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RELATIONSHIP OF ACTIVITIES
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DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy in the Graduate School
of The Ohio State University

By
Leonard A. Colelli, B.S., M.Ed.

* * * * *

The Ohio State University
1985

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Adviser
Educational Theory
and Practice:
Industrial Technology Education
DEDICATION

This dissertation is dedicated to my father:

Professor Leonard M. Colelli.

Throughout the years of my development my father has been a role model for teaching excellence. From him I learned discipline for work, dedication to profession, desire for knowledge, and drive to accomplish well the tasks at hand. All of these qualities were essential to the successful completion and defense of this dissertation.
ACKNOWLEDGMENTS

Words seem to offer very little compensation for the many individuals who have helped the researcher during the course of this study. However, it seems appropriate to express my gratitude and thanks to those who have assisted in the completion of this dissertation.

A special debt of gratitude is owed to Dr. Donald G. Lux, my major adviser. He provided guidance and encouragement throughout my entire graduate program at The Ohio State University. His constructive criticism and efficient editorship were highly significant factors in the successful completion of this study.

Drs. E. Keith Blankenbaker, Michael L. Scott, and William D. Umstattd were very helpful in the initial planning stages of the study and in the constructive evaluation of the final written draft of the dissertation. These individuals also provided data (from prior studies and through contacts at the Ohio State Department of Education) that were extremely valuable during the initial teacher identification phase of the study.

Appreciation is also expressed to Mr. Joe R. Logsdon and Dr. Richard Dieffenderfer (industrial arts consultants with the Ohio State Department of Education) for their
endorsement of the study and for providing the researcher with an updated directory of Ohio industrial arts teachers and school buildings. This information helped refine the accessible population of manufacturing teachers.

Dr. J. David McCracken, professor of agricultural research, was very helpful in the construction of instrumentation, identification of appropriate data analysis techniques, and in the interpretation of data obtained from computer runs. Special thanks is also extended to Mr. Frederick Ruland, senior statistical consultant at The Ohio State University computer center, for his expert assistance in the coding of data and design of computer programs to test the research hypotheses.

The researcher is also grateful to Dr. Edwin McDaniel, Ms. Patricia Weese, Mr. James Daggett, Dr. Edwin Novak, and others for their time and constructive comments in the preliminary field testing and evaluation of the survey instruments. Their advice was of great assistance in the development of the final instruments which undoubtedly contributed to the 95% response rate achieved from the mail survey.

The superb word processing job evidenced throughout this dissertation is the result of a tremendous amount of time and effort devoted to detail and patience with the researcher provided by Ms. Eilene Reece.
Finally, with great appreciation, the researcher is exceptionally grateful to his patient and understanding wife Linda, who spent countless hours typing and editing early drafts of the dissertation and who sacrificed many immediate pleasures of life for a long term commitment to the future of our family.
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CHAPTER I

Introduction to the Problem

The focus of secondary school industrial arts programs has traditionally been on individual projects and the basic hand tool and machine activities of the late 18th and 19th century crafts-person. Kozak (1982) reflects the attitude of many regarding the adequacy of this situation.

The study and practice of 19th century crafts are certainly appropriate as a historical study—but only as a historical study—not as preparation for functioning in the next century. Students cannot be given projects which require several weeks of sanding/polishing and told that it represents today's technology. (p. 58)

The need for change has often been expressed as a central theme in historic and contemporary industrial arts literature. Leaders such as Warner (1947, 1965), Olson (1957), Towers, Lux, and Ray (1965), Maley (1973), Brown (1977), DeVore (1980a), and many others have proposed philosophies and curricula to reflect a broadened view of industry and technology and their societal impact.

During the 1960's and 1970's considerable effort was devoted to the development of curricula and commercial
laboratory activity packages for industrial arts programs at the secondary level. Cochran (1970), Householder (1972), and Maley (1978) provide detailed descriptions and classifications of these many and varied efforts. These efforts were aimed at closing what Melby (1936) referred to, and Schmitt and Pelley (1966) first documented, as an "enormous gap" between theory and classroom practice.

Content emphasized in the developmental efforts was much broader than selected hand and machine production processes of a few craftspersons. These efforts endeavored to present learning experiences involving a wide range of production, management, and personnel processes relating to career, social, and consumer needs.

The majority of these curricular innovations were designed for the secondary level. The major assumption was that change could take place in secondary level industrial arts programs by providing inservice teachers with models of contemporary theory that could be applied to classroom practice. However, this approach has not proven to be very effective in effecting change in the secondary schools.

As we approach the midpoint of the 1980's, there is little evidence to suggest that these programs have resulted in industrial arts curriculum changes in the secondary school (Bame, 1980; DuVall, 1980; LaPorte, 1982; Steeb, 1980; Streichler, 1980). Although the names of the
programs are familiar, only isolated instances of their legacy can be identified today. Lux (1982) agrees with this assessment when he states that:

. . . there is little factual basis for assuming that the field is capable of aggressively closing the continuing theory-practice gap. Despite the extensive development of the 1960's. . . instruction in drafting, metalworking, and woodworking (essentially the 1880 program) still characterized what is taught in the name of industrial arts. (p. 859)

He further states that:

The field uniformly claims it is providing technological literacy for the next generation. Its programs, in the main, appear to be incapable of delivering on this claim. It appears better suited to orienting youth to the tools, materials and processes of craftspersons of the last century rather than to the nature of modern industry and how it affects us. (p. 860)

Reporting on the results of research as part of the national Standards for Industrial Arts Education Program Project, Dugger (1980a) indicated that the perceptions of industrial arts have changed little since an earlier parallel study was conducted by Schmitt and Pelley (1966). The purpose cited as having the highest degree of emphasis was "to develop in students a measure of skill in the use of common tools and machines" (p. 12). The industrial arts courses listed most frequently by secondary level industrial arts chairpersons were general woodworking, general metals, general industrial arts, and drawing. Thus,
despite the major developmental efforts of the 60's and 70's the content matter of industrial arts courses at the public secondary school level appears to remain relatively unchanged.

The question of how to effect change in the public schools has received renewed attention in light of the findings of the National Standards study. Numerous states, including Florida, Iowa, Kansas, Louisiana, Maryland, Ohio, and Virginia have taken action at the state level by producing curriculum guides which promote "broadly-conceived contemporary programs incorporating elements of industrial technology such as energy and power, construction, manufacturing, communications, and transportation" (Lux, 1980, p. 14). Further, the major curriculum guides being planned for development, according to state and territorial supervisors who participated in the National Standards Study, were in areas of transportation/power/energy and communications technology (Dixon & Dugger, 1980, p. 33). This trend toward updating traditional industrial arts curricula at the state level has been viewed as a positive step toward effecting change at the secondary level.

The revised state curriculum guides, however, are viewed by some as only a partial solution to curricular change at the secondary level. The guides, by themselves,
present the same problem as did the innovative curricular designs of the 1960's. They are models of contemporary theory (course titles and objectives) that should (in the opinion of the state) be applied to classroom practice by inservice teachers. Some indication of their effectiveness, without attending to other change related variables, can be seen by examining additional National Standards survey data. While state supervisors most frequently listed broadly-conceived power and energy, communications, and materials processing courses as those they planned to develop in the near future, secondary level industrial arts chairpersons concurrently listed narrowly-conceived skill oriented courses in plastics, graphic arts, electricity, and general metals as those they planned to offer in the near future (Young et al., 1980, p. 19). Here again, the evidence seems to indicate that providing models to inservice teachers does not appear to be a very effective way of promoting change in the secondary schools.

The search for variables that may act as a catalyst for change in the secondary curriculum has lead many industrial arts educators to critically examine the preservice teacher education curriculum. The "teach as they were taught" hypothesis and a growing criticism of conventional teacher education programs has received
considerable attention in the literature (Chang, 1979; Corrigan, 1983; DeVore, 1980b; Gemmill, 1976; Kozak, 1982; Lauda, 1979; Nannay, 1983; Worthington, 1982; & others). Many references also suggest that the context (local school) and its influences has a significant impact on what a teacher teaches (Bro, 1971; Clay, 1980; Caron, 1975; Davis, 1975; Maley, 1980; Mongerson, 1968; Ray, 1980; Withall & Wood, 1982). Still others feel that teacher characteristics (age, sex, years of teaching, attitude, and others) will dictate what happens "come Monday morning" when the shop door closes (LaPorte, 1980; McKee, 1971; Timper, 1973; Trocki, 1977; & others). Much of the literature is a result of hypothetical intuition, some report descriptive findings of isolated situations, but few are the results of theory-based empirical research.

Statement of the Problem

Dyrenfurth and Householder (1979), in Industrial Arts Education: A Review and Synthesis of the Research 1968-1979, have stated that "[t]he most serious weakness [in industrial arts education] is the lack of treatment of the leadership-practitioner gap" (p. 148). One way to address the theory-practice problem is to trace the antecedents of change where change has already occurred.
Secondary level industrial arts teachers who deviate from conventional practice would make an ideal source of data.

The discussion in the preceding paragraphs has established that change has been sought but not achieved. Therefore, the need to study relationships that may exist between change related variables and existing laboratory practice is essential. Further, it seems that going to the teachers whose programs show some degree of theory-practice compatibility is one way to do this.

Logic would suggest that teachers who show some degree of theory-practice compatibility have had prior contact with theory-based laboratory activities. Much previously cited literature suggests that these "background experiences" could impact significantly on what a teacher teaches. Some descriptive data to support the "teachers teach as they were taught hypothesis" was recently published in A Study of Schooling (Goodlad, 1983). However, no empirical studies could be found which directly consider the relationship between teacher background activities and the laboratory activities which they currently teach.

The researcher addressed the theory/practice problem by empirically examining relationships between background activity experiences and actual secondary level laboratory practice of non-conventional industrial arts
teachers. The primary focus of this investigation is to identify the antecedents of content centered teaching practice for non-conventional industrial arts teachers.

Generally, eight basic research questions guided the investigation:

1. How well do the technical background experiences of secondary level teachers of manufacturing match up with an inventory of manufacturing activities that were derived from a codified theory-based body of manufacturing concepts? (Degree of background compatibility)

2. How well do the student laboratory activities provided by secondary level teachers of manufacturing match up with an inventory of manufacturing activities that were derived from a codified theory-based body of manufacturing concepts? (Degree of teaching compatibility)

3. What relationship exists between degree of background compatibility and degree of teaching compatibility? (Do teachers teach what they have previously experienced?)
4. Where do teachers say they gained their background experiences?

5. How well do the technical experiences from specific background sources of secondary level teachers of manufacturing match up with an inventory of manufacturing activities derived from a codified theory-based body of manufacturing concepts (nine degrees of compatibility subscales for degree of background compatibility [DBC])?

6. What relationships exist between nine subscales of background activity compatibility and total degree of background compatibility? (Which background sources make significant contributions to the theory-based background experiences of non-conventional industrial arts teachers?)

7. What relationships exist between specific sources of background activity experience (nine subscales of DBC) and degree of teaching compatibility? (Which background sources make significant contri-
8. What relationships exist between specific sources of background activity experience and three subscales of degree of teaching compatibility: degrees of management, production, and personnel compatibility? (Do non-conventional industrial arts teachers acquire specific types of laboratory activity experiences (management, production, personnel) from unique sources of background experience?)

Based on the results of analysis, the investigator will propose recommendations for the development of a change strategy which will include specific types of background activity experiences as effective agents of change in secondary school industrial arts curriculum.

Statement of Delimitations

The study was conducted under the following delimitations:
1. This study considered only the manufacturing technology component of current industrial arts curriculum content.

2. The manufacturing theory model of this study was the codified body of knowledge for manufacturing technology presented in the Rationale and Structure for Industrial Arts Subject Matter (Towers et al., 1966) and the Manufacturing Education Curriculum Project: A Rationale and Structure for Manufacturing Education in the Senior High School (Umstattd et al., 1975).

3. This study considered only laboratory activities as measures of theory-in-practice. Philosophy, written objectives, teaching methodologies, and other factors were not considered directly.

4. Only laboratory activities involving in-plant management, production, and personnel practices through which the form of materials is altered to add economic value were included. Activities involving the study of the effect of all or any of this technology on society were not included.
5. The theory-practice analyses were delimited to secondary level manufacturing teachers in the State of Ohio.

Objectives of the Study

The principle objectives of this study were to:

1. determine whether secondary level manufacturing teachers teach as they were taught and/or have previously experienced.

2. identify primary sources of background activity experience.

3. identify primary sources of teaching activity practice.

4. identify primary background sources in need of curricular change.

5. determine whether specific sources of background experience uniquely contribute to types of activities taught (management, production, personnel).

6. propose a change strategy that recommends specific types of background activities for curricular
improvement in primary sources of background experience.

Statement of Purpose

The purposes of this study were to:

1. Identify those variables or groups of unrelated variables which account for a significant amount of variance in the degree of teaching theory compatibility. These variables provide the basis for a regression equation which can best predict how well laboratory activities of a secondary level industrial arts teacher will match a theory-based model of manufacturing activities.

2. Provide baseline data on the degree to which secondary level industrial arts teachers teach what they have previously experienced. An empirical link between teacher background activities and their current student laboratory practices will provide evidence to support recent efforts to incorporate contemporary theory
into practice in many state curriculum guides and in a growing number of preservice industrial arts teacher education programs.

3. Identify primary sources of background experience and primary sources of teaching practice (i.e. college level industrial arts laboratory courses, curriculum packages/textbooks, etc.). The primary sources of teaching practice would account for a significant amount of variance in what is actually taught (in terms of a theory-based model of activities). Thus, primary background sources which are not also included in the primary teaching sources set could be easily identified as sources where change efforts must be directed to reduce the theory/practice gap.

4. Identify primary sources which account for a significant amount of variance in management, production, and personnel teaching practices of non-conventional industrial arts teachers. Background
sources which have been identified as sources where change is needed can be evaluated in terms of their lack of contribution in each of the three areas of teaching practice (management, production, personnel). This data may provide direction to changes in the types of activities taught to prospective industrial arts teachers from sources where change has been recommended. Further, the procedure involved in this analysis step can be adopted by individual sources on a regular basis (i.e. undergraduate college follow-up studies of graduates) to evaluate the effectiveness of their curricula on promoting basic activity change at the secondary level.

5. Develop an inventory of theory-based manufacturing activities. (The mail survey instrument.) The application of this instrument is not limited to the parameters of this study. This instrument can serve as a model for the development of additional instruments and program improvement in other
areas (construction, communications, energy/power, transportation) of industrial arts curriculum theory.

6. Develop a theory-in-practice normative profile of Ohio secondary level manufacturing activities. The activity inventory and normative profile may be used as a diagnostic or evaluative tool for existing program improvement by in-service teachers, teacher educators, supervisors, and state educational personnel. The activity inventory and normative profile of manufacturing activities can also aid administrators in their selection of industrial arts teachers who have qualifying background experiences for teaching manufacturing technology.

7. Provide local school administrators with the type of data that would enable them to evaluate objectives and activities of their present industrial arts teachers in terms of current theory-based manufacturing technology curricula.
Research Hypotheses

As purpose for scientific investigation, theory is enhanced through the formulation and testing of hypotheses about the variation of variables that characterize phenomena. Based on the ex post facto nature of this study, the following major and alternative hypotheses were posited:

I. Major Hypotheses

Hm: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by degree of background compatibility.

Hm Group #1 Subhypotheses: concerning specific sources of background experience and degree of theory-practice compatibility. (To identify primary background sources which account for a significant proportion of variance in total teaching practice.)

A significant proportion of variance in the degree of teaching compatibility will be accounted for by degree of background compatibility in:

1-A high school industrial arts laboratory source activities.

1-B college industrial arts laboratory source activities.

1-C student teaching source activities.

1-D curriculum package/textbook source activities.
1-E inservice training source activities.

1-F vocational/technical source activities.

1-G nonschool work experience activities.

1-H school related work experience activities.

1-I other source activities.

Hypotheses: concerning specific sources of background experience and degree of background compatibility. (To identify primary sources of background experience.)

A significant proportion of variance in the degree of background compatibility will be accounted by degree of background compatibility in:

2-A high school industrial arts laboratory source activities.

2-B college industrial arts laboratory source activities.

2-C student teaching source activities.

2-D curriculum package/textbook source activities.

2-E inservice training source activities.

2-F vocational/technical source activities.

2-G nonschool work experience source activities.
2-H school related work experience activities.

2-I other source activities.

Hm Group #3 Subhypotheses: concerning specific sources of background experience and degree of management compatibility. (To identify primary background sources which account for a significant proportion of variance in management teaching practice.)

A significant proportion of the variance in the degree of management compatibility will be accounted for by degree of background compatibility:

3-A high school industrial arts laboratory source activities.

3-B college industrial arts laboratory source activities.

3-C student teaching source activities.

3-D curriculum package/textbook source activities.

3-E inservice training source activities.

3-F vocational/technical source activities.

3-G nonschool work experience source activities.

3-H school related work experience activities.

3-I other source activities.

Hm Group #4 Subhypotheses: concerning specific sources of background experience and degree of production compatibility. (To identify background sources which account for a significant proportion of variance in production teaching practice.)
A significant proportion of the variance in the degree of production compatibility will be accounted by degree of background compatibility in:

4-A high school industrial arts laboratory source activities.

4-B college industrial arts laboratory source activities.

4-C student teaching source activities.

4-D curriculum package/textbook source activities.

4-E inservice training source activities.

4-F vocational/technical source activities.

4-G nonschool work experience source activities.

4-H school related work experience activities.

4-I other source activities.

Hypothesis #5: Concerning specific sources of background experience and degree of personnel compatibility. (To identify background sources which account for a significant proportion of variance in personnel teaching practice.)

A significant proportion of the variance in the degree of personnel compatibility will be accounted for by degree of background compatibility in:

5-A high school industrial arts laboratory source activities.

5-B college industrial arts laboratory source activities.
The major hypothesis and related sets of subhypotheses indicate that theory-based teaching activities are a function of theory-based activities previously experienced by teachers. In other words, teachers teach theory-based activities that they have previously practiced, were taught, or have studied. However, because of the nature of ex post facto research, it would be pointless to test the major hypotheses before a variety of extraneous presage and context variables (variables other than background activity experiences) were identified, quantified, and analyzed for their relationship with degree of teaching compatibility. If teachers with a high degree of background compatibility are significantly different from teachers with a low background compatibility in one or more extraneous presage or context variables that
are significantly related to degree of teaching compatibility, conclusions associated with the major hypothesis may be invalid (Warmbrod & Miller, 1974).

Related literature was used to identify extraneous presage and context variables that could be related to a degree of teaching compatibility. Data associated with these extraneous variables were collected and analyzed to determine which, if any, were significantly related to degree of teaching compatibility.

II. Alternative Hypotheses

The extraneous variables investigated were identified in the following alternative hypotheses.

Ha1: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by the following presage variables.

A. Age in years
B. Philosophy/attitude concerning purpose of industrial arts
C. Amount of professional preparation
D. Undergraduate grade point average (GPA)
E. Number of hours/week in supplemental employment
F. Number of hours/week in leisure time activities
G. Number of years teaching experience
H. Number of years work in industry
I. Type of industrial experience
Ha2: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by the following context variables.

A. Perceived freedom of program use
B. Perceived academic abilities of students
C. Type of school
D. Level of teaching
E. Rotation format
F. Average manufacturing class size
G. Size of school enrollment
H. Number of industrial arts teachers in department
I. Number of industrial arts class periods taught each day
J. Number of types of industrial arts courses taught
K. Percentage of teaching load that is manufacturing
L. Number of preparation periods/week
M. Number of hours in nonteaching duties each week
N. Budget (per pupil expenditure)
O. Years teaching present position
Statement of Assumptions

The following assumptions were made in pursuit of this study.

1. A range of compatibility between educational theory and practice exists in courses taught by inservice teachers.

2. Valid measures of theory-background compatibility can be acquired by comparing teacher background activity experiences with a model of laboratory activities derived from an established body of theory-based knowledge.

3. Valid measures of theory-practice compatibility can be acquired by comparing current student-practiced laboratory activities with a model of laboratory activities derived from an established body of theory-based knowledge.

4. Sources of background activities can be identified by frequency of response on a survey instrument.

5. Primary sources of background activities can be identified by selecting background sources which account for a significant
proportion of variance in measures of background activity practice.

6. Primary sources of teaching activity can be identified by selecting background sources which account for a significant proportion of variance in measures of teaching activity practice.

7. Background sources that require curricular change can be identified by the non-significant proportions of variance that they elicit in measures of teaching practice for nonconventional industrial arts teachers.

8. Background sources that require curricular change can be evaluated by the non-significant proportions of variance that they elicit in measures of management, production, and personnel practice of nonconventional industrial arts teachers.

9. The Status of Ohio Industrial Arts 1980 (Blankenbaker et al., 1980), with an 81 percent individual teacher response, was a representative source from which to begin a census search of
secondary level manufacturing teachers in the state of Ohio.

10. The extraneous presage and context variables identified from the literature review (as part of the ex post facto research method) were valid controls of internal validity in the present study.

11. All survey respondents gave an honest and accurate assessment of each item of the survey instrument based on their actual beliefs rather than upon some preconceived ideas of how the items should be answered. (The questionnaire will not bias respondents' answers.)

Statement of Limitations

When reading this study and attempting to generalize the findings to other situations, the reader should be aware of the following limitations:

1. The design of the study was ex post facto (Campbell & Stanley, 1963; Kerlinger, 1973). The experimental and quasi-experimental manipulation of the variables by the
researcher were not possible due to time constraints. Consequently, cause-effect relationships must be viewed conservatively.

2. The survey respondents were secondary level manufacturing teachers in the State of Ohio. Results of this study may not be generalized beyond the population surveyed in Ohio. However, much of the descriptive data were obtained from questions on instruments which were identical to those of the Phase I nationwide survey of the Standards for Industrial Arts Program Project (Dugger et al., 1980b). Subsequent comparisons made by Blankenbaker et al. (1980) indicate little difference in selected characteristics of the two populations (national and State of Ohio) of industrial arts teachers.

3. The majority of survey respondents were selected from a census of school buildings listed in the data files of the Blankenbaker et al. (1980) status survey of Ohio industrial arts teachers. Only buildings where teachers indicated, by course title, that at least one manufacturing course was taught were initially selected.
4. Systematic efforts to identify manufacturing teachers from the 19% non-response rate of the Blankenbaker et al. (1980) Individual Teacher Questionnaire survey and industrial arts teachers who initiated manufacturing programs since 1980 were inhibited by time and economic constraints.

5. In the few instances where more than one manufacturing teacher was available in the school, only one was asked to participate in the study. The advantage of this process was a control for intercorrelations of context (school related) variables (resulting in an increase in power) and the disadvantage was a slight loss of representativeness.

6. The relatively small numbers of teachers who teach manufacturing in Ohio may decrease the power (ability to reject the null) of the analysis techniques applied to the survey data. However, other factors affected by small numbers of participants (reliability and sampling error) will have little impact on the data because an effort was made to secure a census of manufacturing teachers rather than a representative sample.
Statement of Procedure

The procedure for conducting this study was as follows:

1. Exploratory research was conducted in an area of interest to identify a tentative problem. The literature relating to curriculum, preservice teacher education, and change strategies was reviewed, issues were identified and questions/hypotheses were stated.

2. After discussion with faculty members and graduate students on the staff of the industrial technology education program, area, The Ohio State University, a research proposal was written and approved.

3. Retroactive computerized (MIC-Mechanized Information Center) searches were conducted at The Ohio State University. The initial searches were broad-based in nature and included the following descriptors: industrial arts, curriculum, pre-service, industrial technology, industrial education, and
teacher education. The later searches focused on industrial arts, curriculum innovation, and change strategies. The files of ERIC, Abstracts of Instructional Materials, and Abstracts of Research Materials (AIM/ARM) were searched.

4. A manual search was conducted of the Jelden Dissertation Abstracts in the descriptor areas of: follow-up, innovative programs, teacher education with philosophy, personnel evaluation with teacher education, teacher education with student evaluation, attitude with teacher education with philosophy.

5. Journal articles and abstracts were copied and microfiche/film materials of relevant studies were obtained.

6. Research methodology (Ex Post Facto) was identified and data analysis techniques were selected.

7. Extraneous variables (threats to internal validity) were identified from the literature review and plausible alternative hypotheses were established (Kerlinger, 1973).

8. The teacher survey population was identified from the participating schools:
A. The Blankenbaker et al. (1980) data decks, name/address lists, and descriptive computer printouts were obtained from School Program and Individual Teacher questionnaires.

B. Manufacturing course titles and corresponding school buildings were identified.

C. The population was delimited to secondary school buildings where at least one manufacturing course was taught (grades 7-12).

D. Additional school buildings were identified from the data decks of the Umstattd, 1983-84 follow-up study of Ohio State University Industrial Technology graduates.

E. Demographic data and names of industrial arts teachers within each building were cross-checked and updated with the 1983-84 Directory of Industrial Arts Teachers (Ohio Department of Education) and the 1983-84 Ohio Educational Directory.
F. One manufacturing teacher within each building was identified by means of a return postcard sent to school building principals (see Appendix A). The return postcard also queried convenient days and times to call the school for the initial data gathering telephone survey.

9. An initial Data Gathering Telephone Survey was designed to:
   A. confirm the names of manufacturing teachers.
   B. Interview one manufacturing teacher from each school to gather data (school characteristics and teacher background) concerning extraneous presage and context variables. (See Appendix B)
   C. Identify additional school buildings where manufacturing courses are taught.

10. A mail survey of a random sample of Jackson's Mill symposium participants was conducted to obtain a contemporary theory-based ranking of seven purposes of industrial arts. The ranking allowed the
researcher to construct a continuous variable survey question pertaining to philosophy of industrial arts (see Appendix E).

11. The Manufacturing Activities Inventory (the mailed survey instrument) was designed to gather information concerning technical background and types of laboratory activities taught by manufacturing teachers.

12. The survey instruments were pretested and modified from the recommendations of a validation jury.

13. The survey instruments were reproduced, bound, and coded.

14. The survey cover letter, reminder postcard, second follow-up letter and final follow-up letter were designed and reproduced.

15. The Teacher Identification Data Gathering Telephone Survey was conducted with each participating manufacturing teacher. (See Appendix B)

16. The Manufacturing Activity survey and enclosed cover letter were mailed (see Appendix C).
17. A reminder/thank you postcard was mailed to all teachers seven days after the initial mailing (see Appendix D).

18. The second survey follow-up letter and duplicate survey instrument were mailed to teacher nonresponders two weeks after the first follow-up postcard was mailed (Appendix D).

19. A final follow-up and duplicate survey instrument were sent via certified mail to teacher non-responders three weeks after the second follow-up letter was mailed (seven weeks after the initial mailing). (See Appendix D)

20. Selected presage and context data (obtained from the Telephone Data Gathering Survey) of nonresponders and responders were analyzed to determine if nonresponders differed significantly from responders as a control for nonresponse bias.

21. Respondent survey data were collected and coded.
22. Respondent survey data were parametrically treated, hypotheses were tested and descriptive data pertaining to research questions were analyzed.

23. The findings of the study were reported and a summary, and conclusions and recommendations were made based upon a synthesis of the literature and survey data. (See Fig. 1: Procedural Schematic)

Statement of Terminology

The following definitions are presented for purposes of clarity and consistency:

**Antecedent** - existing, being, or going before; preceding; prior. Defined operationally as any influence of teaching practice which occurred prior to a teaching situation.

**Background Sources** - operationally defined as high school industrial arts laboratory courses (HSLAB), college industrial arts laboratory courses (COLAB), student teaching (STUTEAC), curriculum packages/textbooks (CPACK), inservice training (INSERV), vocational/technical classes (VOCED), non-school related work experience (WORKNON), school (teaching employment) related work experience
Figure 1: Procedural Schematic
(WORKSCH), and other (OTHER) (graduate school, guest speakers, plant visitations, etc.) sources where secondary level teachers have had an opportunity to practice manufacturing activities prior to a teaching situation.

**Context Variables** - variables which describe the local school environment where a manufacturing teacher teaches such as pupil characteristics, school and community characteristics (such as climate, ethnic composition, school size), and classroom characteristics (such as class size, textbooks, etc.) which can affect classroom teaching (Dunkin & Biddle, 1974).

**Degree of Background Compatibility (DBC - Major Independent Variable)** - an interval data measure of the compatibility of an aggregate of antecedent teacher activities with a theory-based model of manufacturing activities. DBC was operationalized as a percentage of the number of background activities checkmarked on the manufacturing activity survey booklet divided by the total number of activities \( \text{DBC} = \frac{N_{\text{BACKGROUND}}}{152} \).

**DBC Subscales** - interval data measures of the compatibility of activities from nine specific background sources (high school, college, inservice training, etc.) with a theory-based model of manufacturing activities. Each subscale is operationalized as a percentage of the number of specific source related background activities.
checkmarked divided by the total number of activities (i.e. the curriculum package/textbook subscale = \(N_{\text{CPACK}}/152\)).

**Degree of Teaching Compatibility (DTC - Major Dependent Variables)** - an interval data measure of the compatibility of current teaching activities (student practiced) with a theory-based model of manufacturing activities. DTC was operationalized as a percentage of the number of current teaching activities checkmarked on the manufacturing activity survey booklet divided by the total number of activities (DTC = \(N_{\text{TEACHING}}/152\)).

A. High teaching compatibility - DTC scores that lie within an area greater than one standard deviation above the DTC population mean.

B. Medium teaching compatibility - DTC scores within an area ± one standard deviation around the DTC population mean.

C. Low teaching compatibility - DTC scores that lie within an area more than one standard deviation below the DTC population mean.

**DTC Subscales** - interval data measures of the compatibility of current teaching activities with management, production, and personnel sublevels of a theory-based model of manufacturing activities.
A. Degree of management compatibility (DMC) - operationalized as a percentage of the number of current teaching activities checkmarked on the management subscale of the activity survey booklet divided by the total number of management activities (DMC = \( \frac{N_{\text{MANAGEMENT}}}{54} \)).

B. Degree of production compatibility (DPC) - operationalized as a percentage of the number of current teaching activities checkmarked on the production subscale of the activity survey booklet divided by the total number of production activities (DPC = \( \frac{N_{\text{PRODUCTION}}}{74} \)).

C. Degree of personnel compatibility (DPERC) - operationalized as a percentage of the number of current teaching activities checkmarked on the personnel subscale of the activity survey booklet divided by the total number of personnel activities (DPERC = \( \frac{N_{\text{PERSONNEL}}}{17} \)).
Inservice Manufacturing Teacher - refers to industrial arts teachers who are currently teaching at least one manufacturing class at the secondary level.

Manufacturing Technology - defined operationally as a concept oriented course with a broad focus on numerous in-plant learning activities involving management, production, and personnel practices where the form of materials is altered to add economic value.

Presage Variables - variables which describe teacher formative experiences (such as social class, age, sex), teacher training experiences (such as preservice curriculum and student teaching), and teacher properties (such as intelligence, motivations, personality traits) which can affect classroom teaching (Dunkin & Biddle, 1974).

Preservice Education - undergraduate industrial arts teacher education curriculum and related experiences prior to obtaining a teaching position.

Secondary Education - refers, in the context of this study, to junior high school, middle school, middle elementary school, and high school: grades 7 through 12.

Primary Background Sources - background sources which elicit a significant proportion of variance in theory-based background activity experience (degree of background compatibility).
Primary Teaching Sources - background sources which elicit a significant proportion of variance in theory-based teaching practice (degree of teaching compatibility).

Theory-based Model of Practice - refers to the manufacturing activity booklet (the survey instrument). A comprehensive list of management, production, and personnel activities derived from a theory-based codified and validated body of manufacturing knowledge (see Appendix C).

Organization of the Study

This study is composed of five chapters. Chapter I contains background information and a statement of the problem. Also, the objectives and purpose are presented, delimitations, limitations, and assumptions are recognized, the study's procedure is explained, and selected terms are clarified.

A review of literature concerning change theory and the relationship of specific presage and context variables to the implementation of curricular innovations is presented in Chapter II. One specific objective was to review and examine identified variables in relation to a theoretical model of classroom teaching (Dunkin & Biddle, 1974).
Chapter III addresses the procedure and methods which were used to collect and compile the data for this study. Such factors are research design and validity, population and teacher identification, characteristics of the instrumentation, survey administration, and the treatment of data were described.

A discussion of the findings were presented in Chapter IV. Included in this chapter are sections concerning descriptive data and relationships of independent variables, variances explained by sets of independent variables and the dependent variable, the identification of primary background sources, the identification of primary teaching sources, variances in specific subscales of the dependent variable explained by background source variables, an evaluation of primary background sources, and the evaluation of the research hypotheses.

Finally, a summary and discussion of the findings are presented in Chapter V. Also included are conclusions and recommendations for further study.
CHAPTER II

REVIEW OF THE LITERATURE

An extensive literature search was conducted of the ERIC system, AIM/ARM Abstracts, Dissertation Abstracts International, and the Jelden Abstracts. Descriptors dealing with innovative programs, pre-service teacher education, curricular innovations, change strategies, and curricular adoption were used to identify variables which might affect curricular change; specifically in areas of innovation, adoption, and implementation.

This chapter was organized into two major sections. The first section includes literature concerning change theory and diffusion strategies. Stages of concern and adoption, change durability, administrator influences, school/community influences, peer group influences, teacher characteristics, mutual adaptation, the informal covenant, and a focus on background experiences and their effects on the change process will be discussed. Limitations of the conventional diffusion strategy will also be presented in this first section.
A theoretical model of variables for the study of classroom teaching will be presented in the second section of the literature review (Dunkin & Biddle, 1974). Presage and context variables identified from literature in Section 1 will be examined in relation to the theoretical model. A composite picture or Gestalt of the variables will be assembled (Tables 3 & 4) to illustrate existing gaps in knowledge and the limitations of previous research efforts. Finally, a rationale for the present study, in terms of its collective contribution to gaps in the model of teaching correlates and limitations of previous studies will be discussed.

Section 1

Change Theory and Literature

The search for new programs and methods of instruction is a continuing one. The era of the 1950's, 1960's, and 1970's saw a large and sustained effort to reform curriculum and instruction in industrial arts and in the broader context of education in general.

A host of expectations were developed for the industrial arts laboratory as leaders such as Warner (1947, 1965), Olson (1957), Towers, Lux, and Ray (1965), Maley (1973), Brown (1977), DeVore (1980a), and many others
proposed philosophies and curricula to reflect a broadened view of industry and technology and their societal impact. Cochran (1970), Householder (1972), and Maley (1978) provide detailed descriptions and classifications of these many and varied efforts.

A unifying theme throughout most of these curricular innovations was a consistent evolution of content and activities into broader than conventional systems of technology such as manufacturing, construction, transportation, and communication. Concept reinforcers developed within these technological systems promoted activities beyond the simple custom production of projects. The proposed activities were to involve the student in researching, developing, engineering, planning and expediting alternative production methods (such as continuous flow, batch, special project, and others), public speaking; written, visual, and electronic communicating; laboratory and site planning; cost estimating and company financing; marketing and distributing; industrial relations; social-cultural impact studies; and others.

Variations in proposed teaching methodologies were evident due to the developmental (i.e. Maryland Plan), social-economic (i.e. Industrial Arts Curriculum Project), social-cultural (i.e. Technology Education), and
human-adaptive (i.e. Jackson's Mill) approaches in which these curricula were designed; however, basal classroom activities were similar throughout most curricula. Use of behavioral objectives; use of inquiry and exploratory methods of teaching; assorted laboratory manuals and materials replacing or supplementing traditional textbooks; extensive use of filmstrips, transparencies, tapes, records, and television; computer and non-computer based programmed instruction; greater use of group dynamics (such as seminars, debates and panels, entrepreneurship organization structures, and role playing); more varied testing and grading procedures; a wider variety and use of community resources and experiences outside the classroom; and other characteristics have been discussed in the literature.

Measured against these expectations; however actual secondary level practice fell disappointingly short. Hopes for long term implementation of the promising plans were tried for a short time and then dropped or significantly modified, leaving curriculum and instruction about the same as it was during the late 19th century (Kozak, 1982). "The primary focus continues to be 'wood shop,' 'metal shop,' 'auto shop,' and 'drafting,' and not on the nature of our present technological world and the projected technologies of the future" (Nannay, 1983, p. 2).
Dyrenfurth and Householder (1979), in *A Review and Synthesis of the Research: 1968-1979*, have said that "... despite the fact that leaders at the cutting edge would have curriculum efforts move in certain directions, it seems obvious that there remains a significantly large portion of those who do not agree with the leaders" (p. 55). Reliance upon the custom production of individual projects based on exponential increases in tool-skill development taught by lecture/demonstration/practice methods in a narrow selection of outdated industrial occupational areas still prevails in a majority of industrial arts laboratories of the late 20th century. The problem, according to Paul DeVore (1980b), is that "[t]here is a ... serious lack of understanding within the profession about change and how it occurs or how to effect it" (p. 9).

Change in social systems is often initiated by individuals or groups of individuals who attempt to link practice institutions, such as school systems, with knowledge producing organizations such as universities and curriculum development centers. As basic research is conducted and the knowledge discovered is applied to practical problems, these individuals act to communicate this knowledge to those in practice institutions who might need it. This action is an overt effort to bridge a gap
between theory and practice. The process of curricular
diffusion and the associated strategies for attempting
durable change are the subject of further review.

Stages of Concern/Adoption of Innovations

Gene Hall and his colleagues at the University of
Texas at Austin's Center of Research and Development on
Teacher Education have focused on methods which document
the processes of practitioner involvement in the
application of innovations. Their research findings
suggest that the adoption of an innovation occurs as a
developmental process characterized by identifiable Stages
of Concern relating to corresponding Levels of Use of an
innovation (Hall, 1974; Loucks & Hall, 1979).

The Concerns-Based Adoption model developed by Hall
and his associates requires change agents to address
specific concerns of practitioners at various stages, as
they progress with involvement in the application of an
innovation. Concerns are periodically assessed as a basis
for determining individual interventions. Interventions
directed by change agents during inservice training or
workshops are aimed at answering the user's concerns,
arousing higher concerns, and thereby advancing the level
of use of an innovation (Hall, 1974).

Eight distinct Levels of Use (LoU) of an innovation
have been identified by Hall et al. (1975). Table 1 shows
the Levels of innovative Use and typical behavioral indicies of each level.

Table 1

Levels of Use of the Innovation: Typical Behaviors

<table>
<thead>
<tr>
<th>LEVEL OF USE</th>
<th>BEHAVIORAL INDICES OF LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI Renewal</td>
<td>The user is seeking more effective alternatives to the established use of the innovation.</td>
</tr>
<tr>
<td>V Integration</td>
<td>The user is making deliberate efforts to coordinate with others in using the innovation.</td>
</tr>
<tr>
<td>IVB Refinement</td>
<td>The user is making changes to increase outcomes.</td>
</tr>
<tr>
<td>IVA Routine</td>
<td>The user is making few of no changes and has an established pattern of use.</td>
</tr>
<tr>
<td>III Mechanical Use</td>
<td>The user is using the innovation in a poorly coordinated manner and is making user-oriented changes.</td>
</tr>
<tr>
<td>II Preparation</td>
<td>The user is preparing to use the innovation.</td>
</tr>
<tr>
<td>I Orientation</td>
<td>The user is seeking out information about the innovation.</td>
</tr>
<tr>
<td>0 Non-use</td>
<td>No action is being taken with respect to the innovation.</td>
</tr>
</tbody>
</table>

(Hord, 1981, p. 9)

One can see by examining Table 1 that as Levels of Use increase, the behavioral indices become less centralized in
the individual as efforts are made to expand, adapt and involve other teachers in the innovation. An important point to note here is that according to Loucks and Hall (1979), an innovation is said to be "institutionalized" when "...teachers are at the Routine Level of Use or above, and have their informational, personal, and management concerns relatively low in intensity" (p. 24).

Other researchers have also identified developmental stages of performance change as individuals become familiar with an innovation. Five Stages of Adoption identified by Dormant and Byers (1981) are shown in Table 2.

Table 2
Stages of Adoption: Typical Behaviors

<table>
<thead>
<tr>
<th>STAGE OF ADOPTION</th>
<th>BEHAVIORAL INDICIES OF ADOPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Adoption</td>
<td>Potential adopter weighs the results of test and decides to reject or accept the innovation.</td>
</tr>
<tr>
<td>4 Testing</td>
<td>Potential adopter tests the innovation in a real or simulated work situation. Considerable training may be needed on how to use the innovation.</td>
</tr>
<tr>
<td>3 Mental Tryout</td>
<td>Potential adopter imagines the innovation in his/her own work situation in terms of cost, efficiency, management, scheduling, time demands, and implementation.</td>
</tr>
</tbody>
</table>

(continued on next page ...
Potential adopter's first concerns are about how the innovation will relate to him/herself. Will the innovation require a new role for the potential adopter or change existing relationships with the administration?

Initial stage, person passively receptive, neither seeking nor avoiding information with regard to the innovation.

The Dormant and Byers Stages of Adoption are very similar to the Non-use (0) through Routine (IVA) Levels of Use that Hall et al. described. The unifying characteristics of both sets are that: (1) individuals must go through all of the stages in a given order; (2) individuals may reject an innovation at any time; (3) individuals need sufficient time at each stage; and (4) the change agent uses matching change strategies (interventions) for each level to address concerns and facilitate greater use of the innovation.

One study identified in industrial arts literature relating to stages of concern and the use of an innovation was conducted by LaPorte (1980) at The Ohio State University. LaPorte focused on the degree of utilization of instructional materials developed through the Industrial Arts Curriculum Project (IACP). He found, contrary to Concerns-Based Adoption theory, that although teachers may progress through stages of concern as they use an
innovation, the level of concern does not appear to be related to the amount of the IACP program use or the amount of experience teachers have with this curriculum.

When interpreting the results of LaPorte's study, one needs to be cognizant of the fact that the lack of significant relationship between level of concern and degree of program utilization may be due to the use of the Stages of Concern instrument in a situation where it was not designed to be used. This instrument was designed for use in inservice and training situations where practitioners could proceed through stages of concern and levels of use in an orderly fashion with planned interventions over a controlled period of time. LaPorte's mail survey and ex post facto methodology ruled out planned interventions and made no allowance for length of time a practitioner needed to achieve or maintain a particular level of utilization.

Change Durability

Change durability refers to the lasting effect of an innovation over a period of time. When an innovation is adopted by a school or individual practitioner, the literature suggests that certain conditions in the local school must be conducive for the practitioner to advance to higher levels of use or higher stages of adoption. A number of factors have been found to influence the process of increasing practitioner use of an innovation. The most
pervasive effects on change durability have been linked to change incentives from administrator influences, teacher characteristics, peer-group influences, and school/classroom contexts. These will each be discussed below.

**Teacher Incentives**

Corbett (1982b) reported the findings of a three-year exploratory study of the durability of change in fourteen elementary, junior high, and high schools in a variety of urban, suburban, and rural settings. Using field work methods that included observation and formal and informal interviews, he and his colleagues examined the nature of a program implementation (basic skills, career education, or citizen education), the school factors or contingencies, the critical post-implementation events, and the continuation status of the changes. Their data indicate that the most important factor promoting continuation of innovations, once the formal inservice training ended, was the availability of teacher incentives.

Data from Corbett's three-year study also supports the need for a continuation of incentives. Corbett (1982a) states that "classroom changes rarely become part of a permanent routine if teachers do not continue to receive incentives" (P. 192). This supports findings of Johnson and Sloat (1980) and Hord and Goldstein (1982) who indicate that incentives need to be continued for long periods of time after the formal inservice training has ended to
maintain a holding power for change. According to Hord and Goldstein (1982):

One year won't do for implementation, if the innovation is complex or requires much change in teacher performance. . . . This is a reality that change is a process requiring much time and effort; there is still a good deal to be done in the second year of implementing a new program. (p. 20)

If teachers have "prospective sources of gratification" for continuing new practices after a period of implementation, chances are good that the practices will persist (Sieber, 1981, p. 118).

Pincus (1974) also agreed that incentives were a very important motivator of teacher behavior; however, he stressed that a "significant restructuring of incentive structures" is needed to create and maintain a program of innovation in present school systems (pp. 113-114). This suggests that traditional diffusion techniques (from principal, through inservice training, to teachers) can only have lasting influences on change if permanent changes are made in present school incentive structures.

Because teachers typically work in isolated settings with very few available rewards. . . ., the switch from a temporary [inservice] system to the permanent one as a major arena for action can be traumatic and problematic for the continuation of change. (Corbett, 1982b, p. 11)

Pincus (1974) offered examples of incentive changes such as "...changing the monopolistic character of public education--vouchers, etc., significant decentralization of
control, and changes in individual incentives offered to practitioners—merit pay, for instance, and more emphasis on institutional accountability" (p. 114). Therefore, the literature does suggest that teacher incentives offered to practitioners are very important for promoting curricular change and that incentives need to become a permanent part of the school environment if new practices are to become routine. However, a formidable task of restructuring school incentive structures is presently needed to promote lasting change.

**Administrator Influences**

A substantial body of literature indicates that the most important source for insuring that incentives are available is the building principal (Haverlock, 1973; Corbett, 1982a; Hord & Goldstein, 1982; Huling et al., 1982; Nicholson & Tracy, 1982; and others). One conclusion of the Principal-Teacher Interaction Study, conducted by Huling et al. (1982), was that "[p]rincipals do have the resources and opportunities to make interventions which can affect teacher's use of instructional innovations" and that "those who focus on instructional leadership make a difference in the teaching and learning that occur in classrooms" (pp. 22-23). "By far, the most important source for maintaining change at the school [is] the building administration" (Corbett, 1982b, p. 11).
When Corbett examined principals' behavior in the context of an entire school district, the data indicate that principals' behavior toward change was similar to that of teachers. "When sources of incentives were made available to motivate them to promote change, they did; when sources were not available, they did not" (Corbett, 1982a, p. 192). Sieber (1976) found that school systems (which include buildings run by principals) are vulnerable to public opinion and persuasion. Therefore, principals tend not to provide incentives for teachers who desire change that (in their opinion) runs the risk of disturbing the local community and/or is perceived to be of little educational value do tend to adopt innovations which are persuasively publicized (regardless of their educational value).

Historically, public opinion has shifted to many short lived educational "bandwagons" (i.e. Progressive Education, Science Education, Career Education, Back to Basics, etc.) which would cause administrative support to vacillate from year to year. Further, recent studies by Mongerson (1969) and Stacy (1980) found that industrial arts teachers' opinions of their administrators' views about industrial arts revealed a majority who feel the program should be based on traditional curriculum. Common (1981) indicates that the requirements of the administrator are "exhaustive
and demanding" if implementation of an innovation is to be successful (p. 46). Therefore, if the building principal is not willing to devote a great amount of time and effort to provide long term incentives to change, conventional practice is likely to prevail in industrial arts as well as in other areas of school curriculum.

School/Community Influences

A number of studies have been conducted by industrial arts researchers to examine relationships between school/community variables and curricular innovation/adoptions. The most common variables identified to have significant relationships in many of these studies include school organizational style and staffing patterns (Bro, 1971; Caron, 1975), amount of expenditure monies (Renkin, 1974; Clay, 1980; Lange, 1981), educational equipment and facilities (Renkin, 1974; Lange, 1981), amount of preparation planning time during school hours (Mongerson, 1968; Renkin, 1974) and school teaching level (Timper, 1972).

An attempt to consider school organizational factors in a study of the adoption of Industrial Arts Curriculum Project (IACP) materials was conducted by Caron (1975). Caron wanted specifically to determine the extent that school organizational style was associated with innovation in the industrial arts classroom.
Data were gathered from a random sample of 23 schools in the state of Ohio that offered industrial arts as part of the curriculum during the 1973-1974 school year. The study included three schools that participated as evaluation centers during the developmental period of the IACP from 1966-1971, five schools who employed teachers who had participated in IACP workshops during the post-developmental period and had instituted the program in their industrial arts programs, five schools who employed teachers who had participated in IACP workshops and had not instituted the program in their industrial arts curriculum, and ten schools where some form of innovation other than IACP had been utilized in the industrial arts laboratory. The data reflecting organizational style were gathered from the teachers and administrators with a pre-developed survey instrument modified and extended for use with Caron's study.

Caron defined innovation as participation in field testing and adoption of IACP programs. He concluded that innovation was more likely to be implemented in schools that have stable organizational structures and staffing patterns.

Bro (1970) compared industrial teacher education departments which, during the period from 1960 to 1970, had implemented major curriculum changes in preparing teachers
for innovative programs in the secondary level. Sixty-five colleges and universities in the upper midwestern area of the United States were classified as either conventional (36 schools) or innovative (29 schools) from the results of a primary (Form I) survey of department chairpersons. Faculty with a rank of assistant professor or above who were teaching professional courses, supervising student teaching, or who were engaged in curriculum research or development received a second survey instrument (Form II).

No significant difference was found between conventional and innovative departments with respect to: number of undergraduate majors, age of physical plant, frequency of federal or private funding for curriculum development and characteristics of chairpersons and staff members regarding chronological age, tenure in present position, highest earned degree, teaching experience, industrial experience, or memberships in professional associations. However, the mean statistics of innovative departments were found to be significantly greater than those of conventional departments regarding: number of graduate majors, expenditures for equipment and curriculum development, number of national meetings attended yearly, number of professional journals subscribed to by department chairpersons, and institutional travel allowance. The participants ranked "insufficient time," "inadequate
equipment," "lack of assistance," and "inadequate physical plant" as the main barriers to change in their departments.

Bro concluded that innovation generally takes place in larger departments with larger graduate enrollments and frequent expenditures for curriculum development.

Renkin (1974) posited conclusions similar to Bro's research concerning barriers to curricular change. Renkin measured the attitudes of 100 randomly selected Kansas senior and junior high school industrial arts teachers toward their participation in innovative curricular programs. Renkin's survey instrument measured inservice participation, dogmatism, propensity for change (change factor index), and selected demographic data.

This study indicated that a majority of these teachers desired courses in the innovative curricula along with a high desire to change their present program. However, as was found in Bro's earlier study, these teachers also identified a lack of money, facilities, equipment, and time as major barriers to curricular change. Further, the findings of these two studies suggest that these barriers to change similarly occur at both the secondary as well as the pre-service college/university levels.

Other studies have indicated similar findings concerning school context barriers to curriculum change (Mongerson, 1969; Withall & Wood, 1982; Goodlad, 1983).
Mongerson (1969) analyzed technological curricular innovations in selected Nebraska secondary schools. He also found that a lack of pre-planning time as well as traditionally oriented administrators were major problems for industrial arts teachers who desired curricular change.

Timper (1972) studied specific characteristics of selected industrial education teachers in relation to barriers to curriculum change. Timper's study will be discussed in greater detail in a later section of this chapter concerning teacher characteristics. However, in terms of school context variables, he found that senior high school industrial arts teachers were more resistant to change than junior high school teachers.

Withall and Wood (1982) indicated that the most telling factors affecting the implementation and outcomes of any change project arise from "properties of the community, the citizenry, and the schools and their personnel" (p. 153). The most significant variables that Withall and Wood identified were taxpayer's and parent's concern, relations and interactions and politicking within the school's board of directors or school board, morale and concerns of teachers, and ambitions and risk avoidance tendencies of principals and superintendents.

Finally, in a recent nationwide Study of Schooling (Goodlad, 1983) a continuing attention to instruction and
the curriculum was recommended for significant change in existing behavior of teachers (p. 555). According to Goodlad teachers, are drawn out of schools as individuals to engage willy-nilly in workshops and courses and are then returned to the isolation of their classrooms where how and what one teaches are not matters for peer-group analysis, discussion, and improvement. Teaching must be taken out of its cloak of privacy and autonomy to become the business of the entire school and its staff. (p. 557)

The concept of continuing attention has been discussed in previous sections dealing with teacher incentives and administrator influences on change durability. However, Goodlad now assails the commonly used curricular change diffusion process (conventional inservice training) of secondary schools. His primary criticism lies in temporary support systems of very short duration with little realistic practice in actual teaching situations. Research studies which support this contention will be presented in a later section of this chapter dealing with the conventional strategy of curricular diffusion.

Peer Group Influences

A major five-year study of Educational Change and School Improvement (SECSI) was conducted during the early 1970's by the Institute for Development of Educational Activities, Inc. (I/D/E/A). The central thesis of the study was that teachers must learn to help themselves, and
therefore peer-group interactions were examined during a process of curricular innovation.

Eighteen elementary and secondary schools were joined in a self help League of Cooperating Schools with the SECSI staff as helpers and encouragers in an attempt to effect curricular change. The basis of the SECSI intervention was to develop peer groups of schools for the purpose of examining school staff interactions and receptivity to change. Selected findings indicated that: (1) teaching "tends to be lonely, often dull, work ringed about by fears of unknown that might result from changes" (Bentzen, 1974, p. 195); and (2) increased interaction among schools helped alleviate the loneliness, dullness and fear. "Staffs within the League Network were more willing to try something new because peers encouraged rather than censured when a staff experienced failure" (Edwards, 1981, p. 7).

The conclusions of the I/D/E/A study proposed peer-group interaction as a means of effective change. "The idea is that [peer-group] interaction will build and maintain group expectations and that the school staffs will, in turn, pressure their individual members to change in the desired direction" (Edwards, 1981, p. 8).

Additional literature seems to support the contention that an absence of peer-group interaction and support of curricular change can actually be a major barrier to
curricular innovation and change. Goodlad (1983), in *A Study of Schooling*, stated that in schools today 
"[t]eachers are relatively isolated from one another and tend not to receive the peer support necessary to overcome the social pressure to conform to conventional methods of instruction" (p. 555). Davis (1975) and others have also found that a consequence of utilizing an educational innovation is that many users face harrassment and/or feelings of antipathy from their peers.

**Teacher Characteristics**

The primary assumption concerning research involving teacher characteristics and curricular innovation is that "the real seat of curricular determination is the teacher" (LaPorte, 1982, p. 77). Research concerning teacher characteristics or teacher properties has typically included variables such as age, sex, teacher skills, intelligence, attitudes, motivations, and personality traits (Dunkin & Biddle, 1974). These and other related variables have been the subject of a number of studies involving the adoption of curricular innovations.
A statistical study employing regression analysis techniques was conducted by Timper (1972) for the purpose of establishing a profile of the industrial education teacher who is resistant to curricular change. Three hundred randomly selected industrial education teachers at the public secondary school level (grades 7-12) in Arizona, Colorado, New Mexico, and Utah were asked to participate in the study. Participating teachers completed a demographic data sheet, and short forms of Swanson's Inventory on Viewpoints on Education and Dempsey's Barriers to Curriculum Change Questionnaire.

The findings of Timper's study indicate that the typical industrial education teacher who is resistant to curricular change: (1) is single, divorced, separated, or widowed; (2) has a minimum amount of professional preparation; (3) has a minimum amount of occupational (trade) experience; (4) has been employed in a large number of school systems; (5) is probably a senior high school teacher; (6) actively seeks out outdoor activities; (7) has a low annual teaching income; and (8) has a high annual total income.

Findings 6 through 8 would seem to indicate that the amount of time devoted to class preparation is an important variable with regard to curricular innovation. These findings suggest that teachers who devote large amounts of
time to outdoor activities and/or secondary income producing activities may be doing this at the expense of time spent improving or changing existing school curricula. These findings further suggest that resistance to curricular change may be reduced if teacher salaries are increased to a point where secondary income producing activities are not required or if teachers can be paid substantial extra income for improvements and/or changes in their existing curricula on a continuing basis.

Teacher dogmatism and educational philosophy were studied in relation to the willingness of industrial education teachers to participate in activities presenting improved instructional practices by McKee (1971). Two hundred and seventy-four industrial educators in the state of Utah participated in this survey research study. The general findings of McKee's study were that: (1) the attitude of teachers involved in educational change played a major role in the acceptance or rejection of an innovation in education (in order to accept change, the individual must be open to alternatives) and that (2) the number of years of teaching experience was also an important factor. Teachers with less than four years of teaching experience exhibited a reluctant attitude toward participating in educational innovations.
McKee's findings concerning teacher attitude and the need for a requisite number of years of teaching experience prior to a readiness for change suggests that teachers initially "cling to conventional teaching practices" because they are "the models with which they are most familiar" (Goodlad, 1983, p. 553). Therefore, interventions in industrial arts experiences (models) obtained prior to the teaching situation would seem to have the greatest impact on changing initial teaching practice while inservice interventions need to be directed toward teachers with at least three or more years of prior teaching experience. Further, when viewed in light of one of Timper's (1972) findings (discussed above), inservice interventions may be most effective for teachers with at least three years of teaching experience in the same school system.

Gemmill (1976) conducted a study to compare the personality characteristics of secondary school industrial arts teachers utilizing the Industrial Arts Curriculum Project (IACP), the Maryland Plan (MDP), and traditional industrial arts (TIA) curriculum plans. Seventy-nine participants who were graduated from The Ohio State University and the University of Maryland with baccalaureates in industrial arts education during or between the summer semester of 1968 and the summer semester
of 1974 were selected to represent five industrial arts curriculum plan teacher groups. The criterion groups were as follows: (1) IACP and combination IACP and Ohio TIA, (2) MDP, (3) Ohio TIA, (4) Maryland TIA, and (5) combination MDP and Maryland TIA.

The California Psychological Inventory (CPI), a 480 item standardized research instrument, was administered to the participants by mail. The instrument was composed of 18 scales pertaining to personality characteristics important to social living and social interaction. Six measures of poise, ascendancy, self-assurance and interpersonal adequacy; six measures of socialization, maturity, responsibility, and interpersonal structuring of values; three measures of achievement potential and intellectual efficiency; and three measures of intellectual and interest modes were obtained (Gemmill, 1976, pp. 23-25).

The CPI was designed for diagnosis and evaluation of favorable and positive personality characteristics or interpersonal behavior of normal (non-psychiatrically disturbed) individuals in a variety of situations. Each of the 18 scales was designed to predict what a person would do in a specific context and/or to identify individuals who had similar personality characteristics. Emphasis was placed on generic social concepts that occurred through
social interactions in all cultures and societies. Major use of the instrument was planned for public school, college, business, and industrial settings (Gough, 1957).

Gemmill's data indicated that industrial arts teachers employing contemporary and traditional curriculum plans were not significantly different in the personality characteristics assessed by all 18 scales of the CPI. Since the type of curriculum taught (contemporary versus traditional) could not be differentiated on basis of specific personality characteristics, Gemmill surmised that variables other than personality characteristics must be related to the behavior of implementing and sustaining a contemporary industrial arts curriculum.

Gemmill suggested that since the key to a reduction in the theory-practice gap does not seem to lie in teacher dependent personality traits, properly placed interventions can be implemented to bring about curricular change at the secondary level. He recommends that the interventions take place in teacher education; specifically in the manner in which technical courses were taught. He states that:

Teacher education technical courses appear to be taught by traditional methods. Thus, beginning teachers may then tend to teach as they have been taught. . . . Since the data of this study indicated no significant differences when comparing the personality characteristics of effective teachers employing different curriculum plans, teacher education should concentrate on assisting preservice and inservice teachers to learn the requisite pedagogical skills for
effective employment of various curriculum plans. Study and practice appear essential to learning the interrelated competencies. Teacher educators need to provide models for successful teaching with the latitude of helping the students to discover the ways of teaching most agreeable to them. Possessing knowledge about and the capacity to reflect various teaching styles as well as various curriculum approaches seem beneficial. (pp. 156-157)

Thus, Gemmill feels that technical courses taught by teacher educators at the college undergraduate level must provide models of contemporary curricular practice because beginning teachers teach as they were taught. Goodlad (1983) and McKee (1971), as discussed above, reached similar conclusions concerning the type of curriculum taught by beginning teachers. Gemmill supports his recommendation with descriptive data that indicates that the major methods employed by University of Maryland graduates (student project, anthropological unit, and line production) were required experiences within the undergraduate program. Elective (non-required) methodologies (research and experimentation and the contemporary unit) were not used as often by inservice teachers (p. 156).

The influence of teacher characteristics (non-personality characteristics) on the utilization of contemporary instructional materials was also studied by LaPorte (1980). This research focused on the degree of use
of World of Manufacturing (WOM) and World of Construction (WOC) textbooks, laboratory manuals, and filmstrips developed through the Industrial Arts Curriculum Project (IACP).

The population of the study consisted of an estimated 935 IACP-adopting schools in 34 states for which state directories of industrial arts teachers were available. Adoption criteria were established based on purchasing information supplied from the McKnight Publishing Company. A systematic stratified sample of 292 schools was drawn and a random selection of WOC and WOM from schools that had adopted both programs was performed. Data were collected by means of a mailed questionnaire and with a cash incentive and three follow-up procedures, 244 instruments (83.6%) were returned. Two hundred (120 WOC and 80 WOM) instruments were considered totally usable.

A set of fourteen teacher characteristics were examined by multiple regression analysis to determine their relationships with the degree of utilization (dependent variable) of WOC and WOM instructional materials. The fourteen teacher characteristic variables that LaPorte examined were:

1. age in years;
2. number of years of teaching experience;
3. number of years teaching the IACP programs;
4. amount of specific training in the use of IACP materials;
5. number of non-college credit professional meetings, seminars, or institutes attended within the past two years;
6. number of visitations made to other schools using IACP;
7. number of years since last earning college course credit;
8. number of selected professional publications which are read regularly;
9. number of selected professional organizations in which membership is held;
10. amount of work experience in construction or manufacturing obtained while "moonlighting" as a full-time teacher;
11. amount of work experience in construction or manufacturing obtained in the summer between school terms;
12. amount of work experience in construction or manufacturing obtained while not directly pursuing a teaching career;
13. amount of leisure-time spent in woodworking, metalworking, or crafts; and
14. the amount of freedom the teacher perceives in
the use of IACP. (LaPorte, 1980, p. 103)

The results of the analysis indicated that the above
teacher characteristics accounted for a statistically
significant 20 percent of the variance in a collective
degree of utilization of both WOC and WOM instructional
materials. Considering the programs separately, the
variance accounted for was 24 percent for WOC and 26
percent for WOM. Further, none of the fourteen teacher
characteristics individually reached statistical
significance at the p < .05 level.

The best predictors of overall degree of utilization
were amount of specific training in the use of IACP
materials and the number of years teaching IACP programs
(LaPorte, 1980, p. 197). Therefore, the empirical findings
of LaPorte's study support Gemmill's (1976) contention
(based on descriptive observation) that the amount of
technical training/practice with innovative curricular
materials and methods is one important variable that can be
related to the use of these materials or methods in the
public school setting.

Mutual Adaptation

A massive federally funded four year study of the
process of change in four different educational programs
(innovative projects, bilingual education, career
education, and the right to read) was conducted by the Rand Corporation from 1974 to 1978. Using a combination of questionnaire and case study data gathering techniques, the project staff sought to identify variables in government policy and local implementation practice that (1) promote change and (2) sustain change.

Selective findings of the Rand study indicated that:

1. few schools actually conduct a rational search for better ways to educate students;
2. the role of the teacher in the change process is very important;
3. teachers with many years of teaching experience were found less likely to change practice;
4. curricular packages/innovations that were adopted were mutually adapted by educational practitioners for use in their own local settings; and
5. teachers were found not likely to continue project methods that they had successfully assimilated without the approval of the principal. (Edwards, 1981, pp. 9-10)

The concept of mutual adaptation was considered the most important single contribution from the Rand study (Berman & McLaughlin, 1975). Mutual adaptation was described by the project staff as a process of adapting
(changing) a curricular innovation so that it will conform into a pre-existing local school and/or classroom setting. Mutual adaptation was found to be the only implementation process that lead to teacher change because "teachers changed only as they adapted the project's design into their particular situation" (Edwards, 1981, p. 9). LaPorte (1980) supported the existence of mutual adaptation in industrial arts when he concluded that there is a great deal of adaptation and variability in the extent to which IACP programs are used (p. 200).

Findings of The National Diffusion Network Study (Emrick et al., 1977) suggest that practitioners will adapt characteristics of their performance to characteristics of the innovation primarily with regard to their understanding of the innovation (in terms of its intended purpose, use, and methods) and the compatibility of the innovation with their existing values, beliefs, and role expectations.

The findings of both the Rand study and the National Diffusion Network study underscore the importance of mutual adaptation in the change process. These findings also indicate that successful mutual adaptation is contingent upon the compatibility of curricular innovation with pre-existing values, beliefs, and role expectations of inservice practitioners. Emrick and Peterson (1980) state that:
When the magnitude of change or the discrepancy in roles/values represented by the innovation exceed some subjective limits, the innovation will be modified until it is within the compliance limits of the practitioner. If conditions of use do not permit such adaptation, the innovation simply will not be used, or at best will be used inappropriately or ineffectively. Under these conditions, even power-coercive tactics to direct and enforce correct use will largely fail, as many program developers, administrators, and change agents have discovered. (p. 17)

Therefore, the literature suggests that inservice teachers with conventional values, beliefs, and role expectations are less likely to adopt, adapt, and continue with contemporary industrial arts innovations than practitioners who are characterized by contemporary values, beliefs, and role expectations.

Studies by Lawson (1973) and Eshiet (1980) and the scholarly writings of many industrial arts leaders (Householder, 1972; Lauda, 1979; DeVore, 1980b; DuVall, 1980; Ray, 1980; Worthington, 1982; Nannay, 1983; and others) imply a direct link between values, beliefs, and role expectations of practicing teachers and the pre-service teacher education program. Thus, a change process involving the diffusion of curricular innovations to inservice teachers could actually be facilitated or inhibited by the type of content and methodologies employed in teacher education programs.
Conventional Curricular Diffusion

Change agents have traditionally attempted to diffuse curricular innovations through an organization generally in a top to bottom manner. Such a theoretical process for change, established by Havelock (1973), has been called the social interaction orientation to organizational change. This change model seems to work well in industry and business settings where competitive market conditions exist concerning goods and services and employees can easily be fired by company executives if the quality of their output is not in line with company goals. However, this model has proven to be ineffective for promoting lasting change when applied to public school settings where competitive market place concerning educational quality do not exists and the retention of teacher jobs is not dependent upon the successful implementation of administrative directed changes. According to Withall and Wood (1982), "[s]ince schools are publicly supported, they will neither cease to operate nor lose clients as a result of implementing or not implementing change" (p. 253). Therefore, the motivation for change in the public schools appears not to come from administrative direction.

While the merits of the top to bottom model of curricular diffusion are questionable in public school settings, this approach continues as an acceptable practice
in many schools today. Traditional wisdom and research, when viewed within this framework, suggest that the principal is critical to successful curricular implementation.

In the early and mid-fifties, the emphasis for attempting change in the public schools focused on the principal as the key to successful implementation of new programs (Carlson, 1965; Cohen & March, 1972). According to Common (1981), one reason that these curriculum innovations failed was that change was "directed from the top, not the grassroots" (p. 42).

By the late sixties through mid-seventies, the focus of efforts to change teaching practice had shifted to teachers. "Institutes, summer workshops, teacher stipends and a variety of techniques were tried by NIE, NSF, USOE and other organizations to train and gain their support in the use of new curriculum techniques" (Krueger & Parish, 1982, p. 133). Krueger and Parish (1982) have indicated that by the late seventies, a number of curriculum researchers felt that the focus on the teacher as a primary change agent (through workshops, courses, and institutes) was not producing any better results than the previous strategy of relying on the principal as the key to change in public schools.
A related industrial arts study concerning the effectiveness of summer workshops for training teachers to use the materials of the Industrial Arts Curriculum Project was conducted by Hyder (1971). A sample of 154 teacher trainees who participated in nine nationwide 1970 IACP summer workshops for World of Construction teachers. The workshops had been located at California State College-Long Beach, Eastern Michigan University, Florida State University, Illinois State University, Kansas State College of Pittsburg, The Ohio State University (two workshops), State University of New York at Oswego, and Trenton State College. Data were collected with three instruments: an achievement test, the Minnesota Satisfaction Questionnaire (MSQ), and a participant follow-up questionnaire. The follow-up questionnaire was mailed to participants approximately nine months after the workshop and was returned with an 82.5 percent response.

Hyder found a significant increase in teacher's knowledge of IACP content and processes, no significant difference in job satisfaction between trainees who implemented the IACP program in their local schools and those who did not, and an initial change factor of 40 percent of the workshop participants who indicated that they did teach the IACP program to some degree during the 1970-1971 academic year.
The teacher centered IACP workshop was found to be an effective strategy for developing teachers' knowledge and understanding of content and processes; however, the long term effectiveness of this conventional diffusion strategy on changing teacher practice in their local school settings is questionable. Findings from the Study of Schooling (Goodlad, 1983) support the findings of the Hyder study in that: "when teachers are exposed intensively to some of the most able consultants on instructional improvement. . .these teachers rarely used what they had been taught, although they were able to reproduce the pedagogical procedures [concerning content and processes] on demand" (p. 557).

Current literature has begun to recognize the "equally important roles of both teachers and the principal" in the change process (Krueger & Parish, 1982, p. 133). A number of researchers in the past twenty years have described a phenomenon that seems to occur in instances when external solutions (such as new curriculum packages developed by outside agencies) are used to attempt to solve problems in local schools (Miles, 1964 & 1979; Lortie, 1975; Sarason, 1971; Berman & McLaughlin, 1976). Parish and Arends (1982) refer to this phenomenon as an "informal agreement or covenant." The Informal Covenant describes both the teacher's role and the principal's role
in all change processes introduced at the local school level. According to Krueger and Parish (1982):

Principals set goals, identify needs, arrange for inservice and training, and allocate resources. They respond to central office, community and internal pressures. The degree to which teachers participate in any of this is frequently determined by the leadership style of the principal and how a principal is perceived by the faculty. Principals, as the most visible member of schools, should be viewed by outsiders as responsive. In addition to their 'regular' teaching responsibilities, teachers will attend inservice activities, training seminars and workshops planned by administrators. However, when teachers return to their classrooms they choose to implement only those portions of a program or system that fits their view of teaching. What may appear to be faculty support for change or modification may, in fact, only reflect the teacher's awareness that no much will happen if teachers choose not to have it happen. Principals agree that teachers are professionals; they know their subject of grade; they know how their children learn. Principals can insist on order and control but they recognize teachers' expertise in instruction and will not intrude into the process of instruction. The Informal Covenant allows those in schools to maintain important control of day-to-day operations as local school sites. (p. 132)

One can see from this discussion that teachers will consider new programs if requested to do so by administrators. As part of the Informal Covenant, they will also attend conferences, inservices and training institutes because these are viewed as professional responsibilities. However, when it comes to actual implementation and continued use of the new programs it is generally agreed that most teachers enjoy a considerable
degree of autonomy with regard to the activities taught in their individual classrooms (Goodlad et al., 1974; Lortie, 1975; Evans, 1979; LaPorte, 1982).

When describing a study which examined the Discontinuation of Innovative Programs at the annual meeting of the American Educational Research Association, Parish and Arends (1982) stated that:

Teacher autonomy not only influenced the aspects of the various programs that would be used, it also decided its ultimate fate. At all five sites in our study, the decision to discontinue was made by teachers and made outside the formal decisionmaking structure of the school. Administrators were informally informed later of that decision. In every instance administrators who were the key decision makers in adoptions accepted the non-implementation decisions of their teachers. (pp. 4-5)

Therefore, one can conclude that principals control access, resources, and adoption decisions and teachers control what is going to actually be implemented. Further, the degree to which a teacher will mutually adapt and implement a curricular innovation depends to a great extent on the teacher's pre-programmed values, beliefs, and role expectations concerning the subject that they teach.

Based on the literature presented in this chapter, the following pre-conditions are needed for the successful adoption and implementation of curricular innovations in the public schools.
1. Planned change must begin with a public relations campaign to positively influence (sell) the local community on the merits of the proposed changes.

2. Representatives of the local community must voice approval and demand administrative support of teachers who desire to adopt innovations at some forum such as school board meetings.

3. School boards and superintendents must provide continued incentives to principals to support the implementation of curriculum innovations.

4. Exhaustive, demanding and continued administrative support of teachers who desire change is required. This will require a "significant restructuring of incentive structures" (Pincus, 1974, pp. 113-114). "Principals need to spend more time interacting with teachers concerning instruction...to develop collaborative work relationships in place of Being Boss" (Krueger & Parish, 1982, p. 138).

5. Teachers must be guided through ordered stages of adoption and must be provided with answers to concerns associated with each stage of adoption.

6. Teacher incentives for change must be provided during inservice change interventions and incentives must be continued on a permanent
basis so the teacher can reach routine and higher levels of use.

7. School organizational structures and staffing patterns must remain stable.

8. A greater number of preparation periods must be provided for teachers who desire to change or update their curriculum.

9. The school board must be committed to provide money, facilities and equipment commensurate with the nature of the new program objectives.

10. Salaries of teachers need to be increased to a point where secondary income producing activities (moonlighting) are not required or teachers should be paid substantial extra income for improvements and/or changes in their existing curricula on a continuing basis.

11. Administrators must actively seek out new curriculum development (theory) within each subject area and should not be held captives of content and methodologies rooted in the past.

12. Teachers involved in change strategies must be provided with regular opportunities for peer group interaction concerning content and methods that each teaches with faculty in their building as well as faculty throughout
the district. Peer-group goals and not administrative expectations should be the benchmark of evaluation.

13. Inservice workshops need to be targeted on teachers with four or more years of teaching experience within that same school system. Teachers with less experience exhibit a reluctant attitude toward participating in educational innovations. However, teachers with many years of experience are also reluctant to change.

14. Teachers must possess values, beliefs, and role expectations that are compatible with the proposed curriculum.

After reading the above list of conditions that are needed to promote change in public schools, one can better comprehend the many reasons for the limited and short lasting successes that have occurred as a result of the conventional diffusion strategies. The bottom line is that few, if any, public schools that exist today are organized to be receptive to conventional curricular diffusion techniques (Sieber, 1976).

The evolution of change theory has resulted in a shifting emphasis of change effort from the building principal, to the classroom teacher, to an equal focus on
both the principal and the teacher. While the focus on personnel has changed during the past 30 years, the underlying assumption that change can take place in public schools by providing inservice teachers with models of contemporary theory (revised state curriculum guides and curriculum packages) that they can apply to classroom practice has remained the same.

Evidence from a recent *National Standards Study of Industrial Arts Education* seems to indicate that providing models to inservice teachers does not appear to be a very effective way to promote change in the public schools. Reporting on the results of their research Dugger (1980a) and his associates indicated that the practices of industrial arts have changed little since an earlier parallel study was conducted by Schmitt and Pelley (1966). Further, a number of pre-conditions for successful adoption and implementation (as discussed above) have been identified which make it extremely difficult for conventionally organized public schools to be receptive to change. Therefore the validity of the assumption above is in serious question. Yet, most change efforts endorsed by leaders in industrial arts/technology today continue to support the conventional diffusion strategy and its underlying assumption without attending to other change related variables.
A Focus on Background Experiences

The search for variables that may act as a catalyst for change in the public schools has lead some educators to focus attention to the role of background experiences in the change process. Values, beliefs, and role expectations (pre-condition number 14) have been linked to past experiences and the relationship between these variables and program implementation has been discussed above. The hypothesis here is that inservice teaching practices are directly related to background experiences gained through prior practice. In other words, teachers teach as they were taught and as they have learned from successive background practices prior to a teaching situation.

Beginning as early as the Eleventh Yearbook of the American Council on Industrial Arts Teacher Education, Essentials of Pre-service Preparation (Lux [ed.], 1962), considerable attention has been devoted to criticism of conventional teacher education programs (Chang, 1979; Corrigan, 1983; DeVore 1980b; Gemmill, 1976; Kozak, 1982; Lauda, 1979; Nannay, 1983; Worthington, 1982; & others). These programs have been viewed as a primary source of propagating conventional values and beliefs concerning what to teach and for providing prospective teachers with many first hand examples (models) of how to teach conventional practice. Many feel that these models with which teachers
are "most familiar" are the same ones that are initially taught in the public school setting (Goodlad, 1983; & others).

Below are selected comments from the writings of a number of industrial arts/technology personalities concerning conventional teacher education programs.

The development of innovative teacher education programs should accompany or precede curriculum development activities for the elementary and secondary schools. Teacher education has probably tended to remain even more tradition-bound than the school programs; this condition must be changed to provide leadership for change at the local level. (Householder, 1972, p. 44)

It is evident to me that the teacher education institutions will have to change; teachers can no longer be trained under one system and then be expected to change significantly when they begin teaching in the public schools. (Worthington, 1982, p. 22)

...if we are to survive as an integral part of today's educational scene, we must drastically alter the content, direction, and emphasis of our technical education courses. These changes must be made immediately at our teacher training institutions to influence effective change in our public schools. (Nannay, 1983, p. 2)

Teacher education programs at both the undergraduate and graduate level are a major influence affecting the type and quality of industrial arts programs found in the public schools. Teachers leaving these programs develop habits, attitudes, and practices that follow them throughout their professional careers. Realistic experiences concerned with industry--its technology, organization, environment, occupations, processes, products, and problems--can be presented only by teachers who have had previous study in these areas. (Copeland, 1982, p. 10)
Today's beginning industrial arts teachers are being taught to teach in the schools of yesterday. Teacher education programs have changed very little; the same skill development approaches prevail. (Kozak, 1982, p. 62)

Teacher education programs must make rapid progress toward modifying undergraduate coursework and experience. . .a firm, progressive philosophical base must be placed in position. (Ray, 1980, pp. 11-12)

. . .teachers inevitably are affected by their preparation. Traditionally-oriented programs are likely to produce traditionally-oriented teachers. Innovative programs, which elaborate upon new concepts and practices, are likely to encourage the same disposition for experimentation in the future teacher. (Chang, 1979, p. 44)

Our problem is that we have not responded to reality since the 1950's. If we are to place blame on any single group, it must be levied at teacher educators. Who else could we blame? The purpose of teacher education is to prepare teaches for the public schools. If they fail to respond to our changing culture, it is not their fault. They teach as they were taught. (Lauda, 1979, p. 30)

If we agree with the old adage that 'we teach as we were taught'--and most of us do agree with it--it seems mandatory that we accept the implications of this 'model function' and plan our instruction accordingly. There is no room in coursework for instructors who preach but do not practice. (Sherman, 1962, p. 101)
Finally, DeVore (1980b) states that teacher education programs:

'...need to re-examine their mission and rededicate themselves to the preparation of teachers for the public schools rather than the preparation of technicians for industry. (p. 11)

One can conclude from the statements above that change efforts need to be directed to the pre-service curriculum as well as the public schools. However, little empirical evidence is currently available to support this contention.

Betts (1974) studies the Extent and Method of Implementation of Selected Innovative Programs in the Undergraduate Industrial Arts Teacher Education Curriculum. The population of the study was 220 four year institutions in the United States that had recently implemented innovative programs. Based on an initial survey, 32 of these programs were selected for further study.

The findings of this study indicated that the Industrial Arts Curriculum Project was the most widely implemented program (55%) and the next most commonly used program was the American Industry Project (14%). Another finding, and perhaps the most important, was that most innovative programs were used for exposure purposes, rather than for indepth understanding. Sixty percent of the institutions devoted six or less semester hours to innovative programs. Therefore, Betts concluded that there
has not been an extensive utilization of innovative programs in the undergraduate industrial arts teacher education curriculum.

Israel (1980) illuminated the Stagnation in Industrial Arts brought about, in part, by the dichotomized approach used to prepare industrial arts teachers. According to Israel:

The potential teacher is informed about what industrial arts is (theory continuum) but is prepared to become a teacher by using curriculum and instructional strategies that are more closely related to practices in the public schools. (p. 10)

Corrigan (1983) and many others feel that prospective teachers must develop a "strong theory-in-use foundation in the study of a profession." They feel that "one does not adequately learn to teach by just learning about it" (p. 7).

In attempting to understand how individuals learn new skills or ideas, it is important to know what part is played by the learner. One of the first things to realize is that the teacher cannot give the learner any skill or knowledge by simply presenting this skill or knowledge to the student. It is not a matter of transferring what the teacher knows into the hands or minds of his pupils. The one who is to learn must do something in which his mind and muscles will take on new ways of behaving. He must not only receive new ideas or skills from the teacher he is observing and listening, but he must attempt to use these skills and ideas himself. It is only when the pupil is engaged in putting into practice what he has seen, heard, or read, that the learning process becomes complete. (Leighbody et al., 1966, p. 2)
The statements above would seem to indicate that change efforts are needed at the pre-service level as well as in the public schools. Further, students at the pre-service level need practice as well as theory concerning the use of innovative curricula. According to Asper (1969), 60 to 80 percent practice time is needed for optimum praxiological learning. The bottom line, according to LaPorte (1982), is that "although many [pre-service] programs have changed, there are a significant number who have not" and those that have changed "may portray adequately the theory of contemporary industrial arts but fail to provide a model of contemporary practice" (p. 76).

Another background variable that has been linked with the values, beliefs, and role expectations of inservice teachers is the planned field experience. Goodlad (1983) feels that "probably the most significant part of... professional preparation was student teaching..." (p. 469). Feirer (1983) also supports the importance of the field experience when he states that "the kind of critic teachers to which student teachers are assigned can have a real impact on the future of our programs" (p. 46).

Forrest W. Parkay's (1982) recent report on the effect of student teaching on attitudes of beginning teachers confirms what a great deal of previous research has already
told us. Field experience "encourages student teachers to value styles of teaching that are more restrictive and custodial than those they valued before student teaching" (p. 705). The perversive impact of the cooperating teacher's attitude on the thinking and perceptions of student teachers concerning content and method of instruction can be summed up in a common forewarning issued to student teachers at the beginning of a planned field experience: "...forget all the high education philosophy, this is the real world" (LaPorte, 1982, p. 76). DeVore (1980b) feels so strongly about the perversive impact that student teaching in a conventional industrial arts setting has on the change process that he recommends that:

Radical surgery is needed including the elimination of student teaching which in most programs is detrimental to change because students intern in traditional programs where out-of-date content and programs exist. ... The result is that out-of-date and traditional is reinforced year after after. (p. 11)

The above literature suggests that field experiences in conventional public school programs appear to have a detrimental effect on the receptivity of inservice teachers to theory-based curricular innovations. Despite this knowledge, the opposite of what DeVore suggests is actually occurring. Teacher certification requirements in many states are actually increasing the number of contact hours
of field experience required for pre-service teachers through the auspices of early field experience programs. Therefore, the opportunity to reinforce traditional practices is exponentially increased.

The pre-service curriculum and student teaching appear to be the primary background variables that have received attention in the literature. Most of the literature dealing with these two variables involves descriptive research or is simply intuitive speculation; few empirical studies could be found. Other background variables which may affect teaching practice such as high school laboratory experiences, vocational education experiences, non-school related work experiences, school related work experiences, and others could not be found in studies concerning teacher practice or curricular change. All of these variables could have an individual or collective impact of values, beliefs, and role expectations which could ultimately affect an inservice teacher's ability to mutually adapt and implement curricular innovations.
Section 2

A Model of Variables for the Study of Classroom Teaching

A theoretical model for the study of classroom teaching was borrowed from Dunkin and Biddle (1974) to provide a framework for identifying independent variables which could affect inservice teacher practices. This model is presented below in Figure 2.

Four major classes of variables are identified on the Dunkin and Biddle model: presage, context, process, and product. Presage variables are those relating to the teacher and his/her background. Included are formative experiences, teacher training, and teacher properties. Context variables relate to the school, community, and the pupils where the teacher is employed. Included are pupil formative experiences, pupil properties, school and community contexts, and classroom/equipment characteristics. Process variables are those which occur in the classroom. Included are teacher behavior and pupil behavior. Product variables refer to the pupil and his/her immediate and long term growth as a result of the classroom experience.

The presage and context variables are the two major classes of independent variables used in the present study.
Figure 2: A Model for the Study of Classroom Teaching
Teacher classroom behavior (in terms of theory-based content-related teaching practices) is the major dependent variable. The objectives of the present study do not include the study of pupil process or product variables.

Lists of presage and context variables and their sources identified from the literature review are presented in Tables 3 and 4. An asterisk to the left of a variable indicates that it has been found to contribute to the change process in at least one study. Each variable that has been found to contribute to the change process must be identified and included in ex post facto research as a rival hypothesis to increase the internal validity of a study. An accepted major hypothesis will become stronger as a greater number of rival hypotheses can be identified and rejected. Platt (1964) refers to this process as "strong inference." He states that:

... in every laboratory we need to try to formulate a multiple alternative hypothesis sharp enough to be capable of disproof. ... When multiple hypotheses become coupled to strong inference, the scientific search becomes an emotional powerhouse as well as an intellectual one. (p. 350)

Therefore, the internal validity of the present study can be greatly increased by incorporating as many of the asterisked variables into the study as possible to serve as alternative (rival) independent explanations of the dependent variable.
<table>
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<th>Variables</th>
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<tr>
<td>I. Teacher Formative Experiences:</td>
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<tr>
<td>* Age</td>
<td>McKee (1971), LaPorte (1980)</td>
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<td>* Sex</td>
<td>Trocki (1977)</td>
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<tr>
<td>* Amount of Trade Experience</td>
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<td>* Amount of Industrial Experience Prior to Preservice Training</td>
<td>Trocki (1977), LaPorte (1980)</td>
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<td>* Type of Industrial Arts Experience Prior to Preservice Training</td>
<td>Trocki (1977), LaPorte (1980)</td>
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<tr>
<td>* Number of Years Teaching</td>
<td>Mongerson (1968), McKee (1971), Clay (1980), LaPorte (1980)</td>
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<tr>
<td>* Number of Years Teaching Contemporary Programs</td>
<td>LaPorte (1980)</td>
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<td>* Number of Years in Present Position</td>
<td>McKee (1971)</td>
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<td>* Number of Districts Employed By</td>
<td>Timper (1972)</td>
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<tr>
<td>* Number of Professional Meetings, Seminars, Institutes Attended Within a Certain Time Period</td>
<td>Bro (1971), LaPorte (1980)</td>
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<tr>
<td>Number of Visitations to Other Schools Using Contemporary Approaches</td>
<td>LaPorte (1980)</td>
</tr>
<tr>
<td>Service in Armed Forces</td>
<td>Lawson (1973)</td>
</tr>
<tr>
<td>II. Teacher Training Experiences:</td>
<td></td>
</tr>
<tr>
<td>* Amount of Professional Preparation</td>
<td>Bro (1971), McKee (1971), Timper (1972)</td>
</tr>
<tr>
<td>* Number of Credit Hours of Contemporary Coursework</td>
<td>Spencer (1969), Trocki (1977), LaPorte (1980)</td>
</tr>
<tr>
<td>Amount of Exposure to Innovative Programs</td>
<td>James and Lawson (1982), Goodlad (1983)</td>
</tr>
<tr>
<td>* Number of Credit Hours Completed in Curriculum Development</td>
<td>Betts (1974), Gemmill (1976), Israel (1981), Goodlad (1983)</td>
</tr>
<tr>
<td>* Student Teaching</td>
<td>McCrory (1983)</td>
</tr>
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</table>

(continued on next page ...)
### Table 3 (continued)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>III. Teacher Properties:</td>
<td></td>
</tr>
<tr>
<td>* Marital Status</td>
<td>Timper (1972)</td>
</tr>
<tr>
<td>* Grade Point Average</td>
<td>Trocki (1977)</td>
</tr>
<tr>
<td>* Total Earned Income</td>
<td>Timper (1972)</td>
</tr>
<tr>
<td>* Amount of Time Spent in Outdoor and Leisure Activities</td>
<td>Timper (1972), LaPorte (1980)</td>
</tr>
<tr>
<td>Social Living and Social Interaction</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Poise, Self-assurance, and Interpersonal Adequacy</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Maturity and Responsibility</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Interpersonal Structuring of Values</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Achievement Potential and Intellectual Efficiency</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Interests</td>
<td>Gemmill (1976)</td>
</tr>
<tr>
<td>Knowledge of Change Process</td>
<td>DeVore (1980b)</td>
</tr>
<tr>
<td>Number of Years Since Last Earning College Credits</td>
<td>LaPorte (1980)</td>
</tr>
<tr>
<td>* Number of Professional Publications Read Regularly</td>
<td>Bro (1971), LaPorte (1980)</td>
</tr>
<tr>
<td>Number of Professional Organizations in Which Memberships Are Held</td>
<td>Bro (1971), LaPorte (1980)</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>Hyder (1971)</td>
</tr>
<tr>
<td>* Perceived Attributes of an Innovation</td>
<td>Trocki (1977)</td>
</tr>
<tr>
<td>* Morale and Concerns of Teachers</td>
<td>Withall and Wood (1982)</td>
</tr>
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</table>

* Variables which have been found to contribute to the change process in at least one study
## Table 4

Context Variables and Sources
Identified from the Literature Review

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. School Contexts:</strong></td>
<td></td>
</tr>
<tr>
<td>* Department Size</td>
<td>Bro (1971)</td>
</tr>
<tr>
<td>* Size of Enrollment</td>
<td>Bro (1971)</td>
</tr>
<tr>
<td>* Amount of Money for Curriculum Development</td>
<td>Bro (1971)</td>
</tr>
<tr>
<td>* Organizational Stability</td>
<td>Caron (1975)</td>
</tr>
<tr>
<td>* School Staffing Patterns</td>
<td>Bro (1971), Caron (1975)</td>
</tr>
<tr>
<td>* School Level (elementary, middle, high school)</td>
<td>Timper (1972), Clay (1980)</td>
</tr>
<tr>
<td>* Number of Years Teaching in Present District</td>
<td>McKee (1971)</td>
</tr>
<tr>
<td>* Teaching Income</td>
<td>Timper (1972)</td>
</tr>
<tr>
<td>* Amount of Travel Allowance</td>
<td>Bro (1971)</td>
</tr>
</tbody>
</table>

(continued on next page...)
<table>
<thead>
<tr>
<th>Variables</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Public Opinion</td>
<td>Seiber (1976)</td>
</tr>
<tr>
<td>* Taxpayers/Parents Concerns</td>
<td>Withall and Wood (1982)</td>
</tr>
<tr>
<td>* Relations and Interactions with School Board</td>
<td>Withall and Wood (1982)</td>
</tr>
</tbody>
</table>

**III. Classroom Contexts:**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sources</th>
</tr>
</thead>
</table>

* Variables which have been found to contribute to the change process in at least one study
One can conclude from examining Tables 3 and 4 that many more presage variables have been used in research studies than context variables. Studies dealing with presage variables have tended to focus primarily on teacher properties and teacher formative experiences. Very few empirical studies have examined the relationship of teacher training experiences in the change process. Studies dealing with context variables have tended to focus primarily on school contexts. Very few empirical studies have examined the relationships of community and classroom contexts with the change process; in fact, no industrial arts/technology studies could be found which included community context variables.

The purpose of change strategies is to promote a behavior change in teacher practice at the local school level. Change strategies in industrial arts/technology have promoted broaden content and have provided suggested models of content reinforcing laboratory activities. The literature abounds with findings that indicate that laboratory activities will provide the best indice of planned or hidden content that is taught. However; no studies could be found in industrial arts/technology or in any other field of literature which used classroom/laboratory activities as an outcome measure (dependent variable) of a planned change strategy. Most
researchers measured attitudes, values, beliefs, or simply requested descriptive presage information about the teacher or context information about the school. While attitudes, values, and beliefs may predispose a teacher to be receptive or non-receptive to an innovation, they may not be good indicators of what is actually being taught.

A study conducted by Keep (1973) compared the theoretical and actual teaching activities exhibited by practical arts and business education teachers involved in both secondary school education and adult education. The data were collected through a mailed survey and through classroom observations. The mailed survey was used to determine what teachers perceived their teaching activities to be and the observations (using the Fahrlander Laboratory Observation Plan as an observation instrument) were used to determine the actual teaching activities used.

Keep found that theoretical teaching activities of a teacher differ from the actual activities of the same teacher in the secondary school classroom. Therefore, there is a need for research that focuses on actual laboratory activities (in a classroom context) taught by secondary level industrial arts/technology teachers as a measure of theory/practice compatibility.
Further, in light of the preponderance of literature which indicates that (1) public schools by themselves are not very supportive of long term curricular change and (2) curricular implementation is dependent upon the values, beliefs, and role expectations that teachers have gained from past experiences, basic research needs to be focused on contemporary as well as conventional laboratory activities and where they were learned (sources). This type of research is needed to provide support for a broadening of change strategies to include sources of background activities (i.e. undergraduate curriculum, types of industrial experience, etc.) which unlike public school settings, may be more adaptable to change.

Finally, a further examination of the studies above reveals that many of the industrial arts/technology research efforts involved a micro approach to examining a small number of variables and their relationships to change. In many instances the variances explained by the few independent variables that were used did not account for over 25 percent of the variance measured leaving about 75 percent of the variance unexplained. A macro approach to the problem is needed to identify a large number of variables which can be streamlined only on the basis of a lack of statistical relationships and variance in the dependent variable(s).
An empirical study which focuses on a macro analysis of background experiences and their contribution to teaching practice seems to be the next logical step in the evolution of change theory. If an empirical link can be established between background experiences and inservice teaching practice, recent efforts to revise pre-service teacher education curricula may be strongly supported. Future action concerning student teaching may also be affected by the findings of such a study. Further, an empirical link between background experiences from sources other than the pre-service curriculum or student teaching and inservice teaching practice could lead to new developments in field experiences for pre-service teachers and inservice training. For example, an empirical link between non-school related work experiences and theory based teaching practice could lend support to the practice of supplementing or replacing student teaching with industrial internships. This approach is currently being tested in a new curriculum revision at the University of Southern Maine at Gorham (Nannay, 1983). Empirical support could pave the way for additional programs to implement this practice.
Summary of the Literature Review

This chapter embodied a review of literature which pertained to change theory. An initial effort was made to identify variables which have been found to affect curricular implementation in secondary schools. Later discussion centered on an examination of identified variables in relation to a theoretical model for the study of schooling. The theoretical model provided a framework to assemble a composite picture of variables which have been used in previous studies and variables which have been suggested as a result of intuitive speculation. Existing gaps in knowledge were identified and the present study was discussed in terms of its contribution to areas of the model where gaps in knowledge existed. Included in the literature were citations from articles, books, conference proceedings, and other scholarly writings. The literature selected for inclusion in this review was presented in a sincere effort to broaden the reader's perspective of change theory in relation to the present study of student activities and activities previously experienced by teachers in secondary level manufacturing classes.

The research findings presented in this review have generally indicated that many interrelated factors are required to successfully implement lasting change at the
secondary level. Change strategies directly aimed at inservice teachers need to provide for stages of concern and adoption, permanent teacher incentives, "exhausting and demanding" support from stable administrative organizations, a system of peer-group interaction and evaluation, inservice training directed to selected populations of teachers who are ready for change (at least three years of experiences in same district at same level and others), monetary increases which would eliminate the necessity of part-time jobs, additional in-school preparation time, budgetary allocations to purchase and maintain equipment and supplies commensurate with the objectives of the curricular innovation, a public relations campaign to positively influence the local community on the merits of the proposed changes, vocal and written local community support of changes directed to superintendents, school boards, and building principals.

The sheer complexity, enormity, and financial burden of a change strategy designed to incorporate the above requirements has made it virtually impossible to promote lasting change in the public schools via conventional change strategies. The bottom line is that few, if any, public schools that exist today are organized to be receptive to change.
Perhaps the most important factors related to curriculum implementation presented in this review were the concepts of mutual adaptation and the informal covenant. Mutual adaptation was described as a process of adapting (changing) a curricular innovation so that it will conform to a pre-existing local school and/or classroom setting. Mutual adaptation was found to be the only implementation process that lead to teacher change. However, research has indicated that practitioners will change their performance only with regard to the compatibility of the innovation with their existing values, beliefs, and role expectations.

The informal covenant was described as a delineation of both the teacher's role and the principal's role at the local school level. The bottom line is that principals control access, resources, adoption decisions, and the arrangement of inservice training and teachers enjoy considerable autonomy with regard to actual implementation and continued use of activities taught in their individual classrooms "Come Monday Morning." Therefore, it appears that pre-existing values, beliefs, and role expectations exhibit a major impact on what a teacher teaches.

During the past thirty years, change theory and strategies have shifted focus from the principal, to the teacher, and are currently recognizing the equally important roles of both the teachers and the principal.
These strategies are typically associated with a curricular diffusion process which attempts to change the practices of inservice teachers by removing them from their classrooms and involving them in short term classes, inservice workshops, or institutes. Few, if any, of these change strategies are designed to address long term beliefs, values, and role expectations or their sources.

Research has indicated that values, beliefs, and role expectations are learned as a result of long term background experiences gained prior to a teaching situation. Research also suggests that a measure of a teacher's true values, beliefs, and role expectations can be obtained by examining the types of laboratory activities that he/she teaches at the secondary level. Therefore, an empirical study which focuses on a macro analysis of contemporary as well as conventional background activities and their contribution to secondary level teaching activities would seem to be the next logical step in the evolution of change theory. This approach would enable primary background sources of activity experience to be identified and change strategies to be directed to those which do not contribute to contemporary values, beliefs, and role expectations. Change strategies of this nature, as well as conventional inservice change strategies, could ultimately reverse the expanding direction of the
theory-practice gap that continues to plague ours as well as many teaching professions.

Chapter III will include a detailed description of the research design and other relevant topics concerning the methodology and instrumentation of the present study.
Chapter III

DESIGN AND METHODOLOGY

This chapter will present the design and methodology used for this study. The objectives, variables of interest, population and teacher identification procedure, instrumentation, and data analysis techniques of this study will be discussed.

Objectives of the Study

The primary objective of this study was to determine the proportion of variance that an aggregate of formative (background) activity experiences contributes to the theory-based activity practices of secondary level Ohio manufacturing teachers. This study addresses the question of whether teachers teach what they have previously practiced. This study was also conducted to identify primary sources of background activity experience and primary sources of current teaching activity practice (high school, college, curriculum packages, inservice training,
etc.) for the purpose of determining which primary sources of background experience are in need of curricular revision to better prepare industrial arts teachers to teach manufacturing. Finally, the contributions of specific background sources to types of theory-based activities taught by secondary level manufacturing teachers (management, production, personnel) will be determined so that specific types of activities can be recommended for the curricular improvement of selected background activity sources.

Variables of Interest

The variables of interest to this study were classified in two categories which have been cited as major influences on teaching practices (Dunkin & Biddle, 1974).

1. Presage Variables
2. Context Variables

The major levels of each are:

I. Presage Variables
   A. Degree of Background Compatibility (DBC major independent variable) and nine subscales

      1) High School Industrial Arts Laboratory Courses (HSLAB)
      2) College Industrial Arts Laboratory Courses (COLAB)
3) Student Teaching (STUTEAC)
4) Curriculum Packages/Textbooks (CPACK)
5) Inservice Workshops (INSERV)
6) Vocational/Technical Classes (VOCED)
7) Work Experience (non-school) (WORKNON)
8) Work Experience (school related) (WORKSCH)
9) Other (OTHER)

B. Age (AGE)
1) 21-25 years
2) 26-30 years
3) 31-35 years
4) 36-40 years
5) 41-45 years
6) 46 or more years

C. Philosophy/Attitude Concerning Purpose of Industrial Arts (PURPIA)
1) Training for a Vocation
2) Promoting Leisure Time Interests
3) Helping Students Make Informed Career Choices
4) Increasing Consumer Knowledge Concerning Industrial/Technological Products
5) Providing Activities with the Use of Common Tools and Machines
6) Developing a Broad Understanding of Management, Production, and Personnel Technologies in Industry/Technology
7) Developing Industrial/Technological Problem Solving Skills

D. Amount of Professional Preparation (PROPREP)
1) Associate
2) Baccalaureate
3) Masters or Equivalent
4) Masters +30
5) Masters +60

E. Undergraduate Grade Point Average (GPA)
1) 2.0 - 2.5
2) 2.5 - 3.0
3) 3.0 - 3.5
4) 3.5 - 4.0

F. Number of Hours Per Week in Supplemental Employment (SUPEMPL)
1) 0 - 3 hours  
2) 4 - 6 hours  
3) 7 - 9 hours  
4) 10 - 12 hours  
5) 13 - 15 hours  
6) 16 or more hours

G. Number of Hours Per Week Spent in Leisure Time Activities (LEISURE)  
1) 1 - 3 hours  
2) 4 - 6 hours  
3) 7 - 9 hours  
4) 10 - 12 hours  
5) 13 - 15 hours  
6) 16 or more hours

H. Number of Years Teaching Experience (TEACHEXP)  
1) 1 - 3 years  
2) 4 - 6 years  
3) 7 - 9 years  
4) 10 - 12 years  
5) 13 - 15 years  
6) 16 or more years

I. Number of Years Work in Industry (YEARIND)  
1) 0 - 3 years  
2) 4 - 6 years  
3) 7 - 9 years  
4) 10 - 12 years  
5) 13 - 15 years  
6) 16 or more years

J. Type or Industrial Experience (TYPEIND)  
1) Management  
2) Production  
3) Combination of Management and Production

K. Number of School Systems in Which Employed (NOSYSEM)  
1) One  
2) Two  
3) Three  
4) Four  
5) Five
L. Number of Professional Association Memberships (PROFMEM)
   1) One
   2) Two
   3) Three
   4) Four
   5) Five
   6) Six or more

II. Context Variables

   A. Perceived Freedom of Program Use (FREEDOM)
      1) No
      2) Little
      3) Some
      4) Much

   B. Perceived Academic Abilities of Students (ACAABIL)
      1) Far Below Average
      2) Below Average
      3) Average
      4) Above Average
      5) Far Above Average

   C. Type of School
      1) City (CITY)
      2) Exempted Village (EXVILL)
      3) County (COUNTY)
      4) Non-Public (NONPUB)

   D. Level of Teaching (LEVTEAC)
      1) Junior High School
      2) Middle School
      3) High School

   E. Class Rotation Format (ROTPERI)
      1) Year
      2) Semester
      3) 12 Weeks
      4) 9 Weeks
      5) Other
F. Average Manufacturing Class Size (AVESIZE)
1) 1 - 15 Students/Class
2) 16 - 19 Students/Class
3) 20 - 23 Students/Class
4) 24 - 27 Students/Class
5) 28 - 31 Students/Class
6) 32 or More Students/Class

G. Size of School Enrollment (SIZESCH)
1) 1 - 500
2) 501 - 1000
3) 1001 - 1500
4) 1501 - 2000
5) 2001 - or More

H. Number of Industrial Arts Teachers in Department (NOIATEA)
1) One
2) Two
3) Three
4) Four
5) Five
6) Six or More

I. Number of Industrial Arts Class Periods Taught Each Day (NOIACOR)
1) One
2) Two
3) Three
4) Four
5) Five
6) Six or More

J. Number of Types of Industrial Arts Courses Taught (TYPIACOR)
1) One
2) Two
3) Three
4) Four
5) Five
6) Six or More

K. Percentage of Teaching Load that is Manufacturing (PERCENT)
0 - 100%

L. Number of Preparation Periods Per Week
1) One - Two
2) Three - Four
The criterion (dependent) variable of interest to this study was the Degree of Teaching Compatibility (DTC) as measured by the percentage of a theory-based model of laboratory activities that teachers indicated they typically taught in their manufacturing classes. Three subscales of DTC were Degree of Management Compatibility (DMC), Degree of Production Compatibility (DPC), and Degree of Personnel Compatibility (DPERC); each measured by percentages of the theory-based model (in terms of
management, production, and personnel laboratory activities) that teachers indicated they typically taught in their manufacturing classes. Further explanation of the dependent variable and related subscales can be found in the terminology section of Chapter I.

**Research Design**

Since the variables of interest, the independent variables, were not subject to true experimental or quasi-experimental manipulation, the design of this study can be classified as ex post facto/correlational. The nature of the study was to determine the proportion of variance accounted for by the major independent variable (degree of background compatibility) in the dependent variable (degree of teaching compatibility). The unique proportions of variance of selected alternative independent presage and context variables (identified through a comprehensive review of literature) were also determined as a control for internal validity.

Much ex post facto research is done in psychology, sociology, and education because many research problems in the social sciences and education do not lend themselves to experimental inquiry. Kerlinger (1973), in his text *Foundations of Behavioral Research*, states that:
...the most important social, scientific, and educational research problems do not lend themselves to experimentation, although many of them do lend themselves to controlled inquiry of the ex post facto kind. (p. 392)

The ex post facto research strategy is to investigate possible cause and effect relationships by observing some existing consequence and by searching back through the data for plausible causal factors. The existing consequence of this study was non-conventional teaching practice by a small number of secondary level industrial arts teachers who teach theory-based manufacturing concepts and practices. The identification and analysis of the major variables which affect what industrial arts teachers teach seems tantamount to understanding how to design effective strategies to close the theory/practice gap that continues to plague the industrial arts/technology profession as well as many other teaching disciplines.

The ex post facto design was utilized because a random selection of participants and random assignment of participants to groups was not feasible due to the small number of secondary level industrial arts teachers (approximately 2% nationwide and statewide) who teach manufacturing classes. Instead, the researcher surveyed an intact group (manufacturing teachers in the state of Ohio) for the purpose of data collection. Further, the random assignment of treatments was not possible as in true and
some quasi-experimental designs. The study was conducted after formative background experiences had occurred. Therefore, no control could be exercised over who was exposed to treatments and the nature of levels and types of treatments. Thus, the treatment was naturally occurring and non-manipulated.

**Internal Validity**

Internal validity refers to the confidence one has in relationships, as shown by significant differences, in research variables (Kerlinger, 1973). The limitations of ex post facto research necessitate that certain design and analysis procedures be taken into account to control sources of internal invalidity. Kerlinger (1973) recommends three major strategies for controlling internal invalidity in ex post facto designs. First, specify major hypotheses to be tested. Next, test alternative hypotheses. Finally, interpret correlations between dependent and independent variables cautiously, without cause-effect explanations (p. 378–394).

In a paper titled *Ex Post Facto Research: A Case Study*, Warmbrod and Miller (1974) summarized Kerlingers' strategy and added additional recommendations.
Ex post facto research must begin with research hypotheses to be tested. The research hypothesis identifies from theory and empirical research the major independent variable(s) that is(are) expected to explain the variability in the dependent variable.

Alternative hypotheses must be tested. Extraneous variables are identified and relationships between extraneous variables and the dependent variable are tested.

Extraneous variables that are significantly related to the dependent variable are, in effect threats to an internally valid interpretation of the relationship between independent and dependent variables indicated in the major hypothesis. The relationships between the identified extraneous variables and the major independent variable must be investigated. This, in effect, is comparing groups of subjects at each level of the major independent variable on the extraneous variables found to be significantly related to the dependent variable.

Interpretation of the findings relative to the major hypothesis must be interpreted in light of (1) the relationships between the extraneous variables and the dependent variable and (2) the relationships between extraneous variables and the independent variable(s) specified in the major hypothesis. Caution must be observed to avoid interpreting correlation as causation.

Multiple regression analysis is a recommended procedure for analyzing ex post facto research. (pp. 9-11)

The major independent variable in this study was degree of background compatibility. The additional presage and context variables formed the basis of the alternative hypothesis strategy that Kerlinger, Warmbrod, and Miller recommended. If the analysis indicates that the rival (extraneous) variables are not related to the dependent
variable, findings concerning the relationship between the degree of background compatibility (the major independent variable and its sublevels) and degree of teaching compatibility (the dependent variable) will be strengthened in terms of internal validity.

Platt (1964) refers to this process of strengthening major hypotheses through the testing and elimination of rival hypotheses as "strong inference." In his article Strong Inference, he states that "...we do not realize the added power that the regular and explicit use of alternative hypotheses and sharp exclusions could give us at every step of our research" (p. 348). Platt further stated that:

...when multiple hypotheses became coupled to strong inference, the scientific search becomes an emotional powerhouse as well as an intellectual one. (p. 350)

If on the other hand, the analysis indicates that some or all of the extraneous variables are related to the dependent variable, interpretation of the findings must be qualified by the findings concerning the variables specified in the alternative hypotheses (Warmbrod & Miller, 1974, pp. 3-4).
Population and Teacher Identification

The population of the study consisted of all secondary level manufacturing teachers in the state of Ohio. Secondary level, for the purpose of this study, refers to junior high schools, middle schools, and high schools. An industrial arts teacher was classified a manufacturing teacher if at least one class of manufacturing was taught per school year regardless of class duration.

The data gathering frame for this study can best be described as a state census of secondary level school buildings where manufacturing courses are taught. While a variety of sampling procedures from a nationwide population of manufacturing teachers would have been most desirable, logistical and economic factors ruled out a national data gathering approach. A more practical approach was to delimit to the state level.

The statewide population of manufacturing teachers was estimated to be approximately 2% of all Ohio industrial arts teachers (Blankenbaker et al., 1980). Due to the small number of industrial arts teachers in the state of Ohio who teach manufacturing, a census data gathering approach was considered a necessity to ensure minimum size data cells per variable for the data analysis techniques.
The first step in identifying manufacturing teachers was to determine in which secondary schools manufacturing was taught. The initial information was obtained from the school program questionnaire data decks of the Blankenbaker et al. (1980) Status of Ohio Industrial Arts census survey of industrial arts teachers. Sixty-five school buildings were identified where department chairpersons indicated that manufacturing was taught in 1980. Nine additional school buildings were identified from the data decks of the Umstattd (1983-1984) follow-up study of The Ohio State University Industrial Technology Education graduates.

Demographic data and the names of industrial arts teachers within each of the seventy-four school buildings were obtained from the 1983-84 Directory of Industrial Arts Teachers (Ohio Department of Education) and the 1983-84 Ohio Educational Directory.

Each building principal was sent an advance survey notification packet on March 10, 1984 (see Appendix A). The principals were notified that their buildings were part of a statewide research study to determine how to better prepare industrial arts teachers to teach manufacturing. They were asked to complete an enclosed, stamped, self-addressed postcard which would identify the name of one industrial arts teacher who taught manufacturing. The principals were also asked to indicate the most appropriate
days and times of day to call the teacher for a fifteen minute telephone interview that would not interrupt class activities. A 72 percent response rate was achieved with 46 of 53 qualifying schools. Seven building principals indicated that manufacturing classes were no longer being taught at their schools.

The remaining 21 non-responding building principals were telephoned to secure the required information. Nine principals indicated that manufacturing was taught and provided information concerning appropriate days and times for the telephone interview. The remaining 12 principals indicated that manufacturing classes were not taught in their buildings. The total number of school buildings where manufacturing courses were taught totaled 55 at the onset of the phase 1 telephone data gathering interviews.

During the telephone interviews each manufacturing teacher was asked to identify additional manufacturing teachers in their geographic location. The principals for these additional buildings were contacted following the same procedure outlined above and eight additional schools were added to the survey population. Sixty-three manufacturing teachers from 63 school buildings participated in the phase 1 telephone data gathering survey.
A small number of schools employed more than one manufacturing teacher. While additional teachers would have provided larger data cell sizes per variable, the independence assumption for the context (school related) variables would have been violated. Since the unit of analysis was the teacher (and not the school) the responses of multiple teachers from the same school building may have lead to correlated context variable measures. According to Pedhazur (1982) "...correlations among independent variables may lead to difficulties in the estimation of regression statistics" (p. 232). Pedhazur refers to a multicollinearity of independent variable measures as a measurement error which could lead to a downward bias in the estimation of $R^2$. An underestimated $R^2$ would decrease the power of a hypothesis test to find significance. For this reason, only one manufacturing teacher from each school was asked to participate in the study.

**Instrumentation**

Two survey instruments were developed for the purposes of this study. A telephone questionnaire was designed to collect alternative hypothesis data relative to independent presage and context variables and a mail instrument was designed to obtain data for the major
independent and dependent variables. The formats of each instrument were developed using the "Total Design Concept" as presented by Dillman (1978).

The Telephone Questionnaire: A Rationale

A number of factors contributed to the decision to include the telephone interviewing technique in the data gathering methodology. Some factors were founded in the theory of social exchange, the tenants of which have been most notably developed by Thibaut and Kelley (1959), Homans (1961), Blau (1964), and others. Dillman (1978) summarizes social exchange theory in the context of survey data gathering procedures when he states that:

It is assumed that people engage in any activity because of the rewards they hope to reap, that all activities they perform incur certain costs, and that people attempt to keep costs below the rewards they expect to receive. Fundamentally then, whether a given behavior occurs is a function of the ratio between the perceived costs of doing that activity and the rewards one expects the other party to provide at a later time. Thus there are three things that must be done to maximize survey response: minimize the costs for responding, maximize the rewards for doing so, and establish trust that those rewards will be delivered. (p. 12)

Dillman feels that "[t]ime is perhaps the major cost experienced by respondents" (p. 14). The large number of independent variables and the complexity of the dependent variable would have required the construction of a mail survey instrument of considerable length. Thus, one reason
for including a telephone interview was to separate the data gathering process into two shorter phases of time duration as opposed to one relatively long period which could be perceived as a greater time cost to survey participants.

The telephone survey further allowed the researcher to build an element of trust and commitment into the data gathering process. Vocal contact with the teachers provided an excellent forum for insuring appropriate rewards for participation. The strategy was to establish a positive researcher/respondent relationship and to secure a verbal commitment from each teacher to participate in the second (mail survey) data gathering phase of the study.

The data provided by the telephone technique also provided a pool of known population characteristics for testing non-response bias in the mail survey follow-up. Selected data provided by the telephone questionnaire were to be used to test whether responders and non-responders of the mail survey instrument differed on characteristics which might affect the external validity of the research findings. This procedure of testing known characteristics is considered much more desirable than other non-response estimate procedures such as comparisons of early and late responders or key question interviews with samples of non-responders.
Finally, the telephone interview enabled the researcher to quickly identify additional schools where manufacturing was taught. Since a current list of secondary level manufacturing teachers in the State of Ohio did not exist, the researcher had to incorporate a systematic procedure for updating the 1980 Blankenbaker et al. state census survey list by including current manufacturing teachers who may have been part of the 27 percent non-response group (school program questionnaire) and industrial arts teachers who may have initiated a manufacturing class since the 1980 data were collected.

Telephone Survey Development and Implementation

The initial draft of the telephone survey instrument was developed for the purposes of this study (see Appendix B). The nature of the instrument was derived from the literature review. Many presage and context variables which illicited significant relationships in previous related studies along with additional variables identified from other sources (journal articles, ERIC microfiches, etc.) formed the basis for structuring questions. The questions were designed to provide a qualitative or quantitative measure for each
presage and context variable that could cause variability in the dependent variable measures. These measures were used to test the alternative hypotheses in the ex post facto research design.

The telephone instrument was pretested during the week of March 11, 1984. According to Dillman (1978), telephone questionnaires must be tested over the telephone so that "such things as normal line noise and the respondent's ability to concentrate while completely dependent on a verbal message are components of the test situation. . ." (p. 229). The typical procedure followed is to purposely overdraw the survey sample and select a portion of the sample for pretesting purposes (Dillman, 1978, p. 229).

Since the relatively small number of subjects in the population required a census data gathering approach, an alternative strategy was adopted to obtain initial pretesting participants. The instrument was initially pretested with a small number of subjects who displayed similar characteristics to those of the population as per Dillman's recommendation (p. 229). Revisions in question wording were made and further pretesting was conducted with actual population members during the first two hours of the telephone interviews. The final revisions involved minor
word changes necessary to promote instruction clarity and reduce question complexity. No substantive changes in the content of the questions were made during the final revision process. The survey instrument was also reviewed by selected faculty members and graduate students in the Industrial Technology Education program area as well as the research reading committee.

The telephone interviews were conducted on a nine-day schedule in late March and early April of 1984. All interviews were conducted by one interviewer using a standardized introduction, question format, and closing statement. Calls were placed as per appropriate days and times indicated on postcards returned from the principal advance survey notification packet (see Appendix A) or in cases where cards were not returned, as per days and times obtained from principal follow-up telephone calls. The timed length of the questionnaire averaged 18 minutes and data were obtained from all 63 identified manufacturing teachers.

Survey of Jackson's Mill Symposium Contributors

One question on the telephone survey asked respondents to select one of seven purposes that they felt was most important for industrial arts (see Appendix B, Question #23). The question was designed to illicit a measure of teacher philosophy concerning the purpose of
industrial arts. This measure was used to test an alternative presage hypothesis concerning the relationship between teacher philosophy and the type of laboratory activities taught by secondary level industrial arts teachers.

Seven purposes of industrial arts were obtained from a list of twelve purposes used in the phase I nationwide data gathering survey of the status of industrial arts education (Bame & Miller, 1980). Dillman (1978) indicated that long telephone survey questions containing several ideas were highly prone to being misunderstood, so an effort was made to reduce the number of response categories (purposes) for this question through consultations with the researcher's advisors and colleagues. Minor modifications in the wording of seven of the twelve purposes resulted in a much more manageable series of purposes as presented below.

- promoting leisure time interests
- providing activities with the use of common tools and machines
- developing industrial/technological problem solving skills
- increasing consumer knowledge concerning industrial/technological products and processes
- training for a vocation
- developing a broad understanding of management, production, and personnel practices in industry/technology
- helping students make informed career choices

Prior to the analysis of data and testing of the hypotheses, a rank order of the seven purposes was needed so that continuous numeric values could be assigned to purposes ranging from high to low. For the purpose of this study, a high value purpose was defined as one relating to an industrial arts class designed to apply recent developments in industrial arts curriculum theory. A low valued purpose was defined as one relating to an industrial arts class designed to apply conventional practice. A significant relationship between teacher philosophy (as represented by purpose statements) and types of activities taught, might indicate that teachers who teach contemporary industrial arts activities have a contemporary philosophy concerning the purpose of industrial arts and teachers who teach conventional industrial arts laboratory activities have a conventional philosophy concerning the purpose of industrial arts.

A panel of experts was utilized to facilitate the rank ordering of the seven purposes of industrial arts. Since the most recent development in industrial arts curriculum theory evolved from the Jackson's Mill Symposium
(Hales & Snyder, 1981), a random sample of Jackson's Hill Symposium contributors was selected to participate in the ranking process. A number was assigned to each contributor's name and a table of random numbers (Hopkins & Glass, 1978, pp. 406-407) was employed to select a 50 percent random sample (n = 10).

A cover letter/questionnaire was sent to the ten member sample and two alternates explaining the nature of the research and asking for their participation in the study (see Appendix E). All ten Jackson's Mill symposium participants responded prior to the June 12th deadline. The data from the alternate responders was not used because a 100% response rate was achieved.

The ten individual rankings of the seven purposes of industrial arts were averaged and combined into a composite ranking (see Appendix E for calculations) as shown in Table 5. The seven purposes were ranked by the greatest (#7) to the least (#1) amount of laboratory time that should be relegated over the term of an ideal secondary level industrial arts course based on the Jackson's Mill Curriculum Theory.

Mail Survey Development

The researcher was attempting to address the theory/practice problem by determining the proportion of variance in current teaching practices of non-conventional
Table 5

Composite Ranking of Seven Purposes of Industrial Arts by Random Sample of Jackson's Mill Symposium Participants

<table>
<thead>
<tr>
<th>Purposes of Industrial Arts</th>
<th>Rank*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training for a vocation</td>
<td>1</td>
</tr>
<tr>
<td>Promoting leisure time interests</td>
<td>2</td>
</tr>
<tr>
<td>Helping students make informed career choices</td>
<td>3</td>
</tr>
<tr>
<td>Increasing consumer knowledge concerning industrial/technological products and processes</td>
<td>4</td>
</tr>
<tr>
<td>Providing activities with the use of common tools and machines</td>
<td>5</td>
</tr>
<tr>
<td>Developing a broad understanding of management, production, and personnel practices in industry/technology</td>
<td>6</td>
</tr>
<tr>
<td>Developing industrial/technological problem solving skills</td>
<td>7</td>
</tr>
</tbody>
</table>

*Note: #7 represents the closest proximity to Jackson's Mill Curriculum Theory

industrial arts teachers contributed by technical background experiences. The study was delimited to the manufacturing component of contemporary industrial arts curriculum theory and secondary level manufacturing teachers in the state of Ohio were selected as the population frame. Thus, for the purpose of this study,
non-conventional industrial arts refers to manufacturing technology and related curriculum theory.

Laboratory activities were selected as a basis for measuring curriculum theory-in-practice. Written taxonomies, objectives, course outlines, and textbooks are not always valid indicators of what is taught in a particular industrial arts class. The activities that students perform provide a better picture of actual content that is formally or informally taught. For this reason, a decision was made to use laboratory activities as a basis for structuring the criterion measure.

The nature of the instrument was derived from an existing codified body of knowledge of manufacturing technology (Umstattd et al., 1975, pp. 88-110). The conceptual elements of the body of knowledge were operationalized into an inventory of manufacturing activities that could be practiced in an ideal (theory-based) manufacturing class. The activity inventory served as a theory based model of activities by which teacher background activity experiences as well as current teaching activity practices could be measured and compared for degrees of theory-background and theory-practice compatibility. Degree of background compatibility (DBC) was the major independent variable and degree of teaching (practice) compatibility (DTC) was the dependent variable in the study. Therefore, the primary objective of this
study was to determine the proportion of variance in degree of teaching compatibility (DTC) that is contributed by degree of background compatibility (DBC).

The development of the activity inventory began with an analysis of the above cited taxonomy of manufacturing technology concepts. The instrument was designed to include three major areas of activities corresponding to the three taxonometric areas of management, production, and personnel technology. The numbers of activities included in each of the three areas of the instrument were proportional to the number of concepts included in each area of the existing taxonomy. Since the purpose of constructing the instrument was to develop a theory-based model of manufacturing activities it was considered essential to proportion the major subdivisions of instrument activities the same as the conceptual structure of the taxonomy. Approximately 36 percent of the activities were management related, 53 percent production related, and 11 percent were personnel related.

The process of identifying activities to be included in the instrument was aided by the nature of the conceptual elements of the taxonomy. The concepts were listed in the form of verbal nouns, or gerunds, which connote action or doing (Towers et al., 1965, p. 169). Therefore, each concept could represent a laboratory activity that could be
performed in a manufacturing class. Three rules applied when examining the concepts at each hierarchial level of the taxonomy to determine their acceptability for the inventory.

1. The concept must describe one mutually exclusive type of manufacturing process.

2. The level of specificity must be capable of further subdivision into specific representations of the general concept. (For example, the general concept molding was included in the instrument because teachers who teach compression transfer, injection, and/or lamination molding processes can include molding as an activity that they teach.) Further, many of these sub-divisions were included on the instrument to help define the concept with examples that teachers might relate to their current teaching practices.

3. The concept must be capable of being operationalized into an observable behavior in a secondary level setting. That is, one must be able to observe what the teacher or student is doing.

The final inventory contained 152 activity statements selected primarily from third and fourth level concepts of taxonomy specificity.
First and second level taxonomy concepts served as a basis for organizing the 152 manufacturing activities into thirteen initial clusters of activities. Related clusters were combined into the nine final clusters listed below.

I. Management
   1. Organizing and Financing a Company (18 activities)
   2. Designing and Engineering Products (10 activities)
   3. Researching and Marketing (14 activities)
   4. Production Planning (12 activities)

II. Production
   5. Pre- and Post-Production (7 activities)
   6. Separating (37 activities)
   7. Forming (18 activities)
   8. Combining (19 activities)

III. Personnel
   9. Personnel Activities (17 activities)

Four clusters were management related containing fifty-four activities (36 percent), four clusters were production related containing eighty-one activities (53 percent), and one cluster was personnel related with seventeen activities (11 percent).

The mail survey instrument (see Appendix C) was designed in booklet format with activities listed alphabetically in a vertical flow pattern within each of
the nine cluster areas. Three parallel columns running vertically along the right side of each page provided response categories for the survey participants.

Manufacturing teachers were first instructed to read each activity and place a check mark in the first column for any activity that they had ever performed, regardless of where it was learned. The sum total of all activities, check marked in column number one divided by the total number of activities (152) and multiplied by one hundred provided a percentage measure of the degree to which a teacher's background activity experiences were compatible with a model of manufacturing activities. This degree of background compatibility (DBC) was the major independent variable of the study.

The respondents were next instructed to examine eight common sources for learning industrial arts activities. The sources, identified from the literature review, were listed in a source key located at the top of each page of the survey instrument. The eight sources are listed below by their identifying code numbers.

1. High school industrial arts laboratory courses
2. College industrial arts laboratory courses
3. Student teaching
4. Curriculum packages/texts
5. Inservice workshops
6. Vocational/technical classes
7. Work experience (non-school)
8. Work experience (school related)

The survey respondents were asked to indicate where each background activity check marked in column number one was learned or practiced by placing a coded source number or numbers in column number two. Additional sources could be added in an other sources box at the bottom of each page.

The sum totals of activities for each background source checked in column number one divided by the total number of activities (152) and multiplied by 100 provided percentage measures of the degree to which teacher background activity experiences from specific sources were compatible with a theory-based model of manufacturing activities.

Finally, teachers were instructed to place a check mark in column number three for activities that their students typically performed in one rotation period (year, semester, 9-weeks, etc.) of their manufacturing class(es). The sum total of all activities checkmarked in column number 3 divided by the total number of activities (152) and multiplied by one hundred, provided a percentage measure of the degree to which current teaching practices of manufacturing teachers were compatible with a theory-based model of manufacturing activities. This degree
of teaching compatibility (DTC) was the dependent (criterion) variable of the study.

Three subscale measures of DTC (Degree of Management Compatibility, Degree of Production Compatibility, and Degree of Personnel Compatibility) were calculated by sum totaling the number of management, production, and personnel activities checkmarked in column number 3 of the survey booklet, dividing each by the total number of activities in each area (54, 74, and 17 respectively), and multiplying each by 100.

The mail survey instrument was pre-tested during the week of March 25, 1984 for the purpose of identifying construction defects and inadequacies. Every effort was made to produce a survey booklet that looked final in size, format, and appearance.

A mock-up was prepared in lieu of actually printing the booklet. Activities were typed on regular sized paper, reduced, photo-copied back-to-back, and saddle stapled together in booklet format. The booklet mock-ups were then submitted to the scrutiny of two colleagues in the Industrial Technology Education Program Area, two secondary level industrial arts teachers, and one survey research specialist in the College of Education.

All reviewers were asked to evaluate the instrument in terms of the following questions.
1. Are directions and wording clearly understood?
2. Does the booklet create a positive impression, one that motivates people to answer it?
3. Does any aspect of the instrument suggest bias on the part of the researcher?
4. What changes would you make to improve this instrument?

While reviewing the returned booklets, the researcher asked the following questions.

1. Is each section measuring what it was intended to measure?
2. Are the directions interpreted similarly by all respondents?
3. Are all sections of the instrument answered correctly?

(Questions adopted from Dillman, 1978, p. 156)

All pre-test recommendations were incorporated into the survey instrument; most involving minor word/phrase clarifications and grammar/punctuation corrections. No substantive changes were made during the revision process.
The validity of the survey instrument was established by two criteria. First, a validated body of manufacturing technology concepts served as the framework for structuring the survey instrument. Second, the instrument was reviewed by faculty members, graduate students, and undergraduate students in the Industrial Technology Education Program Area at The Ohio State University as well as the reading committee.

The finished survey booklets were produced as per the Total Design format recommended by Dillman (1978). (Minor modifications were made in size dimensions to accommodate local resources available to the researcher.) The finished booklet consisted of three 8-1/2" x 13" sheets of paper folded in the middle and stapled to form a booklet, the dimensions of which were 6-1/2" x 8-1/2". Each of the 12 booklet pages were typed on an IBM Selectric typewriter with a carbon ribbon, using 12-point elite type in a 7" x 9-1/2" space on regular 8-1/2" x 11" paper. To fit the booklet format, each page was photographically reduced to 77 percent of the original size.

Printing questionnaires as booklets with photographically reduced pages requires less paper and makes them appear far shorter than they really are. Yet by reducing the size to just over three-quarters of the original typed pages, readability is retained for nearly everyone. (Dillman, 1978, p. 121)
The booklet was reproduced on buff colored paper using the offset printing method to produce copy very close to the original typed copy. Seventy weight opaque offset paper was used to prevent images on one side from showing through to the other side of the pages. The folded booklet (one vertical center fold) fit nicely into the standard business 4-3/16" x 9-3/8" envelope and slightly smaller 3-7/8" x 8-7/8" business return envelopes. Thus, the instrument was designed to give pleasing appearance, fit standard postal envelopes, command efficient use of time and materials, and get into the mail at a minimum weight and cost for first class postage.

**Mail Survey Implementation**

The initial mailing of the survey instrument took place on April 10, 1984 (see Appendix C). A cover letter was designed that emphasized a reasonable explanation of the subject of the study, its benefit to industrial arts, and the individual importance of the respondent to the study's success. The cover letter was reproduced on high-quality stationary with a special two color letterhead logo and address designed to identify the "manufacturing activity survey." The letter was completed by adding, in normal business letter fashion, the exact date the letter was mailed, and the project director's (researcher's) individually applied signature with blue ink pen. An
identification number, an explanation of which was included in the letter, was included on the cover of the survey booklet where it was visible to the respondent. Then the cover letter and a business self-addressed reply envelope were carefully folded in a predetermined fashion and placed for mailing into a regular business stationary envelope on which the respondent's name and address were individually typed. First class postage was affixed to both envelopes by stamps and the mailing was dispatched.

Exactly one week later (April 17th) a postcard follow-up was sent to all recipients of the first mailing (see Appendix D). The card was preprinted, but with an individually typed name and address on one side and an individually applied blue pen signature on the other. The note on this postcard was written as a thank you for those who had returned their survey booklets and a reminder for those who had not.

A second follow-up was mailed to nonresponders exactly three weeks after the original mailout (May 1st). It consisted of a cover letter (see Appendix D) that basically informed them that their booklet had not yet been received and included a restatement of the basic appeals from the original cover letter, a replacement survey booklet, and another prestamped self-addressed return envelope.
A third and final follow-up was mailed six weeks after the original mailing (May 22, 1984). It consisted of a cover letter (see Appendix D) and still another survey booklet and stamped self-addressed return envelope. This follow-up packet was sent certified mail to the remaining nonresponders.

A letter was sent to two respondents who had left one or more pages blank in the survey booklet (see Appendix D). The letter was accompanied by photocopies of the blank page(s) and any instructions needed to fill out the page(s). A first class stamped self-addressed return envelope was included and both respondents thus contacted returned the requested information.

Response Rate

The response rates were calculated as the percentage of people in the original mailing from whom completed survey booklets were obtained. A 46 percent response rate was achieved by the initial mailing, an additional 37 percent response was achieved by the postcard follow-up and additional nine percent and three percent responses were achieved by the second and final follow-ups respectively. Sixty of sixty-three booklets were returned for a final response rate of 95 percent. The individual mailing and final cumulative response rates are summarized in Figure 3.
Figure 3. Individual and cumulative response rates of initial and follow-up mailings to secondary level Ohio manufacturing teachers.
External Validity

External validity refers to the representativeness of a sample and the generalizability of research findings. In other words, "when an experiment has been completed and a relation found, to what populations can it be generalized?" (Kerlinger, 1973, p. 325).

One type of external validity lies in the ability to generalize from the population of subjects that was available to the researcher (the accessible population) to the total population of subjects (the target population). The target population in this study was secondary level manufacturing teachers in the state of Ohio. The accessible population was a group of 63 secondary level manufacturing teachers identified from an attempted statewide census of secondary level school buildings where manufacturing courses were taught.

The relationship between the target population and the accessible population was difficult to define because no accurate statewide listing of manufacturing teachers existed to provide a sampling frame. Two percent of the approximate 2,600 primary and secondary level Ohio industrial arts teachers were estimated to teach manufacturing (Blankenbaker et al., 1980) and the teacher identification methodology of the present study yield a 2.4
percent number of manufacturing teachers. This percentage also closely compares to a national estimate of the percentage of industrial arts teachers who teach manufacturing (Smith & Wright, 1981). Thus, the accessible population in this study was defined in terms of census data and target population parameters rather than sampling data and sampling statistics. Further, the extremely high response rate previously reported provides reasonable assurance that the accessible population is representative of the total population in terms of the external validity of research findings.

Data Analysis

The analysis of telephone and mail survey data involved descriptive and parametrical techniques. The analyses were parametrical in nature because direct effort was made to describe population parameters through a census data gathering methodology. The parametrical analyses included correlational and semi-partial multiple regression procedures. All hypothesis testing involved F-tests with practical significance evaluations of independent variables.

* Statistical interpretations of data apply to methodologies which employ sampling techniques.
Practical significance refers to a minimum acceptable proportion of variance in a dependent variable attributed to an independent variable. Statistical significance refers to a minimum acceptable probability of sampling error. Since a census (not a sample) data gathering methodology was employed, practical significance should be used to evaluate hypotheses associated with independent variables.

The concept of practical significance is rarely communicated in graduate research courses or research literature in general and therefore, may be subject to a lack of understanding and misinterpretation. Due to this possible shortcoming, an effort was made to define practical significance in statistical terminology. Practical significance, for this study, refers to the minimum proportion of variance attributed to an independent variable represented by a hypothesis tested at a statistically acceptable alpha equal to 0.05 or less.

The variables of interest in this study included (1) two sets of alternative independent variables (eleven presage and fifteen context), (2) the major independent variable — DBC (Degree of Background Compatibility), (3) nine background source variables (subscales of the DBC), (4) the dependent variable — DTC (Degree of Teaching Compatibility), and (5) three subscales of DTC (Degrees of Management, Production, and Personnel Compatibility).
These forty variable names and associated data were coded onto IBM Fortran forms and keyed into the WYLBUR data storage and file management system at The Ohio State University. Subprograms from the Statistical Analysis System (SAS) computer package were employed to obtain the descriptive and parametrical (population) analyses which have been described below. The variable list, raw data printout and computer programs for each stage of data analysis are located in Appendix I.

The data from the forty variables were analyzed to obtain descriptive information with the "frequency" and "means" SAS subprograms. Frequency and percentage distributions were used to describe nominal data and means and measures of variability were used to describe interval data (see Appendix J).

Correlational techniques were employed to establish direction and strength of relationship between all independent variables and the dependent variable. The results of an SAS "corr" subprogram (Appendix I, Program 1) enabled the size of the research model to be reduced to those independent variables that elicited significant Pearson Product Moment relationships with the dependent variable (DTC) at the alpha = 0.05 level or less. Complete tables of correlational coefficients for independent and dependent variables can be found in Chapter IV.
Four stages of multiple regression analysis followed the correlation procedure. **Stage one** involved an analysis of **major sets** of independent variables (alternate context, alternate presage, and the major independent variable - DBC) and **specific variables** within sets for their unique contributions to variance in the dependent variable - DTC. The stage one analysis was designed to address the hypothesis that non-conventional industrial arts teachers teach what they have previously experienced. A step-wise multiple regression analysis procedure was also included in stage 1 to develop a regression equation that could best predict the compatibility of secondary level teaching practices with a theory-based model of laboratory activities.

Each reduced set of alternative independent variables (presage and context) and the major independent variable (Degree of Background Compatibility) were applied to a simultaneous multiple regression procedure to determine the unique proportions of variance in the dependent variable that could be explained by each set of variables (Appendix I, Program 2). This technique employed the use of a semi-partial multiple regression correlational coefficient for each set of independent variables. The semi-partial coefficients were calculated by subtracting the proportion of variance explained by a combination of two sets of variables from the proportion of variance explained by the
full regression model (all 3 sets) to obtain the unique proportion of variance explained by the third set. This procedure was exercised three times, isolating a different variable set each time by combining the proportional variance of the remaining two sets for subtraction from the proportional variance of the full regression model. The resulting three squared semi-partial proportions of variance from each set represented the unique variability of each set in the dependent variable.

The three semi-partial proportions of variance were then tested for significance using the equation below presented by Cohen and Cohen (1975, p. 135).

\[
 F = \frac{(R^2_y \cdot AB - R \cdot A) / K}{(1 - R^2_y \cdot AB) / (n - k_A - k_B - 1)}
\]

The resulting three F-tests were evaluated for significance using an alpha level less than or equal to 0.05.

Based on whether significance was obtained, individual variables within significant sets were examined in an effort to determine which variables were explaining significant variance in the dependent variable (Appendix I, Program 2). This procedure also employed the use of semi-partial multiple regression correlational coefficients.

The semi-partial correlational coefficients of individual variables were calculated by subtracting the proportion of variance explained by a combination of all
independent variables within a set, minus the variable of interest, from the proportion of variance from a regression model of the entire variable set. This procedure was repeated to isolate each independent variable within a significant set of independent variables. The resulting squared semi-partial proportions of variance from each independent variable represented the unique variability of each variable in the dependent variable.

The semi-partial proportions of variance for individual variables were then tested for significance using the same equation above as presented by Cohen and Cohen (1975, p. 135).

A step-wise multiple regression analysis was performed (Appendix I, Program 3) to develop a regression equation that could best predict degree of teaching compatibility. The following raw score regression equation was presented by Cohen and Cohen (1975):

\[ \hat{Y} = B_1 X_1 + B_2 X_2 + \ldots + B_K X_K + A \]

The independent variables having significant relationship with the dependent variable were included in the step-wise regression analysis.

Stage two at the multiple regression analyses involved a second analysis of major sets of independent variables and specific variables within sets for their
unique contributions to variance in the dependent variable - DTC. This time the major independent variable (DBC) was replaced with a set of background source variables (subscales of DBC) that were found to be significantly correlated with DTC. The stage two analysis was designed to identify primary sources of teaching practice. Primary teaching sources were defined as those background source variables (high school, college, curriculum packages, etc.) which elicited significant proportions of variance in the dependent variable (Degree of Teaching Compatibility).

The stage two set and individual analyses procedures were identical to those of stage one employing the use of semi-partial multiple regression correlational coefficients and F-tests evaluated for significance using an alpha of less than or equal to 0.05. The stage two SAS subprogram (Program #4) can be found in Appendix I.

The stage three regression procedure involved a semi-partial analysis of background source variables with the major independent variable (Degree of Background Compatibility). The stage three analysis was designed to identify primary sources of background experience. Only those background source variables that were found to be significantly correlated (at an alpha level equal to or less than 0.05) with DBC were included in the regression model (Appendix I, Program 5). Primary background sources
were defined as those background source variables which elicited significant proportions of variance in the major independent variable (Degree of Background Compatibility).

Stage four of the regression analyses involved a third analysis of major sets (alternative context, alternative presage, and background sources) of independent variables and specific variables within sets. However, three subscales of the dependent variable (Degree of Management, Production, and Personnel Compatibility) were substituted for DTC in three separate regression runs. Based on whether significance was obtained, individual variables within the background sources set were examined in an effort to determine which background sources were explaining a significant proportion of variance in Degree of Management Compatibility (Appendix I, Program 6), Degree of Production Compatibility (Appendix I, Program 7), and Degree of Personnel Compatibility (Appendix I, Program 8).

The stage four analyses were designed to determine which background sources uniquely contribute significant proportions of variance to specific kinds of secondary level manufacturing teaching activities. Recommendations could then be made for curricular revision of these primary background sources not also considered primary teaching sources. The recommendations would propose specific types of manufacturing activities that should be addressed by each to better prepare industrial arts teachers to teach manufacturing.
CHAPTER IV

The Findings

This chapter is divided into nine major sections. Descriptive data and relationships of independent variables to the dependent variable will be presented in the first section. An analysis of the proportions of variance in the dependent variable, degree of teaching compatibility, explained by the three sets of independent variables and independent variables within significant sets will be presented in the second major section. A stepwise regression analysis of those variables which best predict degree of teaching compatibility scores will also be presented in the second section. The third section will contain an analysis of the proportion of variance in the major independent variable, degree of background compatibility, explained by background source variables (subscales of DBC). Primary sources of background activity experience, will be identified in this section. An analysis of the proportion of variance in the dependent variable explained by the three independent variable sets, replacing DBC with a set of background source variables
(subscals of DBC), will be presented in section four. Primary sources of teaching activity experience also will be identified in this section. Section five will contain a discussion of activity sources as a focus for curricular change and the identification of primary background sources in need of curricular change. An analysis of the proportions of variance in three subscales of the dependent variable (degrees of management, production, and personnel compatibility) explained by background source variables will be presented in section six. Primary sources of management, production, and personnel teaching practices will be identified in this section. Presented in section seven is an evaluation of primary background sources in terms of their contribution to theory-based management, production, and personnel teaching practice. Also presented in this section are teacher recommendations for curricular improvement. A normative profile of manufacturing activities taught in Ohio secondary schools is presented in section eight and finally, in section nine, is an evaluation of the findings relating to major, alternative, and subhypotheses of this study.
Section 1
Descriptive Data and Relationships of Independent Variables

All descriptive data were summarized in the form of individual frequency/percentage tables for nominal data variables and a composite mean/variability table for continuous data variables. These summary tables are presented in Appendix J.

Correlational matrixes of independent variables with the dependent variable are presented for the presage and context sets of independent variables in section one of this chapter. The following scale suggested by Davis (1971) was employed to describe the magnitude of relationships among variables.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Description</th>
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<tbody>
<tr>
<td>.70 or higher</td>
<td>very strong relationship</td>
</tr>
<tr>
<td>.50 to .69</td>
<td>substantial relationship</td>
</tr>
<tr>
<td>.30 to .49</td>
<td>moderate relationship</td>
</tr>
<tr>
<td>.10 to .29</td>
<td>low relationship</td>
</tr>
<tr>
<td>.01 to .09</td>
<td>negligible relationship</td>
</tr>
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</table>

Only independent variables that elicited relationships with the dependent variable that were significant at the 0.05 alpha level or less were retained for the regression analyses reported in later sections of this chapter.
Alternative Presage Variables

Based on the descriptive data in Tables 22-33 of Appendix J a composite presage profile of a typical secondary level manufacturing teacher in the State of Ohio was developed.

The typical Ohio manufacturing teacher is male (no female manufacturing teachers were identified), is 36-40 years old, has 13-15 years of teaching experience, has been employed in one or possibly two school systems and has spent the last 10-15 years in his current position. This teacher works 7-9 hours a week in supplemental employment, has 0-6 years of production related industrial experience and enjoys 4-6 hours a week in leisure time activity. He has a 2.5-3.5 undergraduate grade point average, has achieved a masters or master's equivalent degree, and believes that problem solving and an understanding of management, production, and personnel practices are the major purposes of industrial arts.

The results from the correlations of alternative presage variables and degree of teaching compatibility (DTC) are presented in Table 6. There was a moderate significant relationship between DTC and the number of school systems employed (r = .31, p < .05). A low significant relationship was found between DTC and number of professional memberships held (r = .28, p < .05). There
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**Note:** \( n = 60 \)  
\( ^a p < .05 \)  
\( ^b p < .01 \)  
\( ^c p < .001 \)
were also low non-significant relationships between DTC and professional preparation \( (r = .23) \) and number of hours supplemental employment per week \( (r = .10) \). Negligible relationships were found between DTC and years in present position \( (r = -.10) \), number of hours in leisure activities per week \( (r = -.08) \), philosophy concerning purpose of industrial arts \( (r = -.02) \), number of years teaching experience \( (r = -.01) \) and age \( (r = .01) \). Virtually no relationship was found between DTC and number of years work in industry \( (r = .001) \) and undergraduate grade point average \( (r = .001) \).

The following significantly related alternative presage variables were identified for further analysis:

1. Number of school systems employed (NOSYSEM)
2. Number of professional memberships (PROFMEM)

**Alternative Context Variables**

The descriptive data from Tables 34-49 in Appendix J were used to develop a composite context profile of a typical secondary level Ohio manufacturing teacher.

Over one-half of the Ohio manufacturing teachers teach in city schools at the high school level. Eighty percent teach in school building sizes of less than 1,000 students which employ from 1-2 industrial arts teachers. Eighty-five percent of Ohio manufacturing teachers teach
five or more industrial arts courses, typically three different types of classes on a daily basis. About seventy-three percent teach 1-2 sections of manufacturing; approximately thirty-three percent of their teaching load. Manufacturing classes are most frequently taught on a semester rotation format with average class sizes of from 16-19 students. The typical operating budget for consumable supplies is from 1-100 dollars per rotation period of one manufacturing class. Ninety-two percent of the teachers indicate that they have at least one preparation period per day and over one-half say they perform from 3-6 hours of assigned nonteaching duties per week during school hours. Most of the teachers feel that the academic ability of their students compares with the average abilities of the general student body and over ninety-five percent indicate that their school system allows them much freedom to teach the content and activities that they desire in their manufacturing classes.

The results from the correlations of alternative context variables and degree of teaching compatibility (DTC) are presented in Table 7. There were moderate significant relationships between DTC and the number of preparation periods per week (r = .33, p < .01), freedom of program use (r = .32, p < .05), and class rotation format (r = -.30, p < .05). There was low significant
Table 7
Correlations of Context Variables and Degree of Teaching Compatibility

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Level Teaching (LEVTEAC)</th>
<th>Size School (SIZESCH)</th>
<th>No. IA Teachers (NOIATEAC)</th>
<th>No. IA Courses (NOIACOR)</th>
<th>Types IA Courses (TYPICOR)</th>
<th>No. Manuf. Sections (NOMASEC)</th>
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<tbody>
<tr>
<td>COUNTY</td>
<td>-1.000&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>LEVTEAC</td>
<td>-0.278&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.278&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>SIZESCH</td>
<td>0.434&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.434&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.049</td>
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</tr>
<tr>
<td>NOIATEA</td>
<td>0.189</td>
<td>-0.189</td>
<td>0.278&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.568&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
</tr>
<tr>
<td>NOIACOR</td>
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<td>-0.186</td>
<td>0.026</td>
<td>-0.222</td>
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</tr>
<tr>
<td>TYPICOR</td>
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<td>0.233</td>
<td>0.608&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.366&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.103</td>
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<tr>
<td>NOMASEC</td>
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<td>ROTPERS</td>
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<td>-0.063</td>
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<td>0.009</td>
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<td>0.000</td>
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<td>0.027</td>
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Note: N = 60.  <sup>a</sup>p < .05  <sup>b</sup>p < .01  <sup>c</sup>p < .001

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Table 7 (continued)

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<td>-0.080</td>
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<td>-0.104</td>
<td>0.322^a</td>
<td>-0.032</td>
<td>0.330^b</td>
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**NOTE:** N = 60  
^a p < .05  
^b p < .01  
^c p < .001
relationships between DTC and the type of school. There were also low nonsignificant relationships between DTC and number of industrial arts courses taught \((r = -0.21)\), number of industrial arts teachers employed \((r = 0.21)\), number of manufacturing sections taught \((r = -0.16)\), average class size \((r = -0.14)\) percent of teaching load that is manufacturing \((r = -0.12)\), perceived academic ability of manufacturing students \((r = -0.10)\) and school size \((r = 0.10)\). Negligible relationships were found between DTC and number of different types of industrial arts courses taught \((r = -0.09)\), number of nonindustrial arts courses taught \((r = -0.03)\), budget \((r = -0.03)\), teaching level \((r = 0.02)\), and number of hours per week performing assigned nonteaching duties \((r = 0.02)\).

The following significantly related alternative context variables were identified for further analysis:

1. Number of preparation periods per week (PREPPER)
2. Freedom of program use (FREEDOM)
3. Class rotation format (ROTPERI)
4. Type of school

Degree of Background Compatibility

Degree of background compatibility (DBC) was the major independent variable in this study. DBC is a percentage measure of the compatibility of an aggregate of
teacher background experiences with a theory-based model of 152 manufacturing activities. Teachers with high DBC scores have had an opportunity to practice a greater number and variety of manufacturing activities than teachers who have low DBC scores.

Descriptive data pertaining to DBC and nine subscales of DBC can be found in Appendix J, Table 50. The population mean for DBC was 56.1 with a standard deviation of 17.4. Twenty percent of DBC scores were found to be greater than one standard deviation below the mean, sixty-six percent were plus-minus one standard deviation around the mean, and fourteen percent were greater than one standard deviation above the mean. A population mean of 56.1 percent indicates that only a little over half of the 152 theory-based manufacturing activities have been previously experienced by typical inservice manufacturing teachers. This finding suggests that primary sources of background experience may provide too narrow a menu of manufacturing activity experience to have a positive impact on closing the theory/practice gap.

The result from the correlation of degree of background compatibility and degree of teaching compatibility is presented in Table 6. There was a substantial significant relationship between DTG and DBC ($r = .64, p < .001$). The magnitude of relationship between the
background experiences and theory-based teaching practices of manufacturing teachers is almost twice as great as the nearest rival hypothesized variable. Further, the probability level of a Type I error (.001) for this relationship is much lower than the significance of any alternative variable finding. Thus, DBC was identified as a strong probable contributor to variance in the dependent variable and will be included in the regression model analysis.

Degree of Teaching Compatibility

Degree of teaching compatibility (DTC) was the major dependent variable in this study. DTC is a percentage measure of the compatibility of current teaching activities (laboratory activities performed by students in secondary level manufacturing classes) with a theory-based model of 152 manufacturing activities. Teachers with high DTC scores generally teach a greater number and variety of manufacturing activities than teachers who have low DTC scores.

Descriptive data concerning DTC and three subscales of DTC can be found in Appendix J, Table 50. The population mean for DTC was 33.1 with a standard deviation of 13.4. Fifteen percent of DTC scores were found to be greater than one standard deviation below the mean,
sixty-eight percent were plus-minus one standard deviation around the mean, and seventeen percent were greater than one standard deviation above the mean. A population mean of 33.1 percent indicates that about one-third of the 152 theory-based manufacturing activities are typically taught by inservice secondary level Ohio manufacturing teachers.

Section 2

Variances Explained in DTC by Sets of Independent Variables Including DBC

Conceptual Model

The conceptual framework of this study maintained three sets of independent variables.
1. Alternative presage variables
2. Alternative context variables
3. Degree of background compatibility

The independent variables within each of the above three sets found to be significantly related to degree of teaching compatibility were further analyzed. The researcher desired to determine the proportion of variance in DTC uniquely attributable to each variable set.

Three semi-partial multiple regression coefficients were calculated by calculating a squared multiple regression correlation coefficient for the full model and
then subtracting the squared multiple regression coefficients of a model containing all but the independent variables of interest for each of the three variable sets. The significance of these coefficients was calculated using the following F-test computational formula.

\[
F = \frac{(R^2_{Y, AB} - R^2_{Y, A})/K_B}{1 - R^2_{Y, AB}(n - K_A - K_B - 1)}
\]

The calculated semi-partial squared multiple regression coefficients and F-tests are presented in Table 8.

<table>
<thead>
<tr>
<th>Variable Set</th>
<th>(K_A)</th>
<th>(K_B)</th>
<th>(sR^2*)</th>
<th>(F)</th>
<th>(df)</th>
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</thead>
<tbody>
<tr>
<td>Alternative Context</td>
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<td>4</td>
<td>.148</td>
<td>5.037(^b)</td>
<td>(4,52)</td>
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<tr>
<td>Alternative Presage</td>
<td>5</td>
<td>2</td>
<td>.043</td>
<td>2.927 (c)</td>
<td>(2,52)</td>
</tr>
<tr>
<td>Degree of Background Compatibility</td>
<td>6</td>
<td>1</td>
<td>.202</td>
<td>27.497 (c)</td>
<td>(1,52)</td>
</tr>
</tbody>
</table>

*\(R^2 = .618\) \(^a_p < .05\) \(^b_p < .01\) \(^c_p < .001\)
Set Variances Explained

Based upon the analysis of data presented, the following findings were determined. First, the alternative context variable set \( K = 4 \) did account for a significant unique proportion of variance in the dependent variable, degree of teaching compatibility. The semi-partial squared multiple regression correlation coefficient \( (sR^2 = .148) \) proved significant \( (F = 5.04; \, p < .01; \, df = 4.52) \).

Second, the alternative presage variable set \( (K = 2) \) did not account for a significant unique proportion of variance in the dependent variable. The semi-partial squared multiple regression correlation coefficient was \( .043 \) with a calculated F-test value of \( 2.93 \) \( (df = 2,52) \).

Third, degree of background compatibility \( (K = 1) \) did account for a significant unique proportion of variance in the dependent variable, degree of teaching compatibility. The semi-partial squared multiple regression correlation coefficient \( (sR^2 = .202) \) proved significant \( (F = 27.50; \, p < .001; \, df = 1,52) \).

Significant Alternative Context Variables

The proportion of variance in the dependent variable, degree of teaching compatibility, explained by the alternative context variables was determined \( (R^2 = .338) \). Alternative context variables were: type of school
(city/county), class rotation period, freedom of program use, and number of preparation periods per week. The unique contribution \((sR^2)\) of each of the alternative context variables was calculated by subtracting the squared multiple regression coefficient for the model with each variable removed, in turn, from .338.

The semi-partial multiple regression coefficients and corresponding F-tests of significance for the alternative context variables are shown in Table 9.

<table>
<thead>
<tr>
<th>Alternative Context Variables</th>
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<th>(K_B)</th>
<th>(sR^2)</th>
<th>(F)</th>
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<td>1</td>
<td>.077</td>
<td>6.397(^a)</td>
<td>(1,55)</td>
</tr>
<tr>
<td>Freedom of Program Use</td>
<td>3</td>
<td>1</td>
<td>.099</td>
<td>8.225(^b)</td>
<td>(1,55)</td>
</tr>
<tr>
<td>Number of Prep Periods</td>
<td>3</td>
<td>1</td>
<td>.076</td>
<td>6.314(^a)</td>
<td>(1,55)</td>
</tr>
</tbody>
</table>

*R^2 = .338 \(a_p < .05\) \(b_p < .01\)
An examination of Table 9 shows that:

1. Type of school (city = 1/county = 2) did not account for a significant proportion of variance in DTC ($R^2 = .051$, $f = 4.24$, $p < .05$, $df = 1,55$),

2. Class rotation period did account for a significant proportion of variance in DTC ($R^2 = .077$, $F = 6.40$, $p < .05$, $df = 1,55$),

3. Freedom of program use did account for a significant proportion of variance in DTC ($R^2 = .099$, $F = 8.23$, $p < .01$, $df = 1,55$), and

4. Number of preparation periods per week did account for a significant proportion of variance in DTC ($R^2 = .076$, $F = 6.31$, $p < .05$, $df = 1,55$).

Thus, all four alternative context variables were found to explain a unique significant portion of the variance in degree of teaching compatibility.

**Correlations of Major Regression Variables**

The following independent variables were found to explain a unique significant proportion of variance in degree of teaching compatibility.
1. Degree of background compatibility.
2. Type of school
3. Class rotation period.
4. Freedom of program use.
5. Number of preparation periods per week.

The significant proportions of variance in DTC explained by the four extraneous context variables (type of school, class rotation period, freedom of program use, and number of preparation periods per week) represent a serious threat to internal validity if these extraneous variables are also significantly related to the major independent variable (DBC). That is, significant relationships between any alternative context variables and DBC would require background experiences to be qualified with selected context factors to explain the current teaching practice of secondary level Ohio manufacturing teachers.

Table 10 indicates that the only significant relationship between DBC and an alternative context variable was for the variable freedom of program use. There was a low significant relationship between DBC and freedom of program use ($r = .26, p < .05$). The fact that the background experiences of teachers who teach in a context of greater program freedom were found to be significantly different from their counterparts threatens the internal validity of the major hypothesis concerning the
Table 10
Correlations of Major Regression Variables and Degree of Teaching Compatibility (DTC)

<table>
<thead>
<tr>
<th>Type of School*</th>
<th>ROTPERI</th>
<th>FREEDOM</th>
<th>PREPPER</th>
<th>NOSYSEM</th>
<th>PROFMEM</th>
<th>DBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROTPERI</td>
<td>-0.039</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FREEDOM</td>
<td>0.066</td>
<td>0.074</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREPPER</td>
<td>0.000</td>
<td>-0.132</td>
<td>0.043</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOSYSEM</td>
<td>0.221</td>
<td>-0.105</td>
<td>0.032</td>
<td>0.570^c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFMEM</td>
<td>-0.007</td>
<td>0.124</td>
<td>0.077</td>
<td>0.053</td>
<td>0.185</td>
<td></td>
</tr>
<tr>
<td>DBC</td>
<td>0.055</td>
<td>-0.092</td>
<td>0.261^a</td>
<td>0.220</td>
<td>0.184</td>
<td>0.163</td>
</tr>
<tr>
<td>DTC</td>
<td>0.259^a</td>
<td>-0.303^a</td>
<td>0.322^a</td>
<td>0.330^b</td>
<td>0.314^a</td>
<td>0.278^a</td>
</tr>
</tbody>
</table>

Note: N=60
\[ a^p < .05 \quad b^p < .01 \quad c^p < .001 \] *City coded 1 and County coded 2
relationship between degree of background compatibility and degree of teaching compatibility.

Prediction of Teaching Compatibility

A stepwise multiple regression analysis was computed to develop a regression equation which could best predict degree of teaching compatibility scores. The following raw-score regression equation was presented by Cohen and Cohen (1975):

\[ \hat{Y} = B_1X_1 + B_2X_2 + \ldots + B_kX_k + A \]

All independent variables in Table 10 having a significant relationship with the dependent variable, degree of teaching compatibility, were included in the stepwise regression analysis. The results of the stepwise regression analysis are presented in Table 11.

Table 11

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>R²</th>
<th>R² Increment</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Background Compatibility</td>
<td>.4089</td>
<td>.4089</td>
<td>40.12c</td>
</tr>
<tr>
<td>Rotation Period</td>
<td>.4691</td>
<td>.0602</td>
<td>25.18c</td>
</tr>
<tr>
<td>Type of School</td>
<td>.5156</td>
<td>.0465</td>
<td>19.87c</td>
</tr>
<tr>
<td>Number of Professional Memberships</td>
<td>.5622</td>
<td>.0466</td>
<td>17.66c</td>
</tr>
</tbody>
</table>

\( c_p \leq .001 \)
The best predictors of degree of teaching compatibility in order of significance were:

1. Degree of background compatibility
2. Class rotation period
3. Type of school (whether county or not)
4. Number of professional memberships

The multiple regression equation with the respective calculated raw score partial regression weights (B's) and intercept value (A) is:

\[ \hat{Y} = .44X_1 + (-2.56)X_2 + (-5.94)X_3 + 1.53X_4 + 19.43 \]

This equation represents those significant variables which best predict degree of teaching compatibility scores. The total multiple regression coefficient, \( R^2 = .56 \), represented the proportion of variance explained in the dependent variable by the equation.

One probable explanation for the exclusion of the variable "freedom of program use" from the prediction equation is that freedom and DBC are significantly related (see Table 10). Thus, DBC shares the same portion of variance in the dependent variable (DTC) as freedom of program use. Therefore, a portion of the variance identified in step 1 of the stepwise regression analysis (pertaining to DBC) concurrently accounted for the portion of variance explained by freedom.
Section 2 Summary of Findings

Based on the semi-partial and stepwise multiple regression analyses of this section of Chapter IV:

1. Variance in the degree to which a teacher's background experiences are compatible with a theory-based model of manufacturing activities can be explained by a combination of:
   
   1.1 the amount and variety of theory-based background experiences obtained from background sources, and
   1.2 the degree of freedom of program use that exists in the teacher's local school context (environment).

2. Variance in the degree to which an inservice teacher's laboratory activities are compatible with a theory-based model of manufacturing activities can be uniquely (independently) explained by each of the following variables:
   
   2.1 a combination of degree of background compatibility and freedom of program use,
   2.2 class rotation period,
   2.3 the number of preparation periods per week, and
   2.4 the type of school.

3. The best predictors of the degree to which an inservice teacher's laboratory activities are going to be compatible with a theory-based model of manufacturing activities in order of importance are:
   
   3.1 a combination of degree of background compatibility and freedom of program use,
   3.2 class rotation period,
   3.3 type of school (whether county or not), and
   3.4 number of professional memberships.
Section 3  
The Identification of Primary Background Sources

The second objective of this study was to identify primary sources of background activity experience for secondary level teachers of manufacturing. Primary background sources were defined as those background source variables which elicited significant proportions of variance in the major independent variable (degree of background compatibility).

Frequency of Response to Background Sources

Participating teachers were asked to indicate where (the source or sources) they learned specific background activities as part of their response on the mail survey instrument. Eight specific source categories and one open (OTHER) category were coded on the survey instrument to facilitate response convenience.

A total of 8,597 total source responses were received from the 60 participating manufacturing teachers. The total percentage breakdown per source category is presented in Figure 4.
The most frequently indicated source of background experience was college industrial arts laboratory courses (34.9%). Nonschool work experience (19.0%), school related work experience (15.9%), and curriculum packages/textbooks (12.9%) followed in an order of decreasing response frequency. The remaining sources (high school industrial arts laboratory courses, inservice training, student teaching, vocational classes, and other sources) did not elicit as great a frequency of response as did the top four.
Figure 5. Percentages of response from specific sources of background experience of the high theory/practice compatibility group of secondary level manufacturing teachers (N = 1,975 responses; 10 teachers).

Figure 6a. Percentages of response from specific sources of background experience of the low theory/practice compatibility group of secondary level manufacturing teachers (N = 811 responses; 9 teachers).
Manufacturing teachers with a high degree of teaching compatibility (greater than one standard deviation above the DTC mean) and low degree of teaching compatibility (greater than one standard deviation below the DTC mean) were also examined for frequency of response to background sources (see Figures 5 and 6).

The most frequently indicated background source for both high and low DTC groups was college level industrial arts laboratory courses. Based on percentage of response, the teachers in the low DTC group seemed to rely more heavily on college level courses as a source for background experiences than teachers in the high DTC group. Curriculum packages/textbooks was almost as strong a background source for the high DTC group as college courses; however, teachers in the low group virtually ignored curriculum packages and textbooks as a background source. Further, teachers in the low DTC group seemed to rely more heavily on work experiences (in school and out-of-school) than their counterparts as background sources. A summary ranking of the top four background sources for each group by frequency of response is presented in Table 12.
Table 12

Summary of Top Four Background Activity Sources for Total, High DTC, and Low DTC Groups of Manufacturing Teachers by Frequency of Response

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total</th>
<th>High DTC</th>
<th>Low DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COLAB</td>
<td>COLAB</td>
<td>COLAB</td>
</tr>
<tr>
<td>2</td>
<td>WORKNON</td>
<td>CPACK</td>
<td>WORKNON</td>
</tr>
<tr>
<td>3</td>
<td>WORKSCH</td>
<td>WORKNON</td>
<td>WORKSCH</td>
</tr>
<tr>
<td>4</td>
<td>CPACK</td>
<td>WORKSCH</td>
<td>HSLAB</td>
</tr>
</tbody>
</table>

N = 60 teachers

Variances Explained in DBC by Background Sources

The results from the correlations of background source variables and degree of background compatibility (DBC) are presented in Table 13. There was a substantial significant relationship between DBC and college industrial arts laboratory courses ($r = .67, p < .001$). There were moderate significant relationships between DBC and curriculum packages/textbooks ($r = .42, p < .001$), nonschool related work experience ($r = .46, p < .001$), and school related work experience ($r = .32, p < .05$). There were low significant relationships between DBC and inservice training ($r = .29, p < .05$) and other ($r = .14, p < .05$). There were also low nonsignificant relationships...
### Table 13

Correlations of Background Source Variables and Degrees of Teaching (DTC), Management (DMC), Production (DPC), and Personnel (DPERC) Compatibility

<table>
<thead>
<tr>
<th></th>
<th>High School (HSLAB)</th>
<th>College (COLAB)</th>
<th>Student Teaching (STUTEACH)</th>
<th>Curriculum Packages (CPACK)</th>
<th>Inservice (INSERV)</th>
<th>Vocational Education (VOCED)</th>
<th>Work Experience Nonschool (WORKNON)</th>
<th>Work Experience School (WORKSCH)</th>
<th>Background Compatibility (DBC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLAB</td>
<td>0.152</td>
<td>0.173</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUTEACH</td>
<td>0.157</td>
<td></td>
<td>0.177</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPACK</td>
<td>-0.101</td>
<td>0.153</td>
<td>0.177</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSERV</td>
<td>0.059</td>
<td>0.082</td>
<td>0.186</td>
<td>0.201</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOCED</td>
<td>0.274*</td>
<td>0.163</td>
<td>0.033</td>
<td>-0.068</td>
<td>-0.034</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORKNON</td>
<td>0.098</td>
<td>0.082</td>
<td>0.029</td>
<td>0.161</td>
<td>0.354b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORKSCH</td>
<td>0.306b</td>
<td>0.077</td>
<td>0.336b</td>
<td>0.124</td>
<td>0.295b</td>
<td>0.083</td>
<td>0.413c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>-0.015</td>
<td>-0.068</td>
<td>0.133</td>
<td>0.395b</td>
<td>0.017</td>
<td>-0.055</td>
<td>0.243</td>
<td>-0.098</td>
<td></td>
</tr>
<tr>
<td>DBC</td>
<td>0.215</td>
<td>0.666c</td>
<td>0.103</td>
<td>0.424c</td>
<td>0.286c</td>
<td>0.112</td>
<td>0.463c</td>
<td>0.324c</td>
<td>0.144c</td>
</tr>
<tr>
<td>DMC</td>
<td>0.184</td>
<td>0.153</td>
<td>0.000</td>
<td>0.370b</td>
<td>0.132</td>
<td>0.039</td>
<td>0.251</td>
<td>0.053</td>
<td>0.316c</td>
</tr>
<tr>
<td>DPC</td>
<td>0.237</td>
<td>0.267a</td>
<td>0.008</td>
<td>0.339b</td>
<td>0.235</td>
<td>0.183</td>
<td>0.255b</td>
<td>0.243</td>
<td>0.120</td>
</tr>
<tr>
<td>DPERC</td>
<td>-0.018</td>
<td>0.148</td>
<td>-0.088</td>
<td>0.451c</td>
<td>-0.038</td>
<td>-0.020</td>
<td>0.156</td>
<td>-0.140</td>
<td>0.201</td>
</tr>
<tr>
<td>DTC</td>
<td>0.234</td>
<td>0.242</td>
<td>-0.008</td>
<td>0.468c</td>
<td>0.169</td>
<td>0.109</td>
<td>0.293b</td>
<td>0.124</td>
<td>0.289b</td>
</tr>
</tbody>
</table>

**Note:** N = 60  
*p < .05  
*p < .01  
*p < .001
between DBC and high school industrial arts laboratory courses \( (r = .22) \), vocational classes \( (r = .11) \), and student teaching \( (r = .10) \).

The following significantly related background source variables were identified for further analysis.

1. College industrial arts laboratory courses (COLAB)
2. Curriculum packages/textbooks (CPACK)
3. Nonschool work experience (WORKNON)
4. School related work experience (WORKSCH)
5. Inservice training (INSERV)

These source variables were entered into a regression model to determine the proportion of variance in DBC uniquely contributed by each. The calculated semi-partial squared multiple correlation coefficients and corresponding F-tests are presented in Table 14.

The proportion of variance in degree of background compatibility explained by background source variables was determined \( (R^2 = .694) \). This means that approximately seventy percent of the variance in the major independent variable can be explained by the five background sources entered into the regression model.
The unique contribution ($sR^2$) of each of the background source variables was calculated by subtracting the squared multiple regression coefficient for the model with each background source variable removed in turn, from $R^2 = .694$. An examination of Table 14 shows that:

1. College industrial arts laboratory courses did account for a significant proportion of variance in DBC. ($sR^2 = .337$, $F = 59.53$, $p < .001$, $df = 1, 154$),

<table>
<thead>
<tr>
<th>Background Source Variables</th>
<th>$K_A$</th>
<th>$K_B$</th>
<th>$sR^2^*$</th>
<th>$F$</th>
<th>$df$</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Lab</td>
<td>4</td>
<td>1</td>
<td>.337</td>
<td>59.529$^c$</td>
<td>(1, 154)</td>
</tr>
<tr>
<td>Curriculum Packages</td>
<td>4</td>
<td>1</td>
<td>.064</td>
<td>11.304$^b$</td>
<td>(1, 154)</td>
</tr>
<tr>
<td>Inservice</td>
<td>4</td>
<td>1</td>
<td>.002</td>
<td>0.353</td>
<td>(1, 154)</td>
</tr>
<tr>
<td>Nonschool Work Experience</td>
<td>4</td>
<td>1</td>
<td>.076</td>
<td>13.424$^c$</td>
<td>(1, 154)</td>
</tr>
<tr>
<td>School Related Work Experience</td>
<td>4</td>
<td>1</td>
<td>.008</td>
<td>1.413</td>
<td>(1, 154)</td>
</tr>
</tbody>
</table>

$R^2 = .694$, $^a_p < .05$, $^b_p < .01$, $^c_p < .001$
2. Curriculum packages/textbooks did account for a significant proportion of variance in DBC \( (sR^2 = .064, F = 11.30, p < .01, df = 1,54) \),

3. Inservice training did not account for a significant proportion of variance in DBC,

4. Nonschool related work experiences did account for a significant proportion of variance in DBC \( (sR^2 = .076, F = 13.42, p < .001, df = 1,54) \), and

5. School related work experiences did not account for a significant proportion of variance in DBC.

Section 3 Summary of Findings

Based on the frequency of response and semi-partial multiple regression analyses presented in this section:

1. The primary sources of background experience for secondary level Ohio manufacturing teachers were college level industrial arts courses, nonschool related work experience, and curriculum packages/textbooks in respective order of importance.

2. Manufacturing teachers in the low degree of teaching compatibility group relied more heavily on college level courses as a source of
background activity experience than teachers in the high DTC group.

3. Curriculum packages/textbooks was almost as strong a background source for the high DTC group as college courses; however, teachers in the low DTC group virtually ignored curriculum packages/textbooks as a background activity source.

4. Teachers in the low DTC group relied more heavily on nonschool and school related work experiences as sources of background activity than teachers in the high DTC group.

Section 4
The Identification of Primary Teaching Sources

The third objective of this study was to identify primary sources of teaching activity for secondary level manufacturing teachers. Primary teaching sources were identified as those background sources which elicited significant proportions of variance in the dependent variable (degree of teaching compatibility).
Frequency of Response to Teaching Sources

Participating teachers were asked to indicate where (source(s)) they learned specific activities they currently teach in their manufacturing classes as part of their response on the mail survey instrument. Eight source categories and one open (OTHER) category (identical to the background source analysis of section 3) were coded on the survey instrument to facilitate response convenience. A total of 6,469 total teaching source responses were received from the 60 participating manufacturing teachers. The total percentage breakdown per source category is presented in Figure 7.

![cumulative bar chart]

**SOURCE KEY**
- HSLAB = High School I.A. laboratory courses
- COLAB = College I.A. laboratory courses
- STUTEAC = Student Teaching
- CPACK = Curriculum packages/textbooks
- INSERV = Inservice Workshops
- VOCEDE = Vocational/technical classes
- WORKNON = Work experience (non-school)
- WORKSCH = Work experience (school related)

Figure 7. Cumulative percentages of response to current teaching activities from background sources of secondary level Ohio manufacturing teachers (N = 6,469; 60 teachers)
The most frequently indicated source of teaching activities was college industrial arts laboratory courses (42.3%). This source was responded to almost three times as often as nonschool related work experience (14.3%), school related work experience (13.3%), and curriculum packages/textbooks (12.6%) which followed in order of decreasing response frequency. The remaining sources did not elicit as great a response frequency as the top four.

The laboratory activities currently taught by manufacturing teachers in categories of high degree of teaching compatibility (greater than one standard deviation above the DTC mean) and low degree of teaching compatibility (greater than one standard deviation below the DTC mean) were also examined for frequency of responses to background sources (see Figures 8 and 9).

The most frequently indicated sources of current teaching activities for both high and low DTC groups was college level industrial arts laboratory courses. Based on percentage of response, the teachers in the low DTC group seemed to rely on college level courses more heavily as a source for current teaching practices than teachers in the high DTC group. Curriculum packages/textbooks elicited an almost equal percentage of response for the high DTC group as college courses; however, teachers in the low group virtually ignored curriculum packages as a source of
Figure 8. Percentages of response to current teaching activities from background sources of the high theory/practice compatibility group of secondary level manufacturing teachers (N = 1,501 responses; 10 teachers).

Figure 9. Percentages of response to current teaching activities from background sources of the low theory/practice compatibility group of secondary level manufacturing teachers (N = 359 responses; 9 teachers).
current teaching practice. Further, teachers in the low DTC group seemed to rely more heavily on work experience (in school and out-of-school) than their counterparts as sources of teaching activities.

A summary ranking of the top four teaching sources for each group by frequency of response is presented in Table 15.

Table 15

Summary Ranking of Top Four Teaching Activity Sources for Total, High DTC, and Low DTC Groups of Manufacturing Teaches by Frequency of Response

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total</th>
<th>High DTC</th>
<th>Low DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COLAB</td>
<td>COLAB</td>
<td>COLAB</td>
</tr>
<tr>
<td>2</td>
<td>WORKNON</td>
<td>CPACK</td>
<td>WORKNON</td>
</tr>
<tr>
<td>3</td>
<td>WORKSCH</td>
<td>WORKNON</td>
<td>WORKSCH</td>
</tr>
<tr>
<td>4</td>
<td>CPACK</td>
<td>HSLAB</td>
<td>HSLAB</td>
</tr>
</tbody>
</table>

N = 60 teachers

The frequency of response to teaching sources and associated source rankings are virtually identical to the response rates and ranking for the background sources presented in the third section of this chapter. Thus, despite the fact that only about 64 percent of teacher background activities are typically transferred to the
secondary school laboratory, the response percentages for specific background source variables and teaching source variables remain relatively consistent among total, high DTC, and low DTC groups of manufacturing teachers.

Correlations of Background Source Variables

The results from the correlations of background source variables and degree of teaching compatibility (DTC) are presented in Table 13. There was a moderate significant relationship between DTC and curriculum packages/textbooks \( (r = .47, p < .001) \). There was a low significant relationship between DTC and nonschool related work experiences \( (r = .29, p < .05) \) and other background sources \( (r = .29, p < .05) \). There were also low nonsignificant relationships between DTC and college industrial arts laboratory courses \( (r = .24) \), high school industrial arts laboratory courses \( (r = .24) \), inservice training \( (r = .17) \), school related work experience \( (r = .12) \), and vocational education \( (r = .11) \). Finally, there was a negligible relationship between DTC and student teaching \( (r = .008) \).
Conceptual Framework of this Analysis Procedure

The conceptual framework of this analysis continued to maintain three sets of independent variables. However, this time the analysis required the replacement of the degree of background compatibility set with a set of background source variables (subscales of DBC) which were significantly correlated with the dependent variable (DTC).

The results from the correlations of background source variables and degree of teaching compatibility (DTC) are presented in Table 13. There was a moderate significant relationship between DTC and the curriculum package/textbook source \((r = .47, p < .001)\). There were also significant relationships between DTC and the non-school work experience source \((r = .29, p < .05)\) and the other source variable \((r = .29, p < .05)\). No other background source variables were significantly correlated with DTC. Therefore, the conceptual framework of this analysis was composed of the following three sets of independent variables.

1. Alternative presage variables
2. Alternative context variables
3. Background source variables (CPACK, WORKNON, OTHER)
The semi-partial analysis procedure for determining squared multiple regression coefficients for sets of variables and individual variables within significant sets was identical to the procedure previously discussed in the second section of this chapter. The researcher desired to determine the proportion of variance in DTC attributed to each significantly correlated background source variable.

The calculated semi-partial squared multiple regression correlation and F-tests for the three sets of independent variables are presented in Table 16.

Table 16
Semi-Partial Multiple Regression Coefficients for Sets of Independent Variables Found to be Significantly Correlated with Degree of Teaching Compatibility (DTC) Replacing DBC with a Set of Specific Source Variables

<table>
<thead>
<tr>
<th>Variable Set</th>
<th>$K_A$</th>
<th>$K_B$</th>
<th>$sR^2$*</th>
<th>$F$</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative Context</td>
<td>5</td>
<td>4</td>
<td>.151</td>
<td>4.754b</td>
<td>(5,50)</td>
</tr>
<tr>
<td>Alternative Presage</td>
<td>7</td>
<td>2</td>
<td>.031</td>
<td>1.952</td>
<td>(2,50)</td>
</tr>
<tr>
<td>Background Sources</td>
<td>6</td>
<td>3</td>
<td>.290</td>
<td>12.175c</td>
<td>(3,50)</td>
</tr>
</tbody>
</table>

*R^2 = .603

\(a_p \leq .05\)  \(b_p \leq .01\)  \(c_p \leq .001\)
Variance Explained by Variable Sets with Teaching Source Variables

Based upon the analysis of data presented, the following findings were determined. First, the alternative context variable set \((K = 4)\) did account for a significant proportion of variance in the dependent variable, degree of teaching compatibility. This finding was consistent with the previous set analysis that included DBC, but not significant background source variables. The semi-partial squared multiple regression correlation coefficient \((\text{sR}^2 = .151)\) proved significant \((F = 4.75; p < .01; \text{df} = 5,50)\).

Second, the alternative presage variable set \((k = 2)\) did not account for a significant proportion of variance in the dependent variable. This finding was also consistent with the previous set analysis. The semi-partial squared multiple regression correlation coefficient was \(.031\) with a calculated F-test value of \(1.95 (\text{df} = 2,50)\).

Third, the background sources set \((K = 3)\) did account for a significant proportion of variance in the dependent variable, degree of teaching compatibility. The semi-partial squared multiple regression correlation coefficient \((\text{sR}^2 = .290)\) proved significant \((F = 12.18, p < .001; \text{df} = 3,50)\).
Variances Explained in DTC by Background Source Variables

The proportion of variance in the dependent variable, degree of teaching compatibility, explained by the significantly correlated background source variables was determined ($R^2 = .397$). Background source variables were included in this analysis were: curriculum packages/textbooks, nonschool work experience, and other sources. The unique contribution ($sR^2$) of each of the background source variables was calculated by subtracting the squared multiple regression coefficient for the model with each variable removed, in turn, from .397.

The semi-partial multiple regression coefficients and corresponding F-tests of significance for the background source variables are shown in Table 17.

<table>
<thead>
<tr>
<th>Background Source Variables</th>
<th>$K_A$</th>
<th>$K_B$</th>
<th>$sR^2$</th>
<th>$F$</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Packages</td>
<td>2</td>
<td>1</td>
<td>.102</td>
<td>9.473b</td>
<td>(1,56)</td>
</tr>
<tr>
<td>Nonschool Work Experience</td>
<td>2</td>
<td>1</td>
<td>.154</td>
<td>14.302c</td>
<td>(1,56)</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1</td>
<td>.004</td>
<td>.372</td>
<td>(1,56)</td>
</tr>
</tbody>
</table>

*$R^2 = .397$  
*a p < .05  
*b p < .01  
*c p < .001
An examination of Table 17 shows that:

1. Curriculum packages/textbooks did account for a significant proportion of variance in DTC ($r^2 = .102$, $F = 9.47$, $p < .01$, $df = 1,56$),

2. Nonschool related work experience did not account for a significant proportion of variance in DTC ($r^2 = .154$, $F = 14.302$, $p < .001$), and

3. Other teaching sources did not account for a significant proportion of variance in DTC.

Two of nine background source variables were found to explain a unique significant proportion of variance in degree of teaching compatibility. Therefore, curriculum packages/textbooks and non-school work experiences were identified as primary teaching sources.

Section 4 Summary of Findings

Based on the frequency of response and semi-partial multiple regression analyses presented in this section:

1. The most frequently selected source of teaching activity for secondary level Ohio manufacturing teachers was college industrial arts laboratory courses,

2. manufacturing teachers in the low degree of teaching compatibility group relied more heavily
on college level courses as a source of teaching activity practice than teachers in the high DTC group,

3. Curriculum packages/textbooks was about as strong a teaching source for the high DTC group as college courses; however, teachers in the low DTC group virtually ignored curriculum packages/textbooks as a teaching activity source,

4. Teachers in the low DTC group rely more heavily on nonschool and school related work experiences as sources of teaching activity than teachers in the high DTC group, and

5. Although the most frequently selected source of teaching activity was college industrial arts courses, the *primary* sources of theory-based teaching activity were curriculum packages/textbooks and non-school work experiences. The non-school work experience variable explained the greatest proportion of variability in the dependent variable, degree of teaching compatibility. Curriculum packages/textbooks were also identified as a primary source of theory-based teaching activity.
Section 5

Activity Sources: A Focus for Curricular Change

Four decades of effort have been spent developing innovative curriculum packages, textbooks, and state curriculum guides aimed primarily at providing inservice teachers with assistance in applying curriculum theory to laboratory practice. However, the effectiveness of a change strategy that requires large numbers of inservice teachers to transfer theory into practice with little prior practice has been quite limited, as discussed in Chapters I and II. Despite the dismal results of such an approach, recent efforts supported by the International Technology Education Association will provide additional materials, focused again with a singular aim of providing inservice teachers with a model of curricular theory (Jackson's Mill Curriculum Theory) that should be applied to laboratory practice.

The literature abounds with recommendations that stress the need for alternative strategies which incorporate theory-based activity experiences for teachers to practice prior to the teaching situation (Corrigan, 1983; Goodlad, 1983; Nannay, 1983; Copeland, 1982; LaPorte, 1982; Worthington, 1982; Lange, 1981; DeVore, 1980b;
Israel, 1980; Ray, 1980b; Chang, 1979; Lauda, 1979; Gemmill, 1976; Betts, 1975; and others). These recommendations must be viewed with increased validity in light of findings in this study which indicate that theory-based background activity experiences are significantly related to and account for a significant proportion of variance in theory-based teaching practice. One purpose of this study was to identify and examine sources of laboratory activity experiences from nonconventional industrial arts teachers as a means of directing attention to those activity sources which are in need of curricular change.

Primary background sources were identified to provide the researcher with specific sources from which non-conventional industrial arts teachers gain a significant amount of background activity experience relative to a contemporary theory-based model of laboratory activities. The primary background sources identified in this study were college industrial arts laboratory courses, nonschool related work experience, and curriculum packages/textbooks.

Primary teaching sources were identified to provide the researcher with specific sources from which non-conventional industrial arts teachers gain a significant amount of experience for activities they
currently teach relative to a contemporary theory-based model of laboratory activities. The primary teaching sources identified in this study were non-school related work experiences and curriculum packages/textbooks.

While nonconventional industrial arts teachers receive a significant amount of background activity experiences from college industrial arts laboratory classes, nonschool work experience, and curriculum packages, the primary contributor to actual teaching practice (relative to theory-based activities) appear to be the non-school work experience and curriculum package/textbook sources. Although college industrial arts courses were identified as primary source of background experience, the findings do not support the contribution of these activities to actual teaching practice relative to theory-based laboratory activities.

The next section of Chapter IV will present findings concerning the contribution of specific background sources to degrees of management, production, and personnel theory/practice compatibility. Recommendations for curricular improvement (in terms of specific clusters of activities) will be made in Chapter V for primary background sources (college industrial arts classes, curriculum packages/textbooks, nonschool work experience) which illicit non-significant proportions of variance in
any or all of the management, production, or personnel areas of theory/practice compatibility.

Section 6
Variances Explained in DMC, DPC, and DPERC by Background Source Variables

The primary objective of the analyses described in Section 6 was to determine the proportions of variance in degree of management compatibility (DMC), degree of production compatibility (DPC), and degree of personnel compatibility (DPERC) uniquely explained by specific teaching source variables. In other words, the researcher wanted to determine the contribution of specific sources of background practice to types of activities taught (management, production, personnel). Background sources could then be evaluated in terms of their degree of contribution to management, production, and personnel teaching activities.

Conceptual Model

The conceptual framework for this analysis involved three sets of independent variables:
1. alternative presage variables,
2. alternative context variables, and
3. background source variables.

Three sets of semi-partial multiple regression coefficients were calculated using the full regression model (alternative presage, alternative context, and background source variables) and each of the three subscales of DTC as a dependent variable.

Correlations and Variances Explained in DMC

Correlations of specific background sources with degree of management compatibility were presented in Table 13. Moderate significant relationships were found between DMC and curriculum packages/textbooks \( r = .37, p < .01 \) and other teacher sources \( r = .32, p < .05 \). No additional teaching source variables elicited significant relationships with DMC.

The proportion of variance in the dependent variable, degree of management compatibility, explained by the background sources set was determined \( R^2 = .265 \). The unique contribution of each of the background source variables was calculated by subtracting the squared multiple regression coefficient for the model with each variable removed, in turn, from .265. The semi-partial multiple regression coefficients and corresponding F-tests
of significance for the background source variables are presented in Table 18.

### Table 18

<table>
<thead>
<tr>
<th>Background Source Variables</th>
<th>( K_A )</th>
<th>( K_B )</th>
<th>( sR^2^* )</th>
<th>( F )</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Lab</td>
<td>8</td>
<td>1</td>
<td>.045</td>
<td>3.0612</td>
<td>(1,50)</td>
</tr>
<tr>
<td>College Lab</td>
<td>8</td>
<td>1</td>
<td>.008</td>
<td>.5442</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Student Teaching</td>
<td>8</td>
<td>1</td>
<td>.010</td>
<td>.6803</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Curriculum Packages</td>
<td>8</td>
<td>1</td>
<td>.070</td>
<td>4.7619(^a)</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Inservice</td>
<td>8</td>
<td>1</td>
<td>.001</td>
<td>.0680</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Vocational Education</td>
<td>8</td>
<td>1</td>
<td>.001</td>
<td>.0680</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Nonschool Work Experience</td>
<td>8</td>
<td>1</td>
<td>.016</td>
<td>1.0884</td>
<td>(1,50)</td>
</tr>
<tr>
<td>School Related Work Experience</td>
<td>8</td>
<td>1</td>
<td>.004</td>
<td>.2721</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>1</td>
<td>.019</td>
<td>1.2925</td>
<td>(1,50)</td>
</tr>
</tbody>
</table>

\[^*\]R^2 = .265  \[^a\]p < .05

An examination of Table 18 shows that:

1. high school industrial arts laboratory courses did not account for a significant proportion of variance in DMC,
2. college industrial arts laboratory courses did not account for a significant proportion of variance in DMC,

3. student teaching did not account for a significant proportion of variance in DMC,

4. curriculum packages/textbooks did account for a significant proportion of variance in DMC ($R^2 = .070$, $F = 4.76$, $p < .05$, df = 1,50),

5. inservice training did not account for a significant proportion of variance in DMC,

6. vocational training did not account for a significant proportion of variance in DMC,

7. nonschool related work experience did not account for a significant proportion of variance in DMC,

8. school related work experience did not account for a significant proportion of variance in DMC, and

9. other teaching sources did not account for a significant proportion of variance in DMC.

Although moderate significant relationships were found between DMC and curriculum packages/textbooks and other teaching sources, only curriculum packages/textbooks was found to explain a significant proportion of the variance in degree of management compatibility.
Correlations of specific teaching sources with degree of production compatibility were presented in Table 13. A moderate significant relationship was found between DPC and curriculum packages/textbooks ($r = .34, p < .01$). Low significant relationships were found between DPC and college industrial arts laboratory courses ($r = .27, p < .05$) and nonschool related work experience ($r = .26, p < .05$). No additional background source variables elicited significant relationships with DPC.

The proportion of variance in the dependent variable, degree of production compatibility, explained by the background sources set was determined ($R^2 = .296$). The unique contribution of each background source variable was calculated by subtracting the squared multiple regression coefficient for the model with each variable removed in turn, from $.296$. The semi-partial multiple regression coefficients and corresponding F-tests of significance for the background source variables are presented in Table 19.

An examination of Table 19 shows that:

1. high school industrial arts laboratory courses did not account for a significant proportion of variance in DPC,

2. college industrial arts laboratory courses did not account for a significant proportion of variance in DPC,
Table 19

Semi-Partial Multiple Regression Coefficients for Teaching Source Variables with Degree of Production Compatibility (DPC)

<table>
<thead>
<tr>
<th>Teaching Source Variables</th>
<th>$K_A$</th>
<th>$K_B$</th>
<th>$sR^2*$</th>
<th>$F$</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Lab</td>
<td>8</td>
<td>1</td>
<td>.027</td>
<td>1.9176</td>
<td>(1,50)</td>
</tr>
<tr>
<td>College Lab</td>
<td>8</td>
<td>1</td>
<td>.030</td>
<td>2.1307</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Student Teaching</td>
<td>8</td>
<td>1</td>
<td>.028</td>
<td>1.886</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Curriculum Packages</td>
<td>8</td>
<td>1</td>
<td>.066</td>
<td>4.6875</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Inservice</td>
<td>8</td>
<td>1</td>
<td>.014</td>
<td>.9943</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Vocational Education</td>
<td>8</td>
<td>1</td>
<td>.012</td>
<td>.8523</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Nonschool Work Experience</td>
<td>8</td>
<td>1</td>
<td>.001</td>
<td>.0710</td>
<td>(1,50)</td>
</tr>
<tr>
<td>School Related Work Experience</td>
<td>8</td>
<td>1</td>
<td>.011</td>
<td>.0710</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>1</td>
<td>.002</td>
<td>.1420</td>
<td>(1,50)</td>
</tr>
</tbody>
</table>

*$R^2 = .296 \quad a \ p \leq .05$

3. student teaching did not account for a significant proportion of variance in DPC,

4. curriculum packages/textbooks did account for a significant proportion of variance in DPC ($sR^2 = .066$, $F = 4.69$, $p < .05$, df = 1,50),

5. inservice training did not account for a significant proportion of variance in DPC,

6. vocational training did not account for a significant proportion of variance in DPC,
7. nonschool related work experience did not account for a significant proportion of variance in DPC,
8. school related work experience did not account for a significant proportion of variance in DPC, and
9. other training sources did not account for a significant proportion of variance in DPC.

Although significant relationships were found between DPC and three background source variables (curriculum packages/textbooks, nonschool related work experiences, and college industrial arts laboratory courses) only the curriculum packages/textbook source was found to explain a significant proportion of variance in degree of production compatibility.

Correlations and Variances Explained in DPERC

Correlations of specific background sources with degree of personnel compatibility were presented in Table 13. A moderate significant relationship was found between DPERC and curriculum packages/textbooks ($r = .45$, $p < .001$). No additional background source variables were found to have significant relationships with DPERC.
The proportion of variance in the dependent variable, degree of personnel compatibility, explained by the background sources set was determined ($R^2 = .322$). The unique contribution of each background source variable was calculated by subtracting the squared multiple regression coefficient for the model with each variable removed, in turn, from .322. The semi-partial multiple regression coefficients and corresponding $F$-tests of significance for the background source variables are presented in Table 20.

Table 20
Semi-Partial Multiple Regression Coefficients for Teaching Source Variables with Degree of Personnel Compatibility (DPERC)

<table>
<thead>
<tr>
<th>Teaching Source Variables</th>
<th>$K_A$</th>
<th>$K_B$</th>
<th>$\text{sR}^2$</th>
<th>$F$</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Lab</td>
<td>8</td>
<td>1</td>
<td>0.012</td>
<td>0.8982</td>
<td>(1,50)</td>
</tr>
<tr>
<td>College Lab</td>
<td>8</td>
<td>1</td>
<td>0.006</td>
<td>0.4491</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Student Teaching</td>
<td>8</td>
<td>1</td>
<td>0.006</td>
<td>0.4491</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Curriculum Packages</td>
<td>8</td>
<td>1</td>
<td>0.194</td>
<td>14.5210$^c$</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Inservice</td>
<td>8</td>
<td>1</td>
<td>0.018</td>
<td>1.3474</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Vocational Education</td>
<td>8</td>
<td>1</td>
<td>0.004</td>
<td>0.2994</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Nonschool Work Experience</td>
<td>8</td>
<td>1</td>
<td>0.040</td>
<td>2.9940</td>
<td>(1,50)</td>
</tr>
<tr>
<td>School Related Work Experience</td>
<td>8</td>
<td>1</td>
<td>0.047</td>
<td>3.5180</td>
<td>(1,50)</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>1</td>
<td>0.004</td>
<td>0.2994</td>
<td>(1,50)</td>
</tr>
</tbody>
</table>

$^cR^2 = .322$ \quad ^c_p < .001

An examination of Table 20 shows that:

1. high school industrial arts laboratory courses did not account for a significant proportion of variance in DPERC,
2. college industrial arts laboratory courses did not account for a significant proportion of variance in DPERC,

3. student teaching did not account for a significant proportion of variance in DPERC,

4. curriculum packages/textbooks did account for a significant proportion of variance in DPERC \( (sr^2 = .194, F = 14.52, p < .001, df = 1,50) \),

5. inservice training did not account for a significant proportion of variance in DPERC,

6. vocational training did not account for a significant proportion of variance in DPERC,

7. nonschool related work experience did not account for a significant proportion of variance in DPERC,

8. school related work experience did not account for a significant proportion of variance in DPERC, and

9. other teaching sources did not account for a significant proportion of variance in DPERC.

Therefore, only one background source variable (curriculum packages/textbooks) was found to explain a significant proportion of variance in degree of personnel compatibility.
Section 7
Evaluation of Primary Background Sources

One purpose of this study was to evaluate primary background sources in terms of their contribution to theory-based management, production, and personnel teaching practice. This data may provide direction for curricular change in the types of activities provided to prospective industrial arts teachers from primary background sources where change has been recommended.

College Industrial Arts Laboratory Courses (COLAB)

Correlations between college industrial arts laboratory courses (COLAB) and DMC, DPC, and DPERC are presented in Table 13. There was a low nonsignificant relationship between COLAB and degree of management compatibility (r = .15), a low significant relationship between COLAB and degree of production compatibility (r = .27, p < .05), and a low nonsignificant relationship between COLAB and degree of personnel compatibility (r = .15).

Semi-partial multiple regression coefficients for COLAB with DMC, DPC, and DPERC can be found in Tables 18, 19, and 20 respectively. Nonsignificant proportions of variance in degrees of management, production, and personnel compatibility were contributed by college industrial arts laboratory courses (COLAB).
Nonschool Work Experiences (WORKNON)

Correlations between nonschool related work experiences (WORKNON) and DMC, DPC, and DPERC are presented in Table 13. There was a low nonsignificant relationship between WORKNON and degree of management compatibility ($r = .25$), a low significant relationship between WORKNON and degree of production compatibility ($r = .26, p < .05$), and a low nonsignificant relationship between WORKNON and degree of personnel compatibility ($r = .16$).

Semi-partial multiple regression coefficients for WORKNON with DMC, DPC, and DPERC can be found in Tables 18, 19, and 20 respectively. Nonsignificant proportions of variance in degrees of management, production, and personnel compatibility were contributed by nonschool related work experiences.

Curriculum Packages/Textbooks (CPACK)

Correlations between curriculum packages/textbooks (CPACK) and DMC, DPC, and DPERC are presented in Table 13. There were moderate significant relationships between CPACK and degree of management compatibility ($r = .37, p < .01$), degree of production compatibility ($r = .34, p < .01$) and degree of personnel compatibility ($r = .45, p < .001$).

Semi-partial multiple regression coefficients for CPACK with DMC, DPC, and DPERC can be found in Tables 18,
19, and 20 respectively. Significant proportions of variance in degrees of management ($sR^2 = .070$, $F = 4.76$, $p < .05$, df = 1,50), production ($sR^2 = .066$, $F = 4.69$, $p < .05$, df = 1,50), and personnel ($sR^2 = .194$, $F = 14.52$, $p < .001$, df = 1,50) compatibility were contributed by curriculum packages and textbooks.

The curriculum package/textbook source was not one of the primary background sources recommended for curricular change because the CPACK source contributed significantly to theory-based teaching practice. There were moderate significant relationships and significant proportions of variance elicited in all three areas (management, production, and personnel) of teaching practice. Therefore, the theory-based curriculum package and textbook designers appear to have achieved their objective in instances where teachers have taken advantage of the CPACK source. However, one must remain cognizant of an earlier finding that there is a radical difference in the contribution of background experiences attributed to curriculum packages between high DTC and low DTC teachers.

One can see in Figure 10 that the low degree of teaching compatibility (low DTC) group (which most closely resembles conventional industrial arts teachers in terms of activities taught) attributed less than three percent of their management and virtually no production and personnel
related background experiences to theory-based curriculum packages and textbooks. The high degree of teaching compatibility (high DTC) group, on the other hand, attributed over fifty percent of management, approximately twenty percent production, and over thirty-five percent of their personnel related background experiences to curriculum packages and textbooks.

![Graph showing percent of background activities attributed to curriculum packages/textbooks by high and low theory/practice groups of secondary level Ohio manufacturing teachers.]

**Figure 10.** Percent of management, production, and personnel background activities attributed to curriculum packages/textbooks by high and low theory/practice groups of secondary level Ohio manufacturing teachers.
Teacher Recommendations for Curricular Improvement

Manufacturing teachers were asked how industrial arts teachers could be better prepared to teach manufacturing. Their telephone interview responses are presented in Appendix F. The same question was asked again on the mail survey instrument and teacher responses are presented in Appendix G. The recommendations of manufacturing teachers were summarized and combined into mutually exclusive groups. The top ten groups were rank ordered by frequency of response and are presented in Table 21.

Eight of the top ten recommendations made reference to specific curricular revisions at the preservice teacher education level concerning nonschool work experience (work, internships, field trips) and industrial arts laboratory courses. One recommendation made reference to a publicity campaign to sell administrators on contemporary industrial arts programs. This recommendation relates to the issue of increasing the freedom of innovative program use (a context variable which contributes significantly to increased theory/practice compatibility) by attempting to change stereotyped administrative views of industrial arts. Finally, one recommendation concerned inservice workshops.
Table 21
Manufacturing Teachers' Recommendations of how Industrial Arts Teachers can be Better Prepared to Teach Manufacturing (Top 10 Rankings)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Recommendation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Provide prospective teachers with more contact in industry (work, internships, field trips) in a broad range of areas such as R&amp;D, finance, production, marketing, etc.</td>
<td>1.0</td>
</tr>
<tr>
<td>12</td>
<td>Teach essential elements of industry, possibly as a capstone entrepreneurship course that applies theory to practice.</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>Provide more direction on how to organize, teach, and evaluate contemporary programs and curriculum packages.</td>
<td>3.0</td>
</tr>
<tr>
<td>8</td>
<td>Update existing curriculum materials and textbooks to reflect a less than year duration format and include high school programs with specialized areas of manufacturing.</td>
<td>4.5</td>
</tr>
<tr>
<td>8</td>
<td>Provide pre-service teachers with opportunities to develop/construct jigs, fixtures, and product materials to take with them to the school setting.</td>
<td>4.5</td>
</tr>
<tr>
<td>6</td>
<td>Provide more workshops with successful practicing manufacturing teachers and/or industrial personnel.</td>
<td>6.0</td>
</tr>
<tr>
<td>5</td>
<td>Provide pre-service teachers with a wider variety of tool and machine skills.</td>
<td>7.0</td>
</tr>
<tr>
<td>4</td>
<td>Teach how to deal with special problems that are encountered when implementing and operating a manufacturing program (funding, how to sell products, dealing with administrators, etc.).</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>Teach activities that can be taught in typical secondary level industrial arts laboratories.</td>
<td>8.5</td>
</tr>
<tr>
<td>3</td>
<td>Design and implement a publicity campaign to sell administrators on contemporary industrial arts programs.</td>
<td>10.0</td>
</tr>
</tbody>
</table>
Section 8
Profile of Manufacturing Activities in
Ohio Secondary Schools

One purpose of this study was to develop an inventory of theory-in-practice manufacturing activities. The 152 manufacturing activities that comprised the major dependent variable of this study (DTC) were organized into four management, three production, and one personnel activity clusters. The clusters were:

(M) 1. organizing and financing a company,
(M) 2. design and engineering,
(M) 3. research and marketing,
(M) 4. production planning,
(P) 5. production forming,
(P) 6. production separating,
(P) 7. production combining, and
(PERS) 8. personnel.

These eight cluster areas formed the basis for structuring the manufacturing activity profile.

Percentages of teaching response for each of the laboratory activities within the eight cluster areas were calculated for the high DTC group (N = 10), the low DTC group (N = 9), and a composite (total) group (N = 60) of manufacturing teachers (see Appendix H). The individual
activity percentages representing the three groups of manufacturing teachers were summarized into cluster percentages as shown in Figure 11.

Figure 11 represents a profile of laboratory activities currently taught in eight cluster areas by high DTC, low DTC, and composite groups of secondary level Ohio manufacturing teachers. The relative percentages of activities taught within each cluster area can be easily seen for each group of manufacturing teachers. Therefore, generalizations concerning the types of activities currently taught by high theory/practice, low theory/practice, and composite groups of manufacturing teachers can be made.

The low theory/practice group was consistently low in teaching practice across all eight clusters of manufacturing activities. They teach an average of fifteen percent of the laboratory activities per cluster area. Further, relatively few of the organizing and financing, research and marketing, production forming, and personnel activities are taught by manufacturing teachers in the low DTC group.

The high theory/practice group was consistently high in teaching practice across all eight clusters of manufacturing activities. They teach an average of forty-six percent of the laboratory activities per cluster area.
Figure 11. Percentages of laboratory activities currently taught in eight manufacturing cluster areas by composite, high, and low theory/practice compatibility groups of secondary level Ohio manufacturing teachers.

* (number of activities in this cluster of the theory based model)
area. Further, they tend to teach a large percentage of management activities, but not as great a percentage of production or personnel activities.

Overall, secondary level Ohio manufacturing teachers teach an average of thirty-three percent of the laboratory activities per cluster area. They tend to teach a greater percentage of management activities than production or personnel activities. The greatest percentage of management activities taught is in the design/engineering cluster and the lowest percentage is in the research and marketing cluster. Also, the greatest percentage of production activities taught is in the production separating cluster and the lowest percentage is in the production forming cluster.

The profiles of manufacturing activities (Appendix H) and clusters (Figure 11) are normative benchmarks of laboratory activities taught by the population of secondary level manufacturing teachers in the state of Ohio. Individual teachers or entire industrial arts departments can complete the manufacturing activity instrument (Appendix C) and plot individual or composite department profiles for evaluation against the normative standards established by this study. Further, since a substantial significant relationship and a significant proportion of variance was found between background activity experiences
and teaching activity practice, the profiles can serve as a valuable tool for the selection of industrial arts teachers who are qualified to teach manufacturing. Administrators charged with personnel selection can administer the manufacturing activity instrument and plot profiles of background activity experiences for prospective candidates for comparison with the normative data of the cluster profile. Candidates can then be selected on the basis of their qualifying background activity experiences and can later be evaluated (held accountable) on the basis of activities they actually teach.

Section 9
The Evaluation of Research Hypotheses

The following major and alternative hypotheses were tested as per the ex post facto nature of this study.

Major Hypothesis

Hm: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by degree of background compatibility.

Decision: NOT REJECTED ($sR^2 = .202$, $F = 27.497$, $p < .001$, df = 1,52)

Alternative Hypotheses

Ha1: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by the following presage variables.
A. Age in years
Decision: REJECTED

B. Philosophy/attitude concerning purpose of industrial arts
Decision: REJECTED

C. Amount of professional preparation
Decision: REJECTED

D. Undergraduate grade point average
Decision: REJECTED

E. Number of hours/week in supplemental employment
Decision: REJECTED

F. Number of hours/week spent in leisure time activities
Decision: REJECTED

G. Number of years teaching experience
Decision: REJECTED

H. Number of years teaching experience
Decision: REJECTED

I. Type of industrial experience
Decision: REJECTED

J. Number of school systems in which employed
Decision: REJECTED

K. Number of professional association memberships
Decision: REJECTED
Ha2: A significant proportion of the variance in the degree of teaching compatibility will be accounted for by the following context variables.

A. Perceived freedom of program use
   Decision: NOT REJECTED ($r^2 = .099, F = 8.23, p < .01, df = 1,55$)

B. Perceived academic abilities of students
   Decision: REJECTED

C. Type of school
   Decision: NOT REJECTED ($r^2 = .051, F = 4.24, p < .05, df = 1,55$)

D. Level of teaching
   Decision: REJECTED

E. Class rotation format
   Decision: NOT REJECTED ($r^2 = .077, F = 6.40, p < .05, df = 1,55$)

F. Average manufacturing class size
   Decision: REJECTED

G. Size of school (enrollment)
   Decision: REJECTED

H. Number of industrial arts teachers in department
   Decision: REJECTED

I. Number of industrial arts class periods taught each day
   Decision: REJECTED
J. Number of types of industrial arts courses taught
Decision: REJECTED

K. Percentage of teaching load that is manufacturing
Decision: REJECTED

L. Number of preparation periods/week
Decision: NOT REJECTED ($\text{sR}^2 = .076, F = 6.31, p < .05, \text{df} = 1, 55$)

M. Number of hours in nonteaching duties performed each week
Decision: REJECTED

N. Budget (per pupil expenditure)
Decision: REJECTED

O. Years teaching in present position
Decision: REJECTED

Hm Group #1 Subhypotheses

The following subhypotheses, concerning specific sources of background experience and degree of teaching compatibility, were tested to identify primary sources of teaching practice.

A significant proportion of variance in the degree of teaching compatibility will be accounted for by degree of background compatibility in:

1-A High school industrial arts laboratory source activities

Decision: REJECTED
1-B College industrial arts laboratory source activities

Decision: REJECTED

1-C Student teaching source activities

Decision: REJECTED

1-D Curriculum package/textbook source activities

Decision: NOT REJECTED ($\text{sR}^2 = .102, F = 9.47, p < .01, \text{df} = 1,56$)

1-E Inservice training source activities

Decision: REJECTED

1-F Vocational/technical source activities

Decision: REJECTED

1-G Nonschool work experience activities

Decision: NOT REJECTED ($\text{sR}^2 = .154, F = 14.30, p < .001, \text{df} = 1,56$)

1-H School related work experience activities

Decision: REJECTED

1-I Other source activities

Decision: REJECTED

Hm Group #2 Subhypotheses

The following subhypotheses, concerning specific sources of background experience and degree of background compatibility, were tested to identify primary sources of background activity experience.
A significant proportion of variance in the degree of background compatibility will be accounted by degree of background compatibility in:

2-A  High school industrial arts laboratory source activity

Decision: REJECTED

2-B  College industrial arts laboratory source activities

Decision: NOT REJECTED ($sR^2 = .337$, $F = 59.53$, $p < .001$, df = 1,54)

2-C  Student teaching source activities

Decision: REJECTED

2-D  Curriculum package/textbook source activities

Decision: NOT REJECTED ($sR^2 = .064$, $F = 11.30$, $p < .01$, df = 1,54)

2-E  Inservice training source activities

Decision: REJECTED

2-F  Vocational/technical source activities

Decision: REJECTED

2-G  Non-school work experience source activities

Decision: NOT REJECTED ($sR^2 = .076$, $F = 13.42$, $p < .001$, df = 1,54)

2-H  School related work experience activities

Decision: REJECTED

2-I  Other source activities

Decision: REJECTED
Hm Group #3 Subhypotheses

The following subhypotheses, concerning specific sources of background experience and degree of management compatibility, were tested to identify primary sources of management teaching practice.

A significant proportion of the variance in the degree of management compatibility will be accounted for by degree of background compatibility in:

3-A High school industrial arts laboratory source activities
   Decision: REJECTED

3-B College industrial arts laboratory source activities
   Decision: REJECTED

3-C Student teaching source activities
   Decision: REJECTED

3-D Curriculum package/textbook source activities
   Decision: NOT REJECTED ($sR^2 = .070, \ F = 4.76, p < .05, df = 1,50$)

3-E Inservice training source activities
   Decision: REJECTED

3-F Vocational/technical source activities
   Decision: REJECTED

3-G Non-school work experience source activities
   Decision: REJECTED
3-H School related work experience activities
Decision: REJECTED

3-I Other source activities
Decision: REJECTED

Hm Group #4 Subhypotheses

The following subhypotheses, concerning specific sources of background experience and degree of production compatibility, were tested to identify primary sources of production teaching practice.

A significant proportion of the variance in the degree of production compatibility will be accounted for by degree of background compatibility in:

4-A High school industrial arts laboratory courses
Decision: REJECTED

4-B College industrial arts laboratory courses
Decision: REJECTED

4-C Student teaching source activities
Decision: REJECTED

4-D Curriculum package/textbook source activities
Decision: NOT REJECTED ($sR^2 = .066, F = 4.69, p < .05, df = 1,50)$

4-E Inservice training source activities
Decision: REJECTED

4-F Vocational/technical source activities
Decision: REJECTED
4-G Non-school work experience activities
Decision: REJECTED

4-H School related work experience activities
Decision: REJECTED

4-I Other source activities
Decision: REJECTED

Hm Group #5 Subhypotheses

The following subhypotheses, concerning specific sources of background experience and degree of personnel compatibility, were tested to identify primary sources of personnel teaching practice.

A significant proportion of the variance in the degree of personnel compatibility will be accounted for by degree of background compatibility in:

5-A High school industrial arts laboratory source activities
Decision: REJECTED

5-B College industrial arts laboratory source activities
Decision: REJECTED

5-C Student teaching source activities
Decision: REJECTED

5-D Curriculum package/textbook source activities
Decision: NOT REJECTED ($sR^2 = .194, F = 14.52, p < .001, df = 1,50$)
Summary of the Findings

This chapter was divided into nine major sections. Descriptive data and relationships of independent variables to the dependent variable were presented in the first section and in Appendix J (Tables 22-50). The typical Ohio manufacturing teacher was found to be male (no female manufacturing teachers were identified), is 36-40 years old, has 13-15 years of teaching experience, has been employed in one or possibly two school systems and has spent the last 10-15 years in his current position. This teacher typically works 7-9 hours a week in supplemental employment, has from 0-6 years of production related industrial experience and enjoys 4-6 hours a week in leisure time activity. He had a 2.5 - 3.5 undergraduate graduate point average, has achieved a masters or master's
equivalent degree, and believes that problem solving and an understanding of management, personnel, and production practices are the major purposes of industrial arts.

Over one-half of the Ohio manufacturing teachers were found to teach in city schools at the high school level. Eighty percent teach in school building sizes of less than 1,000 students which employ from 1-2 industrial arts teachers. Eighty-five percent of Ohio manufacturing teachers teach five or more industrial arts courses, typically three different types of classes on a daily basis. About seventy-three percent teach 1-2 sections of manufacturing; approximately thirty-three percent of their teaching load. Manufacturing classes are most frequently taught on a semester rotation format with an average class size of from 16-19 students. The typical operating budget for consumable supplies is from 1-100 dollars per rotation period of one manufacturing class. Ninety-two percent of the teachers indicate that they have at least one preparation period per day and over one-half said that they performed from 3-6 hours of assigned non-teaching duties per week during school hours. Most of the teachers surveyed felt that the academic abilities of their students compared with the average abilities of the general student body and over ninety-five percent indicated that their school system allowed them much freedom to teach the
content and activities that they desired in their manufacturing classes.

Degree of background compatibility (DBC) was the major independent variable in the study and the dependent variable was degree of teaching compatibility (DTC). DBC was a percentage measure of the compatibility of an aggregate of teacher background experiences with a theory-based model of 152 manufacturing activities. DTC was a percentage measure of the compatibility of an aggregate of actual teacher activities practiced in the classroom with the same theory-based model of 152 manufacturing activities.

There was a substantial significant relationship between the major independent variable (DBC) and DTC ($r = .64$, $p < .001$). Thus, DBC was identified as a strong probable contributor to variance in the dependent variable. The alternative presage independent variables that were significantly related to the dependent variable (DTC) were number of school systems employed ($r = .31$, $p < .05$) and number of professional memberships held ($r = .28$, $p < .05$). The alternative context independent variables that were significantly related to the dependent variable were number of preparation periods per week ($r = .33$, $p < .01$), freedom of program use ($r = .32$, $p < .05$), class rotation period ($r = -.30$, $p < .05$), and type of school ($r = .26$, $p < .05$).
The significant relationships of the alternative independent variables could represent a threat to the internal validity of the study. Therefore, all of the significantly related variables above were included in the conceptual analysis model to determine their unique contributions to variance in the dependent variable (DTC).

The second section of this chapter contained (1) an analysis of the proportions of variance in the dependent variable (DTC) explained by the three major sets of independent variables (DBC, alternative presage, and alternative context), (2) an analysis of the proportions of variance in the dependent variable explained by individual variables within each significant set, and (3) a stepwise regression analysis to determine which variables which best predict degree of teaching compatibility (DTC).

The combined contribution of all seven independent variables of the model used in these analyses explained an unprecedented 62 percent of the variance measured in the dependent variable.

The alternative context variable set did account for a significant unique proportion of variance in the dependent variable (DTC). Also, each of the four independent variables (type of school, rotation period, freedom of program use, and number of preparation periods per week) were also found to contribute to significant unique proportions of variance in the dependent variable.
The alternative presage variable set did not account for a significant unique proportion of variance in the dependent variable. Therefore, the variables included in this set (number of school systems employed, and number of professional memberships held) were dropped from the analysis model.

The major independent variable (degree of background compatibility) did account for a significant unique proportion of variance in the dependent variable (DTC). This variable elicited the largest unique proportion of variance in the dependent variable ($sR^2 = .202$), the largest F value of 27.5, and the lowest probability of Type I error ($p < .001$) of all the independent variables used in the model.

Correlation coefficients of the major independent variable (DBC) with the four significant alternative context variables (type of school, freedom of program use, rotation period, and number of preparation periods per week) were examined to control the internal validity of the present study. Significant relationships between DBC and significant alternative independent variables would indicate a combined (intercorrelated) effect of these variables on variance in the dependent variable rather than the hypothesized singular effect of the major independent
variable (DBC). The only significant relationship between DBC and an alternative context variable was with the variable freedom of program use. This variable elicited a low significant relationship with DBC ($r = .26, p < .05$).

Finally, all variables that were significantly correlated with the dependent variable were included in a stepwise multiple regression analysis to determine the best predictors of degree of teaching compatibility. The best predictors of DTC in order of significance were: (1) degree of background compatibility, (2) class rotation format, (3) type of school, and (4) number of professional memberships.

The third section of Chapter IV was concerned with the identification of primary sources of background activity experience for teachers who teach manufacturing in the state of Ohio. Primary background sources were identified by an analysis of the proportion of variance in the major independent variable (degree of background compatibility) explained by nine background source variables (subscales of DBC) that were significantly correlated with DBC.

Five background source variables were found to be significantly correlated with DBC (college laboratory courses, curriculum packages/textbooks, inservice training, non-school work experiences, and school related work experience). These variables were entered into a regression
model similar to the one used in section 2 to determine the portion of variance in DBC uniquely contributed by each background source. These five variables explained approximately seventy percent of the variance in the major independent variable. College laboratory activities appeared to be the strongest contributor to variance in DBC ($R^2 = .337$, $F = 59.53$, $p < .001$, df = 1, 54). Non-school repeated work experience and curriculum packages/textbooks also accounted for a significant proportion of variance in DBC. Inservice training and school related work experiences were no identified as significant contributors to variance in theory-based background activity experiences (DBC).

The fourth section of this chapter was concerned with the identification of primary sources of theory-based laboratory teaching activity. Primary teaching sources were identified by an analysis of the proportions of variance in the dependent variable (degree of teaching compatibility) explained by background source variables that were significantly correlated with DBC.

Three background sources were found to be significantly correlated with DTC (curriculum packages/textbooks, non-school work experiences, and other background experiences). These variables were entered into a regression model similar to the one used in sections 2 and 3 to determine the portion of variance. Variance in
DTC uniquely contributed by each background source. Three variables explained approximately forty percent of the variance in the dependent variable.

Only two of these background source variables (curriculum packages/textbooks and non-school work experiences) accounted for significant proportions of variance in DTC.

Section 5 contained a discussion of activity sources as a focus of curricular change and identified primary background sources in need of curricular change. While non-conventional industrial arts teachers received a significant amount of background activity experiences from college industrial arts laboratory courses, non-school work experience, and curriculum packages/textbooks, the primary contributor to actual theory-based teaching practice appeared to be the curriculum package/textbook and non-school work experiences sources. Although college industrial arts courses were identified as a primary source of background experience, the findings did not support its contribution to actual teaching practice relative to theory-based laboratory activities.

An analysis of the proportions of variance in three subscales of the dependent variable DTC (degrees of management, production, and personnel compatibility) explained by the nine background source variables was
presented in the sixth section of this chapter. Primary sources of management, production, and personnel teaching practices were identified in analyses identical to those used in identifying primary overall teaching sources (section 4). The only background source variable which contributed a significant proportion of variance to degree of management compatibility (DMC), degree of production compatibility (DPC), and degree of personnel compatibility (DPERC) was the curriculum package/textbook source. No other background sources were found to contribute significantly in either management, production, or personnel theory-based laboratory activities.

Presented in the seventh section was an evaluation of primary background sources in terms of their contribution to theory-based management, production, and personnel teaching practice. Low non-significant relationships between the college industrial arts laboratory source and DMC, DPC, and DPERC were measured and non-significant proportions of variance in DMC, DPC, and DPERC were contributed by this primary background source. Low non-significant relationships between the non-school work experience source and DMC, DPC, and DPERC were measured and non-significant proportions of variance in DMC, DPC, and DPERC were also contributed by this primary background source. However, moderate significant relationships
between the curriculum package/textbook source and DMC, DPC, and DPERC were measured with significant proportions of variance in DMC, DPC, and DPERC contributed by this primary background source.

Ohio manufacturing teachers were then separated into high and low groups of theory-practice compatibility to see how each group interacted with the curriculum package/textbook source. The low degree of teaching compatibility (Low DTC) group (sources of teachers greater than one standard deviation below the DTC mean—closely resembling conventional industrial arts teachers in terms of activities taught) attributed less than three percent of their management and virtually no production or personnel related background experiences to curriculum packages/texts. Conversely, the high degree of teaching compatibility (High DTC) group (scores of teachers greater than one standard deviation above the DTC mean) attributed over fifty percent of management, approximately twenty percent production, and over thirty-five percent of their personnel related background experiences to curriculum packages/textbooks.

The results of a telephone and mail question asking how to better prepare industrial arts teachers to teach manufacturing was also presented in section 7. Eight of the top ten recommendations of Ohio manufacturing teachers
Table 21) made reference to specific curricular revisions at the pre-service teacher education level concerning non-school work experience (work, internships, field trips) and industrial arts laboratory courses.

A normative profile of manufacturing activities taught in Ohio secondary schools was presented in section eight and finally, in section nine, was an evaluation of the findings relative to the major, alternative, and subhypotheses of the study.

A summary of the study is presented in Chapter V. Also included are conclusions and recommendations.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains a comprehensive overview of the study. It includes a restatement of the problem and a summary of the research methodology. Other components of this chapter include a discussion of conclusions and recommendations for further study.

Summary

The problem of this study grew out of a "serious weakness" in industrial arts/technology research concerning the "lack of [adequate] treatment of the leadership-practitioner gap" (Dyrenfurth & Householder, 1979, p. 148). The need for change has often been expressed as a central theme in historic and contemporary industrial arts/technology literature. Leaders such as Warner (1947, 1965), Olson (1957), Towers, Lux, and Ray (1965), Maley (1973), Brown (1977), DeVore (1980a), and
many others have proposed philosophies and curricula to reflect a broadened view of industry and technology and their societal impact.

During the 1960's and 1970's considerable effort was devoted to the development of curricula and commercial laboratory packages for industrial arts programs at the secondary level. Cochran (1970), Householder (1972), and Maley (1978) provide detailed descriptions and classifications of these many and varied efforts. Use of behavioral objectives; use of inquiry and exploratory methods of teaching; assorted laboratory manuals and materials replacing or supplementing traditional textbooks, extensive use of filmstrips, transparencies, tapes, records, and television; computer and non-computer based programmed instruction; greater use of group dynamics (such as seminars, debates and panels, entrepreneurship organization structures, role playing); more varied testing and grading procedures; a wider variety and use of community resources and experiences outside the classroom, and other characteristics have been discussed in the literature.

The majority of these curricular innovations were and continue to be designed for the secondary level. The major assumption is that change will take place in secondary level industrial arts programs by providing inservice
teachers with models of contemporary theory that can be applied to inservice classroom practice. This same logic continues to prevail in recently revised state curriculum guides and Jackson's Mill curriculum theory development efforts. This approach to affecting change in the secondary schools has not been very effective, yet it continues to be the singular change strategy supported by many in our profession.

As we approach the midpoint of the 1980's there is little evidence to suggest that these programs have resulted in widespread industrial arts/technology curriculum changes in the secondary school. Reliance of the custom production of individual projects based on exponential increases in tool-skill development taught by lecture/demonstration/practice methods in a narrow selection of outdated industrial occupational areas still prevails in a majority of industrial arts laboratories of the late 20th century (Bame, 1980). The problem, according to Paul DeVore (1980b), is that "[t]here is a . . .serious lack of understanding within the professional about change and how it occurs or how to effect it" (p. 9).

A literature review was conducted pertaining to change theory. The research findings uncovered by this review generally indicated that many interrelated factors are required to successfully implement lasting change at the
secondary level. Change strategies directly aimed at inservice teachers need to provide for stages of concern and adoption, permanent teacher incentives, "exhausting and demanding" support from stable administrative organizations, a system of peer-group interaction and evaluation, inservice training directed to selected populations of teachers who have the propensity for change, monetary increases which would eliminate the necessity of part time jobs, additional in school preparation time, budgetary allocations to purchase and maintain equipment and supplies commensurate with the objectives of the curricular innovation, a public relation campaign to positively influence the local community, and vocal and written local community support of changes directed to superintendents, school boards, and building administrators. The sheer complexity, enormity, and financial burden of a change strategy designed to incorporate the above requirements has made it virtually impossible to promote lasting change from curricular models designed by external sources using conventional change strategies because few, if any, public schools that exist today are organized to be receptive to this type of change.

One encouraging factor also found in the literature review was that teachers enjoy a considerable autonomy with regard to actual curricular implementation. The "informal
"covenant" was used to describe a delineations of both the teacher's role and principal's role regarding change in local schools (Krueger & Parish, 1982). Principals control access, resources, adoption, and arrangement of inservice training; however, teachers control actual implementation and continued use of activities taught in their classrooms. Research has indicated that regardless of school conditions, practitioners may change their performance depending on the compatibility of an innovation with their existing values, beliefs, and role expectations regarding the innovation and that values, beliefs, and role expectations are learned as a result of prior (background) experiences. Therefore, a focus on background experiences, their sources, and the relationships of these to actual teaching practice was deemed the next logical step in the evolution of change theory.

One way to study teaching practice is through an examination of activities taught. The literature abounds with studies that indicate that laboratory activities will provide the best indice of planned or hidden content that is taught. However, no studies should be found in industrial arts/technology or any other field of literature which used classroom/laboratory activities as an outcome measure (dependent variable) of a planned change strategy. Most researchers measured attitudes, values, beliefs, or
simply requested descriptive presage information about the teacher or context information about the school. While attitudes, values, and beliefs may predispose a teacher to be receptive or non-receptive to an innovation, the literature suggests they may not be good indicators of what is actually being taught (Keep, 1973). Further, no empirical studies could be found which measured directly the relationship between teacher background activities and laboratory activities which are currently taught.

A further examination of the literature revealed that many previous industrial arts/technology research efforts involved a micro approach to the problem; examining a small number of variables and their contributions to change. In many instances the few independent variables that were used did not account for more than 25 percent of the variances measured in the dependent variables, leaving a very large proportion of variance (from unidentified variables) left unexplained.

This researcher used a macro approach to the problem. The present study utilized a theory-based model of the Study of Classroom Teaching (Dunkin & Biddle, 1974) to provide a comprehensive framework for identifying independent variables which could affect inservice practice. All independent variables that were identified in the literature were applied to the model and variables
which were found significant in at least one previous research study were built into the present study. A large number of variables were identified and streamlined on the basis of a lack of relationship and/or variance in teaching practice (dependent variable). An unprecedented 62 percent of the variance in the dependent variable was explained by the independent variables that were eventually used in the research model of this study.

One way to address the theory-practice problem is to trace the antecedents of change where change has already occurred. This was the method that was selected for the present study. Secondary level industrial arts teachers who deviated from conventional practice (specifically those who taught manufacturing in Ohio schools) provided an ideal source of data. Since the outcome (changed practice) had already occurred and variables of interests (the independent variables) were not subject to true experimental or quasi-experimental manipulation, the design of this study can be classified as ex post facto/correlational.

The ex post facto research strategy is to investigate possible cause and effect relationships by observing some existing consequence and by searching back through the data for plausible causal factors. The existing consequence of the present study was non-conventional teaching practice by
a small number of secondary level industrial arts teachers who taught contemporary theory-based manufacturing concepts and laboratory activities.

The primary objective of the present study was to determine the proportion of variance that an aggregate of formative (background) activity experiences contributed to the theory-based activity practices of secondary level Ohio manufacturing teachers. This study addressed the question of whether past activity experiences affect what teachers teach and if so where do teachers of contemporary practice learn to teach contemporary activities. This study identified primary sources of background activity experience and primary source of current teaching practice (high school, college, curriculum packages/textbooks, inservice training, etc.) for the purpose of determining which primary sources of background experience are in need of curricular revision to better prepare industrial arts/technology teachers to teach non-conventional industrial arts (manufacturing, construction, etc.) activities. Finally, the contributions of primary background sources to types of theory-based activities (management, production, and personnel) were determined so that specific types of activities could be recommended for the curricular improvement of primary background activity sources.
The variables of interest to this study were identified and classified into two categories which were cited as major influences on teaching practices by Dunkin and Biddle (1974). Presage variable dealt with teacher formative experiences, teacher training experiences, and teacher properties. Context variables deal with school contexts, community contexts, and classroom contexts.

The major independent variable of this study was degree of background compatibility (DBC) and the dependent variable was degree of teaching compatibility (DTC). DBC was a percentage measure of the compatibility of an aggregate of teaching background experiences with a theory-based model of 152 manufacturing activities. DTC was a percentage measure of the compatibility of an aggregate of actual teacher activities practiced in the classroom with the same theory-based model of 152 manufacturing activities. The major research hypothesis of this study was that a significant proportion of the variance in current theory-based teaching practice (DTC) would be accounted for by theory-based background activity practices (DBC).

Three subscales of the dependent variable (DTC) were degree of management compatibility (DMC), degree of production compatibility (DPC), and degree of personnel compatibility (DPERC). Each of these measures were
determined by percentages of the theory-based model of 152 activities (in terms of management, production, and personnel laboratory activities) that teachers indicated they typically taught in their manufacturing classes. Sub-hypotheses of the major research hypothesis concerned the relative contributions of nine sources of background activity (high schools, college laboratory courses, inservice training, curriculum packages, etc.) to theory-based management, production and personnel activities taught by secondary level Ohio manufacturing teachers. Additional sub-hypotheses dealt with the relative contributions of the nine sources of background activity to DBC (to identify primary background sources of activity experience) and the contribution of the nine sources of background activity to DTC (to identify primary teaching sources of activity).

All other variables identified in the literature review were classified as either alternative presage (11 variables) or alternative context (15 variables). Alternative hypotheses concerning the relative contributions of these extraneous context and presage variables to variance in the dependent variable were posited and tested in an effort to control internal validity in this ex post facto research design as recommended by Kerlinger (1973) and Warmbrod and Miller.
(1974). The elimination of rival variables through the testing and rejection of alternative hypotheses strengthens the internal validity of a major hypothesis that is not rejected.

In summary, the initial research model for this study included three sets of independent variables: (1) the major independent variable (DBC), (2) a set of 11 alternative presage variables, and (3) a set of 15 alternative context variables, and the dependent variables (DTC). The major independent variable (DBC) was comprised of nine background source variables: (1) high school IA laboratory courses, (2) college IA laboratory courses, (3) student teaching, (4) curriculum packages/textbooks, (5) inservice workshops, (6) vocational/technical classes, (7) non-school work experience, (8) school related work experience, and (9) all other sources identified by the teachers. Finally, the dependent variable (DTC) was comprised of three subscales: Degree of Management compatibility, Degree of Production compatibility, and Degree of Personnel compatibility.

Two survey instruments were developed to measure the variables of the study. A telephone questionnaire was designed to collect data to test the alternative hypotheses relative to the independent presage and context variables. A mail survey instrument was designed to obtain data for
the major independent and dependent variables. The formats of each instrument were developed using the "Total Design Concept" as presented by Dillman (1978).

The population of this study consisted of all secondary level teachers of manufacturing in the state of Ohio. The data gathering frame for this study can best be described as a state census of secondary level school buildings where manufacturing courses were taught. Seventy-four schools were initially identified from the data decks of the Blankenbaker et al. (1980) Status of Ohio Industrial Arts census survey and the Umstattd (1983-84) follow-up study of The Ohio State University Industrial Technology Education graduates. Nineteen of these schools were dropped from the study after a mail and telephone advance notification survey of building principals indicated that manufacturing was no longer taught in their schools. Therefore the total number of school buildings where manufacturing courses were taught totaled 55 at the onset of the phase I telephone data gathering interviews. Eight additional schools were identified during the phase I telephone interviews and were added to the survey population bringing the total number of participating schools to sixty-three.
The telephone interviews were conducted on a nine-day schedule in late March and early April of 1984. Calls were placed as per appropriate days and times indicated on postcards returned from the principal advance survey notification packet or in cases where cards were not returned, as per days and times obtained from principals follow-up telephone calls. Data were obtained from all 63 identified manufacturing teachers.

One question on the telephone survey asked respondents to select one of seven purposes that they felt was the most important for industrial arts. The question was designed to illicit a measure of teacher philosophy concerning the purpose of industrial arts. Seven purposes of industrial arts were obtained from the phase I nationwide data gathering survey of the status of industrial arts education (Bame & Miller, 1980). A panel of experts was utilized to facilitate the rank ordering of the seven purposes of industrial arts so that teacher responses could be coded on a basis of how closely their philosophy matched current industrial arts curriculum theory. Since the most recent development in industrial arts curriculum theory evolved from the Jackson's Mill Symposium (Hales & Snyder, 1981), a 50 percent random sample of Jackson's Mill Symposium contributors was selected to participate in the ranking process. A cover letter/questionnaire was sent to this
sample and all participants responded prior to the stated
deadline date. The individual rankings of the seven
purposes of industrial arts were averaged and combined into
a composite ranking for use in the telephone survey data
analysis.

The initial mailing of the mail survey instrument took
place on April 10, 1984. Exactly one week later (April
17th) a postcard follow-up was sent to all recipients of
the first mailing. The note on this postcard was written
as a thank you for those who had returned their survey
booklets and a reminder for those who had not. A second
follow-up was mailed to non-responders exactly three weeks
after the original mail out (May 1st). It consisted of a
cover letter that basically informed them that their
booklet had not yet been received and included a
restatement of the basic appeals from the original cover
letter, a replacement survey booklet, and another
pre-stamped self-addressed return envelope. A third and
final follow-up was mailed six weeks after the original
mailing (May 22, 1984). It consisted of a cover letter and
still another copy of the survey booklet and stamped
self-addressed return envelope. This follow-up packet was
sent certified mail to the remaining non-responders.

A 46 percent response rate was achieved by the initial
mailing, an additional 37 percent response was achieved by
the postcard follow-up and additional nine and three percent responses were achieved by the second and final follow-up mailings respectively. Sixty of sixty-three booklets were returned for a final response rate of 95 percent.

The analysis of telephone and mail survey data involved descriptive and parametrical techniques. The analyses were parametrical in nature because direct effort was made to describe population parameters through a census data gathering methodology as opposed to describing sample characteristics with statistical analyses. The parametrical analyses included correlational and semi-partial multiple regression procedures. All hypothesis testing involved F-tests with significance levels evaluated at an alpha equal to 0.05 or less.

Correlational techniques were employed to establish direction and strength of relationship between all independent variables and the dependent variable. The size of the research model was reduced to those independent variables that elicited significant Pearson Product Moment relationships with the dependent variable (DTC) at the alpha 0.05 level or less. There was a substantial significant relationship between the major independent variable (DBC) and DTC ($r = .64$, $p < .001$). Thus, DBC was identified as a strong probable contributor to variance in
the dependent variable. The alternative *presage* independent variables that were significantly related to the dependent variable (DTC) were number of school systems employed and number of professional memberships held. The alternative *context* independent variables that were significantly related to the dependent variable were number of preparation periods per week, freedom of program use, class rotation period, and type of school. All of these significantly related variables were included in the conceptual analysis model to determine their unique contributions to variance in the dependent variable (DTC).

Four stages of semi-partial multiple regression analysis followed the correlation procedure. **Stage one** involved an analysis of *major sets* of independent variables (alternative context, alternative presage, and the major independent variable—DBC) and *specific variables* within sets for their unique contributions to variance in the dependent variable. The major independent variable *did* account for a significant unique proportion of variance in the dependent variable and therefore the major research hypothesis (Hm) was not rejected. The alternative presage variable set *did not* account for a significant unique proportion of variance in the dependent variable and therefore, this alternative research hypothesis (Ha1) was rejected. The alternative context variable set *did* account
for a significant unique proportion of variance in the dependent variable (DTC). Also each of the four independent variables in this set (type of school, rotation period, freedom of program use, and number of preparation periods per week) were also found to contribute to significant unique proportions of variance in the dependent variable. Therefore, alternative context hypotheses $H_{a2-A}$, $H_{a2-C}$, $H_{a2-E}$, and $H_{a2-L}$ were not rejected and all other alternative context hypotheses were rejected.

Stage two of the semi-partial multiple regression analyses involved a second analysis of major sets of independent variables and specific variables within sets for their unique contributions to variance in the dependent variable (DTC). This time, however, the major independent variable (DBC) was replaced with a set of background source variables (subscales of DBC) that were significantly correlated with the dependent variable (DTC). The stage two analysis was designed to identify primary sources of teaching practice. Only those background source variables which elicited significant proportions of variance in the dependent variable (DTC) were considered primary teaching sources. The background source set was found to contribute significantly to variance in DTC and the individual background sources that explained unique significant proportions of variance in DTC were curriculum
packages/textbooks and non-school work experiences. Therefore, Hm group #1 subhypotheses 1-D and 1-G were not rejected and the other seven Hm Group #1 subhypotheses were rejected.

The stage three semi-partial multiple regression procedure involved an analysis of background source variables with the major independent variable (DBC) to identify primary sources of background experience. Primary background sources were defined as those background source variables which elicited significant proportions of variance in the major independent variable (DBC). The background source set was found to contribute significantly to variance in DBC and the individual background sources that explained unique significant proportions of variance in DBC were curriculum packages/textbooks, college industrial arts laboratory courses, and non-school work experience. Therefore, Hm group #2 subhypotheses 2-B, 2-D, and 2G were not rejected and the other six Hm group #2 subhypotheses were rejected.

Stage four of the semi-partial regression analysis involved a third analysis of major sets (alternative context, alternative presage, and background sources) of independent variables and specific variables within significant sets. However, three subscales of the dependent variable (degrees of management, production and
personnel compatibility) were substituted for DTC in three separate regression runs. The stage four analyses were designed to determine which background sources uniquely contributed significant proportions of variance to specific kinds of secondary level manufacturing teaching activities (management, production, and personnel). The only background source variable that contributed a significant unique proportion of variance to the degree of management compatibility, degree of production compatibility, and degree of personnel compatibility was the curriculum package/textbook source. No other background sources were found to contribute significantly in either management, production, or personnel theory-based laboratory activities. Therefore, Hm group #3 subhypothesis 3-D, Hm group #4 subhypothesis 4-D, and Hm #5 subhypothesis 5-D were all not rejected and all of the remaining Hm group #3, #4, and #5 subhypotheses were rejected.

Descriptive presentations for each of the alternative presage and context variables were included in Appendix J; Tables 22 to 49. Descriptive measures of central tendency and variability concerning the major independent variable, the nine subscales of the independent variable, the dependent variable and the three subscales of the dependent variable are presented in Appendix J, Table 50. Normative profiles of laboratory activities taught by Ohio
manufacturing teachers were presented in Chapter IV, Figures 11 (by clusters) and in Appendix H (by all 152 individual theory-based laboratory activities). Verbal responses to the telephone survey question of how to better prepare secondary level industrial arts teachers to teach manufacturing were presented in Appendix F and written responses to that same question on the mail survey were presented in Appendix G. A ranking of the top ten responses to this same question was presented in Chapter IV, Table 21. Eight of the top ten recommendations of Ohio manufacturing teachers made reference to specific curricular revisions needed at the pre-service teacher education level concerning non-school work experiences (work, internships, field trips) and industrial arts laboratory courses.

Conclusions

The conclusions which follow were derived from the findings of the study. The generalizability of these conclusions beyond the teachers whose responses were received is questionable in three respects. First, the study considered only teachers in one state. Second, not all of the manufacturing teachers in the state of Ohio may have been identified. The relationship between the target population and the accessible population was difficult to
define because no accurate statewide listing of manufacturing teachers existed. Two percent of the approximately 2,600 primary and secondary level Ohio industrial arts teachers were estimated to teach manufacturing in a 1980 statewide census survey of industrial arts programs by Blankenbaker et al. The teacher identification methodology of the present study yielded a 2.4 percent number of manufacturing teachers; however, this study was conducted four years after the 1980 Blankenbaker et al. study and baseline data concerning the growth rate of manufacturing programs in Ohio was not available. Third, in the few instances where principals indicated that more than one industrial arts teachers in their building were teaching manufacturing, only one of these teachers was asked to participate in this study to reduce the possibility of intercorrelating the context variable data and thus reducing the power of the data analysis techniques.

The conclusions which follow must also be viewed with the knowledge that the research design for this study was ex post facto in nature. The interplay of independent variable interventions which caused teachers to behave the way they did occurred long before this study was initiated. Appropriate techniques were employed to control internal validity (see Chapter III); however, the control of
extraneous sources of variance lacks the rigidity of the true or quasi-experimental research designs.

Conclusions Concerning the Major Hypotheses

The following conclusions relate specifically to the principal problem and the major hypotheses (Hm, Ha1 and Ha2).

1. Manufacturing teachers do appear to teach theory-based activities that they have previously experienced. A significant proportion of variability in the amount of theory-based teaching practice was attributed to the amount of theory-based background activities that secondary level manufacturing teachers had experienced.

2. The extent that a secondary level manufacturing teacher's laboratory activities will be compatible with contemporary industrial arts theory may be explained by a combination of the number and variety of theory-based activities previously experienced and the amount of freedom that teachers feel they have in their local school contexts to teach the content and activities of their choice.
3. The fact that there was a low significant relationship between degree of background compatibility and freedom of program use suggests that the attainment of a greater number of contemporary background experiences is fostered when inservice teachers are allowed greater freedom to teach contemporary activities. Literature concerning teacher autonomy (Goodlad et al., 1974; Lortie, 1975; Evans, 1979; & LaPorte, 1982) and the "informal covenant" (Parish & Arends, 1982; Krueger & Parish, 1982) also suggests that teachers have considerable autonomy in what is taught and that regardless of what administrators say or feel about content and activities, they will not cross an "informal" line and attempt to force their ideas on teachers. Therefore, regardless of the relationship between DBC and freedom of program use, if teachers are aware of their autonomy in the classroom, their prior background experiences may tend to dictate their current practice.

4. The extent that a secondary level manufacturing teacher's laboratory activities will be compatible with contemporary industrial arts
theory will also depend independently on the class rotation period, the number of preparation periods they are allowed each week, and type of school where they are employed. Longer class formats (such as the semester or year), a greater number of preparation periods per week (five was the average), and the county school system all seemed to independently contribute to the teaching of a greater number of contemporary based manufacturing laboratory activities.

5. The best predictors of the extent to which the laboratory activities of a secondary level industrial arts program will be compatible with contemporary industrial arts theory in order of importance are: (A) a combination of the amount and variety of theory-based background activity experiences of the teacher and the degree of teaching freedom that they perceive exists at their school, (B) the length of the class (in weeks), and (C) the type of school.
Conclusions Concerning Primary Background and Primary Teaching Sources

The following conclusions relate specifically to the Hm Group #1 and Group #2 subhypotheses concerning primary background and primary teaching sources of activity experience.

1. Secondary level manufacturing teachers receive background manufacturing activity experiences from three primary sources: college industrial arts laboratory courses, curriculum packages/textbooks, and non-school related work experience.

2. The theory-based activities actually taught by manufacturing teachers in secondary level industrial arts laboratories originate from two primary sources: non-school related work experiences and curriculum packages/textbooks.

3. College industrial arts laboratory activities do not appear to promote theory-based teaching practice at the secondary level. This primary background activity source did not account for a significant proportion of variability in the
dependent variable (degree of teaching compatibility with a theory-based model of manufacturing activities).

4. The primary background source in need of curricular revision is the college industrial arts laboratory source. Support for this conclusion can be obtained from evidence which indicates that teachers in the low DTC group (which most closely resembles conventional industrial arts teachers in terms of laboratory activities taught) rely more heavily on college industrial arts laboratory courses than teachers in the high DTC group. Further, eight of the top ten recommendations for better preparing industrial arts teachers to teach manufacturing (provided by inservice manufacturing teachers) suggest changes in industrial arts laboratory courses which reflect theory-based activities that are provided by many contemporary curriculum packages.

5. Since college industrial arts laboratory courses appear to have the greatest impact in the low DTC group of manufacturing teachers and the majority of industrial arts teachers in the field teach
conventional activities (Dugger, 1980a), a vastly greater number of "captive" pre-service industrial arts teachers can be taught theory-based activities from this source than the low percentage of inservice teachers who have made the extra effort to seek out, acquire, and learn activities from curriculum packages.

6. Student teaching, as experienced by the teachers in this study, does not appear to either contribute to theory-based background experiences or promote theory-based teaching practice. Therefore, the present study tends to support Parkay's (1982) conclusion that student teaching "encourages pre-service teachers to value styles of teaching that are more restrictive and custodial than those they valued before student teaching." (p. 705)

7. Non-school work experiences appear to contribute to theory-based background experiences as well as promote theory-based teaching practice of manufacturing teachers at the secondary level. Therefore, the present study lends support to recent suggestions that student teaching be either replaced or supplemented with industrial observations, cooperative
training programs or internships (DeVore, 1980b; Nannay, 1983).

8. Inservice training does not appear to either contribute to theory-based background experiences or promote theory-based teaching practice for secondary level manufacturing teachers. Therefore, support for the finding of Hyder (1971), Krueger and Parish (1982), and Goodlad (1983) is provided by this study.

9. Curriculum packages/textbooks appear to contribute to theory-based background experiences as well as promote theory-based teaching practice of manufacturing teachers at the secondary level. Teachers in the high DTC group relied a much greater extent on curriculum packages than their low (conventional) DTC group counterparts. This finding, when coupled with those that fail to link inservice training with theory-based teacher practice, and those which describe the low percentage of teachers who actually have changed, suggests that designers and diffusers of innovative curriculum packages should focus more attention on the teacher education level.
Conclusions Concerning Variances Explained by Background Sources in Management, Production, and Personnel Activities Taught

The following conclusions relate specifically to the Hm Group #3, Hm Group #4, and Hm Group #5 subhypotheses concerning the variances explained by activities from specific background sources on the theory-based management, production, and personnel laboratory activities taught by secondary level manufacturing teachers.

1. The activities of curriculum packages/textbooks appear to be primary contributors to theory-based management, production, and personnel activities taught in secondary level manufacturing laboratories. The curriculum package/textbook source was the only background source to explain a significant proportion of variability in each of three subscales of the dependent variable (degrees of management, production, and personnel compatibility). Therefore, the theory-based curriculum package and textbook developers appear to have achieved their objectives in the relatively few occurrences in Ohio and nationwide where teachers have taken advantage of this source.
2. The greatest hope for reversing the expanding direction of the gap between industrial arts theory and practice may lie in incorporating all three types of activities (management, production, and personnel) provided by theory-based curriculum packages/textbooks into college industrial arts laboratory courses. The college industrial arts laboratory source not only failed to explain a significant proportion of variance in degree of management and personnel theory/practice compatibility: but, this source also failed to explain a significant proportion of variance in degree of production theory/practice compatibility.

Recommendations

Based on the findings of this study, the following recommendations were proposed:

Recommendations for Further Research

1. Further studies should be conducted to substantiate the data or refute the present findings. The methodology should be slightly modified to obtain a random sample from the entire population of
industrial arts teachers in the state of Ohio. Manufacturing teachers can then be classified on the basis of compatibility scores obtained from the mail survey instrument. The methodology could also be modified to include a nationwide random sample of manufacturing teachers. Data concerning the identification of the target population of manufacturing teachers may be obtained from the Phase I data base of the National Standards Study of Industrial Arts Programs Project (Dugger et al., 1980b).

2. Parallel studies should be conducted with secondary level teachers of construction, communications, transportation, and power/energy. At the present time, a parallel study with construction teachers would hold the most promise for success at the state level. Theory-based curriculum materials in construction technology have been available to teachers about as long as those in manufacturing and these preceed recent curriculum development and diffusion efforts in communication, transportation, and power/energy by at least a decade.
3. A major finding of the present study was that nonconventional secondary level teachers teach activities that they have previously experienced from curriculum packages. A conclusion was drawn that suggested major curricular revisions at the preservice teacher education level. This finding and conclusion could be supported by a comparative follow-up study conducted of secondary level industrial arts teachers who were graduated from undergraduate programs which are selected on the basis of amount of instruction time devoted to theory-based industrial arts laboratory activities. The major independent variable in this study should be amount (high, medium, low, none) of theory-based laboratory activities experienced by undergraduates and the dependent variable could be some measure of theory/practice compatibility such as the dependent variable of the present study. Graduates of a program that provided a considerable amount of theory-based laboratory experiences (such as the American Industry Program or Technology Education at the University of Wisconsin - Stout) could be compared with graduates of programs that have approximately one-half, very little, and no (conventional programs) instruction time devoted to theory-based laboratory activities.
4. Further research needs to be conducted to examine the relationships of teacher values, beliefs, and role expectations with preservice training and secondary level teaching practice. Since these variables have been linked with curricular implementation, this type of research may provide useful data for improving the long term effectiveness of inservice training programs.

5. The findings of the present study indicate that nonschool work experiences do contribute to theory-based laboratory practices of secondary level manufacturing teachers. Therefore, further examination of this source of activity experience is warranted. A comparative longitudinal study could be conducted to determine the effects of varying amounts and varying types (management, production, personnel, and combinations) of industrial field experiences provided to preservice teachers on the theory/practice compatibility of activities that are taught by those who are later employed as secondary level industrial arts teachers.

6. The instrument that was used in this study to measure the degree of compatibility between theory and practice appears to offer promise as a research tool. No problems were evident in securing responses in the desired manner from
Recommendations for Change Agents

1. Curriculum developers must consider the evidence provided by the present study and begin to focus greater attention on the teacher education level. Good theory-based instructional packages have been designed for the secondary level, but relatively few inservice teachers have taken advantage of these materials. Further, evidence also suggests that conventional inservice diffusion strategies are doomed to failure because public schools are not organized to be receptive or supportive of change.

2. The preservice industrial arts teacher education curriculum has been identified as a source of needed curricular change. The findings of this study suggest that aggressive curricular revision...
in all areas of activity experience (management, production, and personnel) must be pursued if this primary background source is to contribute to a reduction in the theory/practice gap at the secondary level.

3. Laboratory activities of the preservice curriculum should be augmented by the use of theory-based curriculum packages and textbooks. Further, non-school industrial related work experiences should be systematically integrated into the curriculum incorporating experiences in all areas of industrial activity (management, production, and personnel).

4. Administrators who desire innovative programs in their schools should encourage freedom of program use, provide additional preparation time as an incentive to teachers who desire to change, and adopt long class rotation schedules (semester or year) for industrial arts classes.

5. Since a strong relationship does exist between background activity experience and teaching practice, administrators who desire to hire industrial arts teachers who are competent to teach theory-based manufacturing should employ the mail survey instrument developed for this
study as a preselection screening tool. The background activity cluster scores of prospective teachers can be plotted to create a profile which can be compared to the normative profile of manufacturing cluster areas for Ohio secondary schools (as presented in Figure 11). A nationwide study which parallels the present study could establish a nationwide normative profile which would be even more valuable for this purpose.

6. Administrators who desire contemporary industrial arts teaching practice in their schools should also use the survey instrument as a diagnostic or evaluative tool for existing program improvement by inservice teachers.
APPENDIX A

ADVANCE SURVEY NOTIFICATION TO BUILDING PRINCIPALS
COVER LETTER TO BUILDING PRINCIPALS

(inside address here)
(salutation here)

Within a week or so, we will be calling your school from Columbus as part of a research study. This is a statewide survey in which we are seeking to determine how to better prepare industrial arts teachers to teach manufacturing. This research has the approval and support of Joe R. Logsdon, State Supervisor of Industrial Arts at the Ohio Department of Education.

Your school has been identified as one of the small number in Ohio where a manufacturing course or courses may be taught. When our interviewer calls, he (or she) will ask to interview one manufacturing teacher. Altogether, the interview should take about fifteen minutes.

We are writing in advance of our telephone call because we have found that many principals appreciate being advised that a research study is in progress, and that a member of their teaching staff will be called.

Please complete the enclosed stamped, self-addressed postcard at your earliest convenience. The purpose of the postcard is to identify a convenient time of day to call (lunch or free period, before or after school hours, etc.).

Your help and that of one manufacturing teacher in your building is essential for us to successfully determine how to better prepare industrial arts teachers to teach manufacturing. We greatly appreciate it.

If you have any questions, please don't hesitate to contact me by phone at (614) 422-7471.

Cordially,

Joe R. Logsdon
State Supervisor of Industrial Arts

Leonard A. Colelli
Project Director

College of Education
1. Number of industrial arts teachers __________
2. Number of manufacturing teachers __________
3. Name of one manufacturing teacher: ______________________
4. Most convenient day(s)/time(s) to call:

<table>
<thead>
<tr>
<th>M</th>
<th>T</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
</table>

Phone # (if evening) ______________________

(____) ______________________

Phone # (if weekend) ______________________

(____) ______________________
APPENDIX B

TELEPHONE BACKGROUND INTERVIEW
OHIO MANUFACTURING ACTIVITY SURVEY
Telephone Data Gathering Phase

Name ______________________________
Phone # ____________________________
School ______________________________
Street ______________________________
City ________________________________

(TEACHER IDENTIFICATION)

Hello. Is this (name of school)? (IF NO, The number I was calling is __________.) (IF WRONG NUMBER, TERMINATE WITH E.G.: I am sorry to have bothered you.)

May I speak with a teacher from the industrial arts department please? My name is _______________ and I am calling from The Ohio State University.

Hello. My name is ________________ and I am calling from The Ohio State University. I would like to talk with a manufacturing teacher. Is there a manufacturing teacher at your school?

YES ...... 1
NO ...... 2

Would that be you?

YES ...... 1
NO ...... 2

May I speak with that person?

YES ...... 1
NO ...... 2

When may I call back to reach (him/her)?

So that I will know who to ask for when I call back, what is the manufacturing teachers name? (REPEAT BACK TO BE SURE YOU HAVE AND SHOW PRONUNCIATION IF IT IS A PROBLEM) IF RESPONDENT OBJECTS TO PROVIDING NAME: "We only need the person's first name, the last is not necessary."
May I ask who I am speaking with? ________________________ (Name of Teacher)

We are conducting a state-wide research study to find out how to better prepare industrial arts teachers to teach manufacturing. The reason that we are calling manufacturing teachers is that a great deal of effort has been spent during the past 15 years to promote manufacturing in the public schools, but still only about 2% of industrial arts teachers in the state of Ohio teach manufacturing. We are trying to determine why some teachers, like yourself, teach manufacturing while a great many do not.

Your school was identified as one of the small number where manufacturing is taught in the directory of industrial arts programs at the Ohio Department of Education.

The questions I need to ask should take about 10-15 minutes. But, before starting them, I want to mention that I would be happy to answer any questions you might have about the study now or later. Okay?

CALL RECORD

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Result</th>
<th>Code for Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Abbreviations:

NA = No answer  
NP = Not present  
WR = Will return (when)  
REF = Refused (when, why, at what point, M or F)  
IC = Interview completed  
PIC = Partially completed  
WN = Wrong number  
DISC = Disconnect

Code for Recalls:

A = Respondent not selected  
B = Respondent selected only  
C = Have talked with respondent (instructions for interview)

There are two general types of questions that I need to ask you: questions that deal with your school and teaching responsibilities, and questions that deal with your background and experience.

Let's start with questions about your school and teaching responsibilities.
Q-1 Are you teaching at a junior high, middle school, or high school?

JUNIOR HIGH ................. 1
MIDDLE SCHOOL ................. 2
HIGH SCHOOL ................. 3

Q-2 We need to know the approximate size of your school. About how many students are enrolled in your school?

1 - 500 ......................... 1
501 - 1000 ..................... 2
1001 - 1500 .................... 3
1501 - 2000 .................... 4
2001 or more ................... 5
(don't know) ..................... 6
(refused) ....................... 9

Q-3 How many industrial arts teachers are there in your school building?

ONE ......................... 1
TWO ......................... 2
THREE ....................... 3
FOUR ....................... 4
FIVE ....................... 5
SIX OR MORE .................. 6
(refused) ..................... 9

Q-4 How many Industrial Arts courses do you teach each day?

ONE ......................... 1
TWO ......................... 2
THREE ....................... 3
FOUR ....................... 4
FIVE ....................... 5
SIX OR MORE .................. 6
(refused) ..................... 9

Q-5 How many types of industrial arts courses do you teach each day such as manufacturing, woods, metals, etc.?

ONE ......................... 1
TWO ......................... 2
THREE ....................... 3
FOUR ....................... 4
FIVE ....................... 5
SIX OR MORE .................. 6
(refused) ..................... 9

What are the names of these courses?

Q-6 So you teach sections

(Q-6) of manufacturing each day and no other type of class?

YES ... 1
NO ... 2

No. MANUFACTURING SECTIONS TAUGHT (NOMASEC) 1 : 23

COMPUTER CODE

(Deck:Column)

LEVEL OF TEACHING (LEVTEAC) 1 : 13

SIZE OF SCHOOL (SIZESCH) 1 : 15

No. IA TEACHERS (NOIAATEA) 1 : 17

No. IA COURSES TAUGHT EACH DAY (NOIAACOR) 1 : 19

TYPES OF IA COURSES TAUGHT (TYIAACOR) 1 : 21

So you teach manufacturing, ________, ________.

(Repeat all that were listed above for confirmation.)

YES ......... 1
NO ......... 2

How many sections of manufacturing do you teach each day?

ONE TWO THREE FOUR FIVE SIX OR MORE

1 2 3 4 5 6

(GO TO QUESTION 6)
Q-6 Do you teach any non-industrial arts courses?

<table>
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<tr>
<th>YES</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>7</td>
</tr>
</tbody>
</table>

How many non-industrial arts classes do you teach each day?

| ONE | 1 |
| TWO | 2 |
| THREE | 3 |
| FOUR | 4 |
| FIVE | 5 |
| SIX OR MORE | 6 |
| (refused) | 9 |

Q-7 What is the average class size for your manufacturing class(es)?

1 - 15 students/class ........ 1
16 - 19 ....................... 2
20 - 23 ....................... 3
24 - 27 ....................... 4
28 - 31 ....................... 5
32 or more .................... 6
(refused) ...................... 9

Q-8 What is the rotation format for your manufacturing class(es)?

In other words, do you teach manufacturing for a year, semester, nine-weeks, or other period before a new group of students enter your class?

| YEAR | 1 |
| SEMESTER | 2 |
| 12 WEEKS | 3 |
| 9 WEEKS | 4 |
| OTHER | 5 |
| (Please list) | |
| (refused) | 9 |

Q-9 This next question concerns the class-standing or academic ability of students in your manufacturing class(es) compared with the general academic ability of the total student body. Would you say that the students in your manufacturing class(es) are far below average, below average, average, above average, or far above average when compared with the rest of the student body?

| FAR BELOW | 1 |
| BELOW | 2 |
| AVERAGE | 3 |
| ABOVE AVERAGE | 4 |
| FAR ABOVE AVERAGE | 5 |
| (Don't know) | 8 |
| (refused) | 9 |

CALCULATE PERCENTAGE OF TEACHING LOAD THAT IS MANUFACTURING WITH INFORMATION FROM QUESTIONS Q-4 THROUGH Q-6 AFTER SURVEY IS COMPLETED.
Q-10 How I would like to ask you how much freedom you feel that you have to teach what you want in your manufacturing class (es). A lack of freedom would mean that you are formally or informally required to teach certain content or activities that are established by the building principal or school board. Do you feel that you have much, some, little or no freedom to teach what you want in your manufacturing classes?

<table>
<thead>
<tr>
<th>Freedom Level</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much</td>
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</tr>
<tr>
<td>Some</td>
<td>2</td>
</tr>
<tr>
<td>Little</td>
<td>3</td>
</tr>
<tr>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td>(don't know)</td>
<td>5</td>
</tr>
<tr>
<td>(refused)</td>
<td>6</td>
</tr>
</tbody>
</table>

Q-11 Does your school allocate an operating budget specifically for your manufacturing class (es)?

- YES ........... 1
- NO ............. 2

How do you purchase supplies?

---

About how much money do you spend for one manufacturing class for each rotation period?

<table>
<thead>
<tr>
<th>Budget Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1-100</td>
<td>1</td>
</tr>
<tr>
<td>$101-200</td>
<td>2</td>
</tr>
<tr>
<td>$201-300</td>
<td>3</td>
</tr>
<tr>
<td>$301-400</td>
<td>4</td>
</tr>
<tr>
<td>$401-500</td>
<td>5</td>
</tr>
<tr>
<td>OVER 500</td>
<td>6</td>
</tr>
<tr>
<td>(don't know)</td>
<td>8</td>
</tr>
<tr>
<td>(refused)</td>
<td>9</td>
</tr>
</tbody>
</table>

Q-12 How many preparation periods do you have each week?

- ONE - TWO ................. 1
- THREE - FOUR .............. 2
- FIVE - SIX .................. 3
- SEVEN - EIGHT ................ 4
- NINE - TEN .................. 5
- ELEVEN OR MORE ............. 6
- (refused) ................. 9

Q-13 Do you perform any non-teaching duties during school hours such as restroom, hall, lunch or study hall supervision?

- YES ............. 1
- NO .............. 2

About how many hours of non-teaching duties do you perform each week during school hours?

- ONE - TWO ................. 1
- THREE - FOUR .............. 2
- FIVE - SIX .................. 3
- SEVEN - EIGHT ................ 4
- NINE - TEN .................. 5
- ELEVEN - TWELVE ............. 6
- (refused) ................. 9

**COMPUTER CODE**

- **PERCEIVED FREEDOM OF PROGRAM USE**
  - (FREEDOM) 1 : 37

- **BUDGET**
  - (BUDGET) 1 : 39

- **PREP PERIODS PER WEEK**
  - (PREPPER) 1 : 41

- **NON-TEACHING DUTIES**
  - (NONTEAC) 1 : 43
Nov 1: I would like to ask you some questions about your background and experience. But, before we get to these questions, are there any questions that you have at this time?

Q-14 What is your age?

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25</td>
<td>3</td>
</tr>
<tr>
<td>26-30</td>
<td>2</td>
</tr>
<tr>
<td>31-35</td>
<td>5</td>
</tr>
<tr>
<td>36-40</td>
<td>4</td>
</tr>
<tr>
<td>41-45</td>
<td>5</td>
</tr>
<tr>
<td>46-65</td>
<td>6</td>
</tr>
<tr>
<td>66+</td>
<td>9</td>
</tr>
</tbody>
</table>

Q-15 How many years of secondary level teaching experience do you have if you include this year?

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td>4-6</td>
<td>2</td>
</tr>
<tr>
<td>7-9</td>
<td>3</td>
</tr>
<tr>
<td>10-12</td>
<td>4</td>
</tr>
<tr>
<td>13-15</td>
<td>5</td>
</tr>
<tr>
<td>16 or more</td>
<td>6</td>
</tr>
<tr>
<td>(Refused)</td>
<td>9</td>
</tr>
</tbody>
</table>

Q-16 Have you been employed in other school systems since you started teaching?

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
</tbody>
</table>

IF NO, DON'T ASK Q-17; JUST RECORD "1" IN COMPUTER CODE 1:49

Q-17 Do you have supplemental employment after school hours like coaching, drives education, or part-time work?

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1:47</td>
</tr>
<tr>
<td>No</td>
<td>1:53</td>
</tr>
</tbody>
</table>

About how many hours a week do you spend in supplemental employment?

<table>
<thead>
<tr>
<th>Hours Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td>4-6</td>
<td>2</td>
</tr>
<tr>
<td>7-9</td>
<td>3</td>
</tr>
<tr>
<td>10-12</td>
<td>4</td>
</tr>
<tr>
<td>13-15</td>
<td>5</td>
</tr>
<tr>
<td>16 or more</td>
<td>6</td>
</tr>
<tr>
<td>(Refused)</td>
<td>9</td>
</tr>
</tbody>
</table>

COMPUTER CODE

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:45</td>
<td>Age</td>
</tr>
<tr>
<td>1:47</td>
<td>Teaching Experience</td>
</tr>
<tr>
<td>1:49</td>
<td>Teaching Experience (blanks)</td>
</tr>
<tr>
<td>1:51</td>
<td>Years in Present Position</td>
</tr>
<tr>
<td>1:53</td>
<td>Supplemental Employment</td>
</tr>
</tbody>
</table>
Q-16 Do you have any work experience in industry?

YES .............. 1
NO .............. 2 RECORD A "J" IN COMPUTER CODE 1:55

GO TO QUESTION # 19

18-A If you were to combine all of your industry related experience together, how many years would this be?

0-3 YEARS .................. 1
4-6 YEARS .................. 2
7-9 YEARS .................. 3
10-12 YEARS ............... 4
13-15 YEARS ................ 5
16 OR MORE ................ 6
(don't know) ............... 8
(refused) ................... 9

18-B Would you say that your industrial experience was management related, production related, or some combination of both?

MANAGEMENT ............. 1
PRODUCTION ............. 2
COMBINATION ............. 3
(don't know) ............... 8
(refused) ................... 9

Q-19 How many hours a week do you spend in leisure time activities like sports, recreation, and hobbies?

0-3 ........................................ 1
4-6 ........................................ 2
7-9 ........................................ 3
10-12 ................................. 4
13-15 ................................. 5
16 OR MORE ..................... 6
(don't know) ............... 8
(refused) ................... 9

Q-20 Next I want to ask you about your educational background. What college degrees have you earned?

ASSOCIATE ..................... 1
BACCALAUREATE ............. 2
MASTERS OR EQUIVALENT (430) ........ 3
MASTERS + 30 .................. 4
MASTERS + 60 .................. 5
OTHER .......................... 6
(specify) ______________

Q-21 I'm going to read you four grade point average ranges and I would like you to tell me in which of the ranges was your final academic standing for your bachelors degree. The ranges are 2.0 to 2.5, 2.5 to 3.0, 3.0 to 3.5, and 3.5 to 4.0.

2.0 TO 2.5 .................. 1
2.5 TO 3.0 .................. 2
3.0 TO 3.5 .................. 3
3.5 TO 4.0 .................. 4
(don't know) ............... 8
(refused) ................... 9
Q-22 Are you a member of any professional associations like the American Industrial Arts Association, Epsilon Pi Tau, Ohio Industrial Arts Association, or others?

Yes ........ 1
No ........ 2 — GO TO QUESTION #23

How many active memberships do you hold?

ONE .................. 1
TWO .................... 2
THREE .................. 3
FOUR .................. 4
FIVE .................. 5
SIX OR MORE ........ 6
(don't know) .......... 8
(refused) ............. 9

Q-23 Finally, I'm going to read you seven purposes for Industrial arts. After I read each purpose, please tell me if you think it is very important, some importance, little importance, or no importance as a purpose for Industrial arts.

1. First, do you think that to develop skill in the use of common tools and machines is very, some, little, or of no importance as a purpose for Industrial arts?

2. Is developing leisure time interests very, some, little, or of no importance?

3. The next purpose is to develop problem solving skills.

4. What about to develop consumer knowledge concerning industrial products?

5. Providing vocational training for students.

6. To help students make informed career choices.

7. To develop in each student a broad understanding of the nature and characteristics of management, production, and personnel technologies in industry.

COMPUTER CODE

PROFESSIONAL
MIDGERSHIP
(PROMEP)
1 : 65

NO LITTLE SOME VERY

1 2 3 4

If more than one very important is given

You've indicated that
(how many)
of the purposes for industrial arts are very important. How I would like you to tell me which of these you would spend the most time on in your classes. If you would like, I would be very happy to read your very important purposes once more.

IF ONLY ONE VERY IMPORTANT IS GIVEN

So you feel that
(read purpose)
is the most important purpose for Industrial arts?

YES ........ 1
NO ........ 2

CIRCLE PURPOSE

1 2 3 4 5 6 7

GO TO INTERVIEW
CONCLUSION
PAGE 9
That was the last of the questions we need to ask you about your school and your background.

The only thing we need now to complete our research is some information about the types of laboratory activities you teach in your manufacturing class (es). This kind of information cannot be acquired over the phone so we are going to send you a list of manufacturing activities in the mail. We just want you to place a check mark next to those activities you have learned and another check mark next to those activities that your manufacturing students are learning in your manufacturing classes. You should receive this list in about two weeks.

Do you have any questions that you would like to ask us, or any additional information that you feel could be used to better prepare more industrial arts teachers to teach manufacturing in Ohio secondary schools?

I would like to thank you for your time and I hope this interview wasn't an inconvenience to you. You have been very helpful and it has been nice talking with you.
APPENDIX C
MANUFACTURING ACTIVITY SURVEY
COVER LETTER
AND
COMPUTER CODING SHEET
(inside address here)
(salutation here)

During our recent telephone conversation I told you that only two percent of secondary-level industrial arts teachers in the state of Ohio teach manufacturing despite a great deal of time and effort spent in promoting this teaching area. We are trying to determine why some industrial arts teachers teach manufacturing while many others do not. The best way we know how to find this out is to ask manufacturing teachers like yourself.

The information that you provided during our recent telephone interview (concerning characteristics of the school where you teach and your background experience) was very helpful. The final thing that we need to complete our research is some information about the types of laboratory activities that are performed in your manufacturing class(es). This information and the information that you provided through the telephone interview will be used to better prepare industrial arts teachers to teach manufacturing.

You are one of a small number of individuals who teach manufacturing in the state of Ohio. In order that the results of this study will truly represent the actual background and practices of manufacturing teachers, it is important that your questionnaire be completed and returned.

You may be assured of complete anonymity. The identification number on the questionnaire is for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

The results of this research will be made available to representatives in the Ohio State Department of Education, teacher educators, and local school administrators. You may receive a summary of results by writing COPY OF RESULTS REQUESTED on the back of the return envelope, and printing your name and address below it. Please do not put this information on the questionnaire itself.

I would be happy to answer any questions that you may have. Please write or call me at (614) 422-2661. Thank you for your assistance.

Sincerely,

[Signature]

Leonard A. Colelli
Project Director
MANUFACTURING IN OHIO SECONDARY SCHOOLS

HOW CAN INDUSTRIAL ARTS TEACHERS BE BETTER PREPARED TO TEACH MANUFACTURING?

This questionnaire is the second part of a two phase data-gathering effort that will be used to better prepare industrial arts teachers to teach manufacturing. We are asking for a little of your time and the results of your experience to gather information on the technical background of practicing manufacturing teachers and on the types of laboratory activities that their manufacturing students typically perform.

Please complete all parts of this booklet. If you wish to comment on any activity items or qualify your answers, feel free to use page margins or the space provided on the back cover. Your comments will be taken into account.

Thank you for your consideration and cooperation.

Return this booklet to:
Ohio Manufacturing Activity Survey
190 W. 19th Ave., Room 200
The Ohio State University
Columbus, OH 43210
DIRECTIONS

This booklet contains a comprehensive listing of activities that could be taught in a manufacturing class given ideal conditions (unlimited time, money, resources, etc.). We need to know three things: 1) which activities have YOU performed, 2) WHERE (source) did you learn to perform these activities, and 3) which activities do YOUR MANUFACTURING STUDENTS typically perform? Your responses will be combined with many others who are teaching manufacturing in Ohio secondary schools. No reference will be made to your specific responses and all information you give will be kept in strict confidence.

STEP 1:

Read each activity and place a check (✓) in COLUMN #1 for activities that YOU have performed, no matter where they were learned. Leave column #1 blank for any activity that you have NOT ACTUALLY PERFORMED.

STEP 2:

Common sources for learning industrial arts activities are listed in a SOURCE KEY located at the top of every page of the survey instrument. Examine the source key. To the left of each source is an identifying number (1 through 8). Tell us WHERE you learned how to perform each activity that you checked in column #1 by placing a source number or numbers in COLUMN #2. Additional sources may be added (see OTHER SOURCES box) at the bottom of each page.

STEP 3:

Read each activity and place a check (✓) in COLUMN #3 for activities that YOUR STUDENTS typically PERFORM in one rotation period (year, semester, 9-weeks,...) of your manufacturing class(es). Leave column #3 blank for any activity that your students do NOT typically perform.
### Manufacturing Activity Survey

1. Column 1 — check any activity that YOU have ever performed.
2. Column 2 — indicate WHERE you learned each checked activity (see source key).
3. Column 3 — check any activities that YOUR MANUFACTURING STUDENTS perform.

#### Source Key
1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Tests
5. Vocational/Technical Classes
6. Inservice Workshops
7. Work Experience (non-school)
8. Work Experience (school related)
9. Other

*Other — PLEASE NUMBER AND LIST AT BOTTOM OF PAGE*

### A. Organizing and Financing a Company

<table>
<thead>
<tr>
<th></th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electing a board of directors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Selecting a product for production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Selecting a company name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Designing a company trademark (logo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Adopting bylaws for the company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Organizing a top management team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Obtaining a state charter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Estimating fixed costs (wages, overhead, ... )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Estimating variable (material) costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Pricing the product (what price to sell?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Calculating number of stock sales for start-up costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Selling stock or obtaining loans for start-up costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Keeping corporate records (balance sheets, ... )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Calculating profit/loss margins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Constructing a break-even chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Estimating dividend payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Preparing financial reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Liquidating the company</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Other Sources (Label and use throughout the rest of the booklet)*

9. 
10. 
11. 

---

Page 1 of 9 pages
MANUFACTURING ACTIVITY SURVEY

1. Column 1 -- check any activity that YOU have ever performed.
2. Column 2 -- indicate WHERE you learned each checked activity. (see source key)
3. Column 3 -- check any activities that YOUR MANUFACTURING STUDENTS perform.

**SOURCE KEY**
1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Texts
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)
*Other -- PLEASE NUMBER AND LIST AT BOTTOM OF PAGE

<table>
<thead>
<tr>
<th>B. DESIGNING AND ENGINEERING PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sketching product ideas (thumbnails, rough, ...)</td>
</tr>
<tr>
<td>2. Constructing three-dimensional mockups (paste-up, appearance, ...)</td>
</tr>
<tr>
<td>3. Drawing product specifications (details, multi-views, assemblies, ...)</td>
</tr>
<tr>
<td>4. Writing parts specifications</td>
</tr>
<tr>
<td>5. Building production prototypes</td>
</tr>
<tr>
<td>6. Testing production prototypes</td>
</tr>
<tr>
<td>7. Revising design specifications</td>
</tr>
<tr>
<td>8. Presenting design alternatives to management</td>
</tr>
<tr>
<td>9. Designing product packaging</td>
</tr>
<tr>
<td>10. Writing/illustrating product instruction manuals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. PRE- AND POST-PROCESSING ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Receiving and unpacking equipment and supplies</td>
</tr>
<tr>
<td>2. Storing equipment and supplies in appropriate locations (flammables, perishables, ...)</td>
</tr>
<tr>
<td>3. Altering products to meet individual specifications (special attachments, personalized designs, ...)</td>
</tr>
<tr>
<td>4. Packaging products</td>
</tr>
<tr>
<td>5. Installing products (library bookshelves, doors, electrical receptacles, auto parts, ...)</td>
</tr>
<tr>
<td>6. Maintaining tools, equipment, appliances, ... on a periodic basis</td>
</tr>
<tr>
<td>7. Repairing non-functioning tools, equipment, appliances, ...</td>
</tr>
</tbody>
</table>

* OTHER SOURCES (Label and use throughout the rest of the booklet)

9.
10.
### MANUFACTURING ACTIVITY SURVEY

1. **Column 1** — check any activity that YOU have ever performed.
2. **Column 2** — indicate WHERE you learned each checked activity (see source key).
3. **Column 3** — check any activities that YOUR MANUFACTURING STUDENTS perform.

#### SOURCE KEY

1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Texts
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)

*Other -- PLEASE NUMBER AND LIST AT BOTTOM OF PAGE

#### D. RESEARCHING AND MARKETING ACTIVITIES

1. Retrieving information from books, magazines, ...
2. Experimenting with materials, processes and/or products
3. Identifying consumer demands (consumer survey)
4. Reporting market findings (market research report)
5. Making a sales forecast
6. Developing a sales program
7. Selecting advertising media
8. Designing promotional materials
9. Preparing advertising scripts and storyboards
10. Preparing copy for print media
11. Producing image carriers for print media (spirit masters, screen stencils, offset plates...)
12. Rehearsing and recording electronic advertisements
13. Distributing products (wholesale)
14. Selling products (retail)

* OTHER SOURCES (Label and use throughout the rest of the booklet)

9. 
10. 
...
### MANUFACTURING ACTIVITY SURVEY

1. Column 1 — check any activity that YOU have ever performed.
2. Column 2 — Indicate WHERE you learned each checked activity. (see source key)
3. Column 3 — check any activities that YOUR MANUFACTURING STUDENTS perform.

#### SOURCE KEY

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2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Texts
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)

*Other — PLEASE NUMBER AND LIST AT BOTTOM OF PAGE

<table>
<thead>
<tr>
<th>E. PLANNING PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preparing operation sheets</td>
</tr>
<tr>
<td>2. Developing a production flow chart</td>
</tr>
<tr>
<td>3. Developing route sheets</td>
</tr>
<tr>
<td>4. Designing laboratory floor plan for efficient routing</td>
</tr>
<tr>
<td>5. Requisitioning equipment and materials</td>
</tr>
<tr>
<td>6. Organizing a mechanical materials handling system (assembly lines, escalators, slides, ...)</td>
</tr>
<tr>
<td>7. Automating production processes with programmed control devices (NO machines, robotics, ...)</td>
</tr>
<tr>
<td>8. Fabricating special jigs, fixtures, templates, ...)</td>
</tr>
<tr>
<td>9. Testing the production set-up</td>
</tr>
<tr>
<td>10. Fabricating inspection gages, and other quality control measuring devices</td>
</tr>
<tr>
<td>11. Conducting time and motion studies</td>
</tr>
<tr>
<td>12. Conducting supply inventories</td>
</tr>
</tbody>
</table>

* OTHER SOURCES (Label and use throughout the rest of the booklet)

9.
10.
**MANUFACTURING ACTIVITY SURVEY**

1. Column 1 — check any activity that YOU have ever performed.
2. Column 2 — indicate WHERE you learned each checked activity. *(see source key)*
3. Column 3 — check any activities that YOUR MANUFACTURING STUDENTS perform.

**SOURCE KEY**
1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Texts
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)

*Other — PLEASE NUMBER AND LIST AT BOTTOM OF PAGE*

**F. PRODUCTION FORMING ACTIVITIES**
*(alphabetical order)*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Source 1</th>
<th>Source 2</th>
<th>Source 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bending (die, wrap, squeeze, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Casting (sand, die, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Crystallizing (seeding, evaporation, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Curing (salting, drying, vulcanization, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Drawing (cold, tube, shell, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Extruding (hot, cold, slot-die, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Forging (hammer, press, swage, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Freezing (evaporation, conduction, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Heat treating (annealing, normalizing, hardening,...)</td>
<td></td>
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</tr>
<tr>
<td>10. Melting (crucible, cupola, electric furnace, ...)</td>
<td></td>
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</tr>
<tr>
<td>11. Metal spinning (curl, smooth, head, ...)</td>
<td></td>
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</tr>
<tr>
<td>12. Molding (compression, injection, transfer, ...)</td>
<td></td>
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<tr>
<td>13. Peen finishing (shot, press, impact, ...)</td>
<td></td>
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</tr>
<tr>
<td>14. Founding (hammering, tamping, ...)</td>
<td></td>
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</tr>
<tr>
<td>15. Pressing (cold, hot, finish textile, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Rolling (cold, continuous, strip, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Sintering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Vacuum forming (plastic, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*OTHER SOURCES* *(Label and use throughout the rest of the booklet)*

9.
10. 
...
**MANUFACTURING ACTIVITY SURVEY**

1. Column 1 -- check any activity that YOU have ever performed.
2. Column 2 -- indicate WHERE you learned each checked activity. (see source key)
3. Column 3 -- check any activities that YOUR MANUFACTURING STUDENTS perform.

### SOURCE KEY

1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Texts
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)

*Other -- please number and list at bottom of page*

### G. PRODUCTION SEPARATING ACTIVITIES
(Alphabetic order)

<table>
<thead>
<tr>
<th></th>
<th>COLUMNS 1</th>
<th>COLUMNS 2</th>
<th>COLUMNS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ablading (hand, belt, disc, ...)</td>
<td>(check if you have done)</td>
<td>(source)</td>
</tr>
<tr>
<td>2.</td>
<td>Absorbing (vapor-on-solid, vapor-on-liquid, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Adsorbing (plate tower, sieve tray, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Blasting (sand, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Boring (horizontal, vertical, jig, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Broaching (push, pull, surface, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Brushing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Buffing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Burning (electrical discharge, oxy-fuel, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Centrifuging (tubular bowl, hydrocyclone, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Crushing (cone, hammer, roll, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Distilling (flash, fractional, vacuum, simple, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Drilling (bench, gang, turret, mortise, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Drying (direct, radiant, dielectric, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Etching (photo, chemical, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Evaporating (forced circulation, flash, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Filing (rasp, surform, single cut, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Filtering (hydrostatic, cartridge, vacuum, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Float separating (pneumatic, vacuum, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Grinding (disc, surface, cam, ...)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*OTHER SOURCES* (Label and use throughout the rest of the booklet)

9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
### Manufacturing Activity Survey

1. **Column 1** — check any activity that YOU have ever performed.
2. **Column 2** — indicate WHERE you learned each checked activity. (see source key)
3. **Column 3** — check any activities that YOUR MANUFACTURING STUDENTS perform.

#### Source Key
- 1. High School IA Lab Courses
- 2. College IA Lab Courses
- 3. Student Teaching
- 4. Curriculum Packages/Texts
- 5. Inservice Workshops
- 6. Vocational/Technical Classes
- 7. Work Experience (non-school)
- 8. Work Experience (school related)
- *Other — PLEASE NUMBER AND LIST AT BOTTOM OF PAGE

**G. Production Separating (continued)**

<table>
<thead>
<tr>
<th></th>
<th>Columns 1</th>
<th>Columns 2</th>
<th>Columns 3</th>
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</thead>
<tbody>
<tr>
<td>21. Honing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Induced fracture cutting (glass, ceramic, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Jointing (surface, edge, end, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Leaching (open tank, continuous centrifuge, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Magnetizing (suspended magnet, magnetic drum, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Milling (hand, thread, ram, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Milling (tumble, ring roller, hammer, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Planing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. Polishing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Sawing (circular, band, reciprocating, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. Scraping (hand, cabinet, spoke, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. Screen separating (rotary, vibrating, oscillating)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Sedimenting (batch, tray, continuous, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. Shaping (universal, horizontal, router, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35. Shearing (blanking, punching, notching, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. Stripping (pressure reduction, heat, chemical, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Turning (faceplate, screw-machine, chucking, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Other Sources* (Label and use throughout the rest of the booklet)

9. 
10. 

...
### MANUFACTURING ACTIVITY SURVEY

1. Column 1 — check any activity that YOU have ever performed.
2. Column 2 — indicate WHERE you learned each checked activity. (see source key)
3. Column 3 — check any activities that YOUR MANUFACTURING STUDENTS perform.

#### SOURCE KEY

1. High School IA Lab Courses
2. College IA Lab Courses
3. Vocational/Technical Classes
4. Curriculum Packages/Texts
5. Work Experience (non-school)
6. Work Experience (school related)
7. Other — PLEASE NOTE AND LIST AT BOTTOM OF PAGE

#### H. PRODUCTION COMBINING ACTIVITIES (alphabetical order)

1. Beating (paddle, gate, impeller, ...)
2. Blending (immiscible liquid, agitation, ...)
3. Brazing/soldering
4. Brushing
5. Dip coating
6. Dyeing (electrolytic, diazotizing, pigment, ...)
7. Electroplating (salt bath, organic electrolytic, ...)
8. Enameling (fired, fused, painted, ...)
9. Felting (flocking, ...)
10. Gluing
11. Impregnating (saturate, infuse, permeate, ...)
12. Kneading (batch, continuous, ...)
13. Laminating
14. Mechanical fastening (dowels, nails, screws, ...)
15. Oxide coating (anodizing, ...)
16. Printing (letterpress, offset, screen, ...)
17. Rolling (paint, ...)
18. Spraying (atomizing liquids, hot metal, ...)
19. Welding (arc, oxy-fuel, M.I.G., ...)

*Other SOURCES (Label and use throughout the rest of the booklet)

9.
10.
### MANUFACTURING ACTIVITY SURVEY

1. Column 1 -- check any activity that YOU have ever performed.
2. Column 2 -- indicate WHERE you learned each checked activity. (see source key)
3. Column 3 -- check any activities that YOUR MANUFACTURING STUDENTS perform.

#### SOURCE KEY
1. High School IA Lab Courses
2. College IA Lab Courses
3. Student Teaching
4. Curriculum Packages/Tests
5. Inservice Workshops
6. Vocational/Technical Classes
7. Work Experience (non-school)
8. Work Experience (school related)

*Other -- PLEASE NUMBER AND LIST AT BOTTOM OF PAGE

#### I. PERSONNEL ACTIVITIES

<table>
<thead>
<tr>
<th></th>
<th>CHECK IF YOU HAVE DONE</th>
<th>SOURCE IF YOU LEARNED</th>
<th>CHECK IF YOUR STUDENTS DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Writing job descriptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Recruiting for position vacancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Writing a resume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Applying for employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Interviewing for position vacancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Taking performance tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hiring employees for position vacancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Training employees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Promoting (advancing) employees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Enforcing job performance standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Reprimanding, demoting, discharging employees who fail to maintain performance standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Maintaining personnel records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Organizing a local labor union</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Participating in a collective labor/management bargaining situation</td>
<td></td>
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</tr>
<tr>
<td>15</td>
<td>Participating in a union/management grievance situation</td>
<td></td>
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</tr>
<tr>
<td>16</td>
<td>Establishing an accident prevention program</td>
<td></td>
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<tr>
<td>17</td>
<td>Participating in a simulated retirement situation</td>
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</tr>
</tbody>
</table>

#### OTHER SOURCES

9.  
10.  
...
Is there anything that you would like to tell us about how we can better prepare industrial arts teachers to teach manufacturing at the secondary level? If so, please use this space for that purpose.

Your contribution to this effort is very greatly appreciated. If you would like a summary of results, please print your name and address on the back of the return envelope. (NOT on this booklet)

We will see that you get it when the study is completed.
### Phase II: Mail Survey Variables & Computer Code

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<thead>
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<td>(DBC)</td>
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<td>(DBC)</td>
<td>2: 13-15</td>
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#### 2. Source Frequencies

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<td>2: 57-59</td>
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<td>2: 61-63</td>
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<tr>
<td>2: 65-67</td>
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</tbody>
</table>

#### 3. Degree of Teaching Compatibility (UTC)  

(Independent Variable)
APPENDIX D

FOLLOW-UP CORRESPONDENCE
REMINDER AND THANK YOU POSTCARD
TO ALL OHIO MANUFACTURING ACTIVITY QUESTIONNAIRE RECIPIENTS

OHIO MANUFACTURING ACTIVITY SURVEY
190 W. 19th Ave., Room 200
The Ohio State University
Columbus, OH 43210
DATE

Last week a questionnaire seeking information about your technical background and the types of laboratory activities that your manufacturing students perform was mailed to you.

If you have already completed and returned it to us please accept our sincere thanks. If not, please do so today. Because of the relatively small number of industrial arts teachers who teach manufacturing, it is extremely important that your responses be included in this study if the results are to accurately represent the actual practices of Ohio manufacturing teachers.

If by some chance you did not receive the questionnaire, or it was misplaced, please call me at (614) 422-7471 and I will get another one in the mail to you immediately.

Leonard A. Colelli
Project Director
FOLLOW-UP LETTER FOR SECOND MAILING OF QUESTIONNAIRE

May 1, 1984

(inside address here)
(salutation here)

About three weeks again I wrote to you to gather information about your technical background and the types of laboratory activities that your manufacturing students typically perform. As of today we have not received your completed questionnaire.

This research is being conducted to determine why some Ohio industrial arts teachers teach manufacturing and many others do not. Our research unit has undertaken this survey because we believe that the practices of manufacturing teachers, like yourself, should be taken into account when planning a program to better prepare industrial arts teachers to teach manufacturing.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. Only two percent of secondary level industrial arts teachers teach manufacturing, and all that could be identified were asked to participate in this study. In order for the results of this study to be truly representative of the background and practices of Ohio manufacturing teachers, it is essential that each person return their questionnaire. Please call me at (614) 422-7471 if you have any questions.

Just in case your original questionnaire was misplaced, or never reached you, a replacement is enclosed. Your cooperation is greatly appreciated.

Cordially,

Leonard A. Colelli
Project Director

LAC/er
Enclosure
May 22, 1984

FINAL FOLLOW-UP LETTER TO SECONDARY LEVEL MANUFACTURING TEACHERS

I am writing to you about our study of how industrial arts teachers can be better prepared to teach manufacturing in Ohio secondary schools. We have not yet received your completed manufacturing activity questionnaire.

The large number of questionnaires returned is very encouraging. But, whether we will be able to describe accurately teacher background experiences and current laboratory practices depends upon you and the others who have not yet responded. This is because our past experiences suggest that those of you who have not yet sent in your questionnaire may have quite different characteristics or responses than those who have.

As a former high school manufacturing teacher myself, I can understand that your time is limited. However, this is the first statewide study of this type that has ever been done. Therefore, the results are of particular importance to many teacher educators, state department of education personnel, and local school administrators now considering how to better prepare industrial arts teachers to teach manufacturing. The usefulness of our results depends on how accurately we are able to describe the background and current teaching characteristics of practicing manufacturing teachers like yourself.

It is for these reasons that I am sending this by certified mail to insure delivery. In case our other correspondence did not reach you, a replacement questionnaire is enclosed. May I urge you to complete and return it as quickly as possible.

I'll be happy to send you a copy of the results if you want one. Simply put your name, address, and "copy of results requested" on the back of the return envelope. We expect to have them ready to send early next fall.

Your contribution to the success of this study will be appreciated greatly.

Most Sincerely,

Leonard A. Colelli
Project Director
LEFT TO RESPONDENTS WITH BLANK SURVEY PAGES

(inside address here)
(salutation here)

Thanks for responding to our survey questionnaire. The large number of questionnaires returned so far is very encouraging. Sorry to have to bother you again but --

When we went to key the data from the questionnaires into the computer, we discovered that several people had one or two pages of activities left blank. In many cases, these are the facing pages which evidently stuck together and were never seen.

Since you have gone to the trouble of filling out the rest of the questionnaire, we are hoping that you will not mind responding to the enclosed photocopy pages from your survey booklet. Please send it back in the enclosed envelope at your earliest convenience (we would like to start analyzing the data as soon as possible).

Thanks again for your help.

Cordially,

Leonard A. Colelli
Project Director

LAC/er
Enclosure
APPENDIX E

JACKSON'S MILL PARTICIPANT SURVEY:
SURVEY LETTER, RANDOM SAMPLE,
AND RANK CALCULATIONS
I am currently conducting research to identify major factors that influence the type of laboratory activities that are taught by secondary level industrial arts teachers. One variable of interest is teacher philosophy concerning the purpose of industrial arts.

I need your help to establish a rank order for seven purposes of industrial arts. The purposes must be ranked by the greatest to least amount of laboratory time that should be delegated over the term of an ideal secondary level industrial arts course based on the Jackson's Mill Curriculum Theory.

You are one of a small group of industrial arts educators and curriculum specialists who had the unique opportunity of participating in the Jackson's Mill Symposium. Your participation in this research project is desired because of your knowledge of that curriculum theory.

Below are seven purposes of industrial arts.

- Promoting leisure time interests
- Providing activities with the use of common tools and machines
- Developing industrial/technological problem solving skills
- Increasing consumer knowledge concerning industrial/technological products and processes
- Training for a vocation
- Developing a broad understanding of management, production, and personnel practices in industry/technology
- Helping students make informed career choices

Would you: 1) place a #7 on the line to the left of the purpose that (over the term of the course) should reflect the greatest amount of laboratory activity time; 2) place a #1 on the line of the purpose that should reflect the least (or no) amount of laboratory activity time; 3) rank the remainder 2 through 6 accordingly; and 4) return your response at your earliest convenience?

Thank you for your time and assistance.

Sincerely,

Leonard A. Colelli
Project Director

enclosure:
return envelope

College of Education
RANDOM SAMPLE OF JACKSON'S MILL PARTICIPANTS *

I.D.

1. Dr. Kendall N. Starkweather
   Executive Director
   AMERICAN INDUSTRIAL ARTS ASSOCIATION
   1914 Association Drive
   Reston, VA 22091

2. Dr. Alvin E. Rudinill, Dean
   College of Technology
   EASTERN MICHIGAN UNIVERSITY
   Ypsilanti, MI 48197

3. Dr. Daniel L. Householder, Head
   Department of Industrial Education
   TEXAS A&M UNIVERSITY
   College Station, TX 77843

4. Dr. Frank R. Field
   Coordinator of Graduate Studies
   Industrial Education
   UNIVERSITY OF NEW MEXICO
   Albuquerque, NM 87131

5. Dr. Gary E. Lintereur
   Department of Industry and Technology
   NORTHERN ILLINOIS UNIVERSITY
   DeKalb, IL 60115

6. Mr. James E. Good
   District Supervisor
   Industrial Arts and Vocational Education
   GREECE CENTRAL SCHOOL DISTRICT
   Rochester, NY

7. Dr. Thomas R. Wright
   Department of Industry and Technology
   BALL STATE UNIVERSITY
   Muncie, IN 47306

8. Dr. M. James Benson, Dean
   School of Industry and Technology
   UNIVERSITY OF WISCONSIN-STOUT
   Menomonie, WI 54751

9. Ms. Norma Heasley
   Educational Consultant
   Summit County Board of Education
   973 Harrison Ave.
   Akron, OH 44314

10. Dr. Willis E. Ray (retired)
    56 Westfield Lane
    Palm Coast, FL 32037

ALTERNATES:

Dr. Charles A. Pinder
Industrial Arts Education Program Area
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Blacksburg, VA 24061

Dr. William E. Dugger
Industrial Arts Education Program Area
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Blacksburg, VA 24061

### RANK CALCULATIONS FOR PURPOSE OF INDUSTRIAL ARTS*

<table>
<thead>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total</th>
<th>Ave.</th>
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<tr>
<td>Tools/Machines</td>
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<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
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<td>4</td>
<td>4</td>
<td>51</td>
<td>5.1</td>
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<td>Problem Solving</td>
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<td>5</td>
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<td>6</td>
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<td>6</td>
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<td>6.1</td>
<td>7</td>
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<tr>
<td>Consumer</td>
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#### RANK **★★** PURPOSES OF INDUSTRIAL ARTS

1. Training for a *vocation*
2. Promoting *leisure* time interests
3. Helping students make informed *career* choices
4. Increasing *consumer* knowledge concerning industrial/technological products and processes
5. Providing activities with the use of common *tools* and *machines*
6. Developing a broad understanding of management, *production*, and *personnel* practices in industry/technology
7. Developing industrial/technological *problem solving* skills

*(As per a 50% random sample of Jackson's Mill Symposium participants; N=10)*

**Note: #7 represents the closest proximity to Jackson's Mill Curriculum Theory*
APPENDIX F

RESPONSES OF TELEPHONE SURVEY QUESTION
HOW TO BETTER PREPARE SECONDARY LEVEL I. A. TEACHERS
TO TEACH MANUFACTURING
Responses to the telephone survey question: Do you have any additional information that you feel could be used to better prepare more industrial arts teachers to teach manufacturing?

I. High Degree of Teaching/Theory Compatibility (N = 10)

Set up problem solving situations related to simulated industrial problems that could occur such as worker absenteeism, etc.

Need to provide prospective teachers with an attitude that they will want to teach manufacturing. College level students should be exposed to good positive experiences; they need more direction on how to teach manufacturing. Experiences with packaged programs like IACP allow teachers to reduce the amount of preparation time. Also, workshops with successful manufacturing teachers is very effective.

Young people need to be shown why we need to teach manufacturing. College programs need to incorporate a feeling of worth for the subject area.

Pre-service programs cover manufacturing adequately and state workshops augment it well. Also, summer workshops in manufacturing are offered. The problem does not lie with the universities, they do an adequate job.

The problem lies in monies available to run good manufacturing programs. It is very difficult to acquire funds. Also, there are no standards requiring I.A. in middle schools.

The state should come out with special funding for contemporary programs and university leaders should get out into industry for help. Also local I.A. teachers should go to local manufacturers for help, even if it is only for visitations to the school setting as guest speakers. Teachers should leave college with a pool of local resource people from industry or with a procedure of how to contact industrial resource people.

Teachers must understand the essential elements of industry. They need to know how to form a corporation. Teachers should be taught activities that their students will be doing. Activities dealing with stock sales, mass production, department management, dividends for shareholders, etc. should be set-up in college.

Teachers need more direction at the local level from curriculum coordinators and department heads. Teachers need to be taught how to teach innovative programs at the undergraduate level because they teach as they practice. Also, we need some kind of publicity campaign to educate school boards, supervisors, and department heads.
More I.A. teachers are not actually prepared to teach a unit in manufacturing. Prospective teachers need to be involved in successful manufacturing activities. They also need to be provided with materials proven to work products, jigs, and fixtures to take with them into the school setting.

A book with 100 to 300 simple manufacturing projects cross-references by complexity and categories of material cost should be published. A class can then choose one for production. Plans for jigs and fixtures should be included that aren't too detailed.

Update IACP and projects for high school level. Content OK, but new pictures are needed. Also the tests need to be revised.

II. Medium Degree of Teaching/Theory Compatibility (N = 41)

Keep up-to-date with what is going on in manufacturing.

Push for state standards at the middle school. None currently exist.

More work needs to be done with jigs and fixtures.

More exposure is needed to the real world of industry. Also more field trips, filmstrips or other visual aids concerning different types of industry (coal, petro, chemical, etc.). Further, weekend seminars in manufacturing dealing with the whole set-up for mass production (how to set-up with plans, ideas, and jigs and fixtures to take with them).

Need tool skills first; broad skills in a lot of areas (machines, tools, and materials). Then theory to apply in terms of basic manufacturing concepts. Also, a mini-company course is needed as a capstone involving organization, time cards, labor, etc. Basic tool and machine skills first and then broad manufacturing concepts.

It is very necessary to get industrial experience.

Capital is a problem; also, the product distribution and sales portion of manufacturing causes most problems. Teachers need to be taught typical problems that a manufacturing teacher may run into such as funding, how to actually implement, how to sell the product, etc.

Teachers need training with jigs and fixtures. Also books are needed with mass production product ideas and plans.

We need to get away from ballbat and birdhouse projects, update facilities in CAD/CAM, get rid of the old philosophy in
teacher education programs and get teachers back to school in an industrial setting.

The best way to better prepare industrial arts teachers to teach manufacturing is to implement change at the undergraduate level.

All secondary level students need to have an extra period elective course option added to the school curriculum.

Too much reading in current curriculum packages such as IACP. Mainstreaming is a problem with about 40% of the students unable to read so printed materials are almost out of the question. The answer lies in the use of a video tape machine. A lot of short video sequences demonstrating concepts that are typically confined to textbooks can compensate for the reading disabilities as well as the absenteeism problem that threatens conceptual understanding of group manufacturing processes.

Industrial experience is needed of all bases from internship to student teaching. Perhaps summer credit for working in industry would help. Teachers must have had industrial experience to be able to teach industry. Also it goes back to administrators and what they feel about shop.

Time in industry is most helpful particularly a combination of management and production experiences.

More practical experience is needed before prospective teachers get in the field. Teachers need prior experience setting up a manufacturing program and testing the program with actual students; real or simulated. This experience could be organized in a methods class with actual practice in a cooperating school or laboratory school. Teachers need to have had a successful experience with a proven method.

Teachers need release time from school to visit industrial settings to see current changes because things are changing so quick.

Know the body of knowledge relating to your subject matter, dare to be different and teach to be different than your peers, think big (the kids can handle big ideas) and plan very hard or you will surely fail.

It would be helpful to have industrial experience (combination of management and production) in addition to college courses. Also read alot of articles in professional magazines.
I.A. teachers need industrial training or an apprenticeship in a production setting. Teachers need to be taught how to learn how to learn.

We need updated textbooks. We can't justify buying a textbook published in 1971.

A new textbook is needed for manufacturing. Also special literature needs to be developed for inservice teachers.

There currently is no practice of theory at the undergraduate level. The only dealings at present are to give information.

There is too little money in industrial arts—about 1/3 the amount that vocational education has. Also most prospective teachers don't have the background to set up a manufacturing curriculum. Prospective teachers need to have a pre-set-up course to take with them into the field. A lap series may be good with pull out sections including quizzes, lesson plans, filmstrips, and video cassettes.

We need a course for manufacturing at the undergraduate level. I.A. needs to be related closer to industry in activities. Workshops are very helpful because teachers are able to communicate with other teachers who are teaching.

Manufacturing ought to be covered at the undergraduate level. Hands-on experiences in business activities such as organizing a company are a must.

Teachers have to have tool and machine skills and a sound philosophy at the pre-service level. Workshops help if teachers are willing to work.

Have prospective teachers work in multiple types of industrial areas such as R&D, finance, production, marketing, etc. They also need to develop some management skills on how to control children.

Teachers must have some kind of experience in an industrial setting—class, internship and/or on-the-line training. A prerequisite to this would be a total study of industry in a pre-service manufacturing course. It doesn't have to be a large corporation.

More contact with industry is needed because job related experiences will provide a better feel for what is taught. Also better machine and tool skills are needed.

We were too much on our own in OSU classes. Teachers need to be able to walk out of a pre-service curriculum with something to take into a school setting that is proven to work. Saturday
workshops were very helpful to me for ideas, especially those run by actual classroom teachers.

Change core courses at the teacher education level to manufacturing. There is no relevance to teach traditional skills and no real validity to teach straight theoretical concepts about manufacturing. We need a little of both hands-on experience and conceptual learning about manufacturing at the teacher education level.

Industrial arts teachers need more background in industry in terms of occupational work experience. Perhaps summer internships or twice a week positions for a year duration as a visiting student would accomplish this.

We need courses that teach a broader scope of industrial organization, etc. At the undergraduate level it must be stressed that typical birdhouse courses are not the only emphasis.

The idea of manufacturing as a year long course is an impossibility in an actual school setting. We need to experience short courses in mass production, jigs and fixtures, etc. Undergraduate students leave the program with at least two proven sets of jigs and fixtures to take with them to the school setting.

Too much theory at college and not enough practice (Bowling Green).

Industrial arts teachers need exposure to a manufacturing enterprise at the pre-service level. They need to set-up an enterprise system and participate in field trips to industry.

A capstone course is needed to correlate what is learned in school with actual practice. The course could be set-up as a practicum in industry to see how the whole thing works. Also if we student teach for a semester, we should also be required to complete a semester internship in industry.

III. Low Degree of Teaching/Theory Compatibility (N = 9)

Line supervision courses are needed in colleges. We also need to learn more about jigs and fixtures.

Principals don't really give a damn! Also, workshops are needed to present materials of a less than year duration. Finally, incentives are needed to get teachers to attend the workshops; you can't radically force change on people.

A college intern program into an industrial situation is needed in addition to student teaching.
The major problem lies in the way administrators program industrial arts classes. Can't get anything done in 4-1/2 weeks.

We need to put prospective teachers into an industrial situation in a variety of management and production experiences. Perhaps they could visit a small plant and spend one day at each level or area.

The manufacturing course must be adapted to a semester format and taught at the college level. Students need to develop a curriculum of their own that they can take with them to the school setting that could be implemented in the wood or metal laboratory setting found in typical school buildings. Their curriculum plans should include jigs and fixtures for mass production.
APPENDIX G

RESPONSES OF MAIL SURVEY QUESTION

HOW TO BETTER PREPARE SECONDARY LEVEL I. A. TEACHERS

TO TEACH MANUFACTURING
Responses to the mail survey question: Is there anything that you would like to tell us about how we can better prepare industrial arts teachers to teach manufacturing at the secondary level?

I. High Degree of Teaching Theory Compatibility (N = 10)

Updated workbook and text, updated illustrations in textbooks, gear project booklets move towards high school student, junior and senior high school students seem to do the same type of projects

Have prospective teachers in pre-service curriculum take classes set up as if they were in an actual high school situation. A cap stone course or courses (after specific tool and skill machinery courses) where they actually set up a company, design finance market, and distribute a product as it is done in industry.

Have industrial co-op programs set up in addition to student teaching which require a student to get a "big picture" (broad) of industry possibly as summer jobs each summer prior to student teaching.

In order for manufacturing as a curriculum to succeed, teachers must believe that there is a need to communicate that content to students.

Teach the teachers as we are teaching the high school students. Teach them how to set up a corporation and everything involved with manufacturing and selling a product. They should also have hands-on experiences with various materials.

Teachers should also be exposed to all levels of management and labor and a study of unionism.

I learned most of the activities in a summer World of Manufacturing class. I think a longer course where more time could be spent to go to more depth on some activities would be very helpful.

Time needs to be spent learning to solve problems in implementing production activities in a school shop.

II. Medium Degree of Teaching/Theory Compatibility (N = 41)

Because of the wide background of each student, teach the I. A. teacher student the way and the processes you would like them to teach. Stay at a level that is high school or below. Remember most shops are not and will never be equipped to the degree of a college or university. I feel the old saying that an I. A. teacher must be a "Jack of all trades and master of none" is more important than most people realize.

I believe the low number of teachers who are teaching manufacturing is due to the fact that great numbers of college students do now first work in the fields of industry. Why not give credit for those students who have [industrial work experience] or induce those students to ask the employer to give evaluation of their work—in lieu of a lesser class.
I meet with 6 classes which have 30-35 students for a 12 week duration. What I need is up-to-date textbooks and lab manuals. Lab activities, working with equipment and supplies is very difficult.

Getting students involved in a small business of their own, would really bring home many of the manufacturing concepts.

Comment on questionnaire—Because of our sem. time limit, some of the activities listed are omitted but were more time available, additional activities would be included. Other activities are discussed but because of time factor there is not an activity to go with the discussion. These were not marked on the questionnaire. The questionnaire did not address itself to historical development of mfg. which is included in our course.

Although high student skill in using tools and materials may not be necessary for students in manufacturing, the teacher should have tool and machine skill to produce classroom materials etc. and to be able to teach the skills when necessary for a process required on a production product.

Instilling in students the idea that teaching IA is not always an 8-3 activity and outside effort is going to be required to be successful and to give their students a positive experience in their IA exposure

1. Keep textbook specific and on target! Students at the Jr. High level are "lost" with vague generalities.
2. Keep projects short and to the point--10 day projects seem to work best.
3. Projects should have high student appeal.
4. Projects usually considered too difficult for Jr. High can be greatly simplified with correct jigs and fixtures to help insure high student success. Student success is IMPORTANT.
5. Back up the textbook during teacher demonstrations while in the shop show "why we studied" the textbook.
6. Don't expect more out of the students than the teacher is willing to give! The IACP program for example is far more demanding of the teacher than "general shop"--I know, I've done both!
7. I see a need for lots of individual one week type workshops (for graduate credit) that I.A. teachers can participate in--no "B.S.," forget philosophical papers to write, etc., and get down to the business of how to teach!!

Since Industrial Arts Education has separated into construction and manufacturing, curriculum has drifted further into the area of business ed. and away from Industrial Technology. We should concentrate more on the development of technical skills and less economics.

I personally got "turned on" to manufacturing during my student teaching experience. Here I see how it really works vs. how it is sometimes taught in college.

I feel it's a excellent unit to teach if for no other reason than it's so cost effective! There is virtually no expense to the
school district for materials/supplies as the students pay for this from the capital earned selling stock.

1. Be organized
2. Plan ahead
3. Let the students—do the work you control—steer them where you want to go
4. Introduce careers, this is important
   a) Vo. Ed. schools
   b) Tech schools
   c) College
   Don't dwell on one educational system
5. Display past prototypes
6. Have 1 or 2 shop ass't to help
7. Safety test covering machines 90 % or better before students work

Workshop on the subject headed by industry in cooperation with education

The trouble is--not every IA teacher goes to OSU--and to my knowledge you are the only ones who teach manufacturing.

Many things have been learned by trial and error. I'm sure that many other manufacturing teachers are in the same predicament.

Teach them the reality of trying to implement all of this textbook theory.

To better prepare any Student Teacher for any teaching experience, should have more practical experience. More on job training. The student teacher should have a solid background in Ind. Arts type experiences from jr. high on through college. This background is very important to becoming a successful and consistant Ind. Arts teacher. People who jump from one field of work and try Ind. Arts teaching, with no previous background from before schooling other than college, usually do not succeed in the field.

Also, better preparing the student teacher for the type of student he will be facing could be of considerable help.

Try to expose prospective educators to more real life manufacturing situations through historic, field trips, research, etc.

I learned most of the mfg. teaching skills on my own about 18 years ago. I made a 16 mm documentation film which eventually was used in part as a part of the OIAA promotional film.

Future problems in I.A. do not lie in material to teach; but, lack of standards to insure that they are taught.

Keeping up-to-date on production processes! This year C.N.C.--what next year?
Gentlemen,

My greatest problem in operating a successful I.A. Program is MONEY. My budget for the '82-'83 school year was $125. This figure has gone from $900, 1970-71, for consumables to a grand total of $0 for the '80-'81 school year. I believe we need more supervision from outside the district to see that we teachers have a budget, other than our own pocketbook, to work with. My wife teaches 1st grade and I I.A. 7-12. On our 1983 taxes we supplemented the district some $1200 for supplies bought for the classroom. This is not right. We need help.
APPENDIX H

PROFILES OF MANUFACTURING LABORATORY ACTIVITIES
IN OHIO SECONDARY SCHOOLS
(COMPOSITE, HIGH, LOW)
Profiles of Manufacturing Laboratory Activities in Ohio Secondary Schools (Composite, High, Low)

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<tr>
<th>Composite</th>
<th>High DTC</th>
<th>Low DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>% of 60 responders</td>
<td>f</td>
</tr>
</tbody>
</table>

### A. ORGANIZING AND FINANCING A COMPANY

1. Electing a board of directors: 8 | 80.0 | 1 | 0.0 |
2. Selecting a product for production: 10 | 100.0 | 5 | 55.6 |
3. Selecting a company name: 10 | 100.0 | 0 | 0.0 |
4. Designing a company trademark (logo): 8 | 80.0 | 0 | 0.0 |
5. Adopting bylaws for the company: 2 | 20.0 | 0 | 0.0 |
6. Organizing a top management team: 9 | 90.0 | 0 | 0.0 |
7. Obtaining a state charter: 3 | 30.0 | 0 | 0.0 |
8. Estimating fixed costs (wages, overhead, ...): 8 | 80.0 | 3 | 33.3 |
9. Estimating variable (material) costs: 8 | 80.0 | 2 | 22.2 |
10. Pricing the product: 9 | 90.0 | 3 | 33.3 |
11. Calculating number of stock sales for start-up costs: 7 | 70.0 | 1 | 11.1 |
12. Selling stock or obtaining loans for start-up costs: 8 | 80.0 | 1 | 11.1 |
13. Keeping corporate records: 8 | 80.0 | 1 | 11.1 |
14. Calculating profit/loss margins: 9 | 90.0 | 0 | 0.0 |
15. Constructing a break-even chart: 7 | 70.0 | 0 | 0.0 |
16. Estimating dividend payments: 9 | 90.0 | 0 | 0.0 |
17. Preparing financial reports: 7 | 70.0 | 0 | 0.0 |
18. Liquidating the company: 9 | 90.0 | 0 | 0.0 |

### B. DESIGNING AND ENGINEERING PRODUCTS

1. Sketching product ideas (thumbnails, ...): 10 | 100.0 | 8 | 88.9 |
2. Constructing three-dimensional mockups (paste-up, appearance, ...): 9 | 90.0 | 6 | 66.7 |
3. Drawing product specifications (details, multi-views, assemblies, ...): 9 | 90.0 | 7 | 77.8 |
4. Writing parts specifications: 7 | 70.0 | 2 | 22.2 |
5. Building production prototypes: 10 | 100.0 | 6 | 66.7 |
<table>
<thead>
<tr>
<th>% of Responders</th>
<th>Activity</th>
<th>High DTC % of Responders</th>
<th>Low DTC % of Responders</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>71.7</td>
<td>6. Testing production prototypes</td>
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<tr>
<td>41</td>
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<td>7. Revising design specifications</td>
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<td>27</td>
<td>33.3</td>
<td>8. Presenting design alternatives to management</td>
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<tr>
<td>20</td>
<td>33.3</td>
<td>9. Designing product packaging</td>
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<td>12</td>
<td>20.0</td>
<td>10. Writing/illustrating product instruction manuals</td>
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C. PRE - AND POST - PROCESSING ACTIVITIES

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<td>24</td>
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<td>1. Receiving and unpacking equipment and supplies</td>
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<td>2. Storing equipment and supplies in appropriate locations (flammables, perishables, ...)</td>
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<td>25</td>
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<td>3. Altering products to meet individual specifications (special attachments, personalized designs, ...)</td>
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<td>21</td>
<td>35.0</td>
<td>4. Packaging products</td>
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<td>17</td>
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<td>5. Installing products (library bookshelves, doors, electrical recepticles, auto parts, ...)</td>
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<tr>
<td>26</td>
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<td>6. Maintaining tools, equipment, appliances, ..., on a periodic basis</td>
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<tr>
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<td>7. Repairing non-functioning tools, equipment, appliances, ...</td>
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D. RESEARCHING AND MARKETING ACTIVITIES

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<th>Low DTC % of Responders</th>
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<td>48</td>
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<td>1. Retrieving information from books, magazines, ...</td>
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<td>34</td>
<td>56.7</td>
<td>2. Experimenting with materials, processes and/or products</td>
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<td>30</td>
<td>50.0</td>
<td>3. Identifying consumer demands (consumer survey)</td>
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<tr>
<td>24</td>
<td>40.0</td>
<td>4. Reporting market findings (market research report)</td>
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<td>15</td>
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<td>5. Making a sales forecast</td>
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<td>18</td>
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<td>6. Developing a sales program</td>
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<tr>
<td>Composite</td>
<td>High DTC</td>
<td>Low DTC</td>
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<td>90.0</td>
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**E. PLANNING PRODUCTION**

1. Preparing operation sheets
2. Developing a production flow chart
3. Developing route sheets
4. Designing laboratory floor plan for efficient routing
5. Requisitioning equipment and materials
6. Organizing a mechanical materials handling system (assembly lines, escalators, slides, ...)
7. Automating production processes with programmed control devices (NC machines, robotics, ...)
8. Fabricating special jigs, fixtures, templates, ...
9. Testing the production set-up
10. Fabricating inspection gages, and other quality control measuring devices
11. Conducting time and motion studies
12. Conducting supply inventories

| % of responders | f | % of responders | f |
| 46 | 60.0 | 40.0 | 0 |
| 36 | 60.0 | 10.0 | 0 |
| 33 | 55.0 | 90.0 | 1 |
| 22 | 36.7 | 60.0 | 1 |
| 19 | 31.7 | 40.0 | 0 |
| 2 | 3.3 | 10.0 | 0 |
| 44 | 73.3 | 100.0 | 3 |
| 44 | 73.3 | 100.0 | 4 |
| 31 | 51.7 | 90.0 | 1 |
| 10 | 16.7 | 20.0 | 0 |
| 14 | 23.3 | 20.0 | 1 |
### F. PRODUCTION FORMING ACTIVITIES

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<th>% of responders</th>
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### F. PRODUCTION FORMING ACTIVITIES (continued)

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### G. PRODUCTION SEPARATING ACTIVITIES

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**H. PRODUCTION COMBINING ACTIVITIES**

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APPENDIX I

COMPUTER PROGRAMS FOR
DATA ANALYSIS
Variable List and Data

DATA LIST RECORDS=2 FIXED/L IDA 1-5 CARDA 6 CITY 7 EXVILL 8
COUNTY 9 NOMPUR 10 LEVTEAC 13 SIZE 15 NQMPUR 19 NTA 22
TYIAAC 23 NOSMNC 25 AVEFAC 27 PERCENT 29-31
ROTPERI 33 ACAABIL 35 FREEDOM 37 BUDGET 39 PREPER 41
NOTPER 43 AGE 45 TEACEXP 47 PROD 57 LEFISER 59 PROP 61 GPA 63
PROMEM 65 PUPRE 67 /2 IDB 1-5 CAP 6 DBC 7-9 DMC 11-13
DPC 15-17 DPERC 19-21 HSLAB 25-27 INCLAB 29-31 STUTAC 33-35
CPACK 37-39 INSERV 41-43 VOCED 45-47 WORKNON 49-51 WORKSCH 53-55
OTHER 57-59 DTC 61-63

1. 1549511121 1 2 2 6 2 3 0 2 050 2 3 4 1 3 0 4 3 1 3 4 41211 3 3 0 6
2. 154952059 063 049 006 000 049 000 000 000 000 001 000 000 047
3. 2012312111 1 2 2 6 2 5 0 0 083 5 3 4 1 3 0 5 6 1 6 1 10002 3 4 6 7
4. 201232071 061 023 006 022 034 060 032 033 000 000 046 000 034
5. 2332512111 2 4 4 3 1 0 2 020 1 3 4 6 4 1 0 6 2 6 1 4210 4 3 6 7
6. 233252064 074 032 088 000 018 000 021 001 000 000 000 000 053
7. 3260711121 2 1 2 4 4 1 0 3 025 2 2 4 1 5 3 5 4 1 21212 2 2 5 6
8. 326072088 074 073 047 028 036 000 036 009 002 078 043 000 068
9. 351962065 074 038 012 000 028 000 005 000 000 036 022 003 049
10. 351962065 074 038 012 000 028 000 005 000 000 036 022 003 049
11. 3536011121 2 1 2 6 2 2 0 3 033 1 3 4 6 3 2 4 3 3 5 11212 2 2 6 6
12. 353602059 059 047 024 011 030 000 036 003 001 017 028 000 050
13. 3911512111 1 3 2 5 2 5 0 3 100 2 3 4 1 2 1 5 6 1 6 1 21214 4 2 6 6
14. 391152064 074 034 066 003 025 000 000 000 000 000 000 014 054
15. 3969311121 2 1 2 6 2 2 0 4 033 4 3 4 2 3 3 3 2 2 1 2126 2 2 5 7
16. 396932093 039 047 000 000 084 000 084 000 000 000 000 000 047
17. 6132512111 2 4 3 5 3 1 0 2 020 1 0 4 3 3 3 2 1 1 4 11212 5 4 6 6
18. 613252076 080 041 035 009 028 005 050 003 000 053 018 015 055
19. 6133311121 2 4 4 6 3 2 0 3 033 1 2 4 3 3 1 1 1 11113 2 1 4 1
20. 613332080 091 031 076 059 068 003 001 001 001 007 006 000 059
21. 12972056 037 034 066 003 025 000 000 000 000 000 000 034 051
22. 12972056 037 034 066 003 025 000 000 000 000 000 000 034 051
23. 0340111121 1 2 1 5 3 2 0 2 040 2 4 4 2 4 2 5 6 2 6 6 11212 3 2 3 6
24. 034002060 089 045 059 018 022 001 026 000 000 026 030 000 059
25. 0477011121 2 1 1 6 6 1 0 1 017 1 3 4 1 3 0 2 2 2 5 21211 2 2 6 6
26. 047702051 046 034 029 000 049 003 000 003 000 000 000 000 038
27. 0517311121 2 2 1 5 5 1 0 2 020 2 3 4 1 3 5 2 3 1 1 6 21123 2 3 4 6
28. 051732067 046 036 006 026 056 006 000 002 011 037 022 000 037
29. 0539712111 1 2 2 6 2 4 0 2 026 7 3 4 3 3 2 3 4 2 3 1 11211 3 2 5 5
30. 053972061 035 026 035 010 052 003 010 000 000 030 033 000 030
PROGRAM 1
Pearson Correlation Matrix Program
of All Independent and Dependent Variables

1. // JOB ,
2. // REGION=1024K
3. /*JOBPARM LINES=10000
4. // EXEC SAS
5. //SYSIN DD *
6. DATA ONE;

** 120 lines of data inserted here

138. PROC PRINT;
139. PROC CORR;
140. VAR CITY--PURPIA DBC--DTC;
141. //
PROGRAM 2

Semi-Partial Multiple Regression Program

for Sets of Independent Variables, Specific Context Variables, and Specific Presage Variables

Significantly Correlated with Degree of Teaching Compatibility

1. // JOB
2. // REGION=1924K
3. /*JOBPARM LINES=10000
4. // EXEC SAS
5. //SYSIN DD *
6. DATA ONF;
7. INPUT IDA 1-5 CARDA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUB 10
8. LEVTEAC 13 SIZESCH 15 NOIATEA 17 NOIA COR 19 TYIA COR 21
9. NOMASEC 23 NONONIA 25 AVE SIZE 27 PERCENT 29-31 ROTPERI 33
10. ACAABIL 35 FREEDOM 37 BUDGET 39 PREPPER 41 NONTEACH 43
11. AGE 45 TEAC EXP 47 NOSYSEM 49 PRESPOS 51 SUPEMPL 53
12. YEAR IND 55 MGM 56 PROD 57 PFERS 58 LEISURE 59 PROPREP 61
13. GPA 63 PROF MEM 65 PURPIA 67 #2 JOB 1-5 CARDB 6 DBC 7-9
14. DMC 11-13 DPC 15-17 OPERC 19-21 HSLAB 25-27 CO LAB 29-31
15. STUTEAC 33-35 CPACK 37-39 INSERV 41-43 VOCED 45-47
16. WKRKNON 49-51 WORK SCH 53-55 OTHER 57-59 DTC 61-63;
17. CARDS;

** 120 lines of data inserted here

138. PROC PRINT;
139. PROC GLM;
140. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER NOSYSEM PROFMEN
141. DBC;
142. PROC GLM;
143. MODEL DTC=NOSYSEM PROFMEN DBC;
144. PROC GLM;
145. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER DBC;
146. PROC GLM;
147. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER NOSYSEM PROFMEN;
148. PROC GLM;
149. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER;
150. PROC GLM;
151. MODEL DTC=COUNTY FREEDOM PREPPER;
152. PROC GLM;
153. MODEL DTC=COUNTY FREEDOM PREPPER;
154. PROC GLM;
155. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER;
157. PROC GLM;
158. MODEL DTC=COUNTY ROTPERI FREEDOM;
159. PROC GLM;
160. MODEL DTC=PROFMEM;
161. PROC GLM;
162. MODEL DTC=NOSYSEM;
163. //
PROGRAM 3
Stepwise Multiple Regression Program
for Independent Variables Significantly Correlated with Degree of Teaching Compatibility

1. // JOB,
2. // REGION=512K
3. // EXEC SPSSX
4. // SYSIN DD *
5. DATA LIST RECORDS=2 FIXED I.CITY 7 COUNTY 9 ROTPERI 33 FREEDOM 37
   PREPPER 41 NOSYSEM 49 PROFMEM 65 /2 DBC 7-9 DTC 61-63
6. BEGIN DATA
   ** 120 lines of data inserted here

128. END DATA
129. REGRESSION VARIABLES=DTC COUNTY ROTPERI FREEDOM NOSYSEM
130. .PREPPER PROFMEM DBC/
131. .DEPNDENT=DTC/STEPWISE/
132. .
PROGRAM 4

Semi-Partial Multiple Regression Program
for Sets of Independent Variables with Degree of Teaching Compatibility
Relacing DBC with a Set of Specific Source Variables
Significantly Correlated With DTC

```sas
1. // JOB 
2. // REGION=1024K 
3. /*JOB PARM LINES=10000 
4. // EXEC SAS 
5. // SYSIN DD * 
6. DATA ONE; 
7. INPUT IDA 1-5 CARNA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUB 10 
8. LEVTEAC 13 SIZESCH 15 NOIATEA 17 NOIACOR 19 TYIACOR 21 
9. NWASEC 23 NONDONA 25 AVFSIZE 27 PERCENT 29-31 PCTPFRI 33 
10. ACAAOIL 35 FREEDOM 37 BUDGET 39 PREPPER 41 NONTEACH 43 
11. AGE 45 TEACEXP 47 NOSYSEM 49 PRESPUS 51 SUPEMPL 53 
12. YEARND 55 MCH 56 PRED 57 PERS 58 LEISURE 59 PREPPEP 61 
13. GPA 63 PROFMEN 65 PURPIA 67 #2 IDA 1-5 CAROB 6 DBC 7-9 
15. SUITEAC 33-35 CPACK 37-39 INSERV 41-43 VMCFD 45-47 
16. WORKCN 49-51 WORKSCH 53-55 OTHER 57-59 DTC 61-61; 
17. ** 120 lines of data inserted here 
130. PROC PRINT; 
131. PROC GLM; 
132. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER NOSYSEM PROFMEN 
133. CPACK WORKN0N OTHER; 
134. PROC GLM; 
135. MODEL DTC=NOSYSEM PROFMEN CPACK WORKN0N OTHER; 
136. PROC GLM; 
137. MODEL DTC=COUNTY ROTPERI FREEDOM PREPPER CPACK WORKN0N OTHER; 
138. PROC GLM; 
139. MODEL DTC=COUNTY ROYPERI FREEDOM PREPPER NOSYSEM PROFMEN; 
140. PROC GLM; 
141. MODEL DTC=CPACK WORKN0N OTHER; 
142. PROC GLM; 
143. MODEL DTC=WORKN0N OTHER; 
144. PROC GLM; 
145. MODEL DTC=CPACK OTHER; 
146. PROC GLM; 
147. MODEL DTC=CPACK WORKN0N; 
148. //
```
PROGRAM 5

Semi-Partial Multiple Regression Program
for Background Source Variables with Degree of Background Compatibility
Using Background Sources Significantly Correlated With DBC

1. // JOB
2. // REGION=1024K
3. /*JOBPAPM LINES=10000
4. // EXEC SAS
5. //SYSIN DO *
6. DATA ONE;
7. INPUT IDA 1-5 CAROA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUB 10
8. LEVTEAC 13 SIZESCH 15 NOIATEA 17 NOIACOR 19 TYIACOR 21
9. NOMASEC 23 NONONIA 25 AVESIZE 27 PEBCENT 29-31 ROPPERI 33
10. ACAABIL 35 FREEDOM 37 BUDGET 39 PREPPP 41 NONTEACH 43
11. AGE 45 TEACEXP 47 NOSYSEM 49 PREPOS 51 SUPER 53
12. YEAPIND 55 MGM 56 PROD 57 PERS 58 LEISURE 59 PROPREP 61
13. GPA 63 PROFMEM 65 PURP 67 #2 IDB 1-5 CARDB 6 DBC 7-9
15. STUTEAC 33-35 CPACK 37-39 INSERV 41-43 VOCED 45-47
16. WORKNON 49-51 WORKSCH 53-55 OTHER 57-59 DTC 61-63;
17. CARDS;

** 120 lines of data inserted here

138. PROC PRINT;
139. PROC GLM;
140. MODEL DBC=COLAB CPACK INSERV WORKNON WORKSCH;
141. PROC GLM;
142. MODEL DBC=CPACK INSERV WORKNON WORKSCH;
143. PROC GLM;
144. MODEL DBC=COLAB INSERV WORKNON WORKSCH;
145. PROC GLM;
146. MODEL DBC=COLAB CPACK WORKNON WORKSCH;
147. PROC GLM;
148. MODEL DBC=COLAB CPACK INSERV WORKSCH;
149. PROC GLM;
150. MODEL DBC=COLAB CPACK INSERV WORKNON;
151. //
PROGRAM 6
Semi-Partial Multiple Regression Program
for Background Source Variables with Degree of Management Compatibility

1. // JOB,
2. // REGION=1024K
3. /*JOBPARM LINES=10000
4. // EXEC SAS
5. // SYSIN DD *
6. DATA ONE;
7. INPUT IDA 1-5 CAROA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUB 10
8. LEVTEAC 13 SIZESCH 15 NOIATEA 17 NOIACOR 19 TYIACOR 21
9. NOMASEC 23 NONONIA 25 AVESIZE 27 PERCENT 29-31 ROTPERI 33
10. ACAABIL 35 FREEDOM 37 BUDGET 39 PREPPER 41 NONTEACH 43
11. AGE 45 TEACEXP 47 NOSYSEM 49 PRESPOS 51 SUPERMPL 53
12. YEARND 55 MGM 56 PERS 58 LEISURE 59 PROPREP 61
13. GPA 63 PROFMEM 65 PURPIA 67 #2 IDA 1-5 CARDB 6 DMC 7-9
15. STUTEAC 33-35 CPACK 37-39 INSERV 41-43 VOCED 45-47
16. WORKNON 49-51 WOPKSCH 53-55 OTHER 57-59 DTC 61-63;
17. CARDS;

** 120 lines of data inserted here

138. PROC PRINT;
139. PROC GLM;
140. MODEL DMC=ROTPERI FREEDOM PREPPER NOIACOR NOIATEA PROPREP
141. GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC CPACK INSERV VOCED
142. WORKNON WOPKSCH OTHER;
143. PROC GLM;
144. MODEL DMC=PROPREP GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC
145. CPACK INSERV VOCED WORKNON WOPKSCH OTHER;
146. PROC GLM;
147. MODEL DMC=ROTPERI FREEDOM PREPPER NOIATEA NOIACOR HSLAB COLAB
148. STUTEAC CPACK INSERV VOCED WORKNON WOPKSCH OTHER;
149. PROC GLM;
150. MODEL DMC=ROTPERI FREEDOM PREPPER NOIATEA NOIACOR PROPREP GPA
151. NOSYSEM PROFMEM;
152. PROC GLM;
153. MODEL DMC=COLAB STUTEAC CPACK INSERV VOCED WORKNON WOPKSCH OTHER;
154. PROC GLM;
155. MODEL DMC=HSLAB STUTEAC CPACK INSERV VOCED WORKNON WOPKSCH OTHER;
156. PROC GLM;
157. MODEL DMC=COLAB STUTEAC CPACK INSERV VOCED WORKNON WOPKSCH OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC INSERV VOCED WORKNON WORKSCH OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK VOCED WORKNON WORKSCH OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV WORKNON WORKSCH OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCFD WORKSCH OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCFD WORKNON OTHER;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
PROC GLM;
MODEL DMC=PROPREP NOSYSEM PROFMEM;
PROC GLM;
MODEL DMC=PROPREP NOSYSEM PROFMEM;
PROC GLM;
MODEL DMC=PROPREP GPA PROFMEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=PROPREP GPA NOSYSEM;
PROC GLM;
MODEL DMC=ROTPERI PREPPER NOIAITEA NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI PREPPER NOIAITEA NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI FREEDOM NOIAITEA NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI FREEDOM NOIAITEA NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI FREEDOM PREPPER NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI FREEDOM PREPPER NOIACOR;
PROC GLM;
MODEL DMC=ROTPERI FREEDOM PREPPER NOIAT EA;
//
PROGRAM 7
Semi-Partial Multiple Regression Program
for Background Source Variables with Degree of Production Compatibility

1. // JOB ,
2. // REGION=1024K
3. // JOBPARM LINES=10000
4. // EXEC SAS
5. // SYSPIN DD *
6. // DATA ONE;
7. INPUT IDA 1-5 CARDA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUB 10
8. LEVTEAC 13 SIZESCH 15 NOIATEA 17 NOIACOR 19 TIYACOR 21
9. NOMASEC 23 NONONIA 25 AVESIZE 27 PERCENT 29-31 ROTPERI 33
10. ACAABIL 35 FREEDOM 37 BUDGET 39 PREPPER 41 NONTEACH 43
11. AGE 45 TIACEXP 47 NOSYSEM 49 PRESPOS 51 SUPEMPL 53
12. YEAR IND 55 MGM 56 PROD 57 PERS 58 LEISURE 59 PROPREP 61
13. GPA 63 PROFMEM 65 PURPIA 67 #2 IDB 1-5 CARDB 6 DBC 7-9
15. STUTEAC 33-35 CPACK 37-39 INSERV 41-43 VOCED 45-47
16. WORKNCN 49-51 WORKSCH 53-55 OTHER 57-59 DTC 61-63;
17. CARDSC:

** 120 lines of data inserted here

138. PRCC PRINT;
139. PROC GLM;
140. MODEL DPC=ROTPERI FREEDOM PREPPER NOIACOR NOIATEA PROPREP
141. GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC CPACK INSERV VOCED
142. WORKNON WORKSCH OTHER;
142. PROC GLM;
142.2 MODEL DPC=ROTPERI FREEDOM PREPPER NOIACOR NOIATEA;
142.3 PROC GLM;
142.4 MODEL DPC=PROPREP GPA NOSYSEM PROFMEM;
142.5 PROC GLM;
142.6 MODEL DPC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON
142.7 WORKSCH OTHER;
143. PROC GLM;
144. MODEL DPC=PROPREP GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC
145. CPACK INSERV VOCED WORKNON WORKSCH OTHER;
146. PROC GLM;
147. MODEL DPC=ROTPERI FREEDOM PREPPER NOIATEA NOIACOR HSLAB COLAB
148. STUTEAC CPACK INSERV VOCED WORKNON WORKSCH OTHER;
**149.** PROC GLM;
**150.** MODEL DPC=RUTPERI FREDDOM PREPPER NOIATEA NOIACOR PROPREP GPA NOASYSEM PROFMEM;
**151.** PROC GLM;
**152.** MODEL DPC=COLAB STUTEAC CPACK INSERV VECED WORKNON WORKSCH OTHER;
**153.** PROC GLM;
**154.** MODEL DPC=HSLAB STUTEAC CPACK INSFRV VECED WORKNON WORKSCH OTHER;
**155.** PROC GLM;
**156.** MODEL DPC=HSLAB COLAB CPACK INSERV VECED WORKNON WORKSCH OTHER;
**157.** PROC GLM;
**158.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**159.** PROC GLM;
**160.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**161.** PROC GLM;
**162.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**163.** PROC GLM;
**164.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**165.** PROC GLM;
**166.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**167.** PROC GLM;
**168.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**169.** PROC GLM;
**170.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**171.** PROC GLM;
**172.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**173.** PROC GLM;
**174.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**175.** PROC GLM;
**176.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**177.** PROC GLM;
**178.** MODEL DPC=HSLAB COLAB STUTEAC CPACK VECED WORKNON WORKSCH OTHER;
**179.** PROC GLM;
**180.** MODEL DPC=FREFDOM PREPPER NOIATEA NOIACOR;
**181.** PROC GLM;
**182.** MODEL DPC=ROTPERI PREPPER NOIATEA NOIACOR;
**183.** PROC GLM;
**184.** MODEL DPC=ROTPERI FREDDOM NOIATEA NOIACOR;
**185.** PROC GLM;
**186.** MODEL DPC=ROTPERI FREDDOM PREPPER NOIATEA;
**187.** PROC GLM;
**188.** MODEL DPC=ROTPERI FREDDOM PREPPER NOIATEA;
PROGRAM 8

Semi-Partial Multiple Regression Program
for Background Source Variables with Degree of Personnel Compatibility

1. // JCR
2. // REGION=1024K
3. /*JOBPARM LINES=10000
4. // EXEC SAS
5. //SYSIN DD *
6. DATA ONE;
7. INPUT IDA 1-5 CARDA 6 CITY 7 EXVILL 8 COUNTY 9 NONPUR 10
8. LEVTEAC 13 SIZESCH 15 NOITAE 17 NIACOR 19 TIAACOR 21
9. NONASCEC 23 NONONIA 25 AVESIZE 27 PERCENT 29-31 ROPPER 33
10. ACAARIL 35 FREEDOM 37 BUDGET 39 PREPPER 41 NONTEACH 43
11. AGE 45 TEACEXP 47 NOSYSEM 49 PRESPOS 51 SUPEMPL 53
12. YEARIND 55 MGM 56 PROD 57 PERS 58 LEISURE 59 PROPREP 61
13. GPA 63 PROFMEM 65 PURPIA 67 #2 IR 1-5 CARDB 6 DBC 7-9
15. STUTEAC 33-35 CPACK 37-39 INSERV 41-43 VOCED 45-47
16. WORKNON 49-51 WORKSCH 53-55 OTHER 57-59 DTC 61-63;
17. CARDS;

** 120 lines of data inserted here

138. PROC PRINT;
139. PROC GLM;
140. MODEL DPERC=ROPERI PREPER NIACOR NOITAEA PROPREP
141. GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC CPACK INSERV VOCED
142. WORKNON WORKSCH OTHER;
143. PROC GLM;
144. MODEL DPERC=PROPREP GPA NOSYSEM PROFMEM HSLAB COLAB STUTEAC
145. CPACK INSERV VOCED WORKNON WORKSCH OTHER;
146. PROC GLM;
147. MODEL DPERC=ROPERI PREPER NIITAEA NIACOR HSLAB COLAB
148. STUTEAC CPACK INSERV VOCED WORKNON WORKSCH OTHER;
149. PROC GLM;
150. MODEL DPERC=ROPERI FREEDOM PREPER NIITAEA NIACOR PROFMEM
151. GPA NOSYSEM PROFMEM;
152. PROC GLM;
153. MODEL DPERC=COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH OTHER;
154. PROC GLM;
155. MODEL DPERC=HSLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH OTHER;
156. PROC GLM;
157. MODEL DPERC=HSLAB COLAB CPACK INSERV VOCED WORKNON WORKSCH OTHER;
158. PROC GLM;
159. MODEL DPERC=HSLAB COLAB STUTEAC INSERV VOCED WORKNON WORKSCH OTHER;
160. PROC GLM;
161. MODEL DPERC=HSLAB COLAB STUTEAC CPACK VOCED WORKNON WORKSCH OTHER;
162. PROC GLM;
163. MODEL DPERC=HSLAB COLAB STUTEAC CPACK INSERV WORKNON WORKSCH OTHER;
164. PROC GLM;
165. MODEL DPERC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKSCH OTHER;
166. PROC GLM;
167. MODEL DPERC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON OTHER;
168. PROC GLM;
169. MODEL DPERC=HSLAB COLAB STUTEAC CPACK INSERV VOCED WORKNON WORKSCH;
170. PROC GLM;
171. MODEL DPERC=GPA NOSYSEM PROFMEM;
172. PROC GLM;
173. MODEL DPERC=PROPREP NOSYSEM PROFMEM;
174. PROC GLM;
175. MODEL DPERC=PROPREP GPA PROFMEM;
176. PROC GLM;
177. MODEL DPERC=PROPREP GPA NOSYSEM;
178. PROC GLM;
179. MODEL DPERC=FEEDOM PREPPER NOIATEA NOIACOR;
180. PROC GLM;
181. MODEL DPERC=ROTPERI PREPPER NOIATEA NOIACOR;
182. PROC GLM;
183. MODEL DPERC=ROTPERI FEEDOM NOIATEA NOIACOR;
184. PROC GLM;
185. MODEL DPERC=ROTPERI FEEDOM PREPPER NOIACOR;
186. PROC GLM;
187. MODEL DPERC=ROTPERI FEEDOM PREPPER NOIATEA;
188. //
APPENDIX J

DESCRIPTIVE TABLES FOR
CATEGORICAL AND CONTINUOUS VARIABLES
Table 22

Grouped Frequency Distribution for Age (AGE) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 21-25</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>2) 26-30</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>3) 31-35</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>4) 36-40</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>5) 41-45</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>6) 46 or More</td>
<td>11</td>
<td>18.3</td>
</tr>
<tr>
<td><strong>N = 60</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 23

Grouped Frequency Distribution for Number of Years Teaching Experience (TEACEXP) of Manufacturing Teachers

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 0-3</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>2) 4-6</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>3) 7-9</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>4) 10-12</td>
<td>14</td>
<td>23.4</td>
</tr>
<tr>
<td>5) 13-15</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>6) 16 or More</td>
<td>22</td>
<td>36.7</td>
</tr>
<tr>
<td><strong>N = 60</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 24
Frequency Distribution for the Cumulative Number of School Systems (NOSYSEM) in Which Secondary Level Manufacturing Teachers Have Been Employed

<table>
<thead>
<tr>
<th>No. Systems</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One</td>
<td>34</td>
<td>56.7</td>
</tr>
<tr>
<td>2) Two</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>3) Three</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>4) Four</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>5) Five</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 25
Grouped Frequency Distribution for Number of Years Manufacturing Teachers Have Taught in Their Present Position (PRESPOS)

<table>
<thead>
<tr>
<th>Years Present Position</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 1-3</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>2) 4-6</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>3) 7-9</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>4) 10-12</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>5) 13-15</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>6) 16 or More</td>
<td>21</td>
<td>35.0</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 26
Grouped Frequency Distribution for Number of Hours Per Week Manufacturing Teachers Are Engaged in Supplemental Employment (SUPEMPL)

<table>
<thead>
<tr>
<th>Hours/Week</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>22</td>
<td>36.7</td>
</tr>
<tr>
<td>4-6</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>7-9</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>10-12</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>13-15</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>More</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 27
Grouped Frequency Distribution for the Number of Years of Industrial Related Work Experience (YEARIND) Obtained by Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>25</td>
<td>41.7</td>
</tr>
<tr>
<td>4-6</td>
<td>19</td>
<td>31.7</td>
</tr>
<tr>
<td>7-9</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>10-12</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>13-15</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>16 or More</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 28

Grouped Frequency Distribution for Type of Industrial Experience (TYPEIND) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Type Industrial Experience</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>Management</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>Production</td>
<td>33</td>
<td>55.0</td>
</tr>
<tr>
<td>Combination</td>
<td>16</td>
<td>26.7</td>
</tr>
</tbody>
</table>

N = 60 100.0

Table 29

Grouped Frequency Distribution for the Number of Hours Per Week Manufacturing Teachers Spent in Outdoor Leisure Activities (LEISURE) Like Sports, Recreation, and Hobbies

<table>
<thead>
<tr>
<th>Hours/Week</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 0-3</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>2) 4-6</td>
<td>11</td>
<td>18.4</td>
</tr>
<tr>
<td>3) 7-9</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>4) 10-12</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>5) 13-15</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>6) 16 or More</td>
<td>8</td>
<td>13.3</td>
</tr>
</tbody>
</table>

N = 60 100.0
Table 30
Grouped Frequency Distribution for Amount of Professional Preparation (PROPREP) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Professional Preparation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Associate</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2) Baccalaureate</td>
<td>24</td>
<td>40.0</td>
</tr>
<tr>
<td>3) Masters of Equivalent</td>
<td>28</td>
<td>46.7</td>
</tr>
<tr>
<td>4) Masters +30</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>5) Masters +60</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>6) Other</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>N = 60</strong></td>
<td></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 31
Grouped Frequency Distribution for Undergraduate Grade Point Average (GPA) of Manufacturing Teachers

<table>
<thead>
<tr>
<th>GPA</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 2.0-2.5</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td>2) 2.5-3.0</td>
<td>28</td>
<td>46.7</td>
</tr>
<tr>
<td>3) 3.0-3.5</td>
<td>22</td>
<td>36.7</td>
</tr>
<tr>
<td>4) 3.5-4.0</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>N = 60</strong></td>
<td></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
### Table 32

Frequency Distribution for Number of Active Memberships in Professional Associations (PROFMEM) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Professional Memberships</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) Zero</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>1) One</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>2) Two</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>3) Three</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>4) Four</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>5) Five</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>6) Six or More</td>
<td>14</td>
<td>23.3</td>
</tr>
</tbody>
</table>

N = 60 100.0

### Table 33

Grouped Frequency Distribution for Secondary Level Manufacturing Teachers' Philosophy of Purpose of Industrial Arts (PURPIA)

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Training for a Vocation</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>2) Leisure Time Interests</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>3) Career Choices</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>4) Consumer Knowledge</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>5) Common Tool &amp; Machine Activities</td>
<td>15</td>
<td>25.0</td>
</tr>
<tr>
<td>6) Broad Understanding of Management, Production, Personnel Practices</td>
<td>17</td>
<td>28.3</td>
</tr>
<tr>
<td>7) Problem Solving</td>
<td>19</td>
<td>31.7</td>
</tr>
</tbody>
</table>

N = 60 100.0
### Table 34

Grouped Frequency Distribution for Type of School Where Manufacturing is Taught

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>36</td>
<td>60.0</td>
</tr>
<tr>
<td>Exempted Village</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>County</td>
<td>24</td>
<td>40.0</td>
</tr>
<tr>
<td>Non-Public</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

N = 60 100.0

### Table 35

Grouped Frequency Distribution for Secondary Level of Teaching (LEVTEAC) Where Manufacturing is Taught

<table>
<thead>
<tr>
<th>Level of Teaching</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior High</td>
<td>11</td>
<td>18.0</td>
</tr>
<tr>
<td>Middle School</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>High School</td>
<td>31</td>
<td>52.0</td>
</tr>
</tbody>
</table>

N = 60 100.0
Table 36

Grouped Frequency Distribution for Size of School (SIZESCH) Where Manufacturing is Taught

<table>
<thead>
<tr>
<th>Size School*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 1-500</td>
<td>13</td>
<td>21.7</td>
</tr>
<tr>
<td>2) 501-1000</td>
<td>35</td>
<td>58.3</td>
</tr>
<tr>
<td>3) 1001-1500</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>4) 1501-2000</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>5) 2001 or More</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

N = 60 100.0

* Number of Students

Table 37

Frequency Distribution for Number of Industrial Arts Teachers (NOIATEA) in the School Building Where Manufacturing is Taught

<table>
<thead>
<tr>
<th>No. IA Teachers</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One</td>
<td>28</td>
<td>46.7</td>
</tr>
<tr>
<td>2) Two</td>
<td>23</td>
<td>38.3</td>
</tr>
<tr>
<td>3) Three</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>4) Four</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td>5) Five</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>6) Six or More</td>
<td>1</td>
<td>1.7</td>
</tr>
</tbody>
</table>

N = 60 100.0
Table 38
Frequency Distribution for Number of Industrial Arts Courses Taught Per Day (NOIACOR) by Manufacturing Teachers

<table>
<thead>
<tr>
<th>No. IA Courses Taught</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2) Two</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>3) Three</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>4) Four</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>5) Five</td>
<td>17</td>
<td>28.3</td>
</tr>
<tr>
<td>6) Six or More</td>
<td>34</td>
<td>56.7</td>
</tr>
</tbody>
</table>

N = 60 100.0

Table 39
Frequency Distribution for the Number of Different Types of Industrial Arts Courses Taught (TYIACOR) by Manufacturing Teachers

<table>
<thead>
<tr>
<th>Types</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>2) Two</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>3) Three</td>
<td>20</td>
<td>33.4</td>
</tr>
<tr>
<td>4) Four</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>5) Five</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>6) Six or More</td>
<td>5</td>
<td>8.3</td>
</tr>
</tbody>
</table>

N = 60 100.0
Table 40
Frequency Distribution for the Number of Manufacturing Sections (NOMASEC) Taught by Manufacturing Teachers

<table>
<thead>
<tr>
<th>Sections Taught</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One</td>
<td>21</td>
<td>35.0</td>
</tr>
<tr>
<td>2) Two</td>
<td>23</td>
<td>38.3</td>
</tr>
<tr>
<td>3) Three</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>4) Four</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>5) Five</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>6) Six or More</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 41
Frequency Distribution for the Number of Non-Industrial Arts Courses (NONOIA) Taught by Manufacturing Teachers

<table>
<thead>
<tr>
<th>Non-IA Courses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) Zero</td>
<td>56</td>
<td>93.3</td>
</tr>
<tr>
<td>1) One</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>2) Two</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>3) Three</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>N = 60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 42  

Grouped Frequency Distribution for Average Class Size (AVESIZE) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Class Size*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-15</td>
<td>15</td>
<td>25.0</td>
</tr>
<tr>
<td>16-19</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>20-23</td>
<td>17</td>
<td>28.4</td>
</tr>
<tr>
<td>24-27</td>
<td>6</td>
<td>16.0</td>
</tr>
<tr>
<td>28-31</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>32 or More</td>
<td>2</td>
<td>3.3</td>
</tr>
</tbody>
</table>

N = 60 100.0

* Students Per Class

Table 43  

Frequency Distribution for Percentage of Teaching Load That is Manufacturing (PERCENT)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>20</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>25</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>33</td>
<td>15</td>
<td>25.0</td>
</tr>
<tr>
<td>40</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>67</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td>80</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>83</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>100</td>
<td>6</td>
<td>10.0</td>
</tr>
</tbody>
</table>

N = 60 100.0
### Table 44

**Grouped Frequency Distribution for Rotation Period (ROTPERI) of Manufacturing Classes**

<table>
<thead>
<tr>
<th>Rotation Period</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Year</td>
<td>14</td>
<td>23.3</td>
</tr>
<tr>
<td>2) Semester</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>3) 12 Weeks</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>4) 9 Weeks</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>5) Other</td>
<td>9</td>
<td>15.0</td>
</tr>
</tbody>
</table>

N = 60 100.0

### Table 45

**Group Frequency Distribution for Perceived Academic Ability (ACAABIL) of Students in Secondary Level Manufacturing Classes**

<table>
<thead>
<tr>
<th>Academic Ability</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Far Below</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>2) Below</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>3) Average</td>
<td>46</td>
<td>76.6</td>
</tr>
<tr>
<td>4) Above</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>5) Far Above</td>
<td>1</td>
<td>1.7</td>
</tr>
</tbody>
</table>

N = 60 100.0
Table 46

Group Frequency Distribution for Teaching Freedom (FREEDOM) of Secondary Level Manufacturing Teachers

<table>
<thead>
<tr>
<th>Freedom</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2) Little</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>3) Some</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>4) Much</td>
<td>57</td>
<td>95.0</td>
</tr>
</tbody>
</table>

N = 60  100.0

Table 47

Group Frequency Distribution for Manufacturing Budget (BUDGET) Per Class Rotation Period

<table>
<thead>
<tr>
<th>Budget</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) $ 0</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>1) $ 1-100</td>
<td>26</td>
<td>43.3</td>
</tr>
<tr>
<td>2) $101-200</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>3) $201-300</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>4) $301-400</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>5) $401-500</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>6) Over $500</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>Don't Know</td>
<td>3</td>
<td>5.0</td>
</tr>
</tbody>
</table>

N = 60  100.0
### Table 48

**Group Frequency Distribution for Number of Preparation Periods (PREPPER) Per Week for Secondary Level Manufacturing Teachers**

<table>
<thead>
<tr>
<th>Prep Periods</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) One-Two</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2) Three-Four</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>3) Five-Six</td>
<td>55</td>
<td>91.7</td>
</tr>
<tr>
<td>4) Seven-Eight</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>5) Nine-Ten</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>6) Eleven or More</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**N = 60** 100.0

### Table 49

**Grouped Frequency Distribution for Number of Hours of Non-Teaching Duties (NONTEAC) Performed Per Week by Manufacturing Teachers During Normal School Hours**

<table>
<thead>
<tr>
<th>No Hours</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) Zero</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>1) One-Two</td>
<td>9</td>
<td>15.0</td>
</tr>
<tr>
<td>2) Three-Four</td>
<td>14</td>
<td>23.4</td>
</tr>
<tr>
<td>3) Five-Six</td>
<td>17</td>
<td>28.3</td>
</tr>
<tr>
<td>4) Seven-Eight</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>5) Nine-Ten</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>6) Eleven-Twelve</td>
<td>1</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**N = 60** 100.0
Table 50

Means, Variances, and Standard Deviations of Major Independent Variable, Dependent Variable, and Related Subscales

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean ($\mu$)</th>
<th>Variance ($\sigma^2$)</th>
<th>Standard Deviation ($\sigma$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Background Compatibility (DBC)</td>
<td>60</td>
<td>56.1</td>
<td>301.2</td>
<td>17.4</td>
</tr>
<tr>
<td>High School Lab (HSLAB)</td>
<td>60</td>
<td>8.8</td>
<td>131.3</td>
<td>11.5</td>
</tr>
<tr>
<td>College Lab (COLAB)</td>
<td>60</td>
<td>32.7</td>
<td>371.8</td>
<td>19.3</td>
</tr>
<tr>
<td>Student Teaching (STUTEAC)</td>
<td>60</td>
<td>2.8</td>
<td>55.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Curriculum Packages (CPACK)</td>
<td>60</td>
<td>12.2</td>
<td>352.3</td>
<td>18.8</td>
</tr>
<tr>
<td>Inservice Training (INSERV)</td>
<td>60</td>
<td>4.2</td>
<td>94.1</td>
<td>9.7</td>
</tr>
<tr>
<td>Vocational Education (VOCED)</td>
<td>60</td>
<td>0.3</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Non School Work (WORKNON)</td>
<td>60</td>
<td>18.8</td>
<td>400.9</td>
<td>20.0</td>
</tr>
<tr>
<td>School Related Work (WORKSCH)</td>
<td>60</td>
<td>16.1</td>
<td>269.9</td>
<td>16.4</td>
</tr>
<tr>
<td>Other Experiences (OTHER)</td>
<td>60</td>
<td>0.7</td>
<td>7.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Degree of Teaching Compatibility (DTC)</td>
<td>60</td>
<td>33.1</td>
<td>179.8</td>
<td>13.4</td>
</tr>
<tr>
<td>Degree Management (DMC)</td>
<td>60</td>
<td>44.8</td>
<td>429.1</td>
<td>20.7</td>
</tr>
<tr>
<td>Degree Production (DPC)</td>
<td>60</td>
<td>27.3</td>
<td>173.5</td>
<td>13.2</td>
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