 7. Apparently, science and mathematics receive ample attention in gifted and talented programs throughout the State, with only one or two subjects being addressed as much in individual programs.

Foreign languages were not addressed nearly as often at any grade level (TABLE 58). Their low ranking of ninth at the elementary grades is consistent with the lack of attention given foreign languages in elementary school as basic subjects receive a greater level of emphasis. Foreign languages increased in prevalence to sixth in high school programs behind mathematics, science, and three other subjects. Computer programming was not listed as a subject area, but rather as a skill area being addressed. Among nine skill areas listed, computer programming ranked sixth in elementary school, fifth in grades 7 through 9, second in grade 10, and first in grades 11 through 12. No other skill area ranged from sixth in any grade to first in another, indicating an awareness of the increasing need for computer programming skills as students grow older.

TABLE 58

SUBJECT AREAS ADDRESSED IN GIFTED AND TALENTED PROGRAMS IN GRADES ONE THRU TWELVE[a]

Subject Area \ Grade	1	2	3	4	5	6	7	8	9	10	11	12
Reading												
Mathematics	2	2	3	2	2	2	1	1	1	1	1	2
Social Studies												
Science	4	4	4	4	4	4	4	3	3	3	3	3
Language Arts/English												
Music												
Dance												
Theater												
Visual Arts												
Foreign Language	9	9	6	8	9	9	9	9	7	6	6	6
Vocational												
Interdisciplinary												
Humanities												
Home Economics												
Business												
Industrial Arts												

[a]average ranking of each science, mathematics, and foreign language (16 possible subject areas)

Vocational Education Students

Because federal legislation mandated that states' needs assessments should be done in cooperation with officials from vocational and technical schools, project staff met with the State coordinators of vocational education, and had informal conversations with vocational school officials. Results of the various meetings were the same: science, mathematics, foreign language, and computing courses are not taught in vocational schools in Indiana; and therefore, teacher certification in these areas was not a concern of vocational school personnel. The reason that science, mathematics, foreign language, and computing courses are not taught is that these schools work primarily with juniors and seniors who have already completed all requirements in these subject areas. When vocational students wish to take additional courses in these areas, they take them at the "home" high school they started at rather than at the area vocational-technical high school.

While, in general, vocational school officials had no interest in science, mathematics, foreign language, and computing courses or teachers, one point concerning mathematics was raised. In Indiana, "shop math" is a course which would be appropriate for many vocational schools and students. However, because the course is classified as mathematics, and because vocational schools rarely have a teacher who is certified in math, the course is not taught. The point was also made that even if a math teacher were made available "on loan" from a conventional high school, that individual might not have the interest or expertise to make shop math interesting and appropriate for vocational students. Thus, the one suggestion vocational and technical school officials did have was to change certification requirements so that vocational school teachers with ample mathematics background could easily become certified to teach shop mathematics.

Business and Industry Employers

The purpose of this aspect of the needs assessment was to: (1) identify the math and science skills required for successful performance in entry-level positions filled by high school graduates in the State of Indiana, and (2) to determine if high school graduates, now in the work force, have those skills. Five employment clusters were identified as being available to high school graduates. College or vocational school enrollment was not considered as a form of employment. Those clusters were: (1) service industries [food service, retail sales, health care], (2) military service [air force, army, marines, navy], (3) clerical [clerk, typist, secretary], (4) manufacturing [assembly], and (5) vocational [utilities, trade apprenticeships, construction]. Potential employers falling into the five clusters for interview purposes were identified with the assistance of the Bloomington (IN) Chamber of Commerce, the Indiana Employment Security Division, and the Brown County (IN) High School Career Counseling Department.

Eighteen supervisors, managers, and/or personnel directors representing a wide range of organizations were interviewed using the "Business/Industry Employers Interview Schedule" (APPENDIX M). The interviews were carried out over a five-week period in the Monroe-Brown-

Marion counties (IN) area. During the interviews no distinction was made between part or full time or temporary or permanent employment. Sixteen face-to-face interviews, and two telephone interviews were conducted. Hiring standards were excluded from the conversation. Employers were first asked to identify given math, science and/or computer skills required for successful entry-level job performance (APPENDIX M - "Business/Industry Employers Interview Schedule"). Next, the employers were asked to identify employees' skill weaknesses. Employers were asked to cite specific examples explaining how the lack of skills influenced job performance. Finally, employers were asked to pinpoint sources of performance problems. Spontaneous questions and probes were employed in addition to the prepared questions (APPENDIX M). Interview times ranged from 30 minutes to 3 hours.

Two areas were found to be deficient or discrepant. A deviation such as a deficiency in terms of a need is when the person lacks the skill; the worker is unable to calculate percentages because he/she has never learned how. Discrepancy, the other deviation with respect to a need, is where the person has the skill but fails to perform for some reason; the worker is able to calculate percentages but chooses not to. These deficient or discrepant areas are: (1) basic math skills and (2) science process, decision making, and problem solving skills. Other areas of concerns of the employers, but not related to this needs assessment, are: (1) work ethic orientation, (2) nonverbal communication skills, (3) interpersonal skills, and (4) inability to learn on-the-job.

Generally, math skills deficiencies focus on slow or incorrect calculation using basic arithmetic, inability to measure, inability to perform advanced arithmetic, and inability to solve somewhat complex math problems. More specifically, the math skills areas of deficiency include: (1) basic arithmetic - add, subtract, multiply, divide accurately and rapidly; (2) measurement-read measuring instruments accurately and only use British system; (3) advanced arithmetic - converts among fractions, decimals and percentages, and converts measurement such as pounds to ounces; and (4) problem solving - solves arithmetic-oriented situations using a mixture of math skills.

Science process skills include cognitive operations such as observing, inferring, predicting, hypothesizing, manipulating variables, experimenting, etc. These skills undergird both the problem solving and decision making processes when seeking information and explanations for on-the-job happenings. Problem solving generally included finding solutions to simple problems whereas decision making usually took into account critical and divergent thinking along with creating original solutions to solve problems. Both higher skill areas include the analysis, synthesis and evaluation of information, and are keys to upward mobility from entry-level positions found in the five employment clusters.

The employers were very willing to make suggestions and recommendations for future enhancement of entry-level math and science process skills. In the area of mathematics the following is a "thumb-nail" outline of their thinking:

A. Develop student's math accuracy

1. Inform students about the importance of accuracy and consequences of error

2. Require students to practice math skills under time, pressure and environmental constraints

B. Commission a study to determine how to prevent students from forgetting their advanced skills

C. Require a measurement course for all work-bound students.

D. Require an advanced arithmetic course (conversions, fractions, percentages) for all work-bound students

E. Develop students' problem solving skills

1. Teach students how to generalize problem solving procedures

2. Teach students to solve mathematical problems that mix several math concepts (geometry, measurement, subtraction)

3. Use problems that transfer--that have real-work application and meaning

4. Integrate math problem solving with other skills (writing, inventory, recipe, recalculation).

In the areas of science several suggestions and/or recommendations were generated by the employers which basically focused on student development of science-technology related decision-making skills.

A. Require a course in the basic science process skills.

B. Require coursework that forces students to analyze, synthesize and evaluate science and/or technological information.

C. Encourage teachers to give assignments that cause students to grapple with uncertainty--assignments that do not have o' right answer. Force students to think critically.

D. Add activities that isolate students in an environment in which they must make decisions on their own without the influence of others. For example, use survival camping to force students to make responsible decisions, decisions that affect their immediate well-being.

E. Stimulate work-world decision-making with games, video-disks, and other methods to give students risk-taking practices. Give feedback on the consequences to help students sharpen their decision-making skills.

* * * * *

IMPLICATIONS FOR ENHANCEMENT

This needs assessment effort was intended to serve as an initial and exploratory venture to formally examine and document identified aspects of mathematics, science, computer and foreign languages education in the State of Indiana. It is hoped that this overall effort would lead to future similar and more refined needs identification and analysis studies. Before making any generalizations from the results and commentary, consideration must be given to the assumptions upon which this needs assessment has been predicated and the design and statistical limitations inherent in the inquiry methodologies.

The design and interpretation of the results have been guided by a set of assumptions and desire to bring the attitudes and experiences of those associated with the teaching of these subjects to bear upon identified critical issues and concerns surrounding the implementation of science, mathematics, computers, and foreign languages in kindergarten through twelfth grade classrooms. This set of assumptions has basically focused on the principal modes of data collection by way of various instruments, interview schedules, open-ended interviews, and survey-type research methods. It was assumed that: (1) the statements on these instruments and questions asked during interviews were not misinterpreted by the respondents; (2) the respondents did not pursue tangential and/or related issues when reflecting and responding to the items; (3) the respondents did not have any strong prejudices against this line of inquiry which might have influenced their response patterns; and (4) the data do not become less valid with the passing of time since specific events occurring in the experiences of the respondents between the time the instruments were administered or questions asked and the present may have caused major changes in the attitudes, opinions, performances, and information held by the respondents.

In terms of subject selection, conventional random sampling techniques were not always employed because existing data bases or settings were not indigenous to any degree which made any study of them limited in scope and population. Volunteers and other populations were used because conditions did not allow for a random sample of subjects. In addition, there was a lack of a set of criteria upon which to determine the expertise of the respondents beyond their role or situational descriptions. There were also no attempts at determining the nature and/or magnitude of the halo or Hawthorne effects potentially operating on the respondents' behalf. There were also probably many uncontrolled extraneous sources of variance that might have been influencing the respondent's perceptions. The assumptions of total validity of these perceptions cannot be made because of a lack of direct observation of science, mathematics, computer, and foreign languages education classroom functioning, the variations in attitudes and behavior patterns of the respondents, and the lack of comparison data from another needs assessment project found in a demographically similar state.

Aside from the acknowledged potential shortcomings, the findings, conclusions, trends or projections resulting from this needs analysis endeavor appear important and worthy of consideration by various groups of decision makers. Further needs assessment or analysis will help clarify

many of the roles, functions and pay-offs associated with science, mathematics, computer, and foreign language education. Continued "front-end" evaluation will also enable this type of intervention to have a greater impact on students in classrooms and future teacher education in general.

Conclusions

Based on the data and information collected by way of a variety of measures and techniques, and within the boundaries of the previously noted limitations, a number of conclusions have been generated as a result of this extensive needs assessment. These conclusions have been grouped into the categories of: (a) teacher certification, (b) teacher quality, (c) underserved populations, and (d) other conclusions.

Conclusions on Teacher Certification

When reading the conclusions on teacher certification, it must be remembered that while many certified teachers are very effective, it is probable that many other certified teachers are not effective. Some teachers were certified years ago under standards which were less stringent than they are today. Teachers certified years ago may also have failed to update their knowledge. In short, it is not appropriate to assume that all certified teachers are highly effective, and thus conclusions about teacher certification do not imply any conclusions about the quality of instruction in Indiana. With this limitation in mind, the following conclusions about teacher certification are presented.

- There is some indication of a shortage of certified physics and general science teachers but virtually no general shortage of certified biology, chemistry, or earth science teachers in Indiana high schools. *(evidence, pp. 5-16)*

The high percentage of certified science teachers found in Indiana public schools was clearly a surprise. National studies of teacher shortages point out that there has been a lack of teachers in science and mathematics; and so an appropriate question is not whether a teacher shortage exists but whether or not it is more severe now than it has been in the past (Levin, 1985). The data from this study indicate the greatest problems with science certification are in physics where 10.8% of the classes are taught by uncertified teachers and in general science where 7.3% of the classes are taught by uncertified individuals. Given the fact that these percentages were higher than the figures from the two other data bases searched to validate these data, it is unlikely that these percentages were too low. Thus, while there is some shortage of science teachers, the fact that the greatest shortage is in physics where less than 11% of the teachers are uncertified reflects that overall, the shortage is not great and is probably not greater than it has been in the past.

- There is no general shortage of certified high school mathematics teachers in Indiana. *(evidence, pp. 10, 17-18)*

As 99% of the mathematics teachers in Indiana public high schools are currently certified, it is simply not possible to argue that a teacher shortage exists in terms of uncertified teachers in the classroom. As was the case with science, the validation of this figure from other data sources beyond the current study indicates that the 99% figure is probably accurate.

- There is no general shortage of certified high school foreign language teachers in Indiana. (*evidence, pp. 19-30*)

As was the case in mathematics and some of the sciences, the percentage of uncertified teachers is small. With the exception of "other languages" where there are only 10 "other language" teachers in the State, the lowest rate of certification was in Latin where 96% of the teachers were certified, and thus it is hard to argue that a teacher shortage in foreign language exists in Indiana.

Conclusions on Teacher Quality

As the main focus of this study was on certification rates in science, mathematics, and foreign language, only limited resources were available for the study of teacher quality. Given the high rates of certification found in this study, it has become apparent that teacher quality rather than certification is the most important issue relating to science, math, and foreign language instruction in Indiana high schools. Thus, while the conclusions on teacher quality are based on rather limited interview data, they are a very important outcome of this study.

- It is probable that a shortage of effective science and mathematics teachers does exist in Indiana. Data from this study are not sufficient to explain the extent of this shortage. (*evidence, pp. 42-48*)

When superintendents and principals were asked about the quality of their science teachers, a majority were pleased with the performance of many of their science faculty. As was pointed out early, however, these individuals were not science content experts, and thus, it is probable that science experts might have more negative perceptions of the quality of science teaching than the administrators did. The fact that 5 of 20 administrators interviewed noted they would replace between 40 and 60 percent of their science teachers were they given the opportunity to do so indicates that in some schools even the administrators are not pleased with the quality of science instruction in their schools. An additional point to be raised in terms of the statistics on the number of certified science teachers is that several of the administrators interviewed reported that they had increased class sizes or not offered courses because they did not have adequate faculty. The extent to which this has made the certification picture look better than it should be is unknown. Finally, the fact that in the State's largest school system 21% of the physics classes and 80% of the high school general science classes were taught by uncertified personnel indicates that in some areas of the State, a shortage of teachers in specific science areas is a severe problem. Thus, it is safe to say that more highly qualified science teachers are needed although it is not possible to estimate the number that would be

needed to significantly improve the overall quality of science education in Indiana.

The reasons for believing a teacher shortage in science exist are also appropriate reasons for believing a teacher shortage in mathematics exist. Administrators are not mathematics experts, yet 2 of the 20 interviewed reported that they would replace more than 60% of their mathematics faculty if given the opportunity. It is probable that mathematics offerings are limited or classes are overcrowded in some schools where qualified personnel have not been found. In short, there are at least some places in the State of Indiana where mathematics instruction suffers from lack of qualified teachers.

- It is probable that a shortage of effective foreign language teachers does exist in Indiana although the shortage may not be as great as it is in science and mathematics. *(evidence, pp. 42-48)*

While 85% of the administrators interviewed said they would replace less than 20% of their foreign language teachers, some still did wish to replace individuals on their foreign language faculties. Again, administrators are not foreign language specialists, and thus, despite their efforts to be honest and accurate, they are probably not the best judges of the quality of foreign language instruction. There is also no information on the extent to which foreign language offerings would be more substantial if school systems could find qualified personnel to teach those courses. Thus, while publicity about shortages in foreign language has not been as great as publicity about shortages in science and mathematics, it is entirely possible if not probable, that an increased supply of high quality foreign language teachers would be beneficial to many high school students in Indiana.

Conclusions on Underserved Populations

- There is a critical shortage of minority and women faculty members in science, mathematics, foreign languages, and computing in institutions of higher education in Indiana. *(evidence, pp. 85-87)*

The statistics on minority and women faculty at institutions of higher education warrent use of the term critical in this conclusion. For example, the survey by Warren (1986) indicated that out of the 31 higher education institutions in Indiana which participated in his study, there were only 157 full-time black faculty across all subject areas. There were only 20 black faculty in schools of education and only one of these individuals was a full professor. A survey of all Indiana University campuses in the areas of science, science education, mathematics, mathematics education, foreign language, foreign language education, and computer science indicated that only 14% of the faculties in these areas were females and less than one-half of one percent were black. Hispanic faculty were more common than blacks but still constituted a very small minority of the faculty population.

- There is a critical shortage of minority role models in science, mathematics, foreign language, and computer learning in the public high schools in Indiana. *(evidence, pp. 89-91)*

As is the case with higher education, the number of minority faculty in science, mathematics, and foreign language in Indiana high schools is very low. In the school systems with at least 5% minority enrollments in Indiana, there is an average minority student population of 24%. In those districts, the percentage of minority teachers was 8% in science, 7% in mathematics, 12% in foreign language, and 3% in computing. With the exception of foreign language in one district, the percentage of minority teachers in science, mathematics, foreign language, or computing is less than the percentage of minority students in every school system in Indiana. In short, there is a critical shortage of minority teacher role models in these subject areas in Indiana high schools.

Other Conclusions

The following conclusions are on topics for which there was not sufficient data available to justify strongly worded recommendations.

- Computer enhanced instruction is rapidly becoming an integral part of the education of children in grades K-12 although the content and the quality of instruction vary considerably with the school where the instruction takes place. The status of computer teaching is changing too rapidly to make any valid conclusions about teacher quality. (*evidence, pp. 34-41*)

As noted in several places in this Report, Indiana does not require that computing teachers have certification in computing, and thus the issue of certification does not apply to computing. Data from this study are not sufficient to make judgments on the quality of computer teachers. Even if such data were complete, they would be out of date by the time they were summarized. Given these limitations, only an overview of exemplary computer instruction in Indiana schools can be given.

In some schools, students use computers for a variety of purposes in a variety of courses. In other schools, computers are available but only used on the initiative of the teachers. The State of Indiana has invested substantial sums of money in training teachers with respect to computers. The State program has been very helpful, but much more needs to be done. Regional meetings, workshops, and self-teaching as opposed to college coursework seem to be the major methods by which teachers are learning to use computers effectively. Probably the most common model for active computer use in a school has been to appoint one or two staff members to be computer coordinators, and then allow those individuals to make many of the decisions involving computer use in the school. Highly motivated computer coordinators can be very effective, but they need high levels of support to overcome the lack of interest and sometimes fear of computers from some teachers and administrators in the school system.

- There is no major shortage of certifiable teachers in science, mathematics, and foreign language in Indiana's non-public high schools. (*evidence, pp. 52-75*)

Certifiable teachers in non-public high schools were defined as individuals who had completed teacher training programs, regardless of whether they had actually applied for State certification. In science the

lack of certifiable teachers in non-public schools was not that much different than in the public schools where a minor problem was found. In mathematics and foreign language, there are small percentages of uncertified teachers in the non-public schools (8 to 16 percent) as compared to almost none in the public schools. As it is unclear that non-public schools would always hire a certified candidate over an uncertified candidate, one must question whether or not non-public schools are having problems hiring the personnel they would like. Individual school data from the non-public schools suggested that a majority of the uncertified teachers come from a handful of schools, and thus, the hypothesis that those schools were not greatly interested in hiring certified candidates would account for the discrepancy between certification rates in public and non-public schools. One factor of interest with respect to non-public schools was the fact that 14.35 of 57.17 full time teacher equivalents (25%) hired last year in science, mathematics, and foreign language were not certified. This rate was substantially higher than that of public schools (6%). In terms of absolute numbers, however, 14.35 teachers is not a large quantity. Along the same line, it should also be noted that as non-public schools employ less than 10% of the State's high school teachers, higher rates of shortage in these schools still translate into far fewer uncertified teachers than in the public schools. In short, while uncertifiability rates among non-public school teachers are somewhat higher than uncertification rates in public schools, the absolute numbers of uncertifiable teachers in non-public schools are quite small, and the issue of certification may be of no concern in the schools where uncertified personnel are teaching.

- There may be a shortage of effective teachers of science, mathematics, and foreign language at the elementary and junior high/middle school school levels. *(evidence, pp. 48-49, 67, 76-78)*

This conclusion is based more on knowledge that Indiana students do not do well on standardized tests than it is on data from this study. These grade levels were only included in this study because several months after the needs assessment projects were authorized by the federal government, representatives of the National Science Foundation and other decision making bodies began to shift the emphasis of funding on teaching and learning away from the high school and toward the elementary and middle schools. Unfortunately, there are so few data on the number of uncertified junior high/middle school teachers in science, mathematics, and foreign language that it is impossible to determine the extent to which lack of certification is more of a problem at the junior high/middle school level than at the high school level. The administrators questioned during the teacher quality interviews had mixed reactions about the extent to which the pool of qualified candidates varied between the two levels. National recommendations such as one resulting from the conference on "School Mathematics, Options for the 1990's" (Romberg, 1984) have called for instruction in mathematics by mathematics specialists starting no later than the fourth grade. Instruction in elementary school mathematics by specialists is almost unheard of in Indiana. There are also many concerns about the extent to which science and foreign language are taught at all in elementary schools in the State. Research must be undertaken to determine the quantity and quality of instruction in science, mathematics, and foreign languages in the elementary and middle schools of Indiana; as

for many students, even good instruction in high school cannot overcome learning difficulties that result from poor training in the earlier grades.

- On the basis of limited evidence, school systems appear to need some types of instructional equipment with most needing science laboratory equipment, computer software and computer hardware. A number of school systems also need additional laboratory space and audiovisual equipment. (*evidence, pp. 77-79*)

The fact that equipment needs received higher ratings than any other category on the "Elementary and Middle School Science, Mathematics, Computer, and Foreign Language Education Identified Needs' Rating Scale" indicates that administrators probably: (a) need equipment; and (b) felt that by circling a high need for equipment on the survey they were likely to be able to use their Title II funds to buy equipment. As 90% of the administrators interviewed were interested in science laboratory equipment, there appears to be little doubt that this need is genuine. The need for computer software and hardware was also very frequently cited although administrators said this need was not as desperate as it had been in the past.

- Science and mathematics are commonly addressed in special programs for gifted and talented students. Foreign language is not often addressed and the extent to which computer learning is addressed is unclear. The fact that most special attention for gifted and talented students occurs through individualization by the classroom teacher indicates that attention must be paid to adequately preparing classroom teachers to deal with special students. (*evidence, pp. 91-95*)

Of sixteen possible subject areas for gifted and talented programs, science and mathematics ranked as two of the top four subjects at all grade levels. Foreign language ranked between sixth and ninth while computer learning was not included as a subject. By far the most common type of programs for gifted and talented were individual enrichment activities provided by the classroom teacher.

- At the present time, vocational high schools rarely have certified teachers in science, mathematics, or foreign language and thus rarely award credit in these areas. With the recent increase in science and mathematics graduation requirements, it is reasonable to expect that vocational education students will take vocationally related science and mathematics courses at vocational schools if such courses are offered. (*evidence, p. 96*)

Vocational schools have commonly offered shop math or an occasional science process course, but these courses were considered elective credit because they were not taught by math or science teachers. When only one year of math and science were required, this was not a problem for students as the elective credit earned in these courses was sufficient for graduation. Now that two years of math and science are required, it is becoming more important that vocational math and science courses carry math and science credit so that students will meet graduation requirements.

- Business and industry employers are interested in hiring high school graduates with critical thinking skills in science and mathematics. (*evidence, pp. 96-98*)

In talking with business and industry employers, interviews were focused on the skills needed by students looking for long term employment immediately after leaving high school. Employers of these individuals spoke of the lack of "common sense" among many high school graduates in combination with their lack of good work habits. Math and science process skills are intended to help students apply knowledge to new situations. As the current study looked predominantly at whether teachers were certified as opposed to whether they were able to teach students to apply their skills, it is not possible to say the extent to which schools attempt to meet the need for critical thinkers by business and industry. It should be noted that critical thinking skills are just as important for college bound students as they are for students looking for permanent employment immediately after high school.

Projections

The following projections, in keeping with the "spirit of the law," are set forth based on the implicit and explicit perceptions, observations, and findings resulting from this needs assessment along with the previously generated conclusions. The projections expressed below have been noted for State-level stakeholders, decision makers, and potential future funders' consideration.

- While there may be some shortages of certified teachers in high school mathematics and foreign languages over the next five years, it is doubtful that the number of job openings will be significantly greater than the number of certified applicants.

The above projection is based on the finding that only 1 percent of mathematics teachers and, depending on the language, only 1 to 4 percent of foreign language teachers are not currently certified. Despite common assumptions to the contrary, there appears to be little evidence that the situation will get worse. It is unclear how many students are currently enrolled in teacher certification programs in these areas but interviews with administrators indicated that through aggressive recruiting they were usually able to fill the openings in their schools. The data that have been collected on expected retirements are somewhat questionable for predicting early or late retirements. In addition, the number of individuals leaving teaching for factors other than retirement may be more of a problem than retirements. The interview data indicate that some but certainly not all administrators have problems with turnover of teachers. Increased graduation requirements in science and mathematics have been postulated as reasons for an increased teacher shortage in these areas. Again, because many administrators noted they would cover the additional students generated by the new requirements through increased class size or other means which did not require hiring new personnel, there are no hard data to support the contention that the increased requirements will aggravate the shortage problem. In short, there are too many factors influencing the number of available teachers in mathematics and foreign language to make reliable five year projections. All that can be said is

that there is no reason to expect the shortage of teachers in mathematics and foreign language will be any greater than it is now.

- Some shortages of certified high school science teachers, particularly physics and general science teachers, are expected over the next five years.

With the exception of biology, there is currently a somewnat higher incidence of uncertified teachers in science (3 to 11 percent, depending on the science) than there is in mathematics or foreign language. Lack of certification is the biggest problem in physics and general science. Unfortunately, it is also these areas where the percentage of teachers expected to retire over the next five years is greatest as 16% of the physics teachers and 18% of general science teachers are projected to retire before 1990. It should be noted, however, that retirement rates in areas other than science, mathematics, and foreign language range from 7% to 14% so the situation in physics and general science is not as critical at this point as some policy makers had feared.

- The quality of instruction in high school science, mathematics, and foreign language in Indiana will not significantly change over the next five years.

This projection is based more on the inability of educational systems to implement rapid change than on any of the data gathered for this study. The professional education community would like to see significant improvements in instruction but view several impediments to the realization of those improvements. First of all, even if a number of highly talented teachers were available, it would not be possible to use them in place of currently tenured staff; therefore, the prospect of improving instruction by replacing poor teachers is slim. A more realistic option is to work at upgrading the skills of current teachers. Because all current teachers either have life licenses or will be eligible for them before they are no longer awarded in 1990, continuing certification requirements will be of no value in forcing current teachers to upgrade their skills. Another option for getting teachers to attend inservice training sessions is to provide financial incentives for teachers to improve their teaching skills. However, with federal, state, and local government budgets all being very tight, it is unlikely that any of these governmental agencies would be willing to spend substantial sums to pay teachers to attend high quality inservice programs. Such programs would need to be relevant to the particular needs of each individual teacher and would need to be ongoing. As several of the administrators interviewed pointed out, "one-shot" inservice programs are rarely effective methods of improving instruction.

- The critical situation involving the lack of secondary school minority role models in science, mathematics, foreign language, and computing will get worse over the next five years.

As pointed out earlier in this Report, data from Warren (1986) indicate that less than 200 blacks are currently enrolled in teacher training programs in the State of Indiana. Note that these data consider blacks in all subject areas, (K-12), and thus, the number enrolled to be teachers of science, mathematics, foreign language, or computing cannot be

very high. There is no reason to believe that the situation is any better for other underserved or underrepresented populations.

- The critical situation involving lack of minority and female role models in science, mathematics, foreign language, and computing in higher education will not change substantially over the next five years.

While there are some good programs such as "EQUALS" and "TEAMS" being funded to encourage minority and female participation in areas such as science and mathematics, the programs are not widespread enough to have a substantial effect on the small number of individuals interested in pursuing higher education as a career.

A Last Word

In closing, it should be noted that the primary purpose of this needs assessment was to determine the number of uncertified high school teachers of science, mathematics, and foreign language in Indiana. A number of additional questions were also considered. The finding that most high school teachers in these subject areas were certified made it apparent that **quality of instruction** as opposed to certification is the major issue facing Indiana educators and policy makers at this time. Of the other issues considered in this study, the lack of representation in the teaching professions by historically underserved populations was by far the most disturbing.

* * * * *

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APPENDIX A

"Original Project Design and Timetable"

Project Design and Timetable

The listing of significant project events and their suggested implementation dates are depicted in the following scenario frames. As the project unfolds, there will probably be more activities than are listed in the frames. The proposed budget has been drafted very closely to the following frames of events.

****

Frame #1: Timetable: 9/01/85-9/06/85

Contact National Science Foundation officials to determine the operationalization of their latest priority shift to focus on and emphasize elementary and middle school/junior high education. It is hoped that state-level efforts and activities coincide with national priorities and preferences. In short, the extent of needs to be determined in terms of this assessment of secondary and postsecondary needs should be expanded to include an extensive assessment of elementary and middle school needs.

****

Frame #2: Timetable: 9/01/85-4/15/86

Begin planning and conduct periodic and/or as per requested meetings with officials of the State of Indiana Commission for Higher Education and the Indiana State Department of Education. Planning sessions are anticipated for the development of the "Needs Assessment Implementation Design," any ancillary data or information collecting devices, taxonomic or information processing schemes, content and format of the preliminary report and the final report.

****

Frame #3: Timetable: 9/01/85-3/15/86

Organize and conduct three meetings of the Project Advisory Committee. This group will provide advice and counsel with respect to all project activities during three strategically scheduled meetings to be held between September 1, 1985 and March 15, 1986. Members of this group will consist of a classroom teacher, a building principal, a school system central office administrator, Associate Dean for Academic Affairs-School of Education, Chairperson of the Department of Curriculum and Instruction, and representatives from the State Board of Education, Indiana State Teachers Association, Hoosier Science Teachers Association, Indiana Council for Mathematics Teaching, Indiana Association for Foreign Language Teaching,

Indiana Association for Computer Teaching, and Indiana Association of Teacher Educators.

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Frame #4: Timetable: 9/01/85-03/15/86

Organize and establish communication channels with an External Validation Panel. These national level professionally recognized experts in the needs assessment process will react to and provide input to materials mailed to them. Examples of packets to be mailed to them for content validation purposes might be the "Needs-Assessment Implementation Design;" any ancillary instruments, interview schedules, typologies or taxonomic schemes which need to be developed; and a copy of the preliminary report.

****

Frame #5: Timetable: 9/01/85-09/15/85

Contact the newly created North Central Regional Education Laboratory (Chicago) to request that they schedule, organize and finance a meeting of midwestern states' needs assessment project directors for sharing ideas and establishing a communications and exchange network. This is within the mission of the regional lab and whose territory includes the states of Indiana, Ohio, Illinois, Michigan, Wisconsin, Minnesota, Missouri, Iowa, and Kentucky.

****

Frame #6: Timetable: 9/10/85-10/15/85

Solicit reactions to the revised instrument package for fine tuning into final form. The Project Advisory Committee, the External Validation Panel, officials of State agencies, and other interested individuals will be asked for input and recommendations for final revisions of all instruments. Based on these recommendations, the proposed project staff will prepare the final instruments (questionnaires, interview schedules, typologies, content analysis schemes, etc.).

****

Frame #7: Timetable: 9/15/85-10/12/85

Adapt, refine and validate Council of Chief State School Officers needs assessment to collect information from teacher preparation institutions, vocational schools, and non-public schools. Modifications might also be

needed to gather more information at the elementary school and middle school/ junior high school levels (SEE: Frame #1).

****

Frame #8: Timetable: 9/15/85-10/15/85

Determine the target sample and mail out the instrument. There are two possible ways of collecting the data. The first involves mailing the instrument package to an entire population such as all principals in the State. A second mailing would be sent to those who did not respond to the first one. This procedure has the advantage of having all possible data solicited. The major disadvantage to this procedure is that return rates are usually low in survey studies of this nature. Even with two or three mailings, a return rate of only 40 to 60 percent could be expected. The second possible procedure would be to select a 20 to 25 percent stratified random sample of the population. An appropriately stratified sample would include principals or other school officials that are representative of the State as a whole. Because the sample would be much smaller than the population, more mailings and follow-up phone calls could be made to those individuals who did not return the questionnaire. Such a procedure could bring a response rate as high as 90%, and thus give a clearer picture of the needs in Indiana. It is also possible to send a short version of the instrument to an entire population and a complete version only to a stratified representative sample (matrix sampling). However, the method to be used will be based on advice from State officials and the project advisory groups.

****

Frame #9: Timetable: 9/15/85-10/01/85

Seek out and establish formal linkages and relationships with official state agencies (SED, HEC, Governor's Office, etc.). Ask for proposed project endorsements (letters) to accompany mailings of questionnaires and other information requests in order to maximize the return response rate.

****

Frame #10: Timetable: 9/15/85-3/01/86

Contact and establish collabortive relationships with the State Board of Vocational Education to request mailing lists, rosters of key personnel, and any existing data bases.

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Frame #11: Timetable: 9/15/85-3/01/86

Establish formal linkages with the Center for Urban and Multicultural Education (CUME) in order to more validly collect needs assessment information from historically underrepresented and underserved groups. Exchange information with CUME staff, and possibly utilize their services and dissemination mechanisms.

****

Frame #12: Timetable: 9/15/85-3/01/86

Contact and establish cooperation with the Gifted and Talented Program of the State Education Department to identify and request existing data bases and to tap into their statewide communication's network.

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Frame #13: Timetable: 9/15/85-3/01/86

Design and implement strategies for interfacing with and collecting information from private schools. While private schools will be included in all data collection, activities, special strategies may be needed to deal with unique goals and organizational structures of some private schools. Consultants and officials of private school organizations will be utilized to make data collection from private schools as representative and accurate as possible.

****

Frame #14: Timetable: 10/01/85-11/15/85

Develop and validate a special Needs Assessment Plan and instrument to collect information from all teacher training institutions in the State of Indiana.

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Frame #15: Timetable: 10/15/85-12/15/85

Contact the Teacher Certification and Licensing Bureau of the State Education Department in order to collect and synthesize teacher certification information and materials.

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Frame #16: Timetable: 11/01/85-4/15/86

Establish linkages and working relationships with the Title II State Education Department funded teacher training projects around the State in the areas of sciences, mathematics, computer, and foreign language education.

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Frame #17: Timetable: 11/01/85-2/01/86

Design data collection vehicles and implement strategies for interfacing with and collecting information from business and industry. Resources such as the State Chamber of Commerce will be used to identify business and industry officials who can speak to the concerns of the private sector. Such concerns would include, but not be limited to, the quality of mathematics, science, computer, and foreign language candidates graduating from secondary and post-secondary institutions in Indiana.

****

Frame #18: Timetable: 11/01/85-1/15/86

Seek out and determine the appropriateness of existing data bases. The Commission for Higher Education has data on enrollments in teacher education programs in India . Other state and local agencies might have additional information on elementary, secondary, and postsecondary programs in the state. Information from these agencies will be collected to validate and supplement data collected during the current needs assessment.

****

Frame #19: Timetable: 11/01/85-1/15/86

Analyze data collected by way of the instrument and prepare a preliminary sub-report. All quantitative information from the instrument will be entered into a computer so that appropriate data reduction processes can be performed. Based on these analyses, a preliminary sub-report on the quantifiable data collected from the instrument will be prepared.

****

Frame #20: Timetable: 11/15/85-2/01/86

Develop and validate (by way of the External Review Panel) a taxonomy of identified needs according to: (1) the instructional areas of science, mathematics, computer, and foreign language education; (2) the organizational levels of high school, junior high school/middle school, and elementary

school; (3) the related agencies of area vocational/technical schools, private schools, teacher organizations, teacher preparation institutions, and business and industry, etc.; and (4) systems approach functions of program identification, solutions determination, solutions strategies selection, need-performance gap determination, and goals/objectives determination and validation.

****

Frame #21: Timetable: 11/15/85-12/01/85

Develop and validate an interview questionnaire as well as a taxonomic scheme for analyzing the collected interview data. The interview questionnaire will be based on questions that were not conclusively answered by the needs assessment instrument that was mailed out. The project advisory committee, officials of state agencies, project consultants, and the External Validation Panel will interact with the proposed project staff to formulate the interview schedules and the schema for analyzing qualitative interview data.

****

Frame #22: Timetable: 11/20/85-12/15/85

Determine the interview samples, conduct the first round of interviews, and prepare a preliminary sub-report on the qualitative data collected. Because interviewing officials from every school corporation in the state is impractical, a 10 to 20 percent stratified random sample will be selected.

****

Frame #23: Timetable: 1/05/86-2/01/86

Carry out a second round of interviews. The second round will focus on individuals who have been identified as possessing information that was not available from other sources. For example, it might be necessary to interview teachers in charge of a "state of the art" school computer education program. A preliminary sub-report will be written illustrating the findings and outcomes of this unique round of interviews.

****

Frame #24: Timetable: 2/01/86-2/15/86

Determine the extent to which a third round of interviews is necessary and conduct these interviews. Data collected so far will be analyzed to look for any missing information. Conduct phone and/or in-person interviews of

individuals previously contacted as well as new individuals to supplement information from preliminary sub-reports.

****

Frame #25: Timetable: 2/01/86-3/01/86

Determine the validity of identified needs in terms of their status as need candidates in reference to a target state (ideal, norm or minimum) and the operationalization of the target states, and some corresponding actual state. Reactions to and input on this process will be sought from the External Validation Panel. This phase of the needs identification process is a necessary precursor for the generation of valid five year projections, recommendations, and descriptions of future programs, initiatives, and resource allocations.

****

Frame #26: Timetable: 2/01/86-3/01/86

Classify identified need-sets into their proper perspectives as to whether they fall under the rubric of the discrepancy perspective, democratic perspective, diagnostic perspective, or the analytic perspective. The External Validation Panel will react to and provide input for their conceptual classification and contextual operationalization.

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Frame #27: Timetable: 2/01/86-3/01/86

Prepare and send a preliminary report to the External Validation Panel. Draft a non-technical version of this preliminary report for lay audiences (initial reactions) and state-wide hearings or forums.

****

Frame #28: Timetable: 2/01/86-3/01/86

Determine the specific target audiences for the final report (or parts of final report). Draft several versions of the report which are appropriate to given target audiences.

****

Frame #29: Timetable: 3/01/86-3/15/86

Conduct a series of hearings or forums around the State (possibly at four geographically and strategically located sites) in order to collect reactions to the preliminary report and to gather input for the final report. Collaborate extensively with officials from the State Board of Education and other professionally recognized stakeholder groups with respect to setting up and conducting the meetings.

****

Frame #30: Timetable: 3/15/86-4/01/86

Prepare as part of the final report formal statements (based on collected data/information) delineating five year projections in terms of: (1) the availability of qualified teachers, (2) needed qualifications of teachers at secondary and postsecondary education levels, (3) needed qualifications of teachers at the elementary school level, (4) State standards for teacher certification, (5) availability of adequate curricula and instructional materials, and (6) the degree of access to science, mathematics, computer, and foreign language instruction of historically underrepresented and underserved groups and of the gifted and talented.

****

Frame #31: Timetable: 3/15/86-4/01/86

Prepare descriptions of and recommendations for programs, initiatives, and resources committed or projected to be undertaken within the State of Indiana in reference to: (1) improving teacher recruitment and retention, (2) improving teacher qualifications and skills, (3) improving curricula and instruction, and (4) improving access for historically underrepresented and underserved groups and for the gifted and talented.

****

APPENDIX B

"Composition and Minutes of Project Advisory Committee"

PROJECT ADVISORY COMMITTEE ROSTER

Dr. Hans Anderson
Science Education
Education 204
Indiana University
Bloomington, IN 47405
(812) 335-8658
(S) 6-703-8658

Dr. Larry Campbell, Director
Office of School Programs
Education 253
Indiana University
Bloomington, IN 47405
(812) 335-5090
(S) 6-703-5090

Ms. Mary Carr
Indiana Foreign Language Assoc.
Lawrence North High School
7802 Hague Rd.
Indianapolis, IN 46256
(317) 849-9455
(after 2:30)

Mr. Mike Kasper, President
Indiana Council of Teachers of Mathematics
Purdue University North Central
Westville, IN 46391
(219) 785-2541
(S) 6-756-9-785-2541

Dr. Neyland Clark, Superintendent
Brown County Schools
P.O. Box 38
Nashville, IN 47448
(812) 988-6601

Dr. Charles Dilk, Principal
Parkside Elementary School
1400 Parkside Drive
Columbus, IN 47203
(812) 376-4314

Dr. J. Marvin Ebbert, Associate Dean
Faculties for Learning Resources
Education/Social Work 2126, IUPUI
Indianapolis, IN 46202
(317) 264-7442(S) 6-723-7442

Mr. David Flowers, President
Indiana Computer Educators
1200 S. Barr St.
Ft. Wayne, IN 46802
(219) 425-7200
(S) 6-710-9-425-7200

Dr. Tom Gregory, Director
Office of Instructional Computing
Education 325
Indiana University
Bloomington, IN 47405
(812) 335-4053
(S) 6-703-4053

Ms. Jennifer Grossman, Teacher
Lakeview Elementary School
9090 South Strain Ridge Rd.
Bloomington, IN 47402
(812) 824-7061

Dr. John Harris, Director
Center for Urban and Multicultural Education
Education/Social Work 3109
IUPUI
Indianapolis, IN 46202
(317) 264-2836
(S) 6-723-2836

Ms. Bettye Lou Jerrel, Member
Indiana State Board of Education
Evansville-Vanderberg Schools
1 S.E. 9th St.
Evansville, IN 47708
(812) 426-5081

Ms. Lorraine Strasheim
Foreign Languages
Education 253
Indiana University
Bloomington, IN 47405
(812) 335-5090
(S) 6-703-5090

Dr. George Swafford, President
Indiana Association for Teacher Educators
Teachers College - Rm. 817
Ball State University
Muncie, IN 47306
(317) 285-1861
(S) 6-732-1861

Mr. Lee E. Williford, President
Hoosier Science Teachers Association
Northwestern High School
3431 N. 400 W.
Kokomo, IN 46901
(317) 457-8101
(S) 6-727-9-457-8101

EX OFFICIO:

Mr. Donald Winslow
Coordinator of School Science
Education 253
Indiana University
Bloomington, IN 47405
(812) 335-5090
(S) 6-703-5090

Mr. Jerry M. Colglazier
Indiana Department of Education
Division of Curriculum
Room 229, State House
Indianapolis, IN 46204
(317) 927-0111
(S) 6-9-927-0111

Dr. Earl Francq
Indiana Department of Education
Division of Curriculum
Room 229, State House
Indianapolis, IN 46204
(317) 927-0111
(S) 6-9-927-0111

Dr. Karen Rasmussen
Indiana Commission for Higher Education
143 West Market Street
Indianapolis, IN 46204
(317) 232-1900

PROJECT STAFF:

Ms. Phyllis Campbell Ault
Graduate Assistant
Education 337
Indiana University
Bloomington, IN 47405
(812) 335-3149
(S) 6-703-3149

Dr. Harold Harty
Science Education
Education 204
Indiana University
Bloomington, IN 47405
(812) 335-3468
(S) 6-703-3468

Dr. Peter Kloosterman
Mathematics Education
Education 337
Indiana University
Bloomington, IN 47405
(812) 335-2546
(S) 6-703-2546

Mr. Jack Matkin
Graduate Assistant
Education 337
Indiana University
Bloomington, IN 47405
(812) 335-3149
(S) 6-703-3149

Notes From Project Advisory Committee Meeting
October 24, 1985

Attendance: L. Campbell, M. Carr, M. Kasper, C. Dilk, J. M. Ebbert, D. Flowers, J. Grossman, J. Harris, L. Williford, E. Francq, P. Ault, B. Harty, P. Kloosterman, J. Matkin

Background of Project Reviewed by Peter Kloosterman
-review core--comments on FTE's:
M. Carr--many teachers in high school with 6 teaching hours per day
E. Francq--How it came about in terms of regulations

Education Security Act: Indiana $2 million
Federal--interested in Math, Science, Foreign Language, and computers
CCSSO--# crunching data
-information will be used for:
1. future billing
2. NSF future proposals
-results will be reported to State Board

Validity Concerns
-North Central--will they allow us access to their information?
They have certification records on emergency certification-- of schools, 75% have accreditation
-should we mention in cover letter tie with future funding?
-staff will send note in future on suggestions on especially good/bad schools to collect data from

Private Schools

-We may want to differentiate types (functions, grades, population)
-We can rely on good honest data from schools like Park Tutor, which others?

Vocational Schools
Bud--random/whole pop question
-Vocational schools are using diskettes to report information to state--we may get some information there

Supplemental Instrument
General concensus that we should pick a small group to interview-- possibly about 12
Questions: -Can we find a model school and compare others?
-Is there a need to address special interest groups--is that an issue in Indiana?
-What are we trying to get at?
-Can we use E.I.R.--They have total #/district in each class

Resources: -Migrant education--has data since state gives money to schools for migrant education
-Gifted and talented--Dr. Feldhusen at Purdue
-Johns Hopkins--did national survey on computers about 3 years ago
-Consortium at IUPUI with curriculum guides
-E.I.P. for computers

Suggestions:
Pg.1 - Questions should be separated
Pg.4 - subjective—can we clarify?
- standardize/define terms
- use descriptive categories
- department chairperson should fill out (if school has one)
- combine column 4 and 5
- we really want to know if there's any carryover between teacher's knowledge and teaching ability
Pg.5 - ask how much instruction is offered
- break "computers" into:
computer languages
C.A.I.
software
development of curriculum
- get good information from a small group
Pg.8 - very important information to obtain
- could we use lickert scale?

Forums

Information on projections could serve as policy making recommendations
-impact on certification requirements
-future grant writing
-legislature decisions
audience--regulations give guidelines
Chamber of Commerce, Farm Bureau, other lobbying groups
--need key people within group
--invite them in advance
--importance of industry representatives
Resource people:
-John Harrold--might suggest interested state legislators
-Superintendents from regional LEA's
-John Hamon--Governor's office representative

Exemplary Programs--i future letter
-state is funding 10 schools this year:
3 Foreign Language
3 Mathematics
3 Science
2 Computers indirectly

Meeting Preferences
M. Kasper--North
M. Carr--not January
L. Williford--second week in February HASTI Board Meeting January

Notes From Project Advisory Board Meeting
May 7, 1986

Attendance: J. Colglazier, D. Flowers, M. Hegg, L. Williford, D. Winslow, P. Ault, B. Harty, P. Kloosterman, J. Matkin

Background of Project (Pete Kloosterman)

* Title II funds for original needs assessment in 1985
* Certification wast he main thrust of this grant
  - 95% return of usable data
  - found surprisingly few uncertified teachers (1% in math - 10.5% in physics, uncertified)
* Clarification of our categories of certified and uncertified: limited certification = uncertified for our purposes
* Review of other topics covered in report

Future Directions (Bud Harty)

* Final draft of document expected by June 1, 1986
  - send by May 15th: any comments or the page with revisions from your document
* Audiences
  - currently: bureaucrats--will be used as a technical document as it is
  - other formats can be derived from original:
    Executive Summary--for State Legislators or State Board members
    Fact Sheet (1 page)--for newsletters or mailings
    Brochure (fold-out)
* Data use
  - board members should feel free to use information or tables for their own presentations, papers, etc.
* Proposals in "the works":
  - alternative certification for people in business and industry
  - assessment of need for teachers at elementary level

Critique of Document (whole group)

* Editorial comments of computer section
* Validation of projections
* Review of conclusions and recommendations

Forums

* Evaluation of need for statewide forums
  - no perceived need was expressed by the group

INDIANA UNIVERSITY
SCHOOL OF EDUCATION
Education Building
3rd and Jordan
Bloomington, Indiana 47405

May 6, 1986

To: Needs Analysis Project Advisory Committee Members
Who Were Unable to Attend May 7 Meeting

From: Peter Kloosterman, Project Director PK
(812) 335-2546/335-4702
[Project Office: 335-3149]

Subj: Comments on Draft of Report

As you are aware, the Needs Analysis Project Advisory Committee met yesterday afternoon. We regret not being able to get input from those of you who could not attend. We do know that this is a busy time of year and certainly understand that other commitments kept you from coming. Those of us who were there discussed the draft of the report that you were sent last week. There was general support for the document although a number of minor changes were suggested. One change was to clarify that the small number of uncertified teachers reported in the study should not be interpreted to mean we are satisfied with the current status of instruction in science, mathematics, foreign language and computing. A second change was the addition of conclusions based on data about vocational education, gifted and talented, and business and industry.

I am writing at this time to ask that if you have additional suggestions for revision of the report, please call me or send them as soon as possible. If you have suggestions concerning specific pages, just pull out those pages and send them back with your comments written on them. The project staff will be meeting May 15 to begin making final corrections with the intention of having the final report ready by June 1. We will be sending you copies of the final report as soon as it is completed.

Let me take this opportunity to thank you for the input you have given us thus far. It has been invaluable in making the study more valid and useful. One discussion item at yesterday's meeting was the writing of a 6 page executive summary and a 2 page fact sheet on study conclusions. These summaries will be distributed to appropriate audiences. As members of the advisory committee, we encourage you to use and disseminate information from the study in any way you find appropriate. You are more than welcome to use data from the study in presentations, papers, newsletter articles, etc.

APPENDIX C

"Survey of Public School Teachers of Science,
Mathematics, and Foreign Languages"

INDIANA UNIVERSITY

SCHOOL OF EDUCATION
Education Building
3rd and Jordan
Bloomington Indiana 47405

TO: Indiana Superintendents
FROM: Dr. Peter Kloosterman, Director
Indiana Needs Analysis Project
SUBJ: Survey of Public School Teachers of Science, Mathematics, and Foreign Languages
DATE: October 30, 1985

To fulfill the requirements of the Education for Economic Security Act (Public Law 98-377), and to be able to project teacher shortages for the State of Indiana, I am directing a survey on certification of mathematics, science, and foreign language teachers in Indiana. The survey is a collaborative project of Indiana University, the Indiana Commission for Higher Education, and the Indiana Department of Education. It is critical that we obtain complete and accurate data from all school systems as Title II funding for Indiana Schools is dependent upon completion of this study. You may be interested to know that this survey is currently being done in 45 states.

The main thrust of the enclosed survey involves the number of mathematics, science, and foreign language teachers in Indiana who do not meet current certification requirements in those subjects. For the purposes of this survey, any teacher with limited certification (also known as temporary or emergency certification) should be included in the category of teachers without certification in these subjects. When all surveys have been returned, my project staff will be conducting interviews at selected sites throughout the state to collect additional information and to verify the accuracy of the data in the survey.

In order to meet federal deadlines for return of this information, we need to receive your completed survey by November 15, 1985. If you cannot meet this deadline, please contact us by phone or mail. We suggest you make a copy of the survey for your records, as the information would serve as a need verification should you decide to apply for state or federal grants to school systems. If you have any questions while completing the survey, please feel free to contact the project office (812-335-3149) or my office (812-335-2546) and we will assist you in every way possible. Thank you for your time and effort in this project.

Enclosures
- Letter from State Superintendent Evans and Commissioner for Higher Education Ingle
- Survey
- Return Envelope
- Brochure from Indiana University Division of Curriculum and Instruction (please pass this to anyone interested)

Indiana Department of Education

H. Dean Evans, Superintendent
Room 229, State House • Indianapolis, IN 46204-2798 • 317/232-6610

M E M O R A N D U M

To: All Superintendents

From: H. Dean Evans, Superintendent and
Clyde R. Ingle, Commissioner

Date: October 29, 1985

Subject: Statewide Needs Assessment

We invite and encourage your participation in a project that should benefit all levels of Indiana education.

The Department of Education and the Commission for Higher Education are jointly sponsoring an assessment of our state's accomplishments and needs in four critical teaching areas: math, science, computer science, and foreign languages. The survey is required by Title II of the federal Education for Economic Security Act and is being conducted by Indiana University School of Education faculty. It will enable Indiana to compare its needs with other states'. But more importantly, it will help Indiana strengthen teaching and teacher education in these four important fields. By responding thoughtfully and completely to the survey instrument, you will be playing an essential role in that process. We are writing to express our appreciation in advance.

H. Dean Evans, Superintendent
Department of Education

Clyde R. Ingle, Commissioner
Commission for Higher Education

INDIANA UNIVERSITY

INDIANA NEEDS
ANALYSIS PROJECT
(812) 335-3149

SURVEY OF PUBLIC SCHOOL TEACHERS OF SCIENCE, MATHEMATICS AND FOREIGN LANGUAGES

A Cooperative Effort with the:

State of Indiana Commission for Higher Education

Indiana Department of Education

The Education For Economic Security Act
(P.L. 98-377, Title II)

School System: _____

School System Size (Check One):

____100,000 +	____4,000-9,999
____50,000-99,999	____500 -3,999
____10,000-49,000	____1 - 499

Person Completing this Form

Name: _____

Title: _____

Phone: ( ) _____

Return Completed Form To:

Dr. Peter Kloosterman, Director
Indiana Needs Analysis Project
Indiana University
School of Education
Third and Jordan
Bloomington, IN 47405

Return Date: November 15, 1985 Code Number: _____

GENERAL DIRECTIONS: Except where otherwise noted, all data should be reported for public schools as of Fall 1985.

I. Indicate the number of individuals teaching the subjects listed in grades 9-12 and, of those, the number who are teaching that subject without certification in that subject.

Individuals should be counted in each subject area regardless of the amount of time spent teaching that subject. For example, a teacher who teaches geometry and physics would be counted in both areas.

Subject Area (Grades 9-12)	Number Teaching This Subject	Number Teaching This Subject Without Certification in This Subject
Science		
Biology		
Chemistry		
Earth Science		
General Science		
Physics		
Mathematics		
Foreign Language		
French		
German		
Latin		
Spanish		
All Other Languages		

Code Number: _____

II. For each of the subjects listed, indicate the total number of class sections taught in grades 9-12 and the number of those sections taught by teachers without certification in that subject.

Subject Area (Grades 9-12)	Number of Class Sections	No. of Class Sections Taught by Teachers Without Certification in This Subject
Science		
Biology		
Chemistry		
Earth Science		
General Science		
Physics		
Mathematics		
Foreign Language		
French		
German		
Latin		
Spanish		
All Other Languages		

Code Number: _____

III. Provide your best estimate of the number of classroom teachers, who are certified to teach in each of the following subject areas, who will retire from teaching in the five year period 1985-86 through 1989-90. NOTE: Grades 7 - 12.

Subject Area	Number Estimated To Retire 1985-86 Through 1989-90
Science	
Biology	
Chemistry	
Earth Science	
General Science	
Physics	
Mathematics	
Foreign Language	
French	
German	
Latin	
Spanish	
All Other Languages	

Code Number: _____

IV. For persons newly hired to teach in the 1984-85 school year, (ie. persons who were not employed to teach in the public schools of your state last year) indicate the number FTE (Full Time Equivalent):

1) teaching the subjects listed in grades 9-12
2) of those, who are teaching that subject without certification in that subject

Of newly hired teachers who entered the teaching force:

3) directly from a teacher training program with no prior teaching experience
4) directly from a teaching position in another state
5) those with prior teaching experience who did not teach last year, either within or outside of your state.

FOR PURPOSES OF THIS SURVEY: IF YOUR SCHOOL'S CLASS LOAD IS 5 class sections per day, each class is .2 FTE_____
6 class sections per day, each class is .17 FTE_____
7 class sections per day, each class is .14 FTE_____

Fractions should be used only for teachers teaching less than a full class load: (7 classes in Mathematics is 1.0 FTE, not .98 FTE).

(Please indicate above which FTE you are using for each grade level.)

Subject Area (Grades 9-12)	New Hires				
	Total Number (FTE) of New Teachers Hired to Teach Each Subject	Number (FTE) Hired to Teach This Subject Without Certification in this Subject	Number (FTE) Directly From a Teacher Training Program	Number (FTE) From a Teaching Position In Another State	Number (FTE) With Prior Teaching Experience Who Did Not Teach Last Year Within or Outside Of Your State
Science					
Biology					
Chemistry					
Earth Science					
General Science					
Physics					
Mathematics					
Foreign Language					
French					
German					
Latin					
Spanish					
All Other Languages					

Code Number: _____

APPENDIX D

"Indiana Clearinghouse for Computer Education's
Computer Utilization Survey Results"

Indiana Clearinghouse for Computer Education

(317) 264-8001
(800) 222-4223

Indiana University-Purdue University at Indianapolis
902 West New York Street, Education Social Work Building, Room 2131
Indianapolis, Indiana 46223

TO: Interested Parties

FROM: Michael Olds, Field Services Coordinator

DATE: April 18, 1985

RE: Indiana Public School Corp'n Computer Utilization Survey

The Indiana Clearinghouse for Computer Education has recently compiled results from the Indiana Public School Corporation Computer Utilization Survey for the 1984-85 school year. Information obtained from the survey is a result of voluntary compliance by personnel from public school corporations in Indiana. Information included herein represents returns from 302 of 305 school corporations surveyed. Accuracy of the information is contingent upon current and projected equipment and programs in the school corporations surveyed, as reported by school district personnel.

The total number of microcomputers used for instructional purposes in the school corporations surveyed was 22,593.

Brand names of computers reported are as follows:

Apple	11,335
Franklin	330
IBM	1,871
TRS-80	3,759
TRS Color Computer	204
Commodore PET	1,716
Commodore 64	2,352
Texas Instruments	382
Atari	483
Digital	83
Other	609

The grade level at which computer literacy instruction is provided in the reporting districts is as follows:

Kindergarten	53
Grade 1	84
Grade 2	85
Grade 3	98
Grade 4	112
Grade 5	139
Grade 6	165
Grade 7	198
Grade 8	210
Grade 9	123
Grade 10	120
Grade 11	131
Grade 12	129

The following instructional applications of computers were reported by the 302 districts:

Computer Assisted Instruction	266
Computer Literacy Instruction	285
BASIC Programming	280
PASCAL Programming	85
LOGO Programming	113
Computer Assisted Design	32
Word Processing	258
Other	70

We appreciate the efforts of school corporation personnel in completing the survey instrument, and hope that the enclosed information will be helpful in future planning.

Additional information about survey results may be obtained by contacting our office

MJO/slt

APPENDIX E

"Computer Education Information Interview Outlines"

Interview Report from Meeting with

Mike Olds, Field Services Coordinator,
Indiana Clearinghouse for Computer Education
and
Phyllis Campbell Ault, Needs Analysis Project

Held January 31, 1986 Indianapolis, IN

Mike Olds began our meeting expressing concern with the purpose of our study and scepticism over the usefullness of collecting data based on numbers of computers. His feeling is that the number of computers in any given school or the number of teachers using computers is changing so rapidly that within a year's time, the data is already outdated. The ICCE did a survey in the spring of 1985 which he noted is clearly outdated already. However for the purpose of general trends and impressions he did share the survey results with me (see Appendix 1).

Several interesting facts emerged as our interview proceeded. Indiana has supported an extensive effort to train teachers in computer use over the last two years. Mike noted that Indiana may have the most extensive program in the country.

WORKSHOPS:
Three-day computer literacy workshops have been available to teachers at nine sites throughout the state. These have been either free to teachers or with stipends in some cases. Approximately 31% of Indiana's teachers have completed the training; somewhere between 18 and 20 thousand teachers. In addition Level II Advanced Training is currently available (for teachers who have taken the original training). In total Mike estimates that 2/3 of the certified staff in the state have had some training.

HARDWARE:
In terms of hardware, Mike noted that the School Technology Advancement Account of $20 million in loans has had a substantial impact on computer purchases by schools. As long as these funds are available (this is the fourth year) he sees schools as continuing to buy computers. In addition the Cumulative Business Fund has been used by schools for computer-related purchases which has added to the increasing numbers.

We went on to discuss instructional trends which are all impressions Mike shared based on his observations of the field statewide.

TRENDS:

* Moving toward other applications: Mike hopes he is correct in seeing a move toward computers being used as "tools" for students and teachers. He suggested uses such as word-processing in writing classes, manipulating data bases in social studies or science courses and telecommunication applications such as information retrieval as tool-oriented uses. He mentioned he hoped teaching programming as the sole use of the computer was "dead".

Clearly future uses will be partly driven by what the State Board does with the computer literacy question.

* Computer Literacy: From the ICCE survey last year, it looks like "Computer Literacy" is generally taught during the middle school years.

* Apple Dominated: By far the majority of schools use Apple Computers (Appendix 1). Mike noted that in addition, 90% of the available software is for Apples.

Mike also identified what he called some "Mini-trends":

* Objective-based Curriculum: IPS is looking at the type of complete systems based on the computer which WYCAT/DOLPHIN/CCC offer. Ft. Wayne currently has such a system in place. Electronic Learning has a recent survey on this type of use.

* Teacher Use: Teachers seem to be using computers for their own purposes more. Uses such as gradebooks, record keeping, and data storage have been useful applications to individual teachers.

* Networking: A possible direction some schools are going is toward networking in the CORVUS or IBM Labs style.

* Interactive Video Disk: Some schools are looking at interactive video uses although this seems to be a consideration more than a real option at this point.

ICCE has a wealth of information and services available free to Indiana Educators. The Preview Center has more than 800 pieces of software for teachers to review. Preview sessions can also be arranged at local schools. Consulting on computer-related topics can be arranged, and the ICCE has a toll free number for easy access throughout the state. It appears that training, funding and selection of software have been effectively reduced as limitations to any school with interest in pursuing computers.

Mr. Olds did suggest possible limitations to computer use.

LIMITATIONS:

* Scheduling equipment within a school.

* "Techno-phobia" of some school personnel.

* Equity. On this topic Mike shared results of a State survey several years ago which compare rural-urban, wealth of districts, and race to see if a discrepancy existed. No differences were found in any of the categories. This was completed before funds were made available to all schools for computers so if anything these issues would be even less likely to be problems now.

Gender equity is a perceived problem by many people however there are few hard facts supporting this as a real limitation.

In closing Mike suggested several resource people I might contact and possible schools to look at in-depth.

Interview Report from School Visit with

Nancy Miller, Computer Coordinator,
Clinton Prairie Schools
and
Phyllis Campbell Ault, Needs Analysis Project

Held March 3, 1986 Frankfort, IN

PROFILE:
Clinton Prairie School is a K-12 school of about 1,000 students. The school is one of the nine Teacher Training sites around the state. 2,000 teachers have been previously trained at this site. The training center plans to train 800 teachers in computer workshops between 9/85 and 8/86.

FACILITIES/MATERIALS:
- 2 labs
- 50 student access micro-computers
- 2 macintoshes
- 5000 - 6000 disks with about 500 titles

Of these, about 20 computers are in the classrooms (6 in elementary rooms, 6-8 in Computer Science room), 2 are in the libraries. The computers are circulated among the classrooms and between labs depending on current needs.

PROGRAMS:
An emphasis is placed on using computers as tools. Teachers are encouraged to use software which builds on current topics of study in their own rooms. "Programming" is de-emphasized, being left to technical schools to teach as they do other technical skills. LOGO is used in the elementary grades because of its capability to teach the concept of programming by students readily going through the whole programming process. An effort is made to use computers optimally, to get the most out of them.

Elementary - K-3 concentrating on LOGO
- each class is scheduled in the lab 1 or 2 times/week
- typically 1/2 class works in l while other 1/2 do a demonstration in classroom, then switch on 2nd day
- 1st graders use software (Magic Slate) and printer to type simple sentences, advances through grades.
- Keyboarding: 2nd grade...home row
  4th grade...all letters
  6th grade...whole keyboard

Upper Grades - Programming (BASIC)
- Independent Study (25 students; 90% 6th,7th, and 8th graders) extending computer learning beyond BASIC to Databases, Spreadsheets, working on word processing, PASCAL, or graphics
- Computer Science Class (work on programming, word processing, data bases, spread sheets)

Title I students - use software for extra help
- some L.D. students use graphics tablet for writing

Special Programs:

Apple Pass-reward system; one child selected from each elementary classroom to do extra activities on the computer.
-held during lunch-recess hour

C.H.A.O.S.-(Computer Happening After Ordinary School day)
-after-school program open to all students
-usually about 75 children each week
-uses "thinking" software

Reading -Jr.-Sr. High program to encourage reading
-contest style program with different levels
-uses computer to give students test questions based on specific book they've read

STAFF:
The computer programs and training center at Clinton Prairie are run by Mrs. Miller with a trainer for the teacher workshops, and three other staff. Of these three, one does more record keeping and organizational work, one works with Title I children, and one is in the lab working with students. Parents have also been used with mixed effectiveness.

Of the 70 total staff at Clinton Prairie, 65 have had some training in computer use. About half of those have used a computer in their classrooms.

TEACHER TRAINING RECOMMENDATIONS:
* Instructional Development course or experience focussing on integrating materials and activities, the I.D. process, applications.

* Training in "Thinking Skills" so teachers can get away from their "right answer" orientation, look at use of DATABASES, processes, problem solving.

COMPUTER COORDINATOR RECOMMENDATIONS:

* Need to be skilled teachers, able to deal with a variety of different activities occurring simultaneously.

* Management skills: how to run computer lab with a service orientation like other media

* Social skills: must be able to support, cajole, push, encourage, and teach staff as well as children. Also maintain a "whole-school" focus, keeping individual needs in perspective.

* Organizational skills: ability to organize programs, staff, and materials for easy access

* Financial skills: ability to write grants, familiarity with various routes for getting financial support.

* Need authority from administration to back up decisions.

Interview report from School Visit with

B.J. Eib, Director of Computer Science,
Linton-Stockton Schools
and
Phyllis Campbell Ault, Needs Analysis Project

Held: March 7, 1986 Linton, IN

PROFILE:
Linton-Stockton Schools are on one campus, K-12 with about 1400 students. The campus is in a rural county. The schools have funded their computer program largely through local corporation funds using both the General Fund and Cummulative Building Fund.

FACILITIES/MATERIALS:
4 labs:

Elementary - 16 Apple II+ on Network
- 3 - 4 floating in classrooms
Jr. High - 10 Apple IIe,
- 1 MacIntosh
High school- 18 Apple IIe
Business Lab:
- 7 Apple IIe
- 1 MacIntosh
- 1 NEC

Future:
Looking toward installation of a WICAT system.

PROGRAMS: Due to support from administrators, computers are used extensively through all grades in the Linton-Stockton schools. Support comes not only for funds for hardware and software but also for a Director of Computer Science position. Much of her time is committed to spending time with teachers and their classes in planning and implementing computer programs (she trouble-shoots hardware and software problems as well). Also funds are available for sending teachers to conferences and workshops to continually build on their knowledge and skills.

Elementary - K-3 use appropriate software; CAI, reading, writing and Drill and Practice packages coordinated with activities in each room (e.g. Milliken, MECC, E7 LOGO). Also pre-programming and pre-keyboarding skill work.
- 3-6 continue using software coordinated with class-work. Incorporate some discussion of computer history and applications.
6th grade use word processors (Bank St.), keyboarding programs (Microtype), and LOGO

Jr. High - 7th grade: required 1/2 year "Computer Literacy" for all students (115-125):
- BASIC
- Word Processing (80 col., MECC writer)
- Databases
- Spread Sheets
- Background: History, Logic, How computers work

- 8th grade: elective 1/2 year "Applications"
-Databases, Spread Sheets, Word Processing
-Utilities
-MacIntosh applications
-"Echo" Speech Synthesizer

High School - Computer Literacy 1/2 year "catch-up" course for students who missed Jr. High course (This is its last year to be offered.)
- BASIC (40 students)
-including arrays and file handling
- Business Applications (5-10 students)
-Word processing and Microsoft applications for MacIntosh
-AppleWorks - Word Processing, Data Base, Spread Sheets
- Independent Study (10 students)
-2nd year computer science
-work on range of topics such as: Pascal, BASIC, LOGO, Assembly Language, Networks, Interfacing, Robotics

SPECIAL PROGRAMS:
Gifted-uses "enrichment" software such as "Snooper Troops" and Graphics Tablets

High School computer classes ... 3 teachers. Business classes ...2 other teachers. Junior High... 2 teachers. All elementary teachers stay with their classes in the lab. The Director of Computer Science often works with classes but the classroom teachers are always with their class as well.

TEACHER TRAINING RECOMMENDATIONS:
* Word Processing experience on at least two different word processors.

* Problem-Solving Emphasis - reduce drill and practice

* Data Base experience - use and manipulation

* Software exposure to: different types
evaluation
use/application
planning to incorporate in subjects

* Encourage attendance at conferences on a regular basis
  - learn how to learn in conference setting
  - get to know which conferences are most useful

PROGRAM RECOMMENDATIONS FOR COMPUTER COORDINATORS:

Classes should be:

* Focussed on integrating computer use in classroom study.

* Taught in a style which models the way they think teachers ought to teach their own students. (When teaching LOGO, don't use lecture format, use hands-on lab setting.)

* Relevant to needs of teachers in the field, such as a class investigating interfacing, robotics and use of Science Probes, or use of Apple Pascal rather than Mainframe Pascal.

* Designed so that experienced/knowledgeable teachers can test-out of them.

* Offered when working teachers can attend them.

Interview Report from School Visit with

Margaruite Hart, Dick Caulfield, and Joyce Vogt
MSD Washington Townsnip Schools
and
Phyllis Campbell Ault, Needs Analysis Project

Held: March 20, 1986 Indianapolis, IN

PROFILE:
Washington Township schools include three middle schools, one high school and several elementary schools (which were not interviewed in this study). The middle school which I visited was felt to be representative of the middle schools. The schools interviewed were:

Northview Middle School	868 students	grades 6-8
North Central High School	3537 students	grades 9-12

FACILITIES/MATERIALS:

Northview

2 labs
-15 computers on CORVUS
-9 portables (6 in other lab)
-1 Apple IIE in library for
-Extensive use of MECC software

Future:
-3rd lab with 15 microcomputers on CORVUS. Planning on doing more Word Processing and more Computer Assisted Instruction integrated into the curriculum.

North Central

2 labs
Multi-service Lab
- 40 Apple IIE's (10 portable)
- 1 large screen monitor

PRIME Lab
- 19 stations
- 1400 C.A.I. programs
- 25% MECC
- labs are 75-80% full daily

Future:
- Next year, 10 additional PRIMES
- Larger capability CORVUS

PROGRAMS AT NORTHVIEW:
Computer use is maximized at Northview with the use of advanced sign-up for lab use and portables. The main focus of the computer curricula is currently on programming and literacy. All students 6-8th grade take a short computer course. This is given as a unit in their math classes.

Computer Literacy Element of Math Class
-required for all students
-3 weeks in lab during math class
-2 students on each computer
-content includes instruction in BASIC, and "literacy"

Basic Skills Class
-keyboarding work
-research skills

Special Programs:
Teamed Projects - Joint efforts by 2 teachers such as the computer science coordinator and science teacher teaming to do LOGO unit or computer science and reading teacher to do Word processing.

Computer Club - Students join out of interest.
- Focus changes with interest of group. Currently working more on software use than programming.

PROGRAMS AT NORTH CENTRAL:

Programming Classes - all elective
Pascal (30 students in 1985-86, 60 students previous year)
-2 years algebra and geometry prerequisites
-more difficult than students anticipated when first offered ('84-'85)

BASIC (100 students)
-algebra and geometry prerequisites
-2 semester class, uses college text

Fortran (2-5 students)
-calculus prerequisite
-students take class through independent study

Computer Augmented Classes (390 students)
-Regular math classes with a computer component
-Students write programs in BASIC which are integrated into their current topic of study.
-This approach gives students a sense of application and use of computer for problem solving.
-Students don't get as much actual practice or depth to their understanding. They do get exposure to programming without a separate class.
-Gives students a head-start on programming.

Special Programs
Subject Area Use
-Computers are used by all subject areas.
-Classes are scheduled into labs during free hours.
-Portables are used in classrooms.
-Many students are involved in writing programs for teachers to use with classes to meet specific objectives.
Writing Lab
-3 PRIME stations and a printer
-presently used by more unskilled writing students

NEEDS IDENTIFIED BY NORTH CENTRAL COMPUTER COORDINATOR:

- Continued support for teachers attending conferences, viewed as "the most valuable thing a township can do for their teachers".
- Expansion of program to include a class of about 20 where students can get broad exposure and skills in computer uses.
- More computers (10 PRIMES will be added next year)
- Ways to increase retention of material learned in middle school.
- Expanded use of writing lab to high-level and average writers who could also benefit from feedback on writing.
- Multi-purpose Word Processor usable from elementary grades through college level.
- Recognition by teachers of usefullness of C.A.I. programs in reinforcing concepts or skills <u>already</u> taught.

TEACHER INVOLVEMENT WITH COMPUTERS AT NORTHVIEW AND NORTH CENTRAL

-High interest and demand for computer use due to a climate of enthusiasm over benefits of using computers, and expectations by staff that they all use computers.

-When teachers can get their whole class on computers at the same time, they see computers as more useful tools.

-Teachers need to feel like computer labs are friendly places, not threatening.

-More creative or innovative teachers often use computers more than other teachers.

COMPUTER COORDINATOR RECOMMENDATIONS:

Most important qualities: Middle School - Management Skills
High School - Programming Skills

Other qualities which coordinators need:

-"People skills", enjoy working with different people and different styles of teaching, maintaining open lines of communication.

-Flexibility in scheduling, meeting, computer applications.

-Patience, tolerance for helping students and teachers.

-Appreciation for <u>all</u> subject areas.

-Training skills for providing inservice programs for teachers.

APPENDIX F

"Computer Education Trends or Directions Interview Schedule"

COMPUTER EDUCATION TRENDS OR DIRECTIONS INTERVIEW SCHEDULE

Interviewee: _____ Date: _____

Site: _____

1. What trends do you see in computer use for the schools in your region?

2. What limitations or problems do you see teachers experiencing in using computers?

3. How are computers set-up in typical schools in your region?

4. Do you have additional thoughts or comments on the status of computer use in the schools?

APPENDIX G

"Teacher Quality/Availability Interview Schedule"

Teacher Quality/Availability Interview Survey

School Corporation Name _____

School Corporation Number _____

Contact Name _____ Phone Number _____

Name of Person Interviewed _____ Phone Number _____

Title of Person Interviewed _____

Interviewer _____ Date of Interview _____

Teacher Quality

1. The first questions I would like to ask are about teacher quality. There are two separate issues I would like to ask questions about. The first is a teacher's mastery of the subject area in which he or she teaches. The second is a teacher's ability to be an effective communicator of the knowledge he or she possesses. Please consider each question individually for your math teachers, science teachers, and foreign language teachers.

Of your high school teachers in math, science, and foreign language, what per cent:	Math	Science	Foreign Language
a. know the subject area very well--probably majored or had a strong minor in it			
b. know the subject area adequately; knowledge may be weak or out-of-date			
c. really don't know the subject very well or may provide incorrect information			

What would you suggest as ways your teachers could improve and increase knowledge in their subject area?

2. Of your high school teachers in math, science, and foreign language, what per cent:

	Math	Science	Foreign Language
a. teach effectively, communicating ideas very well to students, and getting high achievement out of most students			
b. teach adequately, communicating at an acceptable level, some students learning well while others don't learn that much			
c. teach ineffectively, not communicating well, few students learning as much as they should			

What would you suggest as ways your teachers could improve and increase their teaching expertise in their subject area?

3. If you had a pool of highly qualified teachers in math, science, and foreign language and you could replace as many of your current high school math, science, and foreign language teachers as you wanted, what percentage would you replace? (If questioned, say that this is a hypothetical question where there is no need to worry about sufficient money for salaries, problems involving firing of tenured teachers, etc.)

% of math teachers that would be replaced _____

% of science teachers that would be replaced _____

% of foreign language teachers that would be replaced _____

Comments:

The following questions concern availability and turnover of teachers in math, science, and foreign language.

Availability

1. When hiring new teachers in math, science, and foreign languages, have you experienced difficulty finding qualified applicants?

   Have you, because of the lack of well-qualified applicants, hired individuals who were certified but were not really high quality teachers?

   (If yes) How often has this happened? (explain circumstances)

2. In your opinion, is it harder to attract highly qualified teachers at the high school or middle school level?

3. We have been asked by the federal government to make projections about teacher shortages over the next five years. While any such projections are tentative at best, we would like your input on the following question:

"Based on your recent experiences in hiring teachers, do you anticipate a teacher shortage in math, science, or foreign languages during the next five years?"

Can you explain your reasoning?

Do you feel the new requirement for a second year of high school mathematics and science will cause any problems in terms of staffing for the additional math and science courses you will have to offer?

Turnover

1. Are you currently having trouble keeping certified, competent teachers in math, science, or foreign languages?

(If yes) Can you point out any specific factors which have caused this problem?

(Thank the individual for his or her time.)

APPENDIX H

"Survey of Non-Public School Teachers of Science, Mathematics, and Foreign Languages"

INDIANA UNIVERSITY

SCHOOL OF EDUCATION
Education Building
3rd and Jordan
Bloomington, Indiana 47405

TO: Non-Public School Principals
FROM: Dr. Peter Kloosterman, Director
Indiana Needs Analysis Project
SUBJ: Survey of Private School Teachers of Science, Mathematics, and Foreign Languages
DATE: November 15, 1985

To fulfill the requirements of the Education for Economic Security Act (Public Law 98-377) and to be able to project teacher shortages for the State of Indiana, I am directing a survey on certification of mathematics, science, and foreign language teachers in Indiana. The survey is a collaborative project of Indiana University, the Indiana Commission for Higher Education, and the Indiana Department of Education. You may be interested to know that this survey is currently being done in 45 states.

The main thrust of the enclosed survey involves the number of mathematics, science, and foreign language teachers in Indiana who do not meet current certification requirements in those subjects. Understanding that state certification of teachers is not necessarily required in some private schools, we nonetheless believe it is important to know the number of teachers who do/could meet the certification requirements. For purposes of the survey, in questions I and II on pages 2 and 3 respectively we ask for teachers without current state certification in the second column. In the third column, we ask the number of teachers who are not certified but who would meet state certification requirements because of the teacher's completion of a teacher training program or past certification in their specific subject. When all surveys have been returned, my project staff will be conducting interviews at selected sites throughout the state to collect additional information and to verify the accuracy of the data in the survey.

In order to meet federal deadlines for return of this information, we need to receive your completed survey by December 5, 1985. If you cannot meet this deadline, please contact us by phone or mail. If you have any questions while completing the survey, please feel free to contact the project office (812-335-3149) or my office (812-335-2546), and we will assist you in every way possible. Thank you very much for your time and effort in this project.

Enclosures:
- Survey
- Return Envelope
- Brochure from Indiana University Division of Curriculum and Instruction (please pass this to anyone interested)

INDIANA UNIVERSITY

INDIANA NEEDS
ANALYSIS PROJECT
(812) 335-3149

SURVEY OF NON-PUBLIC SCHOOL TEACHERS

OF SCIENCE, MATHEMATICS, AND FOREIGN LANGUAGES

A Cooperative Effort with the:

State of Indiana Commission for Higher Education

Indiana Department of Education

The Education For Economic Security Act
(P.L. 98-337, Title II)

School: _____

School Size (Check One):

_____ 100,000+	_____ 4,000-9,999
_____ 50,000-99,999	_____ 500 -3,999
_____ 10,000-49,000	_____ 1 - 499

Person Completing this Form

Name: _____

Title: _____

Phone: ( ) _____

Return Completed Form To:

Dr. Peter Kloosterman, Director
Indiana Needs Analysis Project
Indiana University
School of Education
Third and Jordan
Bloomington, IN 47405

Return Date: December 5, 1985 Code Number: _____

GENERAL DIRECTIONS. Except where otherwise noted, all data should be reported for public schools as of Fall 1985.

1. Indicate the number of individuals teaching the subjects listed in grades 9-12 and, of those, the number who are teaching that subject without certification in that subject, and of those, the number who meet certification requirements.

   Individuals should be counted in each subject area regardless of the amount of time spent teaching that subject. For example, a teacher who teaches geometry and physics would be counted in both areas.

Subject Area (Grades 9-12)	Number Teaching This Subject	Number Teaching This Subject Without Certification in This Subject	Number Teaching This Subject Without Certification Who Meet Certification Requirements
Science			
Biology			
Chemistry			
Earth Science			
General Science			
Physics			
Mathematics			
Foreign Languages			
French			
German			
Latin			
Spanish			
All Other Languages			

Code Number. ____

II. For each of the subjects listed, indicate the total number of class sections taught in grades 9-12, the number of those sections taught by teachers without certification in that subject, and of those, the number who meet certification requirements.

Subject Area (Grades 9-12)	Number of Class Sections	No. of Class Sections Taught by Teachers Without Certification in This Subject	No. of Class Sections Taught by Teachers Without Certification Who Meet Certification in This Subject
Science			
Biology			
Chemistry			
Earth Science			
General Science			
Physics			
Mathematics			
Foreign Language			
French			
German			
Latin			
Spanish			
All Other Languages			

Code Number: _____

III. Provide your best estimate of the number of classroom teachers, who are certified to teach in each of the following subject areas, who will retire from teaching in the five year period 1985-86 through 1989-90. NOTE: Grades 7 - 12.

Subject Area	Number Estimated To Retire 1985-86 Through 1989-90
Science	
Biology	
Chemistry	
Earth Science	
General Science	
Physics	
Mathematics	
Foreign Language	
French	
German	
Latin	
Spanish	
All Other Languages	

Code Number:

IV. For persons newly hired to teach in the 1984-85 school year, (ie. persons who were not employed to teach in the public schools of your state last year) indicate the number FTE (Full Time Equivalent):

1) teaching the subjects listed in grades 9-12
2) of those, who are teaching that subject without certification in that subject

Of newly hired teachers who entered the teaching force:

3) directly from a teacher training program with no prior teaching experience
4) directly from a teaching position in another state
5) those with prior teaching experience who did not teach last year, either within or outside of your state.

FOR PURPOSES OF THIS SURVEY: IF YOUR SCHOOL'S CLASS LOAD IS 5 class sections per day, each class is .2 FTE_____
6 class sections per day, each class is .17 FTE_____
7 class sections per day, each class is .14 FTE_____
(Please indicate above which FTE you are using for each grade level.)

Fractions should be used only for teachers teaching less than a full class load: (7 classes in Mathematics is 1.0 FTE, not .98 FTE).

Subject Area (Grades 9-12)	New Hires				
	Total Number (FTE) of New Teachers Hired to Teach Each Subject	Number (FTE) Hired to Teach This Subject Without Certification in this Subject	Number (FTE) Directly From a Teacher Training Program	Number (FTE) From a Teaching Position In Another State	Number (FTE) With Prior Teaching Experience Who Did Not Teach Last Year Within or Outside Of Your State
Science					
Biology					
Chemistry					
Earth Science					
General Science					
Physics					
Mathematics					
Foreign Language					
French					
German					
Latin					
Spanish					
All Other Languages					

Code Number:

APPENDIX I

"Elementary School and Middle School/Junior High School
Science, Mathematics, Computer, and Foreign Language
Education Identified Needs Rating Scale"

Elementary School and Middle School/Junior High School Science, Mathematics, Computer, and Foreign Language Education Identified Needs Rating Scale

SUPERINTENDENT'S SIGNATURE _____

COUNTY NUMBER _____ SCHOOL SYSTEM NUMBER _____

WHAT IS YOUR SCHOOL SYSTEM'S NEED FOR ASSISTANCE IN IMPROVING MATHEMATICS, SCIENCE, FOREIGN LANGUAGES, AND COMPUTER LEARNING AT EACH OF THE INDICATED GRADE LEVELS? CIRCLE THE NUMBER THAT BEST REPRESENTS YOUR DISTRICT'S DEGREE OF NEED FOR EACH ITEM LISTED BELOW. A CIRCLE AROUND THE NUMBER 5 INDICATES THE GREATEST DEGREE OF NEED. THE REMAINING NUMBERS INDICATE THE INTERMEDIATE DEGREES OF NEED IN DESCENDING ORDER OF IMPORTANCE.

	NEED FOR	GRADE LEVELS	DEGREE OF NEED
1.	INSERVICE FOR IMPROVING TEACHERS' SUBJECT MATTER COMPETENCIES IN MATHEMATICS, SCIENCE, AND COMPUTER LEARNING.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
2.	INSERVICE FOR IMPROVING TEACHERS' INSTRUCTIONAL SKILLS IN MATHEMATICS, SCIENCE, AND COMPUTER LEARNING.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
3.	INSERVICE FOR IMPROVING TEACHERS' SUBJECT MATTER COMPETENCIES IN FOREIGN LANGUAGES.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
4.	INSERVICE FOR IMPROVING TEACHERS' INSTRUCTIONAL SKILLS IN FOREIGN LANGUAGES.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
5.	SUPPLY OF ADEQUATELY PREPARED MATHEMATICS, SCIENCE, AND COMPUTER LEARNING TEACHERS.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
6.	SUPPLY OF ADEQUATELY PREPARED FOREIGN LANGUAGE TEACHERS.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
7.	INSERVICE IN USE OF TECHNOLOGY WITH MATHEMATICS, SCIENCE, AND COMPUTER LEARNING.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
8.	MATHEMATICS, SCIENCE, FOREIGN LANGUAGE AND COMPUTER LEARNING FOR THE GIFTED AND TALENTED STUDENT.	K-6 7-8	5 4 3 2 1 5 4 3 2 1
9.	MATHEMATICS, SCIENCE, FOREIGN LANGUAGE AND COMPUTER PROGRAMS FOR WOMEN, MINORITIES, HANDICAPPED AND OTHER UNDERREPRESENTED AND UNDERSERVED STUDENTS.	K-6 7-8	5 4 3 2 1 5 4 3 2 1

10.	ADEQUATE INSTRUCTIONAL MATERIALS AND EQUIPMENT FOR MATHEMATICS AND SCIENCE EDUCATION.	K-6	5	4	3	2	1
		7-8	5	4	3	2	1
11.	SCHOOL PROGRAMS AND CURRICULUM FOR THE NONACADEMIC MATHEMATICS STUDENT.	K-6	5	4	3	2	1
		7-8	5	4	3	2	1
12.	SCHOOL PROGRAMS AND CURRICULUM FOR THE NONACADEMIC SCIENCE STUDENT.	K-6	5	4	3	2	1
		7-8	5	4	3	2	1
13.	SCHOOL PROGRAMS AND CURRICULUM FOR THE NONACADEMIC STUDENT IN COMPUTER LEARNING.	K-6	5	4	3	2	1
		7-8	5	4	3	2	1
14.	CURRICULUM AND PROGRAMS FOR REMEDIATING THE LOWER 15 PERCENT OF ELEMENTARY STUDENTS IN THE AREA OF MATHEMATICS.	K-6	5	4	3	2	1

APPENDIX J

"Some Thoughts and Reflections on Analyzing and Assessing Needs in Elementary School Mathematics and Science"

As educators in Indiana, we are all interested in improving instruction and student learning within our State. Science and mathematics are areas where, based on both national commission findings and local test scores, the need for improvement appears to be great. During the late 1970s and early 1980s, emphasis on improving science and mathematics instruction focused on improvement at the high school level. The present needs assessment data, coupled with: (a) the shift in priorities toward needs assessment and/or state of the art studies in the early grades by the National Science Foundation, and (b) the PRIME TIME program for the elementary grades in Indiana, make the elementary school a natural extension of our current study the logical area for investigation on the problem of less than optimal achievement in science and mathematics.

As we look at the current state of instruction in science and mathematics in the elementary school, at least two issues become apparent. The first involves the question of adequate curricular materials while the second involves the quantity and quality of instruction when adequate materials are available. We propose to examine both of these issues through the use of a survey questionnaire and follow-up interviews with elementary school principals and perceived teacher-leaders. When completed, we will have a much clearer picture of what is and is not being taught in elementary school science and mathematics in Indiana. With such data, designing initiatives to improve elementary school science and mathematics instruction will be much easier, and the chances of success of those initiatives much greater.

The major thrust of this study will be the development, validation, and administration of a survey questionnaire to be sent to a stratified random sample of elementary school principals throughout Indiana. The survey instrument will be kept short to promote a high rate of return.

This feature, coupled with the support of the Indiana Association of Elementary and Middle School Principals hopefully will make the return rate high, and thus make conclusions valid, and therefore generalizable throughout Indiana and the midwest.

The first set of items on the survey instrument will focus on the availability of science and mathematics materials beyond adopted textbooks. For example, do schools have materials and supplies for elementary level science experiments? Many mathematics texts suggest the use of base-10 blocks for teaching place value. Do schools have base-10 blocks?

The second, and most important set of questions to be addressed involve how often and how well elementary school personnel actually use the materials available to them. All the science and mathematics materials in the world will be of no value if the teachers do not know how to use them or do not want to use them. There is substantial anecdotal information to infer that science is often taught for only a few days a semester or not at all in many elementary school classrooms. It is also widely believed that, while mathematics is taught daily, a majority of teachers use only drill and practice text assignments and worksheets. Manipulative materials known to produce better understanding of mathematics and quantitative problem solving skills are rarely put before the students. In short, the survey instrument will focus on what is really being done to promote conceptual understanding as opposed to rote memorization of facts in science and mathematics in Indiana elementary schools.

A short series of on-site and/or telephone interviews will be conducted to gather information not easily attainable by the brief survey instrument. The major issue to be addressed with these interviews involves the extent to which teachers and principals actually believe that they can or should be doing more science and mathematics activities where the students are

active participants. If these individuals are not interested in promoting such learning, then simply supplying them with science and mathematics materials will be of little value in enhancing student achievement and positive attitudinal development.

APPENDIX K

"Instructional Materials Survey"

Instructional Materials Survey

School Corporation Name _____

School Corporation Number _____

Contact Name _____ Phone Number _____

Name of Person Interviewed _____ Phone Number _____

Title of Person Interviewed _____

Interviewer _____ Date of Interview _____

Your school corporation completed a Title II Funding survey from the Indiana Department of Education last year indicating a need for additional instructional materials and equipment in science and math. Could you be more specific and describe what types of materials and equipment are most needed? (Allow for open-ended response and then ask about any of these categories not mentioned).

_____ Textbooks

_____ Lab Equipment

_____ Audiovisual Equipment

_____ Computer Hardware

_____ Computer Software

_____ Classroom or Laboratory Space

Could you differentiate these needs by high school, middle school, and elementary school?

(Thank the individual for his or her time.)

APPENDIX L

"Minority Programs Telephone Survey"

MINORITY PROGRAMS TELEPHONE SURVEY

School Corporation Name _____

School Corporation Number _____

Contact Name _____ Phone Number _____

Name of Person Interviewed _____ Phone Number _____

Title of Person Interviewed _____

Interviewer _____ Date of Interview _____

My name is _____ and I work with the Indiana Needs Analysis Project at Indiana University in Bloomington. I'm calling to gather information on several questions concerning minorities which the federal government has asked us to gather information on. This should only take about 5 minutes. Your responses are confidential as we will not be reporting responses on these questions by school or school district.

1. Do you have any special programs for your teachers aimed at increasing enrollments of minorities and/or women in math, science, foreign languages, or computers? (Explain)

_____

_____

_____

_____

_____

_____

_____

_____

2. Do you have any special programs for your students aimed at increasing enrollments of minorities and/or women in math, science, foreign languages, or computers? (Explain)

Thank you for your time!

APPENDIX M

"Business/Industry Employers Interview Schedule"

Business/Industry Employers Interview Schedule

Organization: _____

Date of Interview: _____

1. Tell me about the kinds of positions available to high school graduates.

2. Do high school graduates have opportunities to advance within the company (to higher levels)?

3. What is the future outlook for these positions? Will any of these positions be done away with by automation?

4. What kinds of skills do these jobs require? (math, science, computer science)

5. Do high school graduates have the necessary math, science and/or computer skills to do these jobs?

6. Are the math, science and/or computer skills learned on the job or beforehand in high school?

7. Do you ever find yourself training people in the math, science, and/or computer science skills you thought they came in with? If yes--what?

8. Does the lack of math, science, and/or computer skills apply to middle-aged adults hired as well as high school graduates? Of these skills, are there any that only the recent high school graduates tend to lack?

9. What are the causes of these math, science, and/or computer skill deficiencies?