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THE UNIVERSITY OF ALBERTA

An Identification of the Psychomotor Generic Skills Taught in Alberta Junior High Schools Materials Technology Field of Study

by

Donald Arthur Chidlow

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF MASTERS IN EDUCATION

IN

INDUSTRIAL ARTS

Department of Industrial and Vocational Education

EDMONTON, ALBERTA

SPRING 1989

ISBN 0-315-52894-X

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: Donald Arthur Chidlow

TITLE OF THESIS: An Identification of the Psychomotor Generic Skills Taught in Alberta Junior High Schools Materials Technology Field of Study

DEGREE FOR WHICH THESIS WAS PRESENTED: Master of Education

YEAR THIS DEGREE GRANTED: 1989

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled AN IDENTIFICATION OF THE PSYCHOMOTOR GENERIC SKILLS TAUGHT IN ALBERTA JUNIOR HIGH SCHOOLS MATERIALS TECHNOLOGY FIELD OF STUDY, submitted by Donald A. Chidlow, in partial fulfillment of the requirements for the degree of Master of Education.

Clarence H. Preitz
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Peter Wright

David G. Wangler

Date April 19, 1989

ABSTRACT:

The major purpose of the study was to have junior high school industrial arts teachers identify the psychomotor generic skills they taught in five of the six modules that comprise Materials Technology for the Alberta Multiple Activity Program. Secondary objectives of this study were: to have these teachers from a rural setting identify the psychomotor generic skills for five of the six modules from Materials Technology; to have urban teachers identify these skills; and to determine where these teachers acquired these skills.

A questionnaire was designed and pilot tested. The questionnaire contained 151 skill statements that could be performed by either students or teachers to work with five of the six modules (materials) found in the Materials Technology field of study. This instrument was mailed to a sample of 65 rural and urban industrial arts teachers throughout the province. This sample was taken from a population of 330 junior and senior high school industrial arts teachers.

Of the 65 questionnaires posted, 43 were used in the study. These instruments were coded and analyzed by computer using the SPSS^{X} Frequencies program to produce lists of psychomotor generic skills by area. An analysis of the demographic data resulted in a profile for research participants. These data show the majority of the participants possessed between 6-10 years of experience teaching junior high school industrial arts; taught in a rural jurisdiction; received a bachelor of education degree from The University of Alberta; did not have journeyman certification; and were presently teaching or had taught all six modules found in Materials Technology.

The results of the study found 86/151 or 56.9% of the activities (skills) listed on the instrument to be generic for the research population. These 86 skills were placed on a chart to show their transferability potential. The placement of these skills on the chart were based on the researcher's knowledge as an industrial arts teacher. The skills were placed on the chart to show a high, a medium, or a low transferability potential to the other skills for the five materials studied. Two psychomotor skills that were identified as 100% generic were, "Plan procedure" and "Design, modify, or adapt projects", these are examples of psychomotor generic skills with a high potential for transfer. Skills with a low potential for transfer are those that are material specific; for example, wedging clay in the Earths area.

The study concludes with several recommendations made to selected educational groups in the province and with the observations that were made while the research was being conducted.

ACKNOWLEDGEMENTS

To the many people who have assisted in the completion of this study. I wish to extend my sincerest thank you to Dr. C.H. Preitz, thesis supervisor whose patience and encouragement helped the researcher see this project to its successful completion.

A thank you to is also extended to Dr. D. Wangler and Dr. P. Wright for serving as members of the thesis review committee and for the constructive comments to improve the quality of this report.

Also recognized is Dr. D. Harley, Division of Educational Research Services, Faculty of Education, for his recommendations and assistance with the data input and statistical analysis for the thesis.

The assistance of Dr. V. Nyberg, Department of Educational Psychology, Faculty of Education, is acknowledged for critically reviewing the research instrument and making suggestions for its improvement.

Appreciation is extended to personnel of the Curriculum Design Branch, Alberta Education, for their cooperation in providing the information that was requested; especially to Mr. Joe Pallas who provided the list of practicing industrial education teachers by school for the 1984-85 school year.

Without the cooperation of the school superintendents and industrial arts teachers in Alberta who participated in the study, its completion would have been impossible. The author would like to acknowledge these professionals for their cooperation.

The foundation for this study took a considerable amount of library research. The assistance provided by the librarians of the H. T. Coutts Library, of The University of Alberta library system, to the researcher was invaluable and is acknowledged.

Finally, the author wishes to extend a thank you to Lori Campbell and Barb Schur for their guidance and encouragement.

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The Problem

Introduction

Historically, in Alberta, industrial arts has been traced by a number of researchers and authors; Mathews (1984), Clarke (1983), and Chalmers (1967) to 1900 when it was offered in the schools of the Northwest Territories as manual training. Since that time the title for this subject area has seen many revisions. For example, in 1914 industrial arts was referred to as manual arts, a term that remained in use until 1939 when the name was again changed to technical electives. General shop, a concurrent term with the technical electives term, was also used during this time frame. Both of these terms ceased to be used in 1945 when industrial arts became the term for this special subject area. The term industrial arts continued to be used until 1962 when the Alberta Plan was accepted by the Curriculum Branch of the Department of Education. It was at this time that the organizational pattern, the operation of three or more areas within the same laboratory, for industrial arts education became known as the Alberta Multiple Activity Program. The term industrial arts remained in use until 1972 when the current name, industrial education was introduced. (Preitz, Deleeuw, & Yanitski, 1983, p. 2) The amalgamation of industrial arts and vocational education under the rubric of industrial education (practical arts) is fully described in the next chapter. Currently however, either name, industrial arts or industrial education is associated with the Materials Technology modules found at the junior high school level.

The learning environment where industrial arts is taught at the secondary school level is organized in a multiple activity laboratory setting.

Silvius and Curry (1971) in Managing Multiple Activities in Industrial Education define a multiple activity laboratory as:

> A school industrial laboratory designed and equipped to offer instruction in a variety of industrial or technical areas for breadth or depth purposes in industrial education. It may contain facilities for teaching concurrently, woodworking, metalworking, and plastics technology, or for teaching the variety of instruction essential to some industrial subjects such as metal processing. (p. 154)

At the junior high school level in Alberta the learning activities listed by Silvius and Curry have been expanded to include the broad technologies of graphic communication and power. In Alberta, industrial arts contains four fields of study, Power Technology, Materials Technology, Graphic Communication Technology, and Synthesizing which are an integral part of junior high school industrial education courses. These fields of study are further divided into fifteen modules. (Industrial Education Curriculum Guide, 1982, pp. 3-4) To illustrate, the Materials Technology field of study includes the following five modules: Woods, Metals, Plastics, Earths, Leather and Textiles.

Central to the teaching of a learning activity is the "project" which is used as a means for the student to develop competencies in the affective, cognitive, and psychomotor learning domains. In the secondary schools of the province, even though industrial arts has as its foundation the "Alberta Plan" which has been in existence for twenty five years, little to no research has been conducted to identify the generic skills that are used to work the five materials that comprise the Materials Technology field of study.

Problem Statement

The major problem investigated in this study was to identify the generic skills taught by industrial arts teachers to students as part of the

Materials Technology field of study in a multiple activity laboratory at the junior high school level.

Supporting Objectives

The problem statement of the study was supported by the following objectives:

To have junior high school industrial arts teachers who taught in a multiple activity laboratory in a rural setting identify those skills they considered as generic in cutting, shaping, forming, or assembling materials found in the Materials Technology field of study; woods, metals, plastics, earths, and leather. Excluded from the skills that were analyzed were those that were part of the textiles module.

To have junior high school industrial arts teachers who taught in a multiple activity laboratory in an urban setting identify those skills they consider to be generic to work five of the six materials found in the Materials Technology field of study.

To determine where research participants acquired the skills they identified as generic and which of these skills they taught to their students.

Need for the Study

Possibly the individual who has done the greatest amount of research in the area of generic skills, in both the cognitive and the psychomotor domains, in Canada has been Arthur Smith (1973) who was associated with the Training Research and Development Section of Manpower and Immigration, Prince Albert, Saskatchewan. During the decade that has elapsed between the publication of Smith's first report, the Canadian Employment and Immigration Commission has released a number of publications devoted to both cognitive and psychomotor generic skills. Much of the work completed by Smith with respect to psychomotor generic skills was based on data on the use of 588 tool skills from 1600 workers and supervisors in 131 occupations in Canada. It is evident that much of Smith's work was directed towards manpower planners and developers and toward curriculum designers responsible for designing secondary vocational education programs of study. Totally lacking from the work of Smith is the use of generic skills as they may be applied to university industrial arts content courses. Courses where university students acquire their psychomotor skill base they will use to teach others the skills they developed in these courses. The work of Smith, although it is predominantly directed toward vocational education in nature, has made significant contributions to the literature on the topic of generic skills. Unfortunately, no researcher has considered investigating how generic skills are used by industrial arts teachers in the province teaching the Materials Technology field of study to junior high school students. This void helped to establish a need for the study.

A review of the literature for generic skills indicates that there is little written on the topic of psychomotor generic skills as they relate to the Materials Technology cluster for junior high school industrial arts. As a result, a second need was established for conducting the research.

Closely related to the previous need was the need for the researcher to search existing literature and locate what has been written on the topic of generic skills as it relates to multi-skilling (cross-crafting), transferable skills, and generalizable skills; three related terms for generic skills. Once this need has been fulfilled a list of references on these three topics should be available to other researchers, curriculum planners, or apprenticeship personnel interested in generic skills.

Significance of the Study

Since the acceptance by personnel of the Department of Education for reorganizing industrial arts based on the "Alberta Plan" in 1962 and the concept that it should be taught in a multiple activity laboratory, considerable change has taken place in the technologies and the materials that were used as content organizers for the industrial arts curriculum. These changes have compressed the number of psychomotor skills that a beginning industrial arts teacher must have in order to do an effective and efficient job teaching this subject area.

Although research has been completed on the problems encountered by beginning industrial arts teachers Ible (1974) and Milne (1968). There is a complete lack of research to determine the psychomotor generic skills that a practicing industrial arts teacher teaches to junior high school students. This situation helped to add significance to the current study. With the completion of the study, its results may be useful to those individuals responsible for planning or designing curriculum for junior high school industrial arts in the province.

The result of this research may prove useful to those who are providing leadership to the technology education movement (industrial arts) in the United States. These individuals may want to use the results of this study to design learning activities for students that incorporate the psychomotor generic skills identified from the research. An additional significance may be that personnel of the Occupational and Career Analysis and Development Branch, Canada Employment and Immigration Commission, may find the results of this study useful to them because the results will expand on the work of Smith particularly in the psychomotor domain. A number of separate studies were sequentially conducted by Smith in the cognitive generic skill areas that involved mathematics, communication, reasoning, interpersonal relationships, and science skills. These results have been used by researchers in the United States, Great Britain, and Australia as a benchmark for conducting their research.

Limitations of the Study

To help narrow its scope, the study was limited to a random sample of practicing junior high school industrial arts teachers in the province who taught for either a public or a separate school board in a rural or in an urban setting. Unfortunately, this placed a limitation on the generality of the research findings, but since the study dealt mostly with psychomotor generic skills, the generalizing factor to other groups of teachers would be limited. The survey was also limited by those properties inherent to the stratified random sample method, and it was assumed that everyone who was selected to complete a questionnaire received one through the mail.

Another limitation of the study was the ability of participants to recall those skills that were acquired while enrolled as a student in the skill development courses at university. It is in these courses that the student develops a use level of skill with hand and machine tools to cut, shape, form, and assemble a variety of materials.

The research study was further limited to identifying those skills used in the Materials Technology area of the junior high industrial arts program. Lastly, the survey was limited by the individuals' ability to interpret the questionnaires skill statements with a complete understanding. The survey primarily focused on psychomotor generic skills and did not consider classroom management skills such as record keeping or discipline.

Definition of Terms

Operational definitions are used for terms that appear throughout the study. These terms are defined so that the reader develops a common understanding with the researcher for the context in which the term is used in the research.

Generic Skills - In Generic Skills for Occupational Training, Smith (1973), defined generic skills as "those overt and covert behaviors which are fundamental to the performance of many tasks and sub-tasks carried out in a wide range of occupations and which are basic to both specialized applications and job specific skills" (p. 1). Smith's definition was accepted for this investigation.

Industrial Education - According to the Alberta Education publication, Industrial Education Manual for Guidance to Teachers, Counsellors, and Administrators (1983), industrial education is

> at the junior high school, the exploratory phase of the continuum, which provides the opportunity for the students to explore, reason, experiment and discover the reality of the technological society in which they live. The content of the program deals with industry, its organizations, materials, processes, products, occupations, and the problems resulting from the impact of technology on society. (p. 2)

Since the study's focus was on Alberta and junior high school industrial education as a subject area, the definition for the term industrial education was accepted by the researcher.

Junior High Industrial Arts Teacher - For the purpose of this study, a junior high industrial arts teacher was a teacher who has completed a

Bachelor of Education degree and taught the Materials Technology field of study at the junior high school level, grades 7, 8, and 9.

Materials - The 1982 Junior High Industrial Education Guide, an official document published by the curriculum branch of Alberta Education, identifies the modules under the Materials Technology umbrella to be five: woods, metals, plastics, earths (ceramics), and leather and textiles. (p. 64)

Multiple Activity Laboratory - The 1982 Junior High Industrial Education Guide, defines a multiple activity laboratory as an area in which "there are three or more activities in progress at the same time" (p. 7). The Guide (1982), further delineates those activities into four fields of study: Power Technology, Materials Technology, Graphic Communications Technology, and Synthesizing with modules for each field of study. (p. 4)

Rural Community - Through an information bulletin from the Municipal Administrative Services Division, (1986), an area within the province with a population less than 10,000 was classified as rural. These areas are specified by Alberta Municipal Affairs as either a town or a village. (not paginated)

Urban Community - an urban area was defined as a concentration of population into a large community whose activities are primarily centered in government, trade, manufacturing or allied interests. (Gould & Kolb, 1964) For purposes of this research an urban area of Alberta will include those specified as a "city" by Alberta Municipal Affairs. This provincial agency considers an area to be urban if it has a population of 10,000 or more inhabitants.

Population and Sample

The population for the research consisted of all junior high school industrial arts teachers within the province of Alberta whose names appeared on the "List of Industrial Education Teachers by School, School Year 84-85" which is maintained by the Department of Education. In order to receive this list, the researcher prepared a letter that was sent to the Curriculum Design Branch, Alberta Education. The letter requested that the researcher be sent a copy of a listing of practicing junior high school industrial arts teachers in the province for the purpose of conducting scholarly research. Before the requested list could be released, assurance had to be given to the personnel of this branch that the information collected would guarantee anonymity for the research population and that all information would be destroyed upon completion of the study. After guaranteeing personnel at the Department of Education that research ethics would be adhered to, a list of 330 junior and senior high school industrial arts teachers and the schools where they taught was provided to the researcher by personnel of the Curriculum Design Branch, Alberta Education. This list was cross referenced with the list of "Operating Schools in Alberta 85-86" which was provided by Field Services, Faculty of Education at The University of Alberta. The operating schools list included the name of the school principal, the grade levels taught at the school, and a mailing address for each school. This list was stratified into either rural or urban groupings using the population criterion for rural or urban established by Alberta Municipal Affairs. Using this criterion the 330 school names on the list were stratified into 93 rural and 130 urban junior high schools. The remaining 107 schools were either senior high schools or junior/senior high schools that were not selected to be part of the study. The industrial education personnel teaching in the 223 schools became the population of the study. From that population a random sample of teachers who taught industrial arts at the grade 7-8-9 level were selected to become participants in the study. For the randomization phase, junior high schools junior high schools were assigned a numerical value of 1 through 93 for the rural schools, and 94 through 223 for the urban schools. A random sample was generated with the aid of a list of random numbers from Ary, Jacobs, and Razavieh. (1985, pp. 430-431) Personnel of the Division of Educational Research Services, The University of Alberta, recommended that a random sample of approximately 30% be chosen from each group (31 rural, 43 urban) to make up the sample (N= 74) that would be used in the study. However, since three superintendents chose not to participate in the study, the number of selected junior high school industrial arts teachers dropped from the original 74 to 65 (27 rural and 38 urban). Data in table 1 show the percent of each population that was selected to be part of the research group.

The school name, school phone number, school address and postal code were taken from the List of Operating School in Alberta, School Year 1986-87, and the Directory of Canadian Schools, vol 2, 1986.

Table 1

Sample Size for Generic Skills Research

Type of School	Population	Sample	Percent of Population
Junior high rural	93	27	30.0
Junior high urban	130	38	30.0
Senior high and others	107	----	----
Total	330	65	----

Instrumentation

To assist the researcher in selecting the correct type of research instrument to collect the data for the study, the work of Dillman (1978), Berdie and Anderson (1974), and Oppenheim (1966), were reviewed. From that review, the researcher learned of the procedures used to organize a research instrument; techniques used to word statements to eliminate ambiguity and ensure that the statements would ask what the researcher wanted to ask; how to design open ended and closed ended questions, and the importance of the appropriate sequence for statements in a research instrument. From that review, the researcher found there was consensus among these authors that the questionnaire would be the most appropriate instrument for this type of study. These authors also agreed that the questionnaire has inherent advantages and disadvantages. Among the advantages listed for this type of instrument by the authorities were: the relative low cost, since interviewers are not used, no monies need to be paid out to train and sustain field staff workers, only the costs of planning, printing, sampling, addressing, posting, and analyzing are incurred. Establishment of contact, a letter can be addressed to the particular individual that one wants surveyed, not whomever happens to be home when the interviewer stops by. Ease of covering large geographic areas, ease of completion, elimination of interviewer bias, ease of tabulation and analysis, security of anonymity, and uniform question presentation. Conversely, these authors also point out that the questionnaire has the following disadvantages: possibility of low response rate, the difficulty in checking reliability and validity, limitations imposed by certain types of questions and the random nature of those chosen to respond to the questionnaire. Berdie and Anderson (1974) state that some participants may be prejudiced against the questionnaire because of its impersonality, the use of form letters, or the individuals inability to fill out the questionnaire properly. (pp. 17-22)

The research completed by Smith (1973) on generic skills is probably the most complete on this topic for Canada. In conducting that research, Smith grouped the identified generic skills into the following categories: academic skills, reasoning skills, interpersonal skills, manipulative skills, and science skills. Two of the studies completed by Smith are related to the current study of this researcher. These are: Generic Skills; Trade Families and Generic Skills; Secondary School Vocational Model for Craft Trades. The purpose of the trade families cluster described by Smith was to provide training specifications which will enable graduates to compete for job placements in a wider range of occupations rather than just for the few which they were trained in. (Generic Skills; Trade Families, 1979, p. 2) The psychomotor generic skills that Smith identified include those skills that the worker would use to select appropriate tools for the job, maintain the tools, and operate the tools applying the necessary safety practices. Smith believes that both the cognitive and psychomotor generic skills he identified could be used to help vocational education program designers at the secondary school level decide which vocational education programs could be generalized.

After reviewing Smith's work on generic skills and the literature related to the subject by Haywood (1975), Ible (1974), and Preitz (1969), it was determined that the instruments used by Ible and Haywood were too general to measure the responses particular to the psychomotor generic skills of junior high industrial education teachers of Alberta. Nevertheless, by modifying an existing instrument by Preitz (1969), the researcher was able to create a 240 skill statement questionnaire which included each of the five modules within the Materials Technology field of study of the multiple activity program found in the junior high school industrial arts program.

A number of drafts and revisions of the questionnaire were made. The instrument was reviewed by a specialist in instrument design, Department of Educational Psychology, The University of Alberta. Following that review, revisions were made to the physical layout of the questionnaire to increase the reliability, which according to Oppenheim (1966), is "the consistency of obtaining the same results again" (p. 69). These personnel also suggested how the returning information could be processed and that for analysis phase the Statistical Package for Social Scientists X, (SPSS^{X}) Frequency, be used to compile a list of the most frequently used skills.

Since the questionnaire was a synthesis of previously designed instruments of other researchers and thus untested, a pilot study was conducted.

Pilot Study

The pilot study phase of the research was conducted to pretest the research instrument. Two rural and four urban junior high school industrial education teachers comprised the population of this element for the research. These teachers were not involved in the major data collection phase of the research. These teachers were selected to pilot test the instruments because a) they expressed an interest in the study, b) because of their teaching experience of industrial arts at the junior high school level, and c) because they were readily available to the researcher.

The purpose of the pilot study was to determine if the given instructions were explicit and easy to follow; whether the statements were properly phrased (terminology); whether the psychomotor generic skills listed were complete; whether revisions would have to be made to the instrument; whether any given items were ambiguous or unnecessary; and to determine the amount of time it would take to complete the instrument.

Each of the participants in the pilot study received by mail a covering letter, a questionnaire, and a self addressed stamped envelope to return the completed questionnaire. All six instruments were returned. The time frame from initial mailing to return of the instruments ranged from five days to 18 days.

As a result of the pilot study, the questionnaire was modified according to the recommendations made by those teachers who participated. The number of skill statements was reduced to 151 from 240 because a number of the original statements applied to the learning activities taught at the senior high school level. The phrasing of the skill statements was condensed and revised so that they were easier to understand. Pilot study participants indicated that the minimum amount of time needed to complete the instrument was 20 minutes, while the maximum amount of time needed was 45 minutes. Using these two extreme time limits, the researcher established an average time of 30 minutes as the time needed to complete the research questionnaire by participants.

Prior to the pilot study mailing, the instrument was not codified for key punching. In its final form, the questionnaire was codified so that the data collected could be placed on 80 column cards for computer analysis. A copy of the research instrument can be found in Appendix A, page 134.

Methodology

To collect data for the literature review and instrument development, the researcher conducted a library search using both manual and electronic means. The search included reviewing: periodicals, theses, dissertations, textbooks, and assorted handbooks.

While conducting the literature review, the following reference materials were consulted: The Education Index, The Canadian Education Index, The Alberta Education Index, Resources in Vocational Education, Technical Education Abstracts, Dissertation Abstracts International (Humanities and Social Sciences), Education Theses, and selected government documents. In addition, the following computer based databases were used in the literature search. The Education Resources Information Centre (ERIC and NEW ERIC), The Ontario Education Resources database (ONED), Dissertation Abstracts (DISS), and Resources In Vocational Education (RIVE). NEW ERIC was searched using the SPIRES network at The University of Alberta, while ONED, DISS, ERIC, and RIVE were searched using the Bibliographic Retrieval System (BRS) information technologies database.

Key words were used to conduct the search of both ERIC and NEW ERIC databases. These key words were secured from the Thesaurus of ERIC Descriptors, 11th Edition, 1987.

Not all of the computer based databases provide a thesaurus of key words, therefore, the key words of ERIC were used in searching all databases. The key words (descriptors) used were: competencies, cross crafting, generalization, generic, generic skills, job skills, multi skilling, psychomotor skills, skills, task analysis, transfer, transfer of psychomotor skills, transfer of training, transferable skills, and vocational education. Searches under the author names were also conducted: Arthur Smith, Frank Pratzner, and James Greenan. The summation of this searching produced some 200 abstracts of which 50 articles were selected and reviewed for content. Searching the databases failed to identify any study that dealt with the generic skills of industrial arts junior high school teachers. This helped to establish a need for the study.

To identify the research sample, a population of Alberta's junior high school industrial arts teachers needed to be determined. The procedure used to establish the research sample is explained in the Population and Sample section of this chapter, pages 8-10. Once the research sample had been established, the school district superintendent for each school district where members of the sample were employed were identified from the list of Operating Schools in Alberta, School Year 86-87. The list was provided to the researcher by personnel from the Department of Education. Each district superintendent was contacted through either the Cooperative Activities Program of Field Services, Faculty of Education, The University of Alberta or by a letter from the researcher. A dual purpose letter was prepared by the researcher and was sent to 38 superintendents of Alberta school districts across the province requesting their permission for the researcher to involve the industrial arts teachers of their school district in the study and that they respond by the deadline date stated in the letter. Those superintendents that failed to respond by that date, were dropped from the survey sample population.

Thirty-five of the the 38 superintendents contacted or 92% granted permission for their industrial arts teachers to become involved in the study. One superintendent refused to allow the researcher to involve the industrial arts teachers in the research, one placed excessive demands on the researcher, and one did not respond at all. As a result, the staff members of these three superintendents were eliminated from the research. Industrial arts teachers who comprised the research sample were mailed a questionnaire, a covering letter, and a return envelope. The covering letter explained the purpose and their role in the research, the length of time it should take to complete the questionnaire, directions for returning the completed questionnaire, and a deadline date for returning the completed questionnaire, included with this letter was a self addressed stamped envelope for return of the completed instrument. A copy of this letter can be found in Appendix A, page 134.

Sixty-five questionnaires were mailed to the participating industrial arts junior high school teachers across the province, 27 to rural teachers and 38 to urban teachers. Initially, 18 of 27 rural teacher questionnaires were returned, and 11 of 38 urban teachers responded.

Ten days after the deadline date for the return of the questionnaire, and to increase the rate of return and involve additional industrial arts teachers in the study, a follow-up procedure was used with delinquent teachers. These teachers were contacted by telephone to remind them to return their completed instrument and to emphasize to them their role in the study. From the follow-up phone calls, reminders and, if necessary, additional questionnaires were provided. This procedure yielded another 14 questionnaires which increased the rate of return to 66.2% from 44.6%. After five weeks had elapsed after initiating the follow-up procedure, the researcher and advisor decided that ample time had passed for those who were interested to participate in the study to reply. Shortly after that decision was made, three urban teachers returned their research questionnaires. These additional instruments were noted but not included in the study because the data had already been analyzed. In total, 26 of 27 rural questionnaires were returned and 17 of 38 urban teachers responded to the research instrument. These data are shown in table 2.

Table 2

Return Rate of Instruments by Research Participants

Type of School	Mailed	Returned	Percent of Population
Junior high, rural	27	26 (0)	96.3
Junior high, urban	38	17 (3)*	44.7 (52.6)**
Total	65	43 (3)*	66.2 (70.8)**

(*) = late returns
(**) = total percent

Analysis of the Data

The returned questionnaires were reviewed to determine their completeness. All returned questionnaires were divided into either a rural or an urban grouping using an identification number that was placed on the instrument for coding purposes. Data collected from the questionnaires were placed on 80 column IBM punch cards by personnel of The Division of Educational Research Services, The University of Alberta, for computer analysis. The Frequency program from the SPSS^{X} library counted the number of times each skill and variable were perceived to be generic, its percent of the total (percent value), and its percent of the valid cases -- the number of respondents that actually answered the question (valid percent).

To illustrate the respondents perceptions, charts and tables were constructed from the collected data and comparisons were made between the generic psychomotor skills identified by junior high school teachers in both the rural and the urban school settings. From these data findings, conclusions, and recommendations were made. Observations made by the researcher while conducting the various phases of the study were also reported.

Organization of the Thesis

The purpose of the first chapter was to describe in detail the research design through the following sections: introduction, statement of the problem, supporting objectives, need and significance, limitations, operational definitions, population and sample, instrumentation, pilot study, methodology, and analysis of data.

The second chapter will be divided into three major sections. The first section includes a brief description of the evolution of the industrial education concept and what the Alberta Multiple Activity Program is. The second section reports on the professional literature on generic skills related to the current study. Section three includes a review of research related to the study.

The third chapter provides an analysis and presentation of the data collected from the questionnaires. These data are organized into tabular form for the ease of interpretation and analysis.

The fourth chapter concludes the report with a summary of information collected along with the conclusions, recommendations, and observations made by the researcher while conducting the study.

CHAPTER II

Review of Related Literature and Research

Introduction

The first chapter of this study described the research design and methodology that was used to determine the psychomotor generic skills that junior high school industrial arts teachers use in teaching their students.

This chapter will contain the following sections: an overview of the evolution of the industrial education concept; the Alberta Multiple Activity Program; review of literature on both cognitive and psychomotor generic skills; and review of literature on related research.

Overview of the Evolution of the Industrial Education Concept in Alberta

A number of authors, Freise (1958), Roberts (1965), Silvius and Curry (1971), Baird (1972), and Giachino and Gallington (1977) provide a definition for the all inclusive term industrial education. There is agreement among these authors that among the wide range of programs included under the rubric of industrial education are industrial arts and vocational education. Although these two complementary programs are taught in the learning environment of either a laboratory or a shop, the objectives of each program are different.

Prior to 1969 both industrial arts and vocational education coexisted in Alberta as independent but complementary subject areas. Within the next three years, 1969-1972, these two programs were amalgamated under the umbrella term of industrial education. This time period was one of frustration for both industrial arts and vocational education teachers because of the introduction of a new vocabulary which needed to be acquired and learned and the industrial education concept as it was used to structure the modular curriculum and to reorganize new modules of course content. (Mathews, 1984, p. 110) Industrial education in the province is considered to be a program which consists of courses that "provide a continuum of experiences, starting with exploratory experiences and activities in the elementary and junior high school, expanding in the high school to the development of skills in career fields, and culminating in on-the-job experience" (Industrial Education Manual for Guidance to Teachers, Counsellors, and Administrators, 1983, p. 2).

Following the amalgamation, industrial arts at the junior high school level was renamed Industrial Education; Junior High School Grades 7-8-9 and continued to be taught in a multiple activity laboratory by a generalist. The Curriculum Branch of Alberta Education made available to each junior high school industrial education teacher a modular curriculum guide which consisted of four fields of study and fifteen modules of instructional content. These modules are described in a subsequent section of this chapter.

At the senior high school level industrial arts was renamed Industrial Education 10, 20, 30 and continued to be taught in a multiple activity laboratory by a generalist. Like industrial education at the junior high school level the curriculum for Industrial Education 10, 20, 30 is modularized. That curriculum is made up of the following career fields: Power, Materials, Graphic Communications, Electricity/Electronics, and Computers. These career fields are further sub-divided into 56 modules. This portion of the industrial education program is considered to be the Orientation phase of career choice and development.

When the industrial education concept was accepted by teachers of practical subjects, the term vocational education was replaced with the term Industrial Education 12, 22, 32. Courses that carried these numeric designators were provided with a modular curriculum guide by the provincial Curriculum Branch for each of seventeen approved programs. The learning environment for these courses continued to be a unit shop and the qualifications for the teacher remained as they were previously, journeyman certification or the equivalent plus working experience and a bachelor of education.

For industrial education 12, 22, 32 courses, the Department of Education continues to pay vocational grants to major courses "numbered 22, 32, 25 or 35, and which may include approved minor courses numbered 12 and 15" (Industrial Education Manual for Guidance to Teachers, Counsellors, and Administrators, 1983, p. 52). Courses that carry the 12, 22, 32 designation are classified as preparation courses leading to the world of work. Appendix B, page 147 includes a paradigm which shows the various stages for career choice and development as it relates to the Alberta Industrial Education Program.

The Alberta Multiple Activity Program

The genesis of the Alberta Multiple Activity Program has been traced to the territorial period of the province when it was introduced into the schools of the Northwest Territories as the McDonald Manual Training Plan between 1900 and 1903. Two years after the McDonald Training Plan ended, Alberta became a province. Between that time and 1963, when the Alberta Multiple Activity Program was introduced, a number of different terms were used to identify this subject area. Among the terms that were used were:

Manual Training	1905-1914
Manual Arts	1914-1939
Technical Electives	1939-1945
General Shop	1939-1945
Industrial Arts	1945-1968
Alberta Plan*	1962-1968

(Preitz, Deleeuw, & Yanitski, 1983, p. 2)
* Alberta Plan in this study is used as a synonym for the term Alberta Multiple Activity Program.

With each change in terminology came a related change in the learning environment and in the learning activities that were taught in that environment. To illustrate, manual training was taught in a unit shop learning environment where the emphasis was placed on either woodworking or blacksmithing. The physical setting for the Alberta Multiple Activity Program is a multiple activity laboratory where three or more materials and technologies are taught concurrently by a single teacher in either a junior high school or senior high school setting. (Cochran, 1970, p. 74) The recommended materials to be taught at the junior high school level (grades 7, 8, and 9) include Metals, Woods, Plastics, Earths, Leather and Textiles which were placed under the Materials Technology field of study. The remaining three fields of study that constitute the junior high school curriculum are Power Technology, Graphic Communication Technology, and Synthesizing. Under the Power Technology field of study, the modules included are Power Mechanics, Electricity, Electronics, and Computers. Graphic Communications Technology as a field of study includes Printing, Photography, and Technical Drawing. The fourth field of study is Synthesizing which enables students to bring together their accumulated knowledge through simulation and student contracting modules. (Junior High School Grades 7-8-9, Industrial Education Curriculum, 1983, p. 4) The latter field of study includes Industrial Simulation, Student Contracting, and

Developmental Research; these learning activities are not to be attempted until the learner has had experience with the modules that make up the other three fields of study.

A module includes learning activities, both theoretical and practical, that a teacher can teach to a learner in nine to twelve weeks. Each module represents the basic time frame of fifteen to twenty-five hours of study. The Department of Education recommends that the minimum time allocated for junior high school industrial education be seventy-five hours for each of three years, or a total of 225 hours over the three grades; 7, 8, and 9. (p. 5)

In Industrial Arts Laboratory Planning, a 1968 publication of the Department of Education, the following rationale was given for selecting the multiple activity format for Alberta's industrial arts program:

1. uses instruction sheets, audio-visuals, manuals, and reference books to create a well organized instructional program.
2. the inter-relationships of the technologies can be better illustrated.
3. provisions can be made for many different areas of activity which would otherwise not be economically possible, and
4. it is possible to better meet the needs and interests of a heterogeneous student group, through an environment that resembles in part at least, the diversity of activity found in the world of work. (p. 5)

The physical facility of a multiple activity laboratory is divided into several areas each of which is independent of the other. Each area has a complete complement of the necessary hand tools, special purpose machine tools, and expendable supplies needed by a learner to satisfactorily complete a learning activity. (Preitz, 1973, p. 90) Each area is highly organized to make it self sustaining and to limit the amount of inter-area traffic as well as to maximize the learner's time in the laboratory. This organizational pattern permits small groups of four to six students to work in an area on specific learning activities -- a product. The product is a means to an end through which instruction takes place, i.e., a photograph or a T-shirt with a silk screen logo on it are used to teach concepts or skills related to photography or serigraphy. When this group of students and other groups of students in the laboratory complete the learning activities in an area, they rotate to a new area and begin the learning process over again with a new technology until they have successfully progressed through three modules of instruction.

Review of Literature - Generic Skills

In conducting the review of the literature related to this research, a review was conducted of the standard indices that report the findings of educational research as well as a major computer accessible data base. The data base that was searched was the Educational Resource Information Center, (ERIC) using the descriptors from the ERIC Thesaurus which were detailed in the first chapter, page 15. With these descriptors, the search yielded over 200 hits from which 50 were selected by the researcher for further review and analysis for their applicability to the study.

It became evident to the researcher while conducting the literature review that there were a number of terms that are often used in place of the term "generic skills". The term "generic skills" originated in Canada, through Smith (1973) and the other three terms originate in the United States. These terms were "transferable skills", Pratzner (1978); "generalizable skills", Greenan (1983); and "flexible skills", Wiant (1987).

Smith and his colleagues in their research for Canada Employment and Immigration Commission were the first to attempt to codify the skills that would rationalize training, enhance job mobility, and identify the skills needed during working life. The results of their research had a major influence in the development of the concept of "generic skills". According to Smith (1973) generic skills are:

> those job behaviors which are actively used in work performance, which are transferable from one job or occupation to another and which are needed for promotion to supervisory status. By this definition most communication, simple arithmetic and reasoning skills are highly generic, while advanced algebra and science skills are not. (Generic Skills Keys to Job Performance, 1979, no page given)

The result of Pratzner's (1978) research at the National Center for the Study of Vocational Education in the United States on basic skills and occupations suggests that "transferable skills are generally applicable, multiple-use skills and abilities, knowledge, attitudes, and personal characteristics" (p. 25). This researcher was of the opinion that transferable skills are critical to employment and occupational competence because they have applicability across a broad range of occupations and jobs. Pratzner believed that transferable skills are critical to the successful transfer to the more specific task related skills of an occupation. Transferable skills will not guarantee occupational competence and adaptability, these skills will only help to facilitate occupational change. Thomson and Murphy (1987) provide a more inclusive definition for the term transferable skills, a definition which is fully supportive of the one provided by Pratzner. The definition for transferable skills given by Thomson and Murphy: "are those knowledge, attitudinal and manual skills that an employee brings to a job (or an employer expects an employee to bring) which provide that employee with occupational competence and mobility" (p. 7). Stump (1976) in describing transferable skills as they relate to work wrote "[transferable skills are] the skills and abilities which an individual brings with him/her from job to job and which apply in each job" (p. 15).

The research of Smith and Pratzner focused on the generic or transferable skills of occupations and employment settings. Greenan (1983) in his research investigated the basic skills that were generalizable within and across secondary school vocational education program areas and programs. The concept of generalizable skills is concerned with the transferability of cognitive, affective, and psychomotor abilities which are necessary for success across vocational education programs and occupations. The term generalizable skills can be considered synonymous with those of transferable skills and generic skills because it suggests a skill which enables one with that skill to be better able to change occupations.

Wiant (1987) acknowledges the fact that various researchers have developed lists of flexible or transferable skills (p. 5) and that all skills have some potential for transfer. Skills that have broad applicability, are highly useful and important, skills that are used in many contexts in order to accomplish significant and important tasks are classified as flexible skills by Wiant.

Generally, such skill areas involve the cognitive domain and include an array of elements from mathematics, communication, reasoning, interpersonal, and in some instances the manipulative skill domain. These skills have been referred to by researchers as generic skills, and are the most transferable and useful skills educational institutes can teach. According to Annett and Sparrow (1985) a transferable skill is a skill which can be transferred from one job to another with little or no modification. (p. 116) Or as Royer (1979) pointed out, transferability is "the extent to which the learning of an instructional event contributes to or detracts from subsequent problem solving or the learning of subsequent instructional events" (p. 53). Taylor's (1987) position on generic skills is similar to that of Royer, Annett and Sparrow. In defining a generic skill, Taylor wrote "generic skills are a group or class of skills with common characteristics due to their similarity and their high transferabilities" (Preitz & Follis, 1988, p. 6). Many authors agree that generic skills have some inherent transfer potential which may not assure their ability to transfer to other appropriate situations. Skills are dynamic and are constantly shifting because of new knowledge and new technologies.

The term transfer may then be used to describe the benefit obtained from having had previous training or experience in acquiring a new skill or adapting an old skill to a new situation.

Dansereau and Brooks (1984), wrote "the primary goal of education is to facilitate transfer and to provide students with knowledge and skills that will lead to improved performance in subsequent situations" (p. 373). Clark and Voogel (1985), another cognitive research team have noted that "one of the central purposes of all training is to provide knowledge and skills for future benefit to students" (p. 113). Both teams refer to transferable skills and note that these types of skills will be of increasing importance in the future welfare of all workers.

Dansereau and Brooks (1984) proposed a transfer classification scheme based on the notion that an individuals knowledge can be divided into two general categories; content and skills, and state that learning occurs through the following processes:

a) content to content transfer - from general math to algebra
b) skills to skills transfer - from riding a bicycle to driving a car
c) content to skills transfer - from learning about computers to learning to program
d) skills to content transfer - from construction of electronics circuits to electronic theory. (p. 381)

These authors stress that the learner must possess the prior knowledge and skills necessary for transfer to occur, for the ability to transfer will be greatly influenced by the capability of the individuals knowledge and the characteristics of the transfer task.

The four transfer categories portray a simple framework for thinking of the transfer process. However, as Dansereau and Brooks (1984) noted:

> although the instructional principles relevant to these four transfer areas vary to some extent, their commonalties far outweigh their differences. Further, in most real world instructional systems, there is a greater blending of skills and content within courses that is portrayed by the simple classification used here to subdivide transfer related research. (p. 457)

The research led the authors to suggest that vocational programs may actually enhance the transfer process. Clark and Voogel (1985) cite evidence from a number of recent studies supporting the belief of many in the vocational education stream that the practice of skills in different contexts enhances far transfer. Thus, they conclude "it seems that both near and far transfer are possible with the behaviorally based training methods" (p. 116).

Additionally, Champagne (1986) in Teaching for Workplace Success, supported the claim by Clark and Voogel (1985) that vocational programs provide a favorable context for improving the transferability of learning. Champagne noted the need to include the higher order cognitive skills of reasoning, learning, and problem solving into the role of the vocational education program. This author concluded by stating that understanding, rather than rote learning, is the key to higher order skills:
"If students understand, they remember better, they can reconstruct information when it is forgotten, they can use the information or procedure

to solve problems, and they have the skills and conceptual framework for further learning" (p. 7).

Pratzner (1987) effectively sums up by noting that "vocational education must be both a 'process' and a 'program.' It must aim at reinforcing the development of basic and higher order skills and at developing the application and use of skills in practical settings for practical purposes" (p. 103).

Since the advent of the production line, to meet production schedules, the process of production has been one person, one job; teach the individual only the specific tasks he or she will need to perform the job adequately and properly. Change initiated by industry and increased production indicated that new approaches to education and training were needed. According to Naisbitt (1984), "we are moving away from the specialist who is soon obsolete to the generalist who can adapt" in order to compete in a changing world economy. (p. 32)

In business, Morris (1985), believed "the community [business] should train employees by building on prior knowledge when learning a new job instead of looking at each job as an isolated experience" (p. 15). Through the use of such an approach, people could be trained to move in and out of jobs as they are needed, thereby reducing training time as well as employee turnover. But what of those who are not yet part of the workforce. The educational system of Canada "needs an approach that will provide individuals with a set of skills they can use to adjust to the rapidly changing labour force" (Morris, 1985, p. 16).

To satisfy such a change, Arthur Smith developed the research theme of generic skills as an attempt to provide workers, employers, and vocational program trainers with the greater flexibility needed to survive in the last two decades of the twentieth century. Smith (1980) felt that those groups should work to identify the skills and knowledge requirements which were identical in the different apprenticeable trades as a measure of an "inter-trade transferability potential" (p. 40). Once established, unemployed trades people could be encouraged to seek employment in alternative apprenticeable trades where the skills they currently possessed could be used to secure gainful employment in a related occupation. In the generic tool skills study, Smith and his research associates collected data from 131 occupations and 1600 workers on the transferability of trade tools and the skills that were needed to operate them. Furthermore, where many duplicate skills and knowledge items were identified, Smith suggested that a common apprenticeship or certification system be established. (Smith & Tansley, 1980, p. 40) By taking this approach, area populations could maximize their stationary human resource to the benefit of the whole economic community.

Through the tools skills survey, the Canada Employment and Immigration Commission (CEIC) conducted research to determine if skills were occupationally dependent or independent. That is, are any of the skills a motor mechanic, for example, uses common to any other type of mechanic? If so, what are those skills and would it be beneficial to teach all mechanics the same skills at the same time. The results of the research by Smith (1979) show that an overlap exists in the skills used to manipulate hand and other tools.

Pratzner (1978) stated that individuals lacking in transferable skills may deprive themselves of educational and occupational success because these skills are essential to occupational competence and employability and are transferable to a broad range of occupations. (p. 1) Pratzner in writing about transferable skills for employability, continually stresses the fact that transferable skills are geared to the occupational success of the individual.

Related Research - Cognitive Generic Skills

Historically, tradesmen were taught to perform skills that were occupation specific. However, as a result of new materials, processes, and technological changes, the types and variety of these tasks for numerous occupations have increased to the point where no tradesmen could perform all the tasks associated with an occupation. Until recently, those responsible for education or training have given little thought to the idea of promoting generic skills which would enable an individual to better perform a task, to achieve efficiency in occupational preparation, to be more effective on the job, and to be prepared to transfer from one occupation to another with minimal retraining. The problem for the past half century has been that vocational education and other forms of job training have placed emphasis on specific occupational training rather than on generic skill training for a family of occupations.

There are several reasons why such a generic skills approach would be favorable and result in more cost effective training programs:

> it permits the grouping of occupations for the purpose of training, it allows the integration of basic education and occupational training to prevent over-teaching of basic education beyond the level required by a given occupation, and it allows for academic upgrading and/or other knowledge gained outside of formal education to be recognized. (Generic Skills, 1973, p. 3)

Smith's (1973) research on the commonalty of skills identified two broad categories of generic skills. These are the skills that could be classified as either cognitive generic skills or psychomotor generic skills. The sequential studies conducted by Smith in the area of cognitive generic skills research covered a three year period which began in 1973 and ended in 1976 and involved the identification of the mathematics, communications, interpersonal, and science skills that were found to be transferable to a broad range of occupations and occupational settings. In total, Smith conducted four studies to arrive at a list of cognitive generic skills. Two of the studies were provincial in scope, collecting data from Saskatchewan and Ontario; while the remaining two studies were national in scope, collecting data from several different locations across Canada. Unfortunately, the locations that were involved in the national studies were not identified or listed in the literature. His later work was completed in Ottawa and involved psychomotor generic skills that involved the operational use of hand tools, powered hand tools, shop machinery, test and diagnostic tools, wheeled vehicles, heavy mobile equipment, and their associated safety processes.

In the 1979 publication Generic Skills Secondary School Vocational Model for Craft Trades, Canada Employment and Immigration Commission stated "generic skills are those job behaviors which are actively used in work performance, which are transferable from one job or occupation to another and which are needed for promotion to supervisory status" (p. 2). "By definition, most communication, simple arithmetic, and reasoning skills are highly generic, while advanced algebra and science skills are not" (Generic Skills, Keys to Job Performance, 1979, not paginated).

The concept for the study of generic skills research was initiated in January, 1973, under the direction of Arthur Smith of the Training Research and Development Station, Canada Employment and Immigration Commission, Prince Albert, Saskatchewan and later from the Occupational and Career Analysis and Development Branch, Canada Employment and Immigration Commission, Ottawa. Working with Smith on the initial cognitive generic skills project were D. Stuart Conger, Vernon Mullen, Glen Tippett, and James Williams. The purpose of their work was to "formulate a concept for generic skills which would identify their uses for certain occupational groups, and to prepare specifications for instructional modules in an attempt to provide greater flexibility to workers, employers, and vocational training [education] programs" (Generic Skills, Keys to Job Performance, 1979, not paginated). An additional significant objective of these surveys was to determine the transferability of skills between the occupations identified for the research.

The following criteria were used by Smith et al. in selecting the occupations that would be used in the generic skills study.

> occupations in which worker skills are traditionally developed using federal or provincial training programs, occupations which employ a large number of people, occupations which range from the aid or helper to that of technician level, and occupations from several job families; office workers, construction trades, and transportation operators. (Generic Skills, 1973, p. 31)

Sequential studies were first carried out in the skill areas of mathematics, communications, reasoning, interpersonal relations, science, and later psychomotor skills. A common methodology was used by Smith in conducting these studies. That methodology was first to establish a taxonomy of possible generic skills by analyzing and synthesizing educational and training curricula, occupational analyses, the Canadian Classification and Dictionary of Occupations (CCDO) as well as staff knowledge of the occupations. (Generic Skills, Keys to Job Performance, 1979, not paginated) Data collecting instruments were designed, pilot tested, and refined to collect data from participants to determine the skills that were actually used with the occupations being analyzed.

The designed instrument was used to collect data on skills from selected occupations that represented a cross section of employers in both rural and urban areas. These employers represented large, medium, small, and specialized enterprises as well as government agencies both provincial and federal. The instrument or a modified form of it was used in a number of related studies completed on cognitive generic skills by Smith between 1973 and 1976. These studies were conducted as surveys as noted in table 3, page 37.

Survey One began in 1973 and was completed near midyear, this survey examined the generic mathematics and communication skills from 27 different occupations that at the time of the study represented approximately twenty-five percent of Canada's labour force (excluding technical and professional occupations). (Smith, 1975, p. 69) These occupations were being practiced by workers in the environs in and around Prince Albert, Saskatchewan. These areas included sites from urban and rural Prince Albert, Saskatoon, and Regina. This study was an attempt to determine the commonalty of cognitive generic skills among occupations rather than the uniqueness of occupations, and to discover which commonly taught cognitive generic skills were rarely used in everyday job performances. For this phase of the study, 340 workers and an equal number of supervisors, 340, were interviewed to obtain information on cognitive skills and skill usage. The first survey that was used with these participants included 115 questions that were directly related to the mathematics and to the communication skills that they used in their occupation.

Survey Two began in May 1973, when Smith and his team identified and classified some 200 reasoning and interpersonal skills. These skills were then categorized into distinct and separate groups and incorporated into a revised questionnaire which contained the four cognitive generic skill areas of mathematics, communications, reasoning, and interpersonal skills. Late in 1973 this newly developed questionnaire was pilot tested.

The number of occupations used for data collection for Survey Two was increased to 37 from 27 occupations. Included in these 37 occupations were 18 from Survey One. Similarly, the number of participants for the second survey was increased to 490 workers and 480 supervisors from 340 workers and 340 supervisors. This study, instead of being provincial in nature, became national in scope when it was conducted in nine locations across Canada that were not identified in the literature. The questionnaire for Survey Two contained 221 questions that were related to mathematics, communications, reasoning, and interpersonal skills.

As a result of the pilot study, it became apparent that revisions would need to be made to the questionnaire. To assist with these revisions, several experts were consulted who helped recreate and pilot test the research instrument. This resulted in a third instrument, used with Survey Three, which consisted of 204 questions that again dealt with the mathematics, communications, reasoning, and interpersonal skills. This third survey, like Survey Two, was considered national in scope because data were collected from six areas across Canada that Smith failed to identify when reporting the results of his research. The questionnaire used in Survey Three was administered to 280 first-line foremen and 20 workers from 30 occupations spanning six locations across the nation.

Data in table 3 summarizes the cognitive generic skills involved in the four surveys that Smith completed through his research; the number of participants; survey locations; and total number of skill items in each questionnaire that was used with each survey.

Table 3

Cognitive Generic Skills Survey, Number of Participants, Locations

	1973 Survey 1	1973 Survey 2	1974 Survey 3	1976 Survey 4
No. of occupations	27	37	30	77
Workers interviewed	340	490	20	90
Supervisors interviewed	340	480	280	680
SKILLS SURVEYED:				
Math and Communication	Yes	Yes	Yes	No
Interpersonal	No	Yes	Yes	No
Reasoning	No	Partly	Yes	No
Science	No	No	No	Yes
Survey locations	4 (Sask)	9 (Can)	6 (Can)	6 (Ont)
Skill items examined	115	221	204	698

(Taken from: Generic Skills, Keys to Job Performance, 1979, Canada Employment and Immigration Commission, not paginated).

The collected data for each of the four generic skills of the four surveys were analyzed and used in the construction of cognitive generic skills charts which summarize the skill requirements for communications: reading, writing, listening, and conversing; mathematics: arithmetic, geometric figures, and intermediate mathematics; science: physics topics, biology topics, chemistry topics, and general reasoning: estimating, sort/classify, obtain job related information and work tasks for the ten occupations involved in the surveys. Additional analysis of the skill charts was made of the non-supervisory occupations to determine the percentage of occupations which required each skill. A skill that was used by 75% or more of the occupations surveyed was considered to be a core skill requirement for that occupation. Each chart summarizes the cognitive generic skill requirements for the following 10 occupational families: clerical, science/engineering technologists, medical/health, sales, service, machining, fabricating - assembly and repair, construction, motor transport, farmers, and for 28 supervisory occupations. A legend on the chart identifies the skills needed for each of these occupational families. The chart for generic communication skills includes reading, writing, listening, and conversing skills that are required by workers and supervisors in the 10 occupational families to carry out tasks in a work environment. It becomes evident from an analysis of data in this chart that the ability to communicate effectively is probably one of the most significant reasons why some workers are selected for supervisory positions. A sample of this chart can be found in Appendix C, page 149.

Occupational profiles were prepared by Smith et al. for the 64 occupations of the four domains studied in the first two surveys. An occupational profile chart is similar to a DACUM (Developing A CurriculUM) chart which consists of information placed on a horizontal and a vertical axis grid pattern. On the vertical axis are listed the 21 major generic skills that Smith and his colleagues identified in previous surveys. These were called units. On the horizontal axis of the chart are the tasks an individual must be able to perform to be proficient with the unit. These were referred to as items. All the units and items listed in the occupational profile were taken directly from the Generic Skills Questionnaire. Tasks on the occupational profile are ranked according to their level of difficulty, for example; in dealing with the unit on whole numbers, the items one must be able to do are read, write, and count before they can add, subtract, multiply, divide, do word problems or round off numbers. Data from the occupational profiles were used to establish instructional objectives for each task that were performed by workers from the 30 occupations that were involved in Survey Three. The instructional objectives that were prepared for Unit 1 - whole numbers; Item A - read, write, and count whole numbers were written in this way.

Objectives
1. Count a set of up to 100 objects and state or write the number of objects counted.
2. Identify place value of digits in a given whole number with up to seven digits.
3. Read a given whole number less than 10 million and write its name in words.
4. Write a whole number less than 10 million given the word name of the number.
5. Write a number to one million after counting or reading the word name of the number.
6. Arrange a set of whole numbers in ascending or descending order

(Generic Skills, Technical Supplement, undated, Appendix E)

Smith and his associates assembled several charts to illustrate occupations with similar profiles of skill needs beyond the core clusters for mathematics, communications, science, and reasoning. A sample of this chart appears in Appendix D, page 151. This chart shows that for the 48 occupations grouped into 14 occupational clusters have approximately the same requirements in mathematics, communications, science, and reasoning skills as the occupations in the 10 occupational families and the 28 supervisory occupations that were involved in the surveys. Smith included in this chart eight occupations which were categorized as non-similar occupations. A review of these occupations show that their skill profile was not duplicated by any of the other 48 occupations listed on the chart.

Another chart resulting from the work of Smith and his research team was the Skill Transferability Potential Chart for the cognitive generic skills surveyed. This chart was constructed from 48 of the 77 occupational profiles involved in the four surveys. Each of the 48 occupational profiles were examined against each other for a transferability potential. If the skill elements within the profile exceeded or were the same as the other profile, the skill transferability was considered to be high, that is, indicated by the red color on the legend of the chart. The reader who may be interested in reviewing this information is referred to Generic Skills, Keys to Job Performance, 1979, Canada Employment and Immigration Commission, not paginated. The legend, attached to the chart, classifies the transferability potential of a skill as low, medium, or high. It was found that carpenters have a high potential for transfer to 14 occupations because of the number of cognitive generic skills that a carpenter has in common with these occupations, a medium potential for 17 other occupations, and a low potential for 16 additional occupations.

Smith's research identified cognitive generic skills which were transferable across many occupations which include: (a) communication skills (reading, writing, speaking, and listening), (b) computation skill, (c) problem solving skills, and (d) interpersonal relations skills. The results of the Generic Skills Project indicated that possessing the skills identified would not guarantee occupational success, but a lack of these skills would be a detrimental to occupational entry and success in many occupations. (Greenan, 1984, p. 97)

Miguel (1977) investigated 14 industrial training and guidance programs for adults throughout the United States that were related to occupational transferability skills. "Occupational transferability is an aspect or human performance that enables individuals to move successfully from one occupation to another" (p. 5). From his research, Miguel identified five skills that were related to transfer skills or job adaptation skills that include: (1) task performance skills common to occupations; (2) skills for applying broadly usable knowledge; (3) personal and interpersonal effectiveness skills; (4) self-analysis skills; and (5) career management and productivity skills. (p.

5) This researcher found that individuals lacking in the generic skills identified by Smith (1973) would be excluded from many jobs, would affect the performance level of any worker in any job, and would have a great effect on the success of job transfers. (p. 7) From the observations made during the site visits made by Miguel, the following concepts emerged:

1. Occupational transferability is a dynamic aspect of human development.
2. An individual's repertoire of skills is pliable.
3. Because an individual possesses a skill required in many occupations does not necessarily ensure its transferability.
4. Individuals are more likely to develop skills for occupationally transferability when their educational programs include those skills as part of the explicit curriculum.
5. Developing skills in a variety of contexts enhances occupational transferability.
6. Individuals must understand the multiple occupational utility of their skills.
7. The values-orientations of employers and the work environment itself determine to a great extent which skills can transfer and which cannot.
8. The success of an occupational transfer is dependent upon the nature of the transfer and the implications it has for the individual's career. (pp. 23-26)

Taylor (1973) identified and measured 98 talents, human attributes, or inner process skills based on the world of work needs. This researcher identified six types of skills that were similar to those identified by Smith and Kawula which he considered as being "extremely important" for academic success and for finding and holding a job. These were: "a) academic talent, b) creative or productive thinking talent, c) evaluative or decision making talent, d) planning talent, e) forecasting talent, and f) communication talent" (pp. 99-110).

Smith (1975), Kawula and Smith (1975) identified a list of 192 generic skill items which were transferable across a number of occupations. Data for the initial stage of the investigation were collected from 10 employers in each of 77 professional and non-professional fields to determine those skills which were required within and across these occupations. Of these 77 fields, 31 contained supervisory tasks and were classified as supervisory occupations. The remaining 46 were classified as non-supervisory occupations for which vocational education programs could provide education and training.

Kawula and Smith (1975) used the Dictionary of Occupational Titles (DOT) and the Canadian Classification and Dictionary of Occupations (CCDO) classification system of Data, People, and Things to record their observed results. Data, according to Smith (1974), can be any information or knowledge, observation, investigation, interpretation, visual or mental creation. Written data can take the form of numbers, words, and/or symbols. People are human beings or any animals dealt with on an individual basis, and things are inanimate objects such as substances or materials, machines and equipment. A thing is tangible and has shape, form, and other physical characteristics. (p. 28)

In the Dictionary of Occupational Titles (DOT), worker trait groups were developed by dividing all the 32,000 occupational titles listed in the dictionary of jobs into 22 general groups according to the following commonalties: educational requirements, vocational preparation, aptitude, interests, temperaments, and physical demands. The 22 general groupings were further categorized into 114 worker trait groups. Each of the occupational titles for the worker trait groups were given a six digit code number where each digit could be used to describe the skills or categories of skills that were central to the occupation. The last three numbers of the six digit code represented the ways in which the occupation requires a worker to deal with Data, People, and Things to successfully perform on the job. (Smith, 1973) Smith used this information as the base format for grouping the skills and occupations that he would ultimately use in his generic skills research. Since that time, the DOT has been updated to include new and evolving occupations and is highly regarded as a source for determining essential job elements and potential transferability of job skills.

Wiant (1977), through a series of nine conferences with employers experienced in personnel administration, personnel policies, and policy rationale, identified 77 skills that were required for occupational mobility. Each conference centered around four topics, personal occupational experiences and skills, patterns of occupational mobility, assessment of transferable skills, and usefulness of the transferable skills concept. From these conferences, the researcher identified the following skill areas: a) intelligence / aptitudinal, b) interpersonal, and c) attitudinal. (p. 9) Within these three skill areas Wiant identified additional skills that he placed on a chart according to the frequency that the skills occurred. This ranking was done according to the importance of the skill as perceived by the participants of the conferences. The most important elements were found to be: "a) communicating, b) working with, getting along with, or relating to others, c) problem solving, d) analyzing/assessing, e) planning/layout, f) organizing, g) managing, directing, or supervising, h) diligence, or a positive attitude toward the value of work, i) decision making" (Wiant, 1977, p. 11). A complete listing of all the skills identified by Wiant for this particular study may be found in Appendix E, page 153.

Wiant took the position that the development of transferable skills is a life long process and not the sole responsibility of any one sector of formal education. Further, he noted that more people apparently lose their jobs because they lack the attitudes or adaptive competencies (getting along with others, or dealing with job pressures) than because they lack actual job specific skills.

Sjogren (1977) conducted a review of the literature to identify the skills that were highly transferable in the sense that they were general to a large number of occupations. (p.1) The occupationally transferable skills that he identified were: mathematics skills, communication skills, interpersonal skills, reasoning skills, and manipulative skills. (pp. 22-23) The researcher's position was that there were no non-transferable skills and that a good education through high school will provide an individual with a good base of skills for the world of work. (p. 25)

Nelson (1979) compiled a list of what he termed "occupational survival skills" for students registered in vocational/career education programs at the high school level. As a result of completing the four research studies, opinions from workers, students, parents, teachers, counselors, and administrators were collected. Several of the survival skills these groups identified were: "a) working in organizations, b) understanding self, c) motivation for work, d) interpersonal relations, e) effective communication, f) using creativity at work, g) coping with conflict, h) coping with change, i) adapting and planning for the future, j) problem solving, k) leadership, and l) authority and responsibility" (p. 10). The purpose of collecting these skills was to develop curriculum materials that "would help students adapt and survive in the world of work, and to identify procedures which would help students grow and develop in their future occupations" (p. 10).

The specific skills identified by Nelson in his investigation helped to provide an important component area for student skill identification, assessment, and determination of instructional needs. Peterson (1975) noted that through such work curriculum specialists must redefine the term skill:

> The vocational educator can no longer assume that he has provided a lifetime gift by teaching the student to perform a specific set of skills. In fact, training in this traditional sense probably prepares students for vocational obsolescence, economic disappointment and disillusionment. Curriculum specialists must help define a common core of skills which focus on the coping behaviors that are needed to prepare the flexible, adaptive individual. (Peterson, 1975, pp. 28-29)

A study completed by Selz, Jones, and Ashley (1980) identified the public's perceptions of the importance of functional competence for doing well in work and in life situations. From a three phase study the researchers identified 39 occupational adaptability competencies. This list contains elements which were similar to those identified by Smith, Northcutt, Wiant and could be categorized as cognitive generic skills.

> Many of the competencies that were rated as important to success in work depend on the use of basic reading, writing, and mathematic skills. The top rated occupational adaptability competency (use the reading, writing, and mathematic skills the job calls for) identifies the use of these basic skills as the most important factor in succeeding at work. (Selz, Jones, & Ashley, 1980, p. 21)

These skills were perceived as being generally important and should facilitate the transitions of individuals from school to work, home to work, and job to job. (p. 3)

Greenan (1983) used a selected group of both teachers and students to identify 102 performance tasks that were generalizable across male dominated, female dominated, and sex balanced vocational programs. The tasks were defined as those elements needed by an individual to perform successfully in both vocational education programs and in later employment settings. The tasks identified were categorized into four skill areas:

mathematic skills, communication skills, interpersonal relation skills, and reasoning skills. (p. 99)

These skills were identified as potentially related to success in occupational and vocational education settings. All of the teachers who participated in the study identified 81 of the 102 skills as generalizable and important for their students' scholastic success.

Greenan pointed out that there appears to be a common core of generalizable skills that are necessary and important for success in many programs and occupations. To this end, students may need to possess a high degree of proficiency in the generalizable skill areas of mathematics, communications, interpersonal relations, and reasoning to succeed in such programs and/or employment settings. (Greenan, 1984, pp. 100-101)

Daniels (1984) reported on skills instruction for vocational education programs that were instituted to help students respond to the need for increased career flexibility, versatility, and adaptability that the changing society has placed on schools and educators alike. The economy [business] is forcing the school system to become more accountable and to produce students that are better equipped to function in the changing work world. Daniels identified and recorded a set of transferable skills which would optimize education and enhance student employability. His three categories of skills were:

a) generalizable skills - those actively used in work performance
  - mathematics
  - reasoning
  - communication (written and oral)
  - interpersonal, and
  - attitudinal skills

b) problem solving skills - used to resolve problematic situations
  - interpersonal problems (group and individual)
  - information related problems
  - understanding of human behavior problems

> c) transition skills - use to manage life transitions (occupational)
> - managing changes in environment
> - managing changes in relationships and in self
> - managing stress, loss and grief
> - making decisions. (pp. 34-35)
>
> The nature of work in the future will be characterized by constant change which means that workers will be employed in several different jobs within or across occupations during their lifetimes. Accelerated change represents a significant factor which must be considered by individuals as they study their employability options and prepare for their initial employment. (p. 33)

Through study and acceptance of these change skills, generalizable skills, problem solving skills, and transition skills, students may be taught to adapt to a constantly accelerated rate of change that will guide their adult lives. (p. 34)

Greenan (1984) in his article, The Construct of Generalizable Skills For Assessing The Functional Learning Abilities of Students in Vocational-Technical Programs, quotes Northcutt's (1975) findings of four primary skill areas that were transferable to a wide range of jobs and occupations. These often required transferable skills and knowledge, Northcutt categorized as: "a) communication skills (reading, writing, speaking, listening), b) computational skills, c) problems solving skills, and d) interpersonal relation skills" (Greenan, 1984, p. 96). This researcher pointed out that these skills were actually literacy skills which account for the majority of the requirements society places on adults if they are to be literate in a productive society. As a result of the findings of his research, Northcutt took the position that a special effort should be made to identify, to describe, and to teach these necessary skills to all learners.

More recently, Pratzner (1984) through continued research on transferable skills worked to determine what skills and knowledge requirements were needed to cope successfully within a Quality of Work Life

(QWL) environment. (p. 24) The quality of work life philosophy, according to Pratzner, embodies a set of values, models, and a multitude of practices and techniques for understanding, explaining, and affecting how work is organized and carried out. (p. 28) The skills that Pratzner identified and considered as important to the QWL were:

> group problem solving (interpersonal skills, group process skills, problem solving skills, decision making skills, planning skills, communication skills, thinking skills, and reasoning skills); and organization and management (business economic skills, business operation skills, management skills, and statistical quality control skills). (pp. 33-36)

The results from Pratzner's research found that QWL developments had profound and lasting effects on the way firms organize themselves for production. These effects and changes appear to have significant implications for education and occupations alike. (Pratzner, 1984, p. 27)

Orville Nelson (1986) conducted two surveys of the directors of several post secondary trade and industrial, industrial technology, and industrial arts teacher education programs to determine which skills were most important in enabling students to complete their programs. From the first survey, Nelson collected 65 elements on skills, areas of knowledge, and attitudes that should be developed by pre-service industrial arts teachers in their course work. These elements became part of a second survey where the skills were rated on a four level importance scale from "very important" to "not important". The result of the research identified areas of knowledge, skills, and attitudes. The 11 most important elements were listed as:

a) problem solving skills
b) knowledge of problem solving techniques
c) effective work habits
d) responsibility
e) ability to work effectively with others
f) safe working procedures

g) interest in learning
h) self confidence and self esteem
i) ability to use mathematics and science to solve technical problems
j) oral and written communication
k) understanding of the role and impact of technology in our world. (pp. 13-15)

Nelson commented on the importance of teaching such transferable skills, knowledge and attitudes so that students may, if they desire, move on to post secondary vocational or technical programs. Skills such as problem solving are very important and should be given more emphasis in the curriculum. Effective work habits, the ability to work with others, self confidence, and self esteem need to be refined and reinforced so that teachers may design and implement activities to foster their development.

Taylor (1987) in a presentation to invited vocational education specialists from both Edmonton and Calgary, spoke on generic skills in vocational education. In his presentation, Taylor discussed the importance of teaching generic skills but indicated that a more appropriate term for these skills would be transferable skills, in either an educational or an occupational setting. Taylor noted that there was an important relationship between education and work because generic skills contribute not only to the efficiency of learning new material but also to the retention of what was learned. The skills learned are generally mastered, can be built upon, and are readily transferable.

The generic skills that Taylor (1987) presented include: a) communication skills (oral and written), b) computation skills, c) higher order cognitive skills (reasoning and problem solving), d) interpersonal skills, and e) learning skills. (Speech notes, p. 9) Taylor's position was that these skills are fundamental to learning, universally transferable, and are the foundation on which to build further learning. (p. 3)

To reaffirm the importance of generic skills, transferable skills, Taylor thought a combination of the two should be an explicit goal of schooling where both the teacher and the student actively participate in the educational process. (p. 27)

Research into generic skills, transferable skills, is not unique to North America. In the United Kingdom, the Further Education Unit (FEU) (1982) had identified a set of content areas for a vocational preparation curriculum. One term found in the literature disseminated by the FEU is basic skills; some of the skills included under this broad term may be manipulative skills, literacy (comprehension and communication) skills, numeracy skills, and coping or survival skills. However, the transferable skills, are a more comprehensive set of life skills which are closely related to the generic or transferable skills identified by Northcutt (1975), Smith and Kawula (1975), Wiant (1977), and Greenan (1983) in their research. The FEU's list of transferable skills contains elements that were seen as central to the vocational preparation of students:

> decision making skills for the role and status of youth; interpersonal skills and future choices; appreciation of physical and manipulative skills; moral values and personal relationships; literacy, graphicacy, and numeracy; study skills; planning and problem solving skills; political and economic literacy; develop an appreciation for the physical and technical environment; coping skills; and development of an attitude that promotes a willingness to learn and change with technology. (pp. 45-54)

Through the teaching of such skills, it was hoped that young people who make the transition from school to work will be better prepared to cope in the changing society.

The City and Guilds of London Institute (CGLI) (1982) and the Manpower Services Commission of Great Britain undertook a joint venture to develop a preparatory course that would help young people acquire work experience and find full time employment. The goal of the course was to provide instructors with: instructional skills, communication skills, caring/guidance skills, evaluation skills, and job skills so that they could then assist youth in their hunt for employment. As a result, the CGLI's vocational preparation program was based on a mix of both transferable and occupational skills which included: social abilities; communication; practical and numerical abilities; and decision making abilities. (p. 20) It was the intent of the educators to provide a vocational curriculum that would amalgamate both general and occupational specific skills that would make the learners transition from school to job or from job to job as easy as possible.

The Office of Economic Co-operation and Development (OECD) 1982 through its report <u>Competencies Needed in Working Life</u> sought to introduce measures to improve the competencies which were essential for the work life of students, employees, and employers. The OECD's list of transferable skills, the skills necessary for adaption to working life, include:

> abilities and techniques - reasoning, learning, reading, writing, calculating, manipulating, and elementary technology;
> personal and social skills - social skills, work values, communicating (speaking, knowledge of other languages, non verbal communication, and symbols);
> knowledge of working life - the world of work, finding a job, and survival and development in employment. (pp. 17-26)

The report does not relate the skills to particular occupations, but rather assumes that every worker will need to possess a basic set of such competencies/transferable skills.

While differences exist among the results reported by the various researchers who have identified or compiled lists of generic, transferable, generalizable, and flexible skills, it is apparent that there is more commonalty than difference in their results. These commonalties become more apparent when a comparison is made between the skills which can be placed into the following main categories: a) cognitive skills (learning, planning, reasoning, and problem solving), b) communication skills (reading, writing, speaking, and listening), and c) psychomotor skills (sensory acuity, manual dexterity, and co-ordination). Being able to read, to write, and to do arithmetic no longer guarantee success in the world of work. The worker of tomorrow will need to be schooled in many diverse areas so that he may adapt to new and changing job requirements. Where sixty years ago it was commonplace to specialize in one occupation and retire from that occupation, the worker of tomorrow will need to acquire transferable skills that will allow movement between similar types of occupations. Of all the research previously reported in this section, Smith and Sjogren were the only researchers to report on the psychomotor generic skill development.

Related Research - Psychomotor Generic Skills

This phase of Smith's research dealt with psychomotor generic skills and examined sensory acuity, manual dexterity, and co-ordination elements from the psychomotor/sensory domain of learning. The psychomotor generic skills research was conducted by the Canadian Employment and Immigration Commission (CEIC) in Ottawa and used the Tool Skills Survey as the research instrument to collect relevant data. (Smith, 1981, p. 16) How the Tool Skill Survey was developed by personnel of CEIC is not reported in the literature.

Tool Skills Survey

The goal of the Tool Skills Survey was to examine the commonalty of tool skills used in 131 occupations rather than to examine the uniqueness of the occupations that contained these tool skills. (Generic Skills, Secondary

School Vocational Model for Craft Trades, 1979, p. 2) This survey, conducted by the CEIC, had two major purposes. The first purpose was to determine how much the skills in the 131 occupations were alike and were used to perform the tasks in these occupations. The second purpose of the the study was to identify which commonly taught skills were rarely used in on-the-job performance of the 131 occupations. It is unfortunate that the literature reporting the research on Smith's work fails to list the names of the 131 occupations that were involved in the study.

Data Collection

To collect data for this investigation, a Tool Skills Survey was designed and administered by the CEIC to 1600 tradespeople, trades supervisors, technicians, technologists, and trades helpers in 131 occupations. The literature shows that most of these participants worked in a craft trade. A craft trade, according to Fryklund (1947) in Occupational Analysis Techniques & Procedures, is a synonym for the term custom trade which is considered to be a trade that "involves the production of things" (p. 8). For example, a carpenter is involved in the production of a house. With the Tool Skills Survey, this instrument was able to measure the use of 588 trade tools that were used by individual workers in the 131 occupations. Included as trade tools were: portable and powered hand tools, test and diagnostic tools, shop machinery and equipment, wheeled vehicles, heavy mobile equipment, and the safety practices associated with these tools. (Generic Skills Trade Families, 1979, p. 3)

Data Analysis

The data collected from these workers were tabulated by occupation and by skill to determine which skills "belonged" to a particular occupation and which skills were required in all or most of the other occupations. A cut-off value of 30% was established for eliminating skills from the research. If 30% or more of the workers positively responded to a particular skill, it was recorded as a necessary psychomotor skill requirement for that occupation. Each occupation was compared with another to establish a Commonalty Factor which was the percentage of skills held in common between occupations. The Commonalty Factor was further analyzed to identify occupations for placement into trade families that demonstrated a high degree of similarity in tool skill usage. Using the Commonalty Factor to identify generic psychomotor skills, individual workers as a result of displacement or structural unemployment could be placed in one of several options to retain or to regain employment: a) enter into another trade in the same occupational family, b) enter into another trade in a different occupational family, or c) enter into employment as a trade helper in any field. Also established was a Transferability Factor which was the percentage of skills each occupation used. These skills were compared to the total number of skills held by the other occupation. (Generic Skills, Secondary School Vocational Model for Craft Trades, 1979, p. 2) The Transferability Factor was further analyzed to establish an Active Transferability Rating which is the potential for workers in an occupation to transfer to another occupation; and a Passive Transferability Rating, the potential for occupational shortages to be filled by workers from other occupations. (Generic Skills, Potential Transferability in the Craft Trades, 1979, p. 1)

From the results of the tool skills study the Skills/Unit Group Matrices evolved. (Generic Skills, Secondary School Vocational Model for Craft Trades, 1979, p. 3) These matrices show the degree to which tool skills are used by 29 different occupational unit groups. These unit groups were identified using the numbering system for occupations found in the Canadian

Classification and Dictionary of Occupations, (1971), Volume 1. On each matrix, tool skills are not listed in alphabetical order and are randomly arranged on the horizontal axis of the matrix from the most frequently used to the least frequently used skills. The 29 occupational unit groups are arranged on the vertical axis of the matrix. By comparing what tool skill was used by what occupational group, the CEIC arrived at a list of 116 core tool skills that were considered to be transferable across several occupations. "Each of these tool skills embodies a 'body of knowledge' and it is reasonable to assume that the tool skill and body of knowledge are transferable to another occupation" (Generic Skills, Potential Transferability in the Craft Trades, 1979, no page given). From an analysis of these Skill/Unit Group Matrices it is apparent that a large number of the identified tool skills are universal requirements, at least in the craft trades. Smith believed it would be beneficial to teach their operational use in generalist trade programs rather than in unique occupational courses that prepare the learner for a specific trade. (Generic Skills, Secondary School Vocational Model for Craft Trades, 1979, p. 3) Implied in the name of the tools and equipments is the ability to select the appropriate tools, maintain and repair them (user maintenance), use or operate them, and follow the accepted safety practices when using the tool or piece of equipment. (Generic Skills, Trade Families, 1979, p. 5) "The results indicated that, at least in the trades surveyed, the workers shared a phenomenally high degree of tool skills" (Smith, 1981, p. 8).

Smith saw the following uses for the information that was generated from the Tool Skills Survey. For designers of vocational education programs, to assist them in making the decisions to what degree the programs should be generalized. The data suggests that instead of a school offering a specific "motor vehicle mechanic" course, a more general program such as "mechanical servicing" should be offered which would prepare the learner for a wider array of potential jobs. Trade specific skills could be offered in either the final year of the program or taught at a post secondary institution. This would help the adolescent learner defer important occupational choices to their more formative years.

For adult skills training programs, Smith saw the data from these studies being used to prepare programs to be offered that would develop in the student a skill base that would be both flexible and transferable. Smith suggested that skills that make up the content for any training program should be chosen on the basis of transferability, and perhaps even more important, the attitudes taught should reflect a multi-occupational approach instead of being occupation specific. This way, the graduate would not be destined to look for work in a single occupation but rather to a family of occupations. Such an approach to adult skill training has become known as the generic skills approach.

The process of adult retraining would also benefit from the generic skills approach. Instead of attracting unskilled or semi-skilled individuals into a four or five year training program, unemployed skilled workers could have their skills identified using the Skills/Unit Group Matrices, retrained to acquire the necessary missing skills, and enter the retrained worker into a deficit trade area. Such a process would take less training time, would improve versatility, and would give another worker gainful employment. (Generic Skills, Trade Families, 1979, p. 6)

Chapter III

Analysis and Presentation of Data

Introduction

The content of the previous chapter presented an overview of the industrial education concept as it applies to Alberta, the Alberta Multiple Activity Program, a review of the literature related to generic skills and transferability, as well as a review of research related to the current study. The purpose of this chapter is to present the research data that were collected from the industrial arts teachers who were involved in the investigation.

The population for the study was 65 junior high school rural and urban industrial arts teachers, 43 of whom returned a completed instrument. The data elements from each questionnaire were reviewed by the researcher before these data were entered onto 80 column punch cards by service staff of the Department of Educational Research Services, The University of Alberta, for electronic analysis. Prior to mailing, the questionnaire was formatted into two sections. The first section was designed to collect demographic information from the participating junior high school teachers. The second section contained a two part list of skills from which the teachers were asked to identify the skills they considered to be generic, and two open-ended questions. The first of the two open ended questions asked, in the opinion of the research participants, if they thought the junior high school industrial arts content should be reflective of the four technology education clusters of communication, construction, manufacturing and transportation. The second open-ended question asked those involved in the study to identify the areas of high technology that should be part of the curriculum for industrial arts by the twentieth century.

The input data from the questionnaires were subjected to analysis using a statistical program selected from the $SPSS^{X}$ library of programs, $SPSS^{X}$ Frequencies. This program was selected because it would produce a table of frequencies and percentages for the values of each of the 510 variables that were part of the research instrument. Sample pages from this analysis, a computer readout, may be found in Appendix F, page 155.

For the ease of reporting the collected data, this chapter will be divided into the following sections: Demographics, Psychomotor Generic Skills Analysis, and New Directions. The collected data will be presented in the form of tables so the reader may quickly review the information.

Demographics

The demographics section of the instrument collected information on the teaching background and the professional preparation of the individuals who participated in the study. Within this section of the research instrument there were five questions that dealt with variables such as teaching experience, teaching jurisdiction, possession of a baccalaureate; institution which granted the degree, journeyman certification, and materials technology courses taught.

Question One asked.

1. How many years of experience do you have teaching junior high industrial arts?

1. 1-5 2. 6-10 3. 11-15 4. 16-20 5. 21-(+)

The purpose of this question was to determine the number of years teaching experience each individual had teaching junior high school industrial arts. Collected data appear in table 4. Data in this table indicate that of the 43 junior high school industrial education teachers 35 or 81.4% of that cohort had over six years industrial arts teaching experience in either a rural or an urban junior high school. A further analysis of these data show that 20/43 (46.6%) had more than 11 years of teaching experience; 13/23 (30.3%) had 16 or more years experience teaching industrial education at the junior high school level; and 6/43 (14%) had 21 or more years of experience teaching junior high industrial arts. These data could be interpreted to mean the majority of the teaching force for industrial arts in the province who participated in the research was relatively young when one considers that 30 members of a cohort 43 had fifteen years or less of teaching experience.

Question Two.

2. How is your teaching jurisdiction classified?

1. Rural 2. Urban

This question was written to determine the type of school jurisdiction that employed the teachers involved in the study. The data collected with question two were used to organize table 5. These data show that of 65 questionnaires mailed, 43 were returned for a rate of return of 43/65 or (66.2%). These data also show that the rate of return was higher for rural participants than for urban participants. Of the 27 instruments mailed to rural participants, 26 were returned for a rate of return of 96.3%. Thirty-eight questionnaires were mailed to urban teachers and only 17 were returned. This represented a 44.7% rate of return for this teacher sub-group.

Table 4

Junior High Industrial Education Teaching Experience

(N = 43)

Years of Experience	Rural		Urban		Total	
	No.	%	No.	%	No.	%
1-5	4	15.4	4	23.5	8	18.6
6-10	10	38.5	5	29.4	15	34.9
11-15	5	19.2	2	11.8	7	16.3
16-20	5	19.2	2	11.8	7	16.3
21 +	2	7.7	4	23.5	6	14.0
Total	26	100.0	17	100.0	43	100.0

Table 5

Employing Jurisdiction of Participants

(N = 43)

Employing Jurisdiction	Questionnaires			
	Mailed		Received	
	No.	%	No.	%
Rural	27	41.5	26	96.3
Urban	38	58.5	17	44.7
Total	65	100.0	43	---

Question Three.

Question three was a two part question. The first part required only a simple "yes" or "no" response to the question. Question three asked:

3. Do you possess a Bachelor of Education degree or equivalent from a University other than The University of Alberta?

1. Yes 2. No

If the response was "yes", the participant was asked to identify the institution which granted the degree by circling the appropriate number before one of the universities listed. Participants who did not graduate from one of the Canadian universities listed, could enter that information in the "Other" category (option 9). The second part of question three read:

If YES, please circle the number of the institution which granted the degree:

1. University of British Columbia
2. University of Manitoba
3. University of Toronto
4. McGill University
5. Memorial University
6. University of Saskatchewan
7. Nova Scotia Teachers College
8. University of New Brunswick
9. Other (please identify) ______________________

Data collected from this portion of the question were used to organize tables 6 and 7.

Data in table 6 show that 19 rural teachers and 14 urban teachers of the 43 who participated in the study received their first degree from The University of Alberta. This represented 76.7% of the research population.

Data in this table show that the remaining 10 teachers (23.3%) received a bachelor degree from either a Canadian (other than The University of Alberta) or an American university. By comparing data from table 6 with data in table 7, it was found that participants who did not graduate from The University of Alberta graduated from one of the following Canadian institutions of higher learning: University of British Columbia, 2 (4.7%); University of Saskatchewan, 2 (4.7%); University of Toronto, 2 (4.7%); and Laurentian University, 1 (2.3%). Three of the research participants indicated they graduated from the following American universities: Brigham Young University, 2 (4.7%); and Ohio Northern University, 1 (2.3%). It is evident from these data that more than three quarters, 33 of the 43 junior high school industrial education teachers who were involved in the research were graduates of the industrial arts teacher education program offered at The University of Alberta. Canadian universities, in total, prepared 40 of the 43 teachers and American universities prepared three of the research participants.

Table 6

Graduated from The University of Alberta with Bachelor of Education (N = 43)

University of Alberta Graduate	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	19	73.1	14	82.4	33	76.7
No	7	26.9	3	17.6	10	23.3
Total	26	100.0	17	100.0	43	100.0

Question Four.

Question four helped to determine the number of participants who held journeyman qualifications in addition to the bachelor degree, the type of journeyman specialization, and the province which granted the certificate. The fourth question had three interrelated parts. The first part asked:

4. Do you possess a journeyman certificate?

1. Yes 2. No

If the response was "yes", participants were asked to identify their trade specialization by filling in the blank which was the second part of the question.

For this part of the question, these individuals were asked to identify the province which granted the journeyman certificate. Data collected with this question were used to organize table 8 and show that of the 43 participants, 9 (20.9%) were certificated journeymen in the following areas of specialization: carpentry 5/43 (11.6%); electrical/electronic 2 (4.7%); graphics pressmen 1/43 (2.3%); and mechanic 1/43 (2.3%). An analysis of the questionnaires for these individuals who stated they were certified journeyman indicate that the largest number of journeyman certificates were issued by Alberta (7), followed by Manitoba (1), and Nova Scotia (1). Of the nine members of the study who had journeyman certification, six were employed by rural school jurisdictions while the remaining three were employed by urban school boards. These data can be interpreted to mean that the majority 34/43 (79.1%) of the teaching force responsible for teaching industrial education at the junior high school level are generalists and not specialists. A generalist is a teacher who graduated from the industrial arts teacher preparation program with a use level of skill for a wide variety of tools, machines, materials, and processes. A generalist is not a certified journeyman.

Table 7

Canadian and Other Universities Which Granted Baccalaureate to Participants (N = 43)

Institution	Participants Number	Participants Percent
1. University of British Columbia	2	4.7
2. University of Manitoba	0	0
3. University of Toronto	2	4.7
4. McGill University	0	0
5. Memorial University	0	0
6. University of Saskatchewan	2	4.7
7. Nova Scotia Teachers College	0	0
8. University of New Brunswick	0	0
9. Other:		
Brigham Young University	2	4.7
Laurentian University *	1	2.3
Ohio Northern University	1	2.3

Note. * Laurentian University is a Canadian university located in the western part of the province of Ontario

Table 8

Number of Participants with Journeyman Certification

(N = 43)

Journeyman Certificate	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	6	14.0	3	6.9	9	20.9
No	20	46.5	14	32.6	34	79.1
Type:						
carpentry	3	6.9	2	4.7	5	11.6
electrical/electronic	1	2.3	1	2.3	2	4.7
graphics/pressman	1	2.3	0	00.0	1	2.3
mechanic	1	2.3	0	00.0	1	2.3
Total	6	13.8	3	7.0	9	20.9

Question Five:

The fifth question of the demographics portion of the questionnaire was a two part question. The first part asked participants to identify, from a list, those material technology areas that they were teaching when the research was conducted. The second part of the question was closely related to the first part and asked the participants to identify those material technologies that they had previously taught. The question asked:

5. Please identify which of the following from the Materials Technology field of study you are presently teaching:

11. Woods
12. Metals
13. Earths
14. Leather and Textiles
15. Plastics

or those that you have taught:

16. Woods
17. Metals
18. Earths
19. Leather and Textiles
20. Plastics

Data in table 9 show the number of participants currently teaching the following Materials Technology areas: 42/43 (97.7%) woods; 38/43 (88.4%) metals; 30/43 (69.8%) earths; 32/43 (74.4%) plastics; and only 15/43 (34.9%) leather and textiles. For the second part of the two part question, the data indicated that woods had been previously taught by 35/43 (81.4%); metals by 34/43 (79.1%); earths by 29/43 (67.4%); plastics by 30/43 (69.8%); and leather and textiles by 30/43 (69.8%). Such data could be interpreted to mean that woods, metals, earths, and plastics are relatively stable elements in the Materials Technology curriculum while leather and textiles, on the other hand, seems to be losing their place as learning activities in the multiple activity setting.

Table 9

Junior High Materials Technology Courses Teaching / Taught

(N = 43)

Materials Technology Courses	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Teaching						
woods	25	96.2	17	100.0	42	97.7
metals	21	80.8	17	100.0	38	88.4
carths	19	73.1	11	64.7	30	69.8
leather/textiles	11	42.3	4	23.5	15	34.9
plastics	18	69.2	14	82.4	32	74.4
Taught						
woods	22	84.6	13	76.5	35	81.4
metals	21	80.8	13	76.5	34	79.1
earths	18	69.2	11	64.7	29	67.4
leather/textiles	19	73.1	11	64.7	30	69.8
plastics	18	69.2	12	70.6	30	69.8

Psychomotor Generic Skills Analysis

The skills analysis portion of the instrument comprised the second part of the questionnaire and was divided into the following five sub-sections: Earths Activities; Leatherwork Activities; Metalwork Activities; Plastics Activities; and Woodwork Activities. This was followed by two open-ended questions which asked participants to select from a list of high technology learning activities those activities they felt would be part of the industrial arts content within the next 15 years. The collected data will be presented as tables and supplemented with written commentary for the benefit of the reader.

For the last twenty-five years, the industrial arts laboratory for the junior high school multiple activity program has been organized into a multiple activity learning environment where woods, metals, plastics, earths, leather and textiles have been taught. These materials are considered by the Curriculum Branch of Alberta Education to fall under the Materials Technology field of study.

To identify the psychomotor generic skills involved in the study, the researcher arbitrarily established a pre-set generic skill value, 65%, as the cut-off value for determining whether a skill was generic or not. Those skills that did not meet the 65% criterion were not considered generic and were thus eliminated from the study. To see information on the number of skills at various valid percent scores, the reader is referred to Appendix F, page

There were 24 earths activities, the term activities and skills will be used interchangeably, listed on the research instrument that could be used to process earths in a multiple activity laboratory. Data in table 10 show that of these 24 activities, only four skills were considered by the participants to have generic qualities. Only three of the four activities were considered generic by either the rural or the urban group. Sixty-four percent of the rural teachers identified "apply paint, glaze, or underglaze" to be generic; while 60% of the urban group identified "fettle, repair, and smooth casting" to be generic. Neither of these skills, in their respective jurisdictions, meet the criterion established as the cut-off point and therefore could not be classified as a generic skill. It should be noted that in the tables that follow, all of the skills listed may not be generic to a particular sub-population. In these tables, a skill is identified as generic by a dot (•) in the appropriate column for either sub-population. If the dot (•) is missing, the skill was not considered to be generic for that sub-population.

The data in table 11 identify the skills perceived by research participants to be generic leatherworking skills. Of the 29 skills presented for the leatherwork activities section on the research instrument, 10/29 (34.5%) were found to be generic by both the rural and the urban industrial arts teachers. Of these 10 skills, only six were considered to be generic by both rural and urban teachers. Since "punch for lacing" and "do stamping" were below the established criterion of 65%, these two skills were not classified as generic skills for rural teachers. Similarly, because the skills "do repousse tooling" and "apply leather lacquer, stain, dye" were also below this criterion, they did not qualify as generic skills for the urban teacher sub-population. The results of the study for the activities used to cut, shape, form, or assemble leather as a material could indicate that industrial arts teachers may be using precut manufactured kits to teach their students the skills associated with leatherworking activities.

Table 10

Earth Activities Rated as Generic by Research Participants

(N = 43)

Earth Activities	Sub Population		Percent	
	Rural	Urban	Rural	Urban
Plan procedure	•	•	87.5	92.9
Design, modify, or adapt projects	•	•	80.0	80.0
Fettle, repair, and smooth casting	•		72.0	60.0
Apply paint, glaze, or underglaze		•	64.0	73.3

The 24 metalworking activities identified on the questionnaire were those skills generally involved in benchwork. Sixteen of these 24 skills (66.7%) were rated as having generic status. These data are presented in table 12. Urban junior high school teachers considered all 16 skills to be generic while the rural teachers rated 14 of the 16 skills as generic. The rural teachers did not consider "cut stock with power band saw" and "use soft solder" to be generic skills.

Table 11

Leatherwork Activities Considered Generic by Research Participants

(N = 43)

Leatherwork Activities	Sub Population		Percent	
	Rural	Urban	Rural	Urban
Plan procedure	•	•	81.0	85.7
Design, modify, or adapt projects	•	•	77.3	71.4
Make patterns or transfer designs	•	•	87.5	78.6
Cut to a line with leather shears	•	•	86.4	92.9
Cut to a line with swivel knife	•	•	68.2	78.6
Punch for lacing		•	50.0	92.9
Do stamping		•	45.5	71.4
Do repousse tooling	•		69.2	15.4
Cement leather and linings	•	•	71.4	85.7
Apply leather lacquer, stains, dyes	•		68.2	57.1

Table 13 includes a list of the activities which participating teachers identified as generic to cut, shape, form, and assemble plastic materials. The survey instrument listed 23 activities that could be used by industrial arts students to work with plastic in a multiple activity laboratory. The research sample rated 16/23 (69.6%) of the activities on the instrument as generic. Fourteen skills were rated generic by rural teachers, 15 by urban teachers.

Table 12

Metalwork Activities Classified as Generic by Research Participants

(N = 43)

Metalwork Activities	Sub Population		Percent	
	Rural	Urban	Rural	Urban
Plan procedure	•	•	88.5	87.5
Design, modify, or adapt projects	•	•	76.9	76.5
Use scribe in layout	•	•	80.8	100.0
Layout distance/area with dividers	•	•	84.6	100.0
Measure with a rule	•	•	96.2	100.0
Use a center/prick punch	•	•	69.2	82.4
Use inside/outside calipers	•	•	88.0	88.2
Layout centers on round stock	•	•	70.8	88.2
Cut stock with power band saw		•	60.0	82.4
Saw to a line with hacksaw	•	•	76.9	88.2
File/draw file a surface or edge	•	•	88.0	100.0
Clean file with file card	•	•	88.5	94.1
Drill, countersink with drill press	•	•	84.6	100.0
Cut to a line with snips	•	•	92.3	94.1
Use soft solder		•	50.0	70.6
Hand polish with emery dust	•	•	70.8	88.2

Table 13

Plastic Activities Categorized as Generic by Those Involved in the Study

(N = 43)

Plastic Activities	Sub Population		Percent	
	Rural	Urban	Rural	Urban
Plan procedure	•	•	87.5	87.5
Design, modify, or adapt projects	•	•	78.3	75.0
Layout pattern on stock	•	•	95.7	100.0
Saw to a line with a coping saw	•	•	87.0	93.8
Saw to a line with a backsaw	•	•	87.0	87.5
Saw to a line with a scroll saw	•	•	91.3	93.3
Saw to a line with a band saw	•	•	91.3	100.0
Shape with a disk sander	•	•	69.6	75.0
Shape with sandpaper/files	•	•	91.3	87.5
Drill holes with drill press	•	•	95.7	100.0
Drill holes with hand drill	•	•	78.3	100.0
Chemical/mechanical fasten	•	•	87.0	75.0
Hand buff with liquid abrasive	•		59.1	75.0
Machine buff	•		65.2	62.5
Hand sand edge with sand paper	•	•	95.7	100.0
Use stencil for painting/decorating	•		57.1	71.4

The data in table 14 list 40 activities from the research instrument perceived by research participants to be generic for woodworking at the junior high school level. Of the 51 activities that were listed in the research instrument, 40/51 (78.4%) were considered to be generic skills. Teachers in rural areas rated 26 of the 40 skills as generic. Urban teachers rated all 40 skills as having generic qualities. This was the highest area of disagreement between the two sub-groups of the research sample with a 14/40 (35.0%) perception of skill differential. Conversely, this was the only skill area where both teacher sub-groups identified a skill to be 100% generic, "layout pattern on stock".

Table 14

<u>Woodwork Activities Identified as Generic by Study Participants</u>

(N = 43)

Woodwork Activities	Sub Population		Percent	
	Rural	Urban	Rural	Urban
Plan procedure	•	•	92.3	88.2
Design, modify, or adapt projects	•	•	80.8	76.5
Read working drawings	•	•	92.3	100.0
Copy design via grid squares	•	•	73.1	100.0
Make and use templates	•	•	88.5	94.1
Layout curves with compass	•	•	84.6	100.0
Measure and divide with a ruler	•	•	92.3	100.0
Layout pattern on stock	•	•	100.0	100.0
Saw to line with hand/backsaw	•	•	96.2	100.0
Saw with coping saw	•	•	88.5	94.1
Saw circles with key-hole saw	•	•	68.0	82.4

Table 14. Woodwork Activities (con't.)

Cut tapers with crosscut saw		•	53.8	82.4
Cut miters in a miter box	•	•	65.4	81.3
Plane edge, end, or surface true		•	61.5	76.5
Test square with tri-square	•	•	84.6	94.1
Drill holes with hand drill	•	•	88.5	94.1
Countersink holes with rosebud		•	61.5	94.1
Layout cuts, carpenter's square	•	•	80.8	100.0
Layout angle using sliding T bevel	•	•	80.0	87.5
Gauge lines with marking gauge	•	•	69.2	87.5
Trim and pare with chisel		•	52.0	81.3
Square edges or ends with a file	•	•	88.5	88.2
Shape irregular curves with rasp	•	•	76.9	76.5
Sand flat/curved surfaces smooth	•	•	92.3	94.1
Use bar clamps to glue edge joint		•	57.7	82.4
Glue surface using hand screws		•	56.0	66.7
Cut and resaw stock with band saw		•	64.0	76.5
Mount stock between lathe centers	•	•	65.4	76.5
Size stock with parting tool		•	50.0	70.6
Sand stock in lathe		•	53.8	82.4
Mount stock on faceplate		•	50.0	70.6
Size stock on faceplate		•	53.8	70.6
Hollow out stock on faceplate		•	50.0	76.5
Drill holes with drill press	•	•	92.3	94.1
Set brads with nail set		•	61.5	76.5
Set screws with countersink	•	•	80.8	81.3
Chemical/mechanical fasten	•	•	80.8	94.1

Apply an oil stain finish	•	•	73.1	70.6
Apply a varnish finish		•	57.7	70.6
Finish with wet/dry sand paper	•	•	88.5	100.0

Skill Acquisition (Rural)

The activity section of the questionnaire asked the 43 teachers involved in the research to identify where they acquired the skills listed in each of the the five activity areas. This they did by checking either a "yes" or a "no" in the appropriate column opposite each skill statement. An affirmative response was interpreted by the researcher to mean that the skill had been acquired during the individuals university preparation to become an industrial arts teacher. A negative response was interpreted to mean that the skill had been acquired through inservice training.

It will be recalled that 26 rural industrial arts teachers submitted completed questionnaires for analysis and 17 urban teachers also returned completed questionnaires. The researcher chose an arbitrary cut-off value of 50% to help determine where individual research participants acquired a particular skill. If under the column headed "University", a value of 50% or less was noted, the skill was not acquired at university. A value of 51% or more determined that the skill was acquired at university while studying to become an industrial arts teacher.

The data collected with this portion of the research instrument were used to organize tables 15 through 19.

Data in table 10 indicate that only three of the 24 earths skills listed in the instrument were considered to be generic by the rural teachers. These data were used to formulate table 15 and to show where these teachers acquired these three skills. It is evident from an analysis of data in this table that these teachers acquired these skills as pre-service teachers.

Table 15

Acquisition of Generic Earth Skills: Rural Teachers

(N = 26)

Generic Earth Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	21	62.5	37.5
Design, modify, or adapt projects	20	56.0	44.0
Fettle, repair, and smooth casting	18	52.0	48.0

* = Number of Teachers

Using the data from table 11 as a source, eight generic skills for leatherworking activities identified in that table were used to organize table 16. It is evident from an analysis of these data that for the 26 rural teachers seven of these skills were developed through inservice training. This result is not unusual because students enrolled in the industrial arts teacher preparation program at The University of Alberta do not receive instruction in leatherwork activities because of its predominant craft orientation.

Table 16

Acquisition of Generic Leatherwork Skills: Rural Teachers

(N = 26)

Generic Leatherwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	17	38.1	61.9
Design, modify, or adapt projects	17	36.4	63.6
Make patterns or transfer designs	18	33.3	66.7
Cut to a line with leather shears	19	45.5	54.5
Cut to a line with swivel knife	15	40.9	59.1
Do repousse tooling	18	50.0	50.0
Cement leather and linings	15	47.6	52.4
Apply leather lacquer, stains, dyes	15	40.9	59.1

* = Number of Teachers

Fourteen of the 16 generic skills used to work with metals that were identified by the rural teacher sub-population listed in table 17 were taken from table 12. These data show that not all 26 teachers responded to each skill statement, but for those who did, they identified six of these 14 skills as being learned in university and eight were acquired through inservice.

Table 17

Acquisition of Generic Metalwork Skills: Rural Teachers

(N = 26)

Generic Metalwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	23	57.7	42.3
Design, modify, or adapt projects	20	46.2	53.8
Use scribe in layout	21	61.5	38.5
Layout distance/area with dividers	22	50.0	50.0
Measure with a rule	25	46.2	53.8
Use a center/prick punch	18	53.8	46.2
Use inside/outside calipers	22	64.0	36.0
Layout centers on round stock	17	62.5	37.5
Saw to a line with hacksaw	20	46.2	53.8
File/draw file a surface or edge	22	50.0	50.0
Clean file with file card	23	53.8	46.2
Drill, countersink with drill press	22	50.0	50.0
Cut to a line with snips	24	50.0	50.0
Hand polish with emery dust	17	33.3	66.7

* = Number of Teachers

Table 13 lists 16 psychomotor generic skills to work plastics as a material that were identified by the 43 rural and urban junior high school industrial arts teachers who participated in the study. Of these 16 skills, 14 were used to assemble table 18. These data show that not all 26 rural teachers responded to this portion of the questionnaire. Those who did, indicated that they acquired eight of the generic skills at university, and the remaining six were acquired after they left university.

The 26 woodworking activities listed in table 19 are the generic skills identified by the rural teacher research participant group. This subset of skills from table 14 received a rating of 65% or more by the participants. Not all rural teachers indicated where they acquired each of the 26 generic skills. Of the 26 skills listed in table 19, seven were acquired by rural teachers at university and 19 were acquired by these teachers through inservice.

Table 18

Acquisition of Generic Plastic Skills: Rural Teachers

(N = 26)

Generic Plastic Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	20	60.9	39.1
Design, modify, or adapt projects	18	56.5	43.5
Layout pattern on stock	22	56.5	43.5
Saw to a line with a coping saw	20	43.5	56.5
Saw to a line with a backsaw	20	43.5	56.5
Saw to a line with a scroll saw	21	56.5	43.5
Saw to a line with a band saw	21	69.6	30.4
Shape with a disk sander	16	52.2	47.8
Shape with sandpaper/files	21	43.5	56.5
Drill holes with drill press	22	43.5	56.5

Table 18. Acquisition of Generic Plastic Skills (con't.)

Drill holes with hand drill	18	39.1	60.9
Chemical/mechanical fasten	20	78.3	21.7
Machine buff	15	78.3	21.7
Hand sand edge with sand paper	22	43.5	56.5

* = Number of Teachers

Table 19

Acquisition of Generic Woodwork Skills: Rural Teachers

(N = 26)

Generic Woodwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	24	53.8	46.2
Design, modify, or adapt projects	21	50.0	50.0
Read working drawings	24	57.7	42.3
Copy design via grid squares	19	46.2	53.8
Make and use templates	23	46.2	53.8
Layout curves with compass	22	50.0	50.0
Measure and divide with a ruler	24	46.2	53.8
Layout pattern on stock	26	50.0	50.0
Saw to line, handsaw/backsaw	25	50.0	50.0
Saw with coping saw	23	42.3	57.7
Saw circles with key-hole saw	17	32.0	68.0
Cut miters in a miter box	17	52.0	48.0
Test square with tri-square	22	46.2	53.8
Drill holes with hand drill	23	34.6	65.4

Table 19. Acquisition of Generic Woodwork Skills (con't.)

Layout cuts, carpenter's square	21	30.8	69.2
Layout angle using sliding T bevel	20	40.0	60.0
Gauge lines with marking gauge	18	61.5	38.5
Square edges or ends with a file	23	34.6	65.4
Shape irregular curves with rasp	20	38.5	61.5
Sand flat/curved surfaces smooth	24	50.0	50.0
Mount stock between lathe centers	17	69.2	30.8
Drill holes with drill press	24	50.0	50.0
Set screws with countersink	20	38.5	61.5
Chemical/mechanical fasten	21	42.3	57.7
Apply an oil stain finish	19	61.5	38.5
Finish with wet/dry sand paper	23	61.5	38.5

* = Number of Teachers

Skill Acquisition (Urban)

The data collected with this portion of the research instrument were used to organize tables 20 through 24.

The generic skills for earths activities identified in table 10 for the urban cohort are identical to the skills that were used to organize table 20. In table 20 are data which show that not all of the 17 urban teachers identified where they acquired the skills to work earths. Only 11/17 (64.7%) of the urban teachers provided this information. From an analysis of the data in table 20, it becomes evident that all three skills were acquired while at university preparing to become a teacher.

Table 20

Acquisition of Generic Earth Skills: Urban Teachers

(N = 17)

Generic Earth Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	13	71.4	28.6
Design, modify, or adapt projects	12	73.3	26.7
Apply paint, glaze, or underglaze .	11	80.0	20.0

* = Number of Teachers

The generic leatherwork skills listed in table 11 for urban participants are those used to organize table 21. An analysis of data in this table show that each of the eight generic skills listed were acquired through some form of inservice experience. This is not surprising because leatherwork and its related activities are not part of the prescribed coursework for university students enrolled in the industrial arts teacher preparation program offered by The University of Alberta.

Table 21

Acquisition of Generic Leatherwork Skills: Urban Teachers

(N = 17)

Generic Leatherwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	12	50.0	50.0

Table 21, Acquisition of Generic Leatherwork Skills (con't.)

Design, modify, or adapt projects	10	35.7	64.3
Make patterns or transfer designs	11	28.6	71.4
Cut to a line with leather shears	13	21.4	78.6
Cut to a line with swivel knife	11	21.4	78.6
Punch for lacing	13	14.3	85.7
Do stamping	10	21.4	78.6
Cement leather and linings	12	14.3	85.7

* = Number of Teachers

Table 12 contains 16 metalworking skills that were rated as generic by 65% of the urban research participants. These 16 generic skills were used to organize table 22. Of these 16 skills, 13 were identified as being acquired at university and the remaining three skills being acquired through inservice experience.

Table 22

Acquisition of Generic Metalwork Skills: Urban Teachers

(N = 17)

Generic Metalwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	14	87.5	12.5
Design, modify, or adapt projects	13	58.8	41.2
Use scribe in layout	17	58.8	41.2
Layout distance/area with dividers	17	58.8	41.2
Measure with a rule	17	58.8	41.2

Table 22, Acquisition of Generic Metalworking Skills (con't.)

Use a center/prick punch	14	58.8	41.2
Use inside/outside calipers	15	64.7	35.3
Layout centers on round stock	15	70.6	29.4
Cut stock with power band saw	14	82.4	17.6
Saw to a line with hacksaw	15	41.2	58.8
File/draw file a surface or edge	17	58.8	41.2
Clean file with file card	16	58.8	41.2
Drill, countersink with drill press	17	58.8	41.2
Cut to a line with snips	16	58.8	41.2
Use soft solder	12	47.1	52.9
Hand polish with emery dust	15	35.3	64.7

* = Number of Teachers

Table 23 lists 15 of the 16 generic skills that urban industrial arts teachers identified in table 13 as the skills used to work plastic as a material in the multiple activity laboratory. Of the 15 skills in table 23, urban teachers, by answering affirmatively, indicated that they acquired three of these skills at university and the remaining 12 skills were acquired through some form of inservice activity. An analysis of these skills point to the fact that most of these benchwork skills are used to work sheet plastic such as an acrylic.

Table 23

Acquisition of Generic Plastic Skills: Urban Teachers

(N = 17)

Generic Plastic Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	14	75.0	25.0
Design, modify, or adapt projects	12	68.8	31.2
Layout pattern on stock	16	56.3	43.7
Saw to a line with a coping saw	15	37.5	62.5
Saw to a line with a backsaw	14	37.5	62.5
Saw to a line with a scroll saw	14	43.8	56.2
Saw to a line with a band saw	16	43.8	56.2
Shape with a disk sander	12	40.0	60.0
Shape with sandpaper/files	14	40.0	60.0
Drill holes with drill press	16	43.8	56.2
Drill holes with hand drill	16	37.5	62.5
Chemical/mechanical fasten	12	50.0	50.0
Hand buff edge, liquid abrasive	12	50.0	50.0
Hand sand edge with sand paper	16	43.8	56.2
Use stencil painting/decorating	10	28.6	71.4

* = Number of Teachers

In table 14 there are 40 of the 51 woodworking activities that research participants identified as having generic characteristics. These 40 skills were used to organize table 24. An analysis of these data show that not all of the 17 urban teachers identified where each skill was acquired. Of the 40 skill statements identified from the research, 20 activities were acquired by urban teachers at university with the remaining 20 activities they acquired through inservice.

Table 24

Acquisition of Generic Woodwork Skills: Urban Teachers

(N = 17)

Generic Woodwork Skills	Generic Skills Acquired		
	No. of Tchs*	University	Inservice
Plan procedure	15	76.5	23.5
Design, modify, or adapt projects	13	64.7	35.3
Read working drawings	17	52.9	47.1
Copy design via grid squares	17	29.4	70.6
Make and use templates	16	52.9	47.1
Layout curves with compass	17	35.3	64.7
Measure and divide with a ruler	17	41.2	58.8
Layout pattern on stock	17	58.8	41.2
Saw to line, handsaw/backsaw	17	41.2	58.8
Saw with coping saw	16	41.2	58.8
Saw circles with key-hole saw	14	35.3	64.7
Cut tapers with crosscut saw	14	35.3	64.7
Cut miters in a miter box	13	56.3	43.7
Plane an edge, end, or surface true	13	52.9	47.1
Test square with tri-square	16	47.1	52.9
Drill holes with hand drill	16	41.2	58.8

Table 24. Acquisition of Generic Woodwork Skills (con't.)

Countersink holes with rosebud	16	41.2	58.8
Layout cuts, carpenter's square	17	47.1	52.9
Layout angle using sliding T bevel	14	56.3	43.7
Gauge lines with marking gauge	14	50.0	50.0
Trim and pare with chisel	13	37.5	62.5
Square edges or ends with a file	15	47.1	52.9
Shape irregular curves with rasp	13	41.2	58.8
Sand flat/curved surfaces smooth	16	47.1	52.9
Use bar clamps to glue edge joint	14	52.9	47.1
Glue surface using hand screws	10	60.0	40.0
Cut and resaw stock with bandsaw	13	64.7	35.3
Mount stock between lathe centers	13	58.8	41.2
Size stock with parting tool	12	64.7	35.3
Sand stock in lathe	14	58.8	41.2
Mount stock on faceplate	12	58.8	41.2
Size stock on faceplate	12	58.8	41.2
Hollow out stock on faceplate	13	64.7	36.3
Drill holes with drill press	16	52.9	47.1
Set brads with nail set	13	35.3	64.7
Set screws with countersink	13	37.5	62.5
Chemical/mechanical fasten	16	52.9	47.1
Apply an oil stain finish	12	52.9	47.1
Apply a varnish finish	12	47.1	52.9
Finish with wet/dry sand paper	17	41.2	58.8

* = Number of Teachers

New Directions

To determine teacher satisfaction with the current curriculum for industrial arts and the future direction that this subject area should take, two multiple part open ended questions were made part of the research instrument. The first question required a simple "yes/no" response. Participants who responded "yes" were asked to identify from a list of learning activities those they felt should be removed from the junior high school curriculum. The first part of question one stated:

1. Since its inception in 1964, the curriculum for industrial arts has been revised four times by the curriculum branch of the Department of Education in its effort to keep the program of study current and relevant. Through the product method of the plan, students are exposed to a limited number of tools, machines, materials, processes, and technologies prevalent in a productive society. In contrast, leaders for the industrial arts movement in the United States have altered the program from the traditional tools, machines, materials, processes, and product approach to the clustering of technologies into four broad areas: communication, construction, manufacturing, and transportation. In your opinion, do you feel that industrial education at the junior high school level should be revised to reflect evolving technologies?

1. YES 2. NO

Of the 41 teachers who answered this question, 28 or 65.1% responded "yes" that the curriculum for industrial arts at the junior high school level should be changed these data are found in table 25. The reason given for this change could be clustered under the following headings in this rank order:

to keep current with economy, society, and progressive education (10),

to allow for the integration of new materials and technology (5),

to keep program interesting to students and useful for those entering the workforce (4),

to prevent the stagnation of knowledge (3), and

to make the multiple activity laboratory more effective (2).

Table 25

Participants Response to Junior High Industrial Arts Curriculum Change Statement

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	18	72.0	10	55.6	28	65.1
No	7	28.0	6	33.3	13	30.2
No Response	0	0.0	2	11.1	2	4.7
Total	25	100.0	18	100.0	43	100.0

The 13 remaining teachers by offering a "no" response indicated they were satisfied with the current curriculum. The reasons they gave for this satisfaction in rank order were:

"change" would be nice, however, budget money is generally not available (5), trying to keep current is expensive and counter productive, better to continue to teach hand/eye coordination for skill building (3).

basic skills need to be taught, this is best accomplished at junior high school level (2), and

present curriculum already allows for "change" (2).

From comments made by some of the participants on their research instruments, it was apparent that they did not understand the intent of the question. The intent was to determine curriculum modification in the future for the junior high school industrial arts program to make it more relevant to technological change. Although the curriculum guides for the Alberta Multiple Activity Program has been in use since 1964, as an interim education guide, it has been revised in 1969, 1976, and again in 1982. With each revision, the structure of the course was modified but none of the materials or technologies were rationalized to make room for new materials or evolving technologies.

Curriculum Content to be Removed

Part two of question one asked participating industrial arts teachers to identify those learning activities they would eliminate from the curriculum. From the 30 activities listed, six for each of the five materials taught in the Materials Technology field of study in a junior high school laboratory. The question asked:

If you were in a position of authority, which of the following learning activities would you remove from the curriculum for junior high school? (please circle the response)

<u>Plastics</u>
17. injection molding
18. rotation molding
19. thermoforming
20. fiberglassing

<u>Woods</u>
23. identifying
24. form using power tools
25. form using hand tools
26. product planning

21. laminating
22. compression molding
27. laminating
28. finishing

Leather and Textiles
29. layout and cutting
30. stamping/carving
31. combining/adhering
32. stitching/sewing
33. staining/coloring
34. finishing

Earths
35. jiggering flatware
36. slip casting
37. slab construction
38. coil construction
39. finishing/glazing
40. mold making

Metals
41. machine metal stock
42. welding/brazing
43. sheet metal
44. foundry
45. combining/adhering
46. finishing

Data collected with this statement were used to organize tables 26 through 30. It should be noted that a 0 value under the "No." column or a 00.0 value under the "%" column of any of these tables indicate that the skill was considered significant by that section of the population and should not be removed from the curriculum. In table 26, data indicate that 17/43 or 39.5% of the research population would remove "mold making" from the junior high school curriculum for earths. Other data in this table show that 14/43 (32.6%) of the participants would remove "jiggering flatware"; 13 or 30.2% would remove "slab construction"; 13/43 (30.2%) "coil construction"; 9/43 (20.9%) would remove "slip casting"; and 8/43 (18.6%) would remove "finishing/glazing" from the curriculum.

For example, the process of "jiggering flatware" as part of the earths activities was thought to be unnecessary by 8/26 (30.8%) of the rural teachers and by 6/17 (35.3%) of the urban teachers who responded. As a total, 14/43 (32.6%) of the junior high school teachers felt that this skill was redundant and could be removed from the Materials Technology field of study.

Table 26

Earths Activities to be Removed

(N = 43)

Learning Activity	Rural		Urban		Total	
	No.	%	No.	%	No.	%
jiggering flatware	8	30.8	6	35.3	14	32.6
slip casting	4	15.4	5	29.4	9	20.9
slab construction	7	26.9	6	35.3	13	30.2
coil construction	6	23.1	7	41.2	13	30.2
finishing/glazing	3	11.5	5	29.4	8	18.6
mold making	11	42.3	6	35.3	17	39.5

The data in table 27 show the six leather and textile learning activities that participants would choose to eliminate from the course content. Each of these activities represent a process or an activity that is used to create a product or project. These data show that of the 43 respondents 24/43 (55.8%) would remove "stitching and sewing"; 22/43 (51.2%) "layout and cutting"; 22/43 (51.2%) "stamping and carving"; 22/43 (51.2%) "combining / adhering"; 22/43 (51.2%) "staining and coloring"; and 22/43 (51.2%) would remove the "finishing" activity from the curriculum. It is interesting to note that more than half of the total population felt that all six learning activities to work leather as a material should be removed from the curriculum. Such data reinforces the idea that the leather and textile module is losing the popularity it once held and, in time, may be replaced with a new technology.

These six activities in combination are used by a leather worker to produce an object from raw material to a finished product.

Table 27

Leather and Textile Activities to be Removed

(N = 43)

Learning Activity	Rural		Urban		Total	
	No.	%	No.	%	No.	%
layout and cutting	12	46.2	10	58.8	22	51.2
stamping and carving	12	46.2	10	58.8	22	51.2
combining/adhering	12	46.2	10	58.8	22	51.2
stitching and sewing	14	53.8	10	58.8	24	55.8
staining and coloring	12	46.2	10	58.8	22	51.2
finishing	12	46.2	10	58.8	22	51.2

Data in table 28 indicate the metalwork activities that those involved in the research study felt should not be remove from the industrial arts curriculum for junior high school. Of the six learning activities listed in the table, 4/43 (9.3%) of the total population felt that "foundry" should be removed; 4/43 (9.3%) "welding / brazing"; 2/43 (4.7%) "sheet metal"; 1/43 (2.3%) "machining metal stock"; and none of the 43 teachers felt that "combining/adhering" or "finishing of metal" should be removed.

Table 28

<u>Metals Activities to be Removed</u>

(N = 43)

Learning Activity	Rural		Urban		Total	
	No.	%	No.	%	No.	%
machining metal stock	1	3.8	0	00.0	1	2.3
welding/brazing	0	00.0	4	23.5	4	9.3
sheet metal	2	7.7	0	00.0	2	4.7
foundry	2	7.7	2	11.8	4	9.3
combining/adhering	0	00.0	0	00.0	0	00.0
finishing	0	00.0	0	00.0	0	00.0

The data collected for the plastics activities, table 29, show that of 43 junior high school teachers, 11/43 (25.5%) would remove "fiberglassing" from the curriculum; 10/43 (23.3%) "injection molding"; 9/43 (20.9%) "rotation molding"; 6/43 (14.0%) "compression molding"; 3/43 (7.0%) "thermoforming"; and 3/43 (7.0%) would like to remove "laminating" from the plastics curriculum.

Table 29

Plastics Activities to be Removed

(N = 43)

Learning Activity	Rural		Urban		Total	
	No.	%	No.	%	No.	%
injection molding	7	26.9	3	17.6	10	23.3
rotation molding	8	30.8	1	5.9	9	20.9
thermoforming	3	11.5	0	00.0	3	7.0
fiberglassing	5	19.2	6	35.3	11	25.6
laminating	3	11.5	0	00.0	3	7.0
compression molding	4	15.4	2	11.8	6	14.0

The data in table 30 list six selected learning activities that can be performed in the woods area of a multiple activity laboratory. Three of the 43 junior high school teachers or (7.0%) felt that the activity of "identifying" should be removed from the curriculum guide for the woods area; 1/43 (2.3%) "form with power tools"; 1/43 (2.3%) "form with hand tools"; and 1/43 (2.3%) noted that "laminating" should be removed from the woods area curriculum.

Table 30

Woods Activities to be Removed

(N = 43)

Learning Activity	Rural		Urban		Total	
	No.	%	No.	%	No.	%
identifying	2	7.7	1	5.9	3	7.0
form with power tools	1	3.8	0	00.0	1	2.3
form with hand tools	0	00.0	1	5.9	1	2.3
product planning	0	00.0	0	00.0	0	00.0
laminating	0	00.0	1	5.9	1	2.3
finishing	0	00.0	0	00.0	0	00.0

Considering the previous thirty activities for the five material areas, when participating industrial arts teachers were asked why a selected activity should be removed from the curriculum, the teachers showed a wide variation in their responses which ranged from cost to transferability. The following are selected from the comments that were made:

they are old technology and do not reflect industrial processes;

they are more craft than industry;

they are too hazardous for students at junior high school level;

they are too expensive, messy, or require too much supervision;

they are not found interesting by students; and

they are too specialized and therefore do not lead to transferability.

Some of the participating industrial arts teachers through comments made to the two open-ended questions on the research instrument made reference to the fact that leather and textiles should be removed from the present industrial arts curriculum because the activities involved fall into the arts and crafts category rather than into the Materials Technology classification.

Conversely, when participants were asked to give a reason why the learning activity should be kept, some of the recorded responses were:

keep them, too expensive to start new ones;
nice to have the variety and flexibility of many diverse activities;
the basic "materials" are used to foster general manipulative skills; and
the materials used remain the same, only the processes and equipment change.

Curriculum Change

The last question on the questionnaire was an open ended question which asked participants to predict from a list of 10 evolving technologies those that could become part of the junior high school industrial arts curriculum over the next 15 years. A mark in either column, junior or senior high, indicated a favorable response to the inclusion of the technology into the industrial arts curriculum. The question read:

2. Which of the following do you feel should be an important part of the industrial education curriculum in the next fifteen years; please place an (X) in the appropriate space (or spaces) after the answer:

	Junior High	Senior High
Atomic Power		
Computer Assisted Drafting (CAD)		
Computer Integrated Manufacturing (CIM)		
Computer Numeric Control (CNC)		

Desk-Top Publishing		
Fibre Optics		
Hydroponics		
Lasers		
Robotics		
Solar Energy		

Other Activities (Please List)

The data in tables 31 through 40 illustrate the perceptions that the 43 rural and urban teachers had toward the 10 technologies becoming part of instruction and content for junior high school students in Alberta within the next 15 years.

Data in table 31 indicate that only 3 of the 43 participating junior high school teachers, or 7.0%, felt Atomic Power should be incorporated as content for the industrial arts junior high school curriculum within the next decade and a half. It is interesting to note that the positive responses came only from the urban teacher sub-population.

Table 31

Industrial Arts Curriculum Addition: Atomic Power

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	0	00.0	3	17.6	3	7.0
No	26	100.0	14	82.4	40	93.0
Total	26	100.0	17	100.0	43	100.0

Data from table 32, Computer Assisted Drafting (CAD), received a more positive reaction from both sub-populations than did that of Atomic Power. Of the 43 respondents, 12/43 (27.9%) thought that CAD would become part of the industrial arts curriculum for the junior high school in the immediate future.

Table 32

Industrial Arts Curriculum Addition: Computer Assisted Drafting (CAD)

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	8	30.8	4	23.5	12	27.9
No	18	69.2	13	76.5	31	72.1
Total	26	100.0	17	100.0	43	100.0

Table 33 includes data which show that of the 43 respondents, 18 or 41.9% felt that the technology associated with Computer Integrated Manufacturing would become part of the curriculum content for junior high school industrial arts by the year 2000.

Another computer assisted operation in the manufacturing industry is Computer Numeric Control (CNC). These lathes, milling machines, and drill presses although quite expensive, are becoming increasingly popular in industry due to their speed, accuracy, and programmable capabilities. A number of manufacturers are producing these machines for the educational classroom. Of the respondent group of 43 junior high school teachers, 35 or 81.4% were of the opinion that this technology would become part of the industrial arts curriculum for students in junior high school. These data are part of table 34.

Table 33

Industrial Arts Curriculum Addition: Computer Integrated Manufacturing (CIM)

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	11	42.3	7	41.2	18	41.9
No	15	57.7	10	58.8	25	58.1
Total	26	100.0	17	100.0	43	100.0

Data in table 35 illustrate the perceptions that respondents held toward Desk-Top Publishing as a future learning activity for junior high school industrial arts curriculum content. Six of 43 or 14.0% of these teachers took an affirmative position that Desk-Top Publishing would become curriculum material. Conversely, 86.0% of the research population 37/43, took the opposite position.

Table 34

Industrial Arts Curriculum Addition: Computer Numeric Control (CNC)

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	22	84.6	13	76.5	35	81.4
No	4	15.4	4	23.5	8	18.6
Total	26	100.0	17	100.0	43	100.0

The research cohort was asked to rate Fibre Optics as a possible addition to the industrial arts curriculum. As a cohort, 25 or 58.1% felt that Fibre Optics would become part of the course material for industrial arts over the next 15 years. These data are found in table 36.

Table 35

Industrial Arts Curriculum Addition: Desk-Top Publishing

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	4	15.4	2	11.8	6	14.0
No	22	84.6	15	88.2	37	86.0
Total	26	100.0	17	100.0	43	100.0

Table 36

Industrial Arts Curriculum Addition: Fibre Optics

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	15	57.7	10	58.8	25	58.1
No	11	42.3	7	41.2	18	41.9
Total	26	100.0	17	100.0	43	100.0

The 43 teacher participants were asked to provide their perception as to whether the practice of growing plants in water, without soil, (Hydroponics) was a potential area for study for junior high school industrial arts. These data are presented in table 37 and show that only 8/43 (18.6%) of those involved in the research felt that this "science" would become part of the curriculum for junior high school industrial arts by the turn of the century.

Table 37

Industrial Arts Curriculum Addition: Hydroponics

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	6	23.1	2	11.8	8	18.6
No	20	76.9	15	88.2	35	81.4
Total	26	100.0	17	100.0	43	100.0

Data in table 38 illustrate the opinions of research participants to the question "will LASER technology become part of the curriculum for industrial arts". The use of Light Amplification by Stimulated Emissions of Radiation, (LASER), is seeing widespread use in many facets of Canada's productive society from medicine to manufacturing with considerable research being conducted on this technology at universities across the nation. Of the 43 teachers who responded, 26/43 (60.5%) felt that LASERs would become an integral part of the industrial arts curriculum for junior high school students.

Table 38

Industrial Arts Curriculum Addition: LASERs

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	12	46.2	14	82.4	26	60.5
No	14	53.8	3	17.6	17	39.5
Total	26	100.0	17	100.0	43	100.0

In table 39 are data which illustrate the opinions of those junior high school teachers who were involved in the study toward the addition of Robotics to the junior high school industrial arts curriculum. Nineteen of the 43 teachers, 44.2%, were of the opinion that Robotics would become part of the curriculum for industrial arts at the junior high school level between 1985 and 2000.

Table 39

Industrial Arts Curriculum Addition: Robotics

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	12	46.2	7	41.2	19	44.2
No	14	53.8	10	58.8	24	55.8
Total	26	100.0	17	100.0	43	100.0

The addition of Solar Energy as a possible learning activity as part of the industrial arts curriculum content was another technology participating teachers could select as future content for this subject area. Combining rural (11) and urban (8) sub-populations for a total of 19/43, slightly less than half of the respondents (44.2%) were of the opinion that Solar Energy would be part of the industrial arts curriculum within the next 15 years. These data are shown in table 40.

Table 40

Industrial Arts Curriculum Addition: Solar Energy

(N = 43)

Response	Rural		Urban		Total	
	No.	%	No.	%	No.	%
Yes	11	42.3	8	47.1	19	44.2
No	15	57.7	9	52.9	24	55.8
Total	26	100.0	17	100.0	43	100.0

In the "Other" activities category, those who completed this section of the research instrument listed the following as future learning activities for curriculum content for the subject area of industrial arts:

design and planning,

occupational analysis,

energy conservation,

principles of technology,

computers and their applications,

telecommunications, communications, networking, and

wind and geo-thermal energy.

An overview of the future activities that could be integrated as learning activities for industrial arts at the junior high school level include:

computer assisted drafting (CAD),

computer integrated manufacturing (CIM), computer numeric control (CNC),

fibre optics,

LASERs (Light Amplification by Stimulated Emissions of Radiation),

robotics, and

solar energy.

On the other hand, the remainder of the choices:

atomic energy,

desk-top publishing, and

hydroponics

would probably not play a major role in the curriculum of junior high industrial arts by the year 2000.

Skill Transferability Chart

The skills transferability chart found at the end of this thesis illustrates graphically the degree of "transferability" between the 86 skills that participants identified as generic for five of the six materials from the Materials Technology field of study.

It should be noted that the transferability ranking for each skill on this chart is dynamic. Its transferability rating is based solely on the researcher's knowledge and thus, in practice, may have a higher or a lower transfer potential than that indicated on the chart. What this chart does, however, is present to the reader how one skill from one material area may be used within the other material areas of the multiple activity laboratory.

The chart lists the psychomotor generic skills for these five material areas: Earths, Leathers, Metals, Plastics, and Woods that were identified in the study and shows the transferability potential for each skill between materials. To interpret the skill transferability chart, it is read from left to right and not from top to bottom. For example, to determine how the generic skill "Design, modify, or adapt projects" ranks as a transferable skill, the skill is located on the chart and read across horizontally. Design, modify, or adapt project has a high potential of transfer to 14 skills on the chart; a medium potential to 26 skills; and a low potential for 46 skills.

The chart was constructed by comparing each individual skill to the other 86 skills on the chart. If, in the opinion of the researcher, the skill shared a high degree of similarity to another skill, its transferability potential was considered to be high. If the two skills had slightly less in common, the skill had the potential for medium transferability, and if the two skills were shown to have little in common, their potential for transferability was rated as low.

Chapter IV

Summary, Conclusions, Recommendations, and Observations

Introduction

The third chapter of this study briefly described the research instrument and presented, in tabular form, the data collected from the research population of rural and urban junior high school industrial arts teachers.

This final chapter will consist of four related sections. Section one includes an overview of the problem and the other major components of the research design. Included in this section is a summary of the findings that were generated from the data collected. From these findings, conclusions are made and are an integral part of the second section of the report. The third section presents recommendations resulting from the findings and are made to the following groups: to Department of Education personnel; to other researchers; and to academic staff of The University of Alberta, Department of Industrial and Vocational Education. The fourth and final section presents the observations of the researcher that were made while conducting the research.

Summary

This section summarizes the problem statement, the research population, the instrumentation, and the methodology.

The Problem

The major purpose of this study was to identify the generic skills that practicing junior high school industrial arts teachers taught their students to work, form, shape, cut, finish, and assemble five of the six materials found in the Materials Technology field of study. Three objectives were formulated to give support to the major purpose of the study. These objectives were:

To have junior high school industrial arts teachers who taught in a multiple activity laboratory in a rural setting identify those psychomotor generic skills they considered to be generic in cutting, shaping, forming, and/or assembling these materials; Earths, Leather and Textiles, Metals, Plastics, and Woods, from the Materials Technology fields of study.

The second supporting objective was identical to the first except that it involved having urban industrial arts teachers identify the psychomotor skills to work the five materials.

To determine where research participants acquired the psychomotor skills they identified as generic and at which grade level they taught these skills to their students was the third supporting objective of the research.

To fulfill both the purpose of the study and its supporting objectives, a questionnaire was developed which synthesized questionnaires that were used by other researchers in conducting analogous studies. Prior to being used in the research, the questionnaire was pilot tested. The redesigned questionnaire was reviewed by a specialist in instrument design, Department of Educational Psychology, Faculty of Education, The University of Alberta. By rating statements on the questionnaire, research participants identified the psychomotor skills they considered as generic and the grade level where these skills were taught to the students. From a pool of 151 skill statements, the research participants determined that 86 skills were generic to five of the six materials found in the Materials Technology field of study for junior high school students.

The Population

The population for this study consisted of the 223 junior high school industrial arts teachers whose names appeared on the "List of Industrial Education Teachers by School Year, School Year 84-85" for the province. From the 223 names, a random sample of 74 (30%) names was generated. The sample consisted of 31 rural and 43 urban junior high school industrial arts teachers. These 74 teachers were located in 38 school districts scattered throughout the province. A letter was drafted and sent to each superintendent of the 38 school jurisdictions where these teachers taught requesting permission of the school superintendent to participate in the study by allowing the teachers in their districts to become involved in the research. Thirty-five of the 38 superintendents granted their permission. The three superintendents who elected not to participate in the study reduced the research sample size from 74 to 65 teachers. From this smaller sample of 65, 26 rural teachers and 20 urban teachers responded by submitting completed questionnaires which represented a rate of return of 70.8% (46/65). Three of the returned questionnaires could not be used because they arrived late for data processing and were eliminated from the study. This decreased the overall rate of return from 46/65 (70.8%) to 43/65 or 66.2%.

Instrumentation

The revised instrument was tested through a pilot study. The purposes of the pilot were: to help establish an accurate time frame needed by an individual to complete the instrument and to identify inconsistencies within the research instrument. From the results of the pilot study changes were made to the questionnaire before it was used to collect data.

Those involved in the pilot study were not involved in the main research but were readily available to the researcher, taught in the Alberta Multiple Activity Program at the junior high school level, and helped to direct those designing curricula for industrial education for the Curriculum Branch of the Department of Education.

The questionnaire used in the study consisted of two sections; section one gathered demographic information from research participants. The second section of the research instrument listed 151 psychomotor skill statements that described the processes used to cut, form, shape, assemble, and finish the five of the six materials for Materials Technology. Participant teachers were asked to check whether they considered each skill to be generic or not. They were also asked to determine the grade level where they taught each skill and where they as teachers acquired each skill. Also included in this section were two open-ended questions that were directed at the type of learning activities currently in use that at the junior high school level and that should be removed from the curriculum, and to identify from a predetermined list of learning activities those that might be used as content organizers for industrial arts to update the instructional content for the next decade and a half.

Methodology

After reviewing several electronic (ERIC) and book based libraries, 50 articles were selected and reviewed for their relationship to the current study. This review of the articles provided the researcher with information on generic, transferable, generalizable, and flexible skills from Canada, the United States, Europe, and Australia.

A letter was prepared and mailed to 38 superintendents who represented the school districts of the industrial arts teachers who were selected as the population for the study. Thirty five of the 38 superintendents responded and in doing so permitted the teachers from their jurisdiction to participate in the study. Questionnaire packages which included a covering letter, a questionnaire, and a self addressed envelope were assembled and mailed to 65 research participants in the 35 school districts.

By the deadline date established, 44.6% (29/65) of the research participants returned completed questionnaires. To increase the rate of return, a follow up procedure was initiated either in the form of a letter or a telephone call. This procedure yielded an additional 14 questionnaires which increased the rate of return to 66.2% (43/65).

The collected data from the questionnaires was key punched on to 80 column cards by personnel of The Division of Educational Research Services at The University of Alberta. These data were analyzed using the $SPSS^X$ Frequencies program which yielded frequency and percent values for the 510 variables which made up the body of the research questionnaire.

From the computer printout, these data were placed in tabular form for ease of interpretation and presentation. Chapter three contains the data analysis and the presentation of these data.

Related Literature and Research

The second chapter of this study provides the reader with an overview of the industrial education concept, a short description of the Alberta Multiple Activity Program, and a review of related literature and research for both cognitive and psychomotor generic skills. The review of the industrial education concept discusses how the industrial education program developed from an amalgamation of both the industrial arts and the vocational education subject areas in the late 1960's.

The description of the Alberta Multiple Activity Program charts the development of industrial arts from 1900 to 1963 when it was synthesized into the multiple activity program. Also described is the name change process with its corresponding changes in course content. The section ends with a contemporary account of the multiple activity program as it is presently taught in the junior high schools of the province.

Findings from the review of the generic skills literature indicate that although many authors use such terms as transferable, generalizable, or flexible as synonyms for generic skills, a simple, coherent, and complete list of these skills does not exist. It became evident during the literature review that generic skills can be placed into one of two broad categories: cognitive generic skills and psychomotor generic skills. Arthur Smith began his study of cognitive generic skills in the early part of 1973 for the Canada Employment and Immigration Commission. Over the next three years, Smith and his associates through the Occupational and Career Analysis and Development Branch of this federal agency identified generic skills in the areas of mathematics, communication, reasoning, interpersonal relations, and science. The objective of that research was to identify the generic skills for both workers and employers for certain occupational groups to increase the individuals job utility and transferability potential. Further studies were planned for these areas and for the area of manipulative skills.

In the United States, generic skills research has been conducted by four researchers; J.P. Greenan (generalizable skills, 1983), F.C. Pratzner (transferable skills, 1978), R.E. Taylor (generic skills, 1987), and A.A. Wiant (flexible skills, 1987). These individuals, along with several others, have worked to identify and record lists of generic skills that are used in finding, getting, and holding employment. These multiple-use skills identified by each researcher have been grouped into the following four clusters: communication skills, reasoning skills, interpersonal skills, manipulative skills, and in some instances science and mathematic skills. Even though the lists of "generic skills" varies somewhat for each researcher, all of these researchers agree that possessing such skills will not guarantee success in the marketplace, but without such skills the individual will surely deprive himself of complete occupational fulfillment. These skills identified are generally cognitive in nature, but each researcher has identified skills that are part of the psychomotor domain.

The Advanced Development Division of the Occupational and Career Analysis and Development Branch, Canada Employment and Immigration Commission, furthered Smith's work through the generic skills Tool Skills Survey. Based on data on the use of 588 tool skills obtained from workers and supervisors in 131 occupations; from this research 116 core-skills were identified. These skills are a central group of skills that all of the 1600 workers and supervisors used in the daily routine of doing their jobs. These skills range from measuring with a tape measure to practicing safety precautions for excessive noise.

The Findings of the Study

The following research findings resulted from an analysis of the data that resulted from the study.

By aggregating both sub populations, it was found that 15/43 or 34.9% of the research participants had between 6 and 10 years of experience teaching junior high school industrial arts; eight teachers (18.6%) had 1-5 years of teaching experience; 7/43 (16.3%) had 11-15 years experience; 7/43 (16.3%) had 16-20 years experience; and 6/43 (14.0%) had 21 or more years of experience teaching this subject at the junior high school level. Supporting data for these findings may be found in table 4, page 60.

The majority of the respondents, 33/43 (76.7%), graduated from The University of Alberta with a Bachelor of Education degree. The remaining 10 participants graduated from either a Canadian or an American university with a baccalaureate. Table 7 page 64 shows this information.

Only 9 of the 43 industrial arts teachers, or 20.9%, who were involved in the study were certified journeymen. These teachers held journeymen qualifications in the following trades: carpentry (5), electrician (2), graphics pressmen (1), and automotive mechanic (1).

At the time the study was conducted, the following rank order of percentages show the number of participants who were teaching the five modules from the Materials Technology field of study; woods (97.7%), metals (88.4%), plastics (74.4%), earths (69.8%), leather and textiles (34.9%). These teachers had previously taught the following modules from this field of study; woods (81.4%), metals (79.1%), leather and textiles (69.8%), plastics (69.8%), and earths (67.4%). Table 9, page 67 includes these data.

The research population, as a group, identified 86 of the 151 skills on the questionnaire as generic. More specifically, the study participants identified four earths skills, ten leatherworking skills, 16 metalworking skills, 16 plastic skills, and 40 woodworking skills. These skills are as follows.

Generic earths skills: plan procedure; design, modify, or adapt projects; fettle, repair, or smooth casting; and apply paint, glaze, or underglaze. Data in table 10 show the percentage of rural and urban teachers using these skills. Tables 15 and 20 respectively show where the rural and urban teachers acquired these skills.

Generic leatherwork skills: plan procedure; design, modify, or adapt projects; make patterns or transfer designs; cut to a line with leather shears; cut to a line with swivel knife; punch for lacing; do stamping; do repousse tooling; cement leather and linings; and apply leather lacquer, stains, dyes. Table 11 presents the data which shows the percentage of rural and urban teachers who stated they used the skills. Similarly, tables 16 and 21 present the data that show where the teachers acquired these skills.

Generic metalwork skills: plan procedure; design, modify, or adapt projects; use scribe in layout; layout distance, area with dividers; measure with a rule; use a center/prick punch; use inside/outside calipers; layout centers on round stock; cut stock with power band saw; saw to a line with hacksaw; file/draw file a surface or edge; clean file with file card; drill, countersink with drill press; cut to a line with snips; use soft solder; and hand polish with emery dust. The generic metalwork skills as used by the rural and urban research participants are shown in table 12; tables 17 and 22 show where the participants acquired these skills.

Generic plastic skills: plan procedure; design, modify, or adapt projects; layout pattern on stock; saw to a line with a coping saw; saw to a line with a backsaw; saw to a line with a scroll saw; saw to a line with a band saw; shape with a disk sander; shape with sandpaper/files; drill holes with drill press; drill holes with hand drill; chemical/mechanical fasten; hand buff edge with liquid abrasive; machine buff; hand sand edge with sand paper; and use stencil for painting/decorating. Of the 23 plastic activities listed on the instrument, the preceding 16 were identified as generic. Table 13 lists the percentage of the rural and urban teachers who used these skills, tables 18 and 23 show were these skills were acquired.

Generic woodworking skills: plan procedure; design, modify, or adapt projects; read working drawings; copy design via grid squares; make and use templates; layout curves with compass; measure and divide with a ruler; layout pattern on stock; saw to line with handsaw/backsaw; saw with coping saw; saw circles with key-hole saw; cut tapers with crosscut saw; cut miters in a miter box; plane an edge, end, or surface true; test square with tri-square; drill holes with hand drill; countersink holes with rosebud; layout cuts, carpenter's square; layout angle using sliding T bevel; gauge lines with marking gauge; trim and pare with chisel; square edges or ends with a file; shape irregular curves with rasp; sand flat/curved surfaces smooth; use bar clamps to glue edge joint; glue surface using hand screws; cut and resaw stock with band saw; mount stock between lathe centers; size stock with parting tool; sand stock in lathe; mount stock on faceplate; size stock on faceplate; hollow out stock on faceplate; drill holes with drill press; set brads with nail set; set screws with countersink; chemical / mechanical fasten; apply an oil stain finish; apply a varnish finish; and finish with wet/dry sand paper. Again, the above woodworking skills were identified as generic. Table 14 lists the number of rural and urban teachers (percentage) who used these skills. Tables 19 and 24 show where members of the rural and the urban cohorts acquired the above skills.

A comparison of the psychomotor generic skills identified by the 26 rural industrial arts teachers when compared with their 17 urban counterparts show more similarities than differences. Rural teachers identified 65 of the 151 psychomotor skills as generic. Urban teachers considered 82 of these skills to be generic. In the woods area for example, there were a total of 51 skills (activities) listed on the questionnaire. Twenty-six of these skills were considered generic by the rural teacher cohort while urban teachers considered 40 of these skills as being generic. This difference of 26 to 40 represented the largest perceptual disagreement between the two groups as to the psychomotor generic skills for any section of the research instrument.

In responding to the two open ended questions; 28 of the 43 (65.1%) participants believed that the industrial arts curriculum should be revised to reflect the four evolving technologies of communication, construction, manufacturing, and transportation; 13/43 (30.2%) were of the opinion that a curriculum change was not necessary and 2/43 (4.7%) had no opinion of curriculum update.

For each of the five Materials Technology modules represented within the questionnaire, six learning activities for each were listed. When research participants were asked which of these activities should be removed from each module. Fifty percent of the research population identified all six learning activities for working leather and textiles as activities that could be removed from the curriculum. As a result of this finding, justification could be made by curriculum designers to remove the leather and textiles module from the industrial arts curriculum. Similarly, but not to the degree found within the leather and textile section, other activities were noted to be removed from the earths, metals, plastics, and woods field of study. Supporting data for this finding can be found in tables 26 through 30, pages 93 to 97.

Current professional literature for industrial arts was reviewed and ten learning activities were identified which could become part of the content for the industrial arts curriculum within the next 15 years. Among the activities that were identified were: atomic power, computer assisted drafting (CAD), computer integrated manufacturing (CIM), computer numeric control (CNC), desk-top publishing, fibre optics, hydroponics, LASERs, robotics, and solar energy. From the list, the following were considered by those involved in the research as future content organizers for industrial arts curriculum: computer numeric control (CNC), fibre optics, and Light Amplification by Stimulated Emissions of Radiation (LASERs). Data to support this finding are found in table 41. These data show that 50% or more of the research population were of the opinion that these three technologies should be included as content organizers for future industrial arts curriculum.

Table 41

Activities That Should be Added to Curriculum

Skill Area	Learning Activity	Rate of Total	Percent
Computers	Computer Numeric Control	35/43	81.4
	Fibre Optics	25/43	58.1
	LASERs	26/43	60.5

Conclusions

The following conclusions are reported and are based on the findings from the research.

The focus of this study was to determine the psychomotor generic skills (learning activities) that junior high school industrial arts teachers use with their students to work with five of the materials that are found in the

Materials Technology field of study. Research data show that there is a wide discrepancy between those skills the research participants identified as generic. Some participants identified nearly every skill that was listed on the instrument as a generic skill while other individuals listed only a few. It is possible that the latter group of participants failed to read the directions or did not thoroughly understand these directions before they proceeded to respond to statements on the questionnaire.

It became evident that many psychomotor skills listed on the research instrument were used by the junior high school industrial arts teachers. It could be concluded from the research findings that a number of these skills were not learned at university but rather, participants acquired them through informal sources such as: inservice training, workshops, and demonstrations at conferences.

Considering all of the skills identified as generic and allowing for area diversification of the skills taught, both rural and urban junior high school industrial arts teachers seem to utilize similar skills in teaching the Materials Technology curriculum to their junior high school students. However, with the rural group of teachers identifying 65 generic skills and the urban group identifying 82 skills as generic, it suggests that a difference in curriculum and program content may exist for the different school districts that were involved in the study.

Where the rural and urban teacher groups acquired the psychomotor skills that they identified as generic, is easily interpreted. For the rural group of industrial arts teachers, earth skills, metalworking skills, and plastic skills were generally noted as being acquired through a university education. Conversely, according to the percentages listed for the rural group, leatherworking skills and woodworking skills were acquired through some form of inservice education. Data to support these conclusions may be found in tables 15 through 19.

For the urban cohort of teachers, earth skills and metalworking skills were generally identified as acquired through coursework at university. However, leatherworking skills, plastic skills, and woodworking skills were identified as acquired through inservice education or self taught through teaching experience. The difference between the two cohorts is slight, but nevertheless should be noted. These data may be found in Chapter Three, tables 20 through 24.

Recommendations

The recommendations that follow are based on the findings of the research and conclusions that were made. These recommendations are not listed in any order of importance and are made to the group identified.

Department of Education

Consideration be given by curriculum personnel of the Curriculum Branch to place the list of psychomotor generic skills identified from the research in the hands of curriculum committees. This list could help these committees to design a spiral curriculum so that the exit level skills acquired in grade seven would be the foundational base for skills to be developed in grade eight and beyond.

When determining individual teacher competencies for certification, a list of psychomotor generic skills used by inservice teachers to teach Materials Technology should be used as a checklist or guideline to determine the specific skills that the applicant possess before certification is granted.

When evaluating course objectives and curriculum content, a list of generic skills should be used as a reference for specific tasks, to achieve specific ends, or to observe specific performances.

For periodic teacher evaluation, the Department, as part of its school evaluation program for junior high school industrial education should include a list of generic psychomotor skills become part of the evaluation instrument to determine relevant skills the teachers have and teach in the multiple activity learning environment.

For implementing industrial arts programs at new schools, industrial arts teachers in these schools should be provided with a list of skills that are used to cut, form, shape, assemble, and finish materials so that these teachers can develop core learning activities that employ these skills. The teaching of psychomotor generic skills to junior high school students as part of the industrial arts activities should have the result of aiding these students to make a wiser occupational choice later in life.

Other Researchers

The following recommendations are made to any researcher who may wish to conduct a similar study.

It is recommended that a larger sample be used so that the results of the new study could be more generalizable. With a larger sample, it may be possible to include respondents who received their undergraduate preparation at universities other than The University of Alberta.

It is recommended that the number of modules to be studied be taken from a different field of study for the junior high school industrial arts. For instance, such modules could include: electricity/electronics, power mechanics, robotics, or computers.

It is recommended that this study be replicated so that a comparison of the results of the two studies could be made. This comparison would help to determine if identical or additional psychomotor generic skills could be identified. Additionally, such a study could help determine if the concept of teaching psychomotor generic skills to junior high school students is viable.

It is recommended that the process used to design the questionnaire be explicitly followed but the learning activities be listed alphabetically on the instrument. Further, the skill acquired column include space where the participant could check either "not required at university" or "had skill before entry".

It is recommended that for data collection, the instrument be revised and expanded to include additional questions to determine what the future content of industrial arts should be to keep it relevant. Sample questions asked might include; Should industrial arts include learning activities such as nuclear energy, hydroponic farming, oil recovery, mining, or holographic technology? Should the revised curriculum move away from the traditional materials and basic technologies found in a productive society to one that has as its foundation high technology or Principles of Technology? Information generated by these and other questions would be helpful to curriculum designers at the Department of Education to assist them in determining the future direction of the junior high school industrial arts program.

Lastly, it is recommended that a random sample of junior high school industrial arts students receive a questionnaire in the hope that they would identify which skills they found most useful when transferring from one area of a multiple activity laboratory to another. The skills identified by these students could be cross referenced with those identified by the teachers to determine if there is a correlation between what was taught and what was learned.

Department of Industrial and Vocational Education

It is recommended to personnel of the department of industrial and vocational education at the university that research be conducted among the content courses taught to its students to determine the psychomotor generic skills that are presently taught in the materials and in the technologies courses that are currently offered.

It is further recommended that a generic skill profile be designed that would become part of the students dossier and which would be available to employing school districts.

Observations

The following observations were made by the researcher while conducting the research.

It would have been interesting if another graduate student had conducted similar research so that a comparison could be made between the findings of the two studies. The researcher found very little literature or research on psychomotor generic skills used in a multiple activity learning environment, in vocational education unit shops, in technical education or in an industrial setting. The only related study was the Smith study that identified the psychomotor generic skills for trade families that were used by 1600 workers and supervisors in 131 occupations. Conversely, considerable research has been completed and reported in the professional literature on cognitive generic skills.

An analysis of the questionnaire format by the researcher after the completion of the study indicated that it was difficult for the participant to follow. This criticism could have been alleviated had a different format been used. For example, for the generic skill column, the alternative N/A (not applicable) should should have been included and the Grade Level column removed because the researcher found the collected data difficult to analyze. More complete directions should have been provided for participants that would aid them in identifying the grade level where each skill was taught. A number of respondents listed an inordinate number of the learning activities that were taught at the grade seven level. This could have been the result of incomplete directions. As a consequence, the data collected for the three grade levels where the skill was taught was so confusing that it was found impossible for the researcher to analyze and as a result was eliminated from the study. This was a weakness of the study. The research question could have been strengthened had a statement been prepared that asked participants their opinion about teaching psychomotor generic skills at the junior high school level.

Only 17 of 38 urban junior high industrial arts teachers found time to respond to the questionnaire, while 26 of the 27 rural teachers provided the data requested. This poor rate of participation for urban teachers to become involved with educational research may have influenced the findings of the investigation. Educational research and the publication of its results are a means of improving the profession. Without the cooperation of practitioners, stagnation will result.

It was also observed that the skills listed on the instrument were identical to the skills taught in the two junior and the two senior materials courses taught to preservice industrial arts teachers at university. From the skills identified by research participants, it is possible that, over time, the participants may have forgotten where they acquired the psychomotor skills they taught to their students.

It was observed that industrial arts teachers involved in the study may not have been cognizant of the number of developments in high technology that might be included as part of the future content for industrial arts at the junior high school level. This was evident by the limited number of content area additions that were identified by these teachers found on the research instrument.

BIBLIOGRAPHY

Books

Ary, D., Jacobs, L. C. , & Razavieh, A. (1985). Introduction to research in education. (3 rd ed.). New York: Holt, Rinehart and Winston.

Berdie, D. R. , & Anderson, J. F. (1974). Questionnaires: Design and use. Metuchen, NJ: Scarecrow Press.

Bower, G. H. , & Hilgard, E. R. (1975). Theories of learning. (4 th ed.). New Jersey: Prentice-Hall Inc.

Fryklund, V. C. (1947). Trade and job analysis. Milwaukee: The Bruce Publishing Company.

Giachino, J.W., & Gallington, R. O. (1977). Course construction in industrial arts, vocational and technical education (4th ed.). Chicago: American Technical Society.

Gould, J., & Kolb, W.L. (Eds.). (1964). A dictionary of the social sciences. Toronto: Collier-Macmillian Canada Ltd.

Naisbitt, J. (1984). Megatrends: Ten new directions transforming our lives. New York: Warner Books.

Oppenheim, A. N. (1966). Questionnaire design and attitude measurement. New York: Basic Books.

Peterson, M. (1975). The curriculum specialist in career education. In D. P. Garner (Ed.), The Career Educator (pp. 28-29). Eastern Illinois University, Charleston, Illinois.

Silvius, G. H. & Bohn, R. C. (1961). Organizing course materials for industrial education. Bloomington, Il: McKnight and McKnight.

Silvius, G. H. & Curry, E. H. (1971). Managing multiple activities in industrial education. Bloomington, Il: McKnight and McKnight.

Periodicals

Annett, J. , & Sparrow, J. (1985). Transfer of training: A review of research and practical implications. Programmed Learning and Educational Technology, 22, 2, 116-124.

Clark, R.E. , & Voogel, A. (1985). Transfer of training principles for instructional design. Educational Communication and Technology, 33, 2, 113-123.

Greenan, J. P. (1983). Identification and validation of generalizable skills in vocational programs. Journal of Vocational Education Research, 8, 3, 46-71.

Greenan, J. P. (1984). The construct of generalizable skills for assessing the functional learning abilities of students in vocational-technical programs. Journal of Studies in Technical Careers, 6, 2, 91-104.

Maley, D. (1972). Relationship of industrial arts to occupational orientation. Man/Society/Technology, 31, 209 - 213.

Morris, D. (1985). Developing a multi-skilled workforce through an assembly model. Performance and Instruction Journal, 24, 3, 15-21.

Nelson, O. (1986). Competencies taught in industrial arts. Vocational Education Journal, 61, 4, 13-16.

Padelford, H. E. (1983). A conceptual model of the psychomotor domain. Journal of Industrial Teacher Education, 20, 4, 24-31.

Pratzner, F. C. (1984). Implications of quality of work-life developments for vocational education. Journal of Vocational Education Research, 9, 1, 24-45.

Preitz, C. H. (1973). Developing a program to individualized instruction. Journal of Industrial Teacher Education, 10, 3. 88-97.

Royer, J. M. (1979). Theories of the transfer of learning. Educational Psychologist, 14, 53-69.

Smith, A. D. (1974). Generic skills. Canadian Vocational Journal, 9, 4, 27-28.

Smith, A. D. , & Tansley, D. (1980). Apprenticeship - one trade for a lifetime? Canadian Vocational Journal, 16, 1, 40-43.

Taylor, C. W. (1973). Developing effectively functioning people: The accountable goal of multiple talent teaching. Education, 94, 2, 99-110.

Technical and research reports

Champagne, A. (1986). Teaching for work place success. Occasional paper no. 113. Columbus: The National Center for Research in Vocational Education.

Daniels, H. M. (1984). The development of a model, strategies and procedures for introducing change skills instruction into vocational programs. Carbondale: College of Education.

Dansereau, D. , & Brooks, L. W. (1984). Transfer of learning from one setting to another. In A. Areson and J. DeCaro (Ed.), Educational teaching, learning and development: Volume 1. Rochester, New York: National Technical Institute for the Deaf, Rochester Institute of

Further Education Curriculum Review and Development Unit. (1982). Basic skills. London, England: Author.

Further Education Curriculum Review and Development Unit. (1982). Profiles: A review of issues and practices in the use and development of student profiles. London, England: Author.

Johnson, C. (Ed.). (1978). Identifying and verifying generic teacher competencies. Athens, Georgia: University of Georgia. College of Education.

Miguel, R. J. (1977). Developing skills for occupational transferability: Insights gained from current practices. Columbus: The National Center for Research in Vocational Education.

Nelson, R. E. (1979). Perceptions concerning occupational survival skills. Springfield, Il: Illinois State Board of Education.

Organization for Economic Co-operation and Development. (1982). The competencies needed in working life. Paris, France: Author.

Pratzner, F. C. (1978). Occupational adaptability and transferable skills: Project final report. Information series no. 129. Columbus: The National Center for Research in Vocational Education.

Selz, N., Jones, J.S. , & Ashley, W.L. (1980). Functional competencies for adapting to the world or work. Columbus: The National Center for Research in Vocational Education.

Sjogren, D. (1977). Occupationally transferable skills and characteristics: A review of literature and research. Information series no. 105. Columbus: Center for Vocational Education.

Smith, A. D. (1973). Generic skills for occupational training. Prince Albert, Saskatchewan: Employment and Immigration Canada, Training Research and Development Station.

Smith, A. D. , Kawula, W. J. , Tippett, G. , Curtiss, P. , & Depew J. (1974). Generic skills in the reasoning and interpersonal domains. Prince Albert, Saskatchewan: Employment and Immigration Canada, Training Research and Development Station.

Smith, A. D. (1975). Generic skills; Research and development. Prince Albert, Saskatchewan: Employment and Immigration Canada, Training Research and Development Station.

Smith, A. D. (1981). Generic skills: Improving transferability in occupational training (Technical Study 34). Ottawa, Ontario: Canada Employment and Immigration Commission.

Thomson, P. & Murphy, J. (1987). Transferable skills in technical and further education. Payneham: TAFE National Center for Research and Development.

Wiant, A. A. (1977). Transferable skills: The employers' viewpoint. Information series no. 126. The National Center for Research in Vocational Education.

Woditsch, G. A. (1977). Developing generic skills: A model for competency-based general education. Occupational Paper Series no. 3. Bowling Green: Bowling Green State University, CUE Project Publications.

Proceedings of meetings or symposia

Padelford, H. E. (1984, December). Psychomotor skill acquisition in the technical subjects. Paper presented at an invitational meeting of the American Vocational Association Convention, New Orleans.

Pratzner, F. C. (1987). Sociotechnical literacy: An alternative to the technological perspective. In E. K. Blankenbaker and A. J. Miller (Eds.), Proceedings from an International Symposium on Technological Literacy (pp. 93-106). Columbus, Ohio, The Ohio State University.

Taylor, R. E. (1987, February). Generic skills and vocational education. Paper presented at an invitational meeting of the School Administrators, Edmonton, Alberta.

Wiant, A. A. (1987, September). Flexible skills and training strategies. Paper presented at the seminar on strategies for flexible skills training vocational and industrial board. Republic of Singapore.

Doctoral dissertations and master's theses

Preitz, C. H. (1969). Goals and basis units of instruction for treatment media courses for the preparation of occupational therapists. Unpublished doctoral dissertation, Wayne State University, Detroit, Michigan.

Wheeler, A. M. (1978). An examination of teaching competencies derived from models of teaching and their relationship to generic skills. Unpublished doctoral dissertation, Florida State University. (Ann Arbor, Michigan. University Microfilms International).

Unpublished manuscripts and publications of limited circulation

Alberta Education (1976). Junior high school industrial education curriculum guide. Edmonton: Author.

Alberta Education (1979). Industrial education and the Alberta kids. Edmonton: Author.

Alberta Education (1982). Junior high school industrial education curriculum guide. Edmonton: Author.

Alberta Education (1983). Industrial education manual for guidance to teachers, counsellors, and administrators. Edmonton: Author.

Canada Employment and Immigration Commission. (1979). Generic skills: Keys to job performance. Ottawa, Ontario: Author.

Canada Employment and Immigration Commission. (1979). Generic skills: Secondary school vocational model for craft trades. Ottawa, Ontario: Author.

Canada Employment and Immigration Commission. (1979). Generic skills: Trade families. Ottawa, Ontario: Author.

Canada Employment and Immigration Commission. (1979). Generic skills: Potential transferability in the craft trades. Ottawa, Ontario: Author.

Department of Education (1968). Industrial arts laboratory planning. Edmonton, Alberta: Author.

Preitz, C. H., Deleeuw, J., & Yanitski, N. (1983). An historical overview of industrial arts in Alberta. Edmonton, Alberta: Department of Industrial and Vocational Education.

Preitz, C. H. & Follis, H. (Ed.). (1988). Directions and strategies for vocational education (Monograph). Alberta: The University of Alberta, Department of Industrial and Vocational Education.

APPENDIX A

Included in this appendix is a sample copy of the questionnaire that was used to collect data from rural and urban junior high school industrial arts teachers that comprised the research population.

A copy of the covering letter sent to superintendents requesting permission to involve the teachers of their district is also part of the content of this appendix.

Also included in this appendix is a copy of the covering letter that was mailed with the research instrument to participating teachers, and a copy of the follow-up letter that was sent to those participants who did not submit their questionnaire by the deadline date.

Directions to participant:

Please find attached a two part instrument that the researcher has developed to help collect data for the research on generic skills. The purpose of this study is to identify the skills considered to be generic by industrial education (industrial arts) teachers who teach Materials Technology courses in a junior high multiple activity setting. You are asked as a research participant to complete the attached instrument which, according to the results of the pilot study, should take approximately 30 minutes of your time.

Part one of the instrument asks questions that are directed at the professional preparation of the teacher. The second part of the instrument asks you to identify from the list of skills those you consider to be generic, the grade level you feel the skill should be taught at, and where you, as a teacher, acquired the skill (either through your University preparation or through some type of in-service activity).

> **Generic skill** defined: For the purpose of this research, generic skills are those psychomotor skills which are actively used by the students to perform an operation or process in making a product from a material and are transferable from one within the multiple activity laboratory to another.

Sample of questionnaire question format:

- Place an (X) in **either** the Yes or No column under the heading Generic Skill if you consider that skill to be generic.
- Place an (X) in **one of** the grade 7, 8, or 9 columns to show where the skill is first taught.
- Place an (X) in **either** the Yes or No column under the heading Skill Acquired in University to show where you **first** learned the identified skill.

SKILL	Generic Skill		Grade Level Taught at			Skill Acquired in University	
	YES	NO	7	8	9	YES	NO
EARTHS ACTIVITIES							
Prepare							
Prepare slip	X		X				X
Make a case for a mold	X		X			X	
Prepare and wedge clay		X		X			X

__ 01
1 2 3 4 5

Please answer the following questions by circling the approriate space before the answer.

1. How many years of experience do you have teaching junior high Industrial arts.

   1. 1-5 2. 6-10 3. 11-15 4. 16-20 5. 21 - (+) 6

2. How is your teaching jurisdiction classified?

   1. Rural 2. Urban 7

3. Do you possess a Bachelor of Education degree or equivalent from a University other than the University of Alberta?

   1. YES 2. NO 8

   If YES, please circle the number of the institution which granted the degree:

   1 University of British Columbia
   2 University of Manitoba
   3 University of Toronto
   4 McGill University
   5 Memorial University
   6 University of Saskatchewan
   7 Nova Scotia Teachers College
   8 New Brunswick University
   9 Other ______________

   9

4. Do you possess a journeyman certificate?

   1. YES 2. NO 10

   If YES, please identify trade specialization: ____________.

   Province which granted the certificate: ____________.

5. Please identify which of the following from the Materials Technology field of study you are presently teaching;

   11. Woods
   12. Metals
   13. Earths
   14. Leather and Textiles
   15. Plastics

   11-15

   or those that you have taught:

   16. Woods
   17. Metals
   18. Earths
   19. Leather and Textiles
   20. Plastics

   16-20

SKILL:	GENERIC SKILL: YES	NO	GRADE LEVEL TAUGHT AT: 7	8	9	SKILL ACQUIRED IN UNIVERSITY: YES	NO	DO NOT MARK IN THIS SPACE
EARTHS ACTIVITIES								
Prepare								
Plan procedure								21-23
Design, modify, or adapt projects								24-26
Prepare and wedge clay								27-29
Prepare slip								30-32
Make a case for a mold								33-35
Prepare and apply kiln wash								36-38
Mix and pour plaster of paris								39-41
Make a two / three - piece mold								42-44
Form								
Coil / slab construction								45-47
Make a pinch piece								48-50
Slip cast								51-53
Throw on potter's wheel								54-56
Jigger flatware / jolly hollow ware								57-59
Make jiggering molds / templates								60-62
								DUP 02
								123 45
Finish								
Fettle, repair, and smooth casting								6-8
Attach spout, cover, or handle								9-11
Apply paint, glaze, or underglaze								12-14
Decalcomania								15-17
Texture / sgraffito a surface								18-20
Slip trail a surface								21-23
Stamp a surface								24-26
Stack a bisque / gloss kiln								27-29
Empty a kiln								30-32
Remove scars from glazed ware								33-35
LEATHERWORK ACTIVITIES								
Prepare								
Plan procedure								36-38
Design, modify, or adapt projects								39-41
Make patterns or transfer designs								42-44
Form								
Cut to line with leather shears								45-47
Cut to line with swivel knife								48-50
Skive edges / bevel edges								51-53
Punch for lacing								54-56
Prepare leather for tooling								57-59
Do outline tooling, bevel tooling								60-62
Do simple carving								63-65
Do flat modeling								66-68
Use initial letters								69-71
Do stamping								72-74

SKILL:	GENERIC SKILL: YES	NO	GRADE LEVEL TAUGHT AT: 7	8	9	SKILL ACQUIRED IN UNIVERSITY: YES	NO	DO NOT MARK IN THIS SPACE DUP 03 123 45
Do punched, cut-out work								6-8
Do reposse tooling								9-11
Do background stamping								12-14
Stipple background								15-17
Combine								
Cement leather / linings								18-20
Set eyelets and grommets								21-23
Rivet with speedy rivets								24-26
Machine / hand sew leather								27-29
Single buttonhole lacing								30-32
Whip stitch lacing								33-35
Double layover lacing								36-38
Triple layover lacing								39-41
Florentine lacing								42-44
Splice lacing								45-47
Finish								
Clean leather with saddle soap								48-50
Apply leather lacquer, stains, dyes								51-53
								DUP 04
METALWORK ACTIVITIES								123 45
Prepare								
Plan procedure								6-8
Design, modify, or adapt projects								9-11
Use a scribe in layout								12-14
Layout distance, area with dividers								15-17
Measure with a rule								18-20
Use a centre / prick punch								21-23
Use inside / outside callipers								24-26
Layout centres on round stock								27-29
Cut stock with power band saw								30-32
Saw to a line with hacksaw								33-35
Replace and adjust hacksaw blade								36-38
Shear metal with cold chisel								39-41
File / draw file a surface or edge								42-44
Clean file with file card								45-47
Drill, countersink with drill press								48-50
Adjust die stock								51-53
Tap and die								54-56
Cut to a line with snips								57-59
Bend square corners on stake								60-62
Combine								
Assemble and set rivets								63-65
Tin a soldering iron								66-68
Use soft solder								69-71
Finish								

SKILL:	GENERIC SKILL: YES	NO	GRADE LEVEL TAUGHT AT: 7	8	9	SKILL ACQUIRED IN UNIVERSITY: YES	NO	DO NOT MARK IN THIS SPACE
Hand polish with emery dust								72-74
Machine buff								75-77
								DUP 05
PLASTIC ACTIVITIES								123 45
Prepare								
Plan procedure								6-8
Design, modify, or adapt projects								9-11
Layout pattern on stock								12-14
Saw to line with coping saw								15-17
Saw to line with backsaw								18-20
Saw to line with scroll saw								21-23
Saw to line with band saw								24-26
Shape with disc sander								27-29
Shape with sandpaper / files								30-32
Heat and form (thermoform)								33-35
Turn drawer pulls on metal lathe								36-38
Drill holes with drill press								39-41
Drill holes with hand drill								42-44
Drape form								45-47
Dye surfaces								48-50
Dye and fill carving cavity								51-53
Overlay and inlay								54-56
Combine								
Chemical / mechanical fasten								57-59
Cement with laminating dye								60-62
Finish								
Hand buff edge using liquid abrasive								63-65
Machine buff								66-68
Hand sand edges with abrasive paper								69-71
Use stencil for painting / decorating								72-74
								DUP 06
WOODWORK ACTIVITIES								123 45
Prepare								
Plan procedure								6-8
Design, modify, or adapt projects								9-11
Read working drawings								12-14
Copy design via grid squares								15-17
Make and use templates								18-20
Layout curves with compass								21-23
Measure and divide with a ruler								24-26
Layout pattern on stock								27-29
Form -- Hand								
Saw to line with hand saw/backsaw								30-32
Saw with coping saw								33-35
Saw circles with key-hole saw								36-38
Cut tapers with crosscut saw								39-41

SKILL:	GENERIC SKILL: YES	NO	GRADE LEVEL TAUGHT AT: 7	8	9	SKILL ACQUIRED IN UNIVERSITY: YES	NO	DO NOT MARK IN THIS SPACE
Cut mitres in a mitre box								42-44
Adjust a hand plane								45-47
Plane an edge, end, or surface true								48-50
Test square with tri-square								51-53
Drill holes with hand drill								54-56
Use a brace and bit, expansive bit								57-59
Countersink holes with rosebud								60-62
Layout cuts with carpenter's square								63-65
Layout angle using sliding T bevel								66-68
Gauge lines with marking gauge								69-71
Scrape surface with cabinet scraper								72-74
Trim and pare with chisel								75-77
								DUP 07
								123 45
Hollow surface with a gouge chisel								6-8
Square edges or ends with a file								9-11
Shape irregular curves with rasp								12-14
Sand flat/curved surfaces smooth								15-17
Use bar clamps to glue edge joint								18-20
Laminate surface using hand screws								21-23
Form -- Machine								
Cut and resaw stock with band saw								24-26
Route an edge with router								27-29
Mount stock between lathe centres								30-32
Rough stock down with gouge								33-35
Scrape stock smooth with skew								36-38
Cut cove with gouge								39-41
Cut bead with skew								42-44
Size stock with parting tool								45-47
Sand stock in lathe								48-50
Mount stock on faceplate								51-53
Size stock on face plate								54-56
Hollow out stock on face plate								57-59
Drill holes with drill press								60-62
Combine								
Set brads with nail set								63-65
Set screws with countersink								66-68
Chemical / mechanical fasten								69-71
Finish								
Apply a filler								72-74
Apply an oil stain finish								75-77
								DUP 08
								123 45
Apply a shellac finish								6-8
Apply a varnish finish								9-11
Finish with wet/dry sand paper								12-14

1. Since its inception in 1964, the curriculum for industrial arts has been revised four times by the curriculum branch of the Department of Education in its effort to keep the program of study current and relevant. Through the product method of the plan, students are exposed to a limited number of tools, machines, materials, processes, and technologies prevalent in a productive society. In contrast, leaders for the industrial arts movement in the United States have altered the program from the traditional tools, machines, materials, processes, and product approach to the clustering of technologies into four broad areas: communication, construction, manufacturing, and transportation. In your opinion, do you feel that industrial education at the junior high school level should be revised to reflect evolving technologies?

1. YES 2. NO 16

If YES, please give your reason(s):

If you were in a position of authority, which of the following learning activities would you remove from the curriculum for junior high school? (please circle the response)

Plastics

17. injection molding
18. rotation molding
19. thermoforming
20. fiberglassing
21. laminating
22. compression molding

Woods

23. identifying
24. form using power tools
25. form using hand tools
26. product planning
27. laminating
28. finishing

Leather and Textiles

29. layout/cutting
30. stamping/carving
31. combining/adhering
32. stitching/sewing
33. staining/coloring
34. finishing

Earths

35. jiggering flatware
36. slip casting
37. slab construction
38. coil construction
39. finishing/glazing
40. mold making

Metals

41. machine metal stock
42. welding/brazing
43. sheet metal
44. foundry
45. combining/adhering
46. finishing

Briefly state the reasons why you would remove those learning activities previously identified:

----

2. Which of the following do you feel should be an important part of the industrial education curriculum in the next fifteen years; please place an (X) in the appropriate space (or spaces) after the answer:

	Junior High	Senior High	
Atomic Power			47
Computer Assisted Drafting (C.A.D.)			48
Computer Integrated Manufacturing (C.I.M.)			49
Computer Numeric Control (C.N.C.)			50
Desk-Top Publishing			51
Fibre Optics			52
Hydroponics			53
Lasers			54
Robotics			55
Solar Energy			56

Other Activities (Please List)

Comments:

University of Alberta
Edmonton
Canada T6G 2G5

Department of Industrial and Vocational Education
Faculty of Education
633 Education Building South, Telephone (403) 492-3678

Dear Sir:

I am currently enrolled in the Faculty of Graduate Studies and Research at The University of Alberta where I am completing the requirements for a masters degree. The topic of my research is "Generic Skills Identified by Junior High School Industrial Education Teachers in Alberta".

The research involves surveying a selected group of Alberta's industrial education teachers to ascertain which skills from a selected group of competencies those teachers consider to be generic.

The questionnaire lists 180 skill statements industrial education teachers use on a regular basis. These teachers will be asked to respond to each skill statement in terms of grade level taught, where the teacher acquired the skill, and if indeed they perceive the skill to be generic. The questionnaire does not probe into any personal or school related problems and all responses will be kept confidential.

The purpose of this letter is to ask you to cooperate in the research by permitting the junior high school industrial education teachers under your leadership to participate in the study. Those individuals selected to participate in the research from your school jurisdiction will be asked to respond to the questionnaire.

Enclosed is a response card for you to check and return in the self addressed stamped envelope provided. It would be appreciated if you could return the card to me no later than January 29, 1988 so that the research may proceed according to the time line I have established for its completion.

I believe the results of this study will be of benefit not only to those associated with industrial education in the province but also to those responsible for the teacher education program at The University.

Your assistance in this phase of the research is indeed appreciated.

Sincerely,

Donald Chidlow

ENC

University of Alberta
Edmonton
Canada T6G 2G5

Department of Industrial and Vocational Education
Faculty of Education
633 Education Building South, Telephone (403) 492-3678

After reading the preceding letter, the researcher:

____ is granted permission to survey selected junior high school industrial arts teachers of this school district.

____ is not granted the permission to survey selected junior high school industrial arts teachers of this school district.

____ I would like to receive a summary of the results from the completed study.

Name: ____

School District and Address: ___________________________

____

____

____

____

University of Alberta
Edmonton
Canada T6G 2G5

Department of Industrial and Vocational Education
Faculty of Education
633 Education Building South, Telephone (403) 492-3678

Dear Colleague:

In addition to being a graduate of the industrial arts teacher education program at The University of Alberta, I am presently completing the requirements for the masters degree.

The topic that I have selected for my research thesis is "Generic Skills Identified by Junior-high School Industrial Education Teachers in Alberta". To assist me in collecting data for this study, I have designed a questionnaire.

The purpose of this study is to determine which of those skills identified in the instrument possess generic qualities as determined by industrial education teachers. Further, the instrument will determine what generic competencies are essential for industrial education teachers in the Materials Technology area across all grade levels.

Thus, the reason for this letter is to ask that you participate in the study and return the completed questionnaire to me by February 05, 1987.

As as industrial education teacher I realize how busy you are. To complete the instrument should take about 30 minutes. When you have completed the questionnaire, please place it in the enclosed, stamped, self addressed envelope and return it to me.

All information that you provide will be treated as confidential and will be available only to the researcher. No names will be associated with the survey and all instruments will be destroyed at the conclusion of the study.

Your name has been chosen as one of only 74 junior high school industrial education teachers. I hope that you will find the time to assist me in identifying the information that will be of value to all industrial education teachers, present and future. The success of this, as any study, depends on a high percentage of returns; your opinions are valuable and worth sharing.

When the study is complete, an abstract will be sent to those who wish to see the results. Thank you for your cooperation.

Sincerely,
Donald Chidlow

ENC

University of Alberta
Edmonton

Department of Industrial and Vocational Education
Faculty of Education

Canada T6G 2G5

633 Education Building South, Telephone (403) 492-3678

Dear Colleague:

Several days ago I sent you a questionnaire asking for your input regarding the generic skills that were to be identified by a select group of Alberta junior high school industrial education teachers. I have had encouraging returns to my initial letter from the participating teachers, but I have not received your completed questionnaire.

I realize that your free time is limited, but I would hope that you can see the value of the information I am trying to collect and analyze which I believe is for the betterment of our profession.

There is the possibility that you may have never received the original survey or that it became misplaced; if this is the case, please phone me, collect, at 432-5641 and a new copy of the questionnaire will be sent out for you to complete. It would be appreciated if you could return the completed survey in the stamped self addressed envelope by **10 DAYS FROM MAILOUT**.

Since my sample of industrial education teachers is relatively small, your opinions are necessary and worthwhile. Without a high rate of return, the results of this study will lack significance.

Should you have already responded to the questionnaire and mailed it, please disregard this letter.

Thank you for your time and cooperation.

Sincerely,

Donald Chidlow

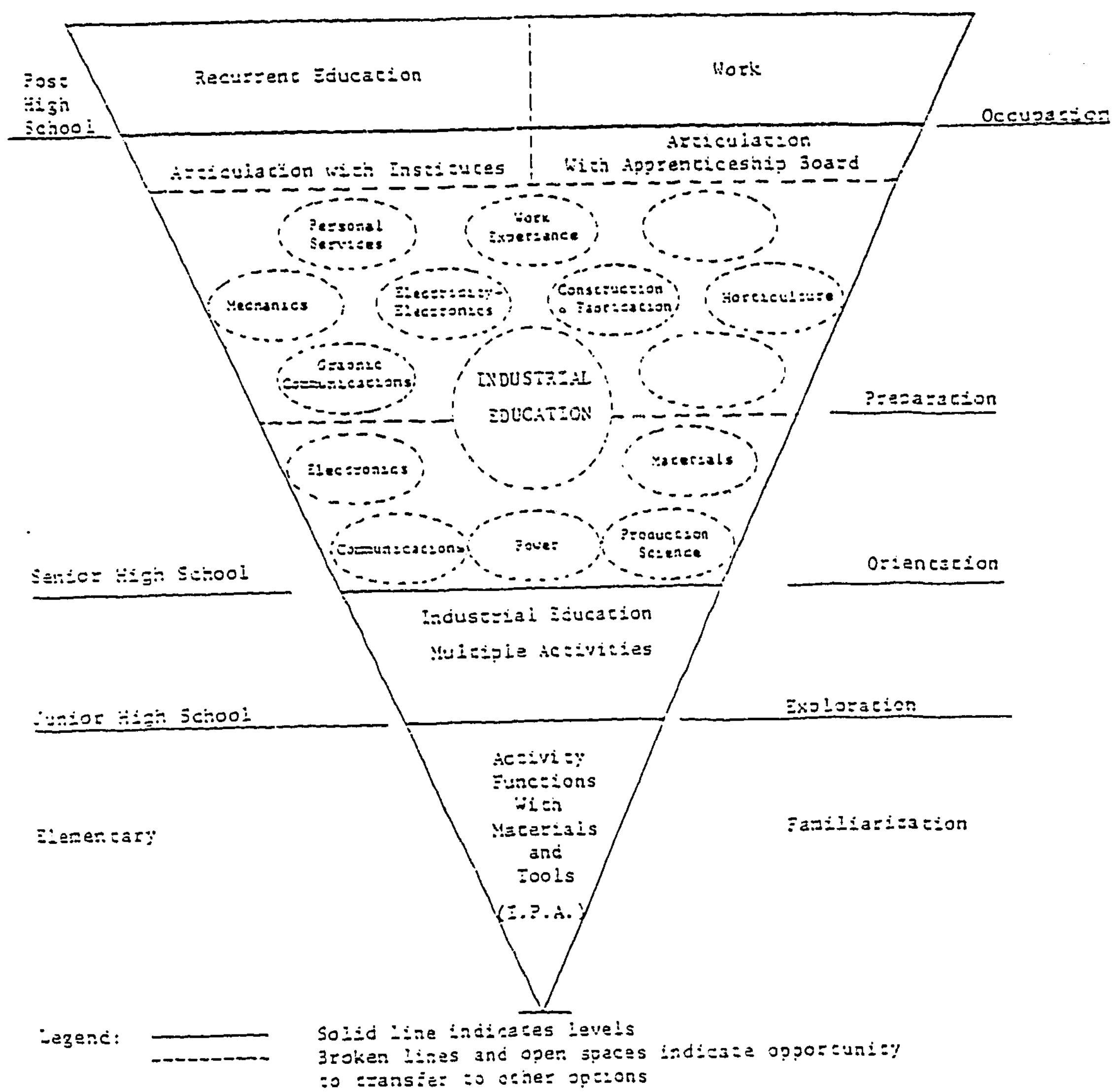
APPENDIX B

The Alberta Industrial Education Program for Career Choice and Development paradigm can be found in this appendix. This diagram shows the relationship between the fields of study available in the junior high school and the career fields taught in the senior high school industrial education courses in the province.

ALBERTA INDUSTRIAL EDUCATION PROGRAM

FOR

CAREER CHOICE AND DEVELOPMENT

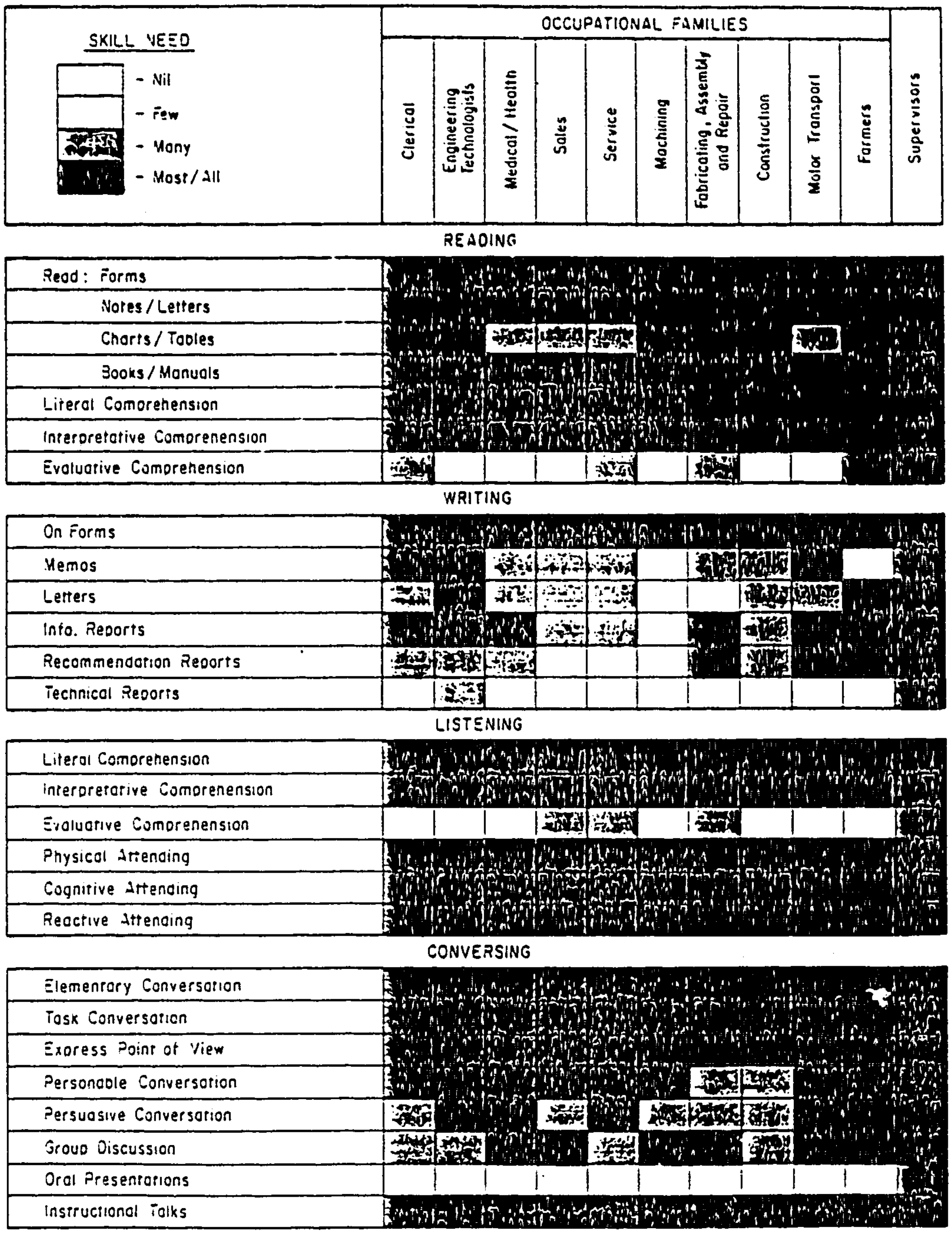


Note. Taken from Industrial Education Manual for Guidance to Teachers, Counsellors and Administrators (p. 3). 1983. Edmonton: Alberta Education.

APPENDIX C

From the initial generic skill studies, Smith and his associates identified the cognitive generic skills for the following five areas: mathematics, communication, interpersonal relations, reasoning, and science. A sample generic skills content chart developed from that research may be found in this appendix.

GENERIC COMMUNICATIONS



Note. Taken from Generic Skills, Keys to Job Performance (not paginated), 1979, Ottawa: Canada Employment and Immigration Commission.

APPENDIX D

This appendix contains a chart from Employment and Immigration Canada, Generic Skills, Keys to Job Performances pamphlet. The chart lists 48 occupations grouped into 14 clusters by way of similar competencies held by participants of Smiths' research.

OCCUPATIONS WITH SIMILAR PROFILES OF SKILL NEEDS BEYOND THE CORE CLUSTERS

COLOUR CODES

- Few/None
- Many
- Most/All

Occupation	Mathematics	Communications	Science	Reasoning
Cashier	Few/None	Few/None	Few/None	Few/None
Route Driver	Few/None	Few/None	Few/None	Few/None
Stenographer/ Typist/ Receptionist	Few/None	Few/None	Few/None	Many
Nurse Aide	Few/None	Few/None	Few/None	Many
Construction Labourer	Few/None	Few/None	Few/None	Many
Product Assembler, Metal	Few/None	Few/None	Few/None	Many
Welder, Combination	Few/None	Few/None	Few/None	Many
Heavy Equipment Operator	Few/None	Few/None	Few/None	Many
Waiter / Waitress	Few/None	Many	Few/None	Few/None
Waiter / Waitress, Formal Service	Few/None	Many	Few/None	Few/None
Barber	Few/None	Many	Few/None	Many
Cosmetologist	Few/None	Many	Few/None	Many
Accounting Clerk	Few/None	Many	Few/None	Many
Bookkeeper	Few/None	Many	Few/None	Many
Bookkeeping Clerk	Few/None	Many	Few/None	Many
Storekeeper	Few/None	Many	Few/None	Many
Meat Cutter	Few/None	Many	Few/None	Many
Cook	Many	Many	Few/None	Many
Janitor	Many	Many	Few/None	Many
Receiving Clerk	Few/None	Few/None	Few/None	Most/All
Taxi / Bus / Truck Driver	Few/None	Few/None	Few/None	Most/All
Maintenance Worker, Building	Many	Many	Few/None	Most/All
Painter	Many	Many	Few/None	Most/All
Truck-Driver, Tractor Trailer	Many	Many	Few/None	Most/All

Occupation	Mathematics	Communications	Science	Reasoning
Carpenter	Many	Few/None	Few/None	Most/All
Sheet Metal Worker	Many	Few/None	Few/None	Most/All
Line Installer - Repairer	Many	Few/None	Many	Most/All
Other Mechanics and Repair Workers	Many	Few/None	Many	Most/All
Packaging - Machine Mechanic	Many	Many	Many	Most/All
Plumber	Many	Many	Many	Most/All
Farmer, General	Many	Many	Most/All	Most/All
Construction Equipment Mechanic	Many	Many	Most/All	Most/All
Motor - Vehicle Mechanic	Many	Many	Most/All	Most/All
Surveyor Helper	Most/All	Many	Many	Most/All
Draughtsman / woman, General	Most/All	Many	Many	Most/All
Police Agent	Most/All	Most/All	Few/None	Most/All
Sales Agent, Insurance	Most/All	Most/All	Few/None	Most/All
Electrician	Most/All	Many	Most/All	Most/All
Medical - Laboratory Technician	Most/All	Many	Most/All	Most/All
Radio / Television Servicer	Most/All	Many	Most/All	Most/All
NON SIMILAR OCCUPATIONS				
Salesperson, Hardware	Many	Few/None	Few/None	Many
Nursing Assistant	Few/None	Few/None	Many	Many
Sales Clerk	Few/None	Many	Few/None	Most/All
Machinist, General	Most/All	Few/None	Few/None	Many
Secretary	Few/None	Most/All	Few/None	Most/All
Commercial Traveller	Many	Most/All	Few/None	Most/All
Nurse, General Duty	Many	Most/All	Most/All	Most/All
Architectural Technologist	Most/All	Most/All	Many	Most/All

Note. Taken from Generic Skills, Keys to Job Performance (not paginated), 1979, Ottawa: Canada Employment and Immigration Commission.

APPENDIX E

This appendix contains the complete list of Wiant's 77 skills that he identified through his nine research seminars on skills required for occupational mobility.

Table 1

Composite List of Transferable Skills Identified by Conference Participants

Intellectual/Aptitudinal

Communicating (44)
Problem solving (17)
Analyzing/assessing (15)
Planning/layout (15)
Organizing (14)
Decision Making (13)
Creativity/imagination or innovation
Problem identification/definition
Managing one's own time
Basic computation
Logical thinking
Evaluating
Ability to relate knowledge/transfer experiences
Coping with labour market and job movement
Understanding others
Synthesizing
Marshalling available resources
Accommodating multiple demands
Judgement
Foresight
Trouble shooting
Job awareness
Mechanical aptitude/tool usage
Typing
Accounting/finance/bookkeeping
Implementing
Self-understanding/awareness/actualization
Situational analysis
Assessing environment/situations
Understanding human system interactions
Occupational savvy
Conceptualization
Generalization
Goal setting
Controlling
Quantitative thinking
Dealing with work situations
Artistic ability
Business sense
Tolerance of ambiguity

Interpersonal

Working with, relating to others (28)
Managing,/directing/supervising (13)
Empathizing, being sensitive to others
Teaching/training or instructing
Counseling
Motivating
Gain acceptance/build rapport
Helping or cooperating
Cultivating cooperation
Selling
Accepting supervision
Delegating
Instilling confidence
Team building

Attitudinal

Diligence, positive work attitude (11)
Value of work attitude
Receptively, flexibility or adaptability
Determination/perseverance
Accepting/concern for others
Responsibility
Willingness to learn
Ambition/motivation
Self-confidence
Self-discipline
Pride
Enthusiasm
Patience
Self-actualization
Assertiveness
Honesty
Loyalty
Reliability
Risk taking
Compromising
Kindness

Note: Items are listed in approximate order of frequency within each category. Most frequently mentioned items are followed by a figure in parenthesis to indicate relative frequency; thus "Communicating" was mentioned about 44 times as often as "Tolerance for ambiguity".

Note. Taken from Transferable skills: The employers' viewpoint (p. 10), 1977, The National Center for Research in Vocational Education.

APPENDIX F

The output from the SPSS^{X} Frequencies computer program generated 555 pages of data for this study. From these pages, three have been selected and are included in this appendix to show typical data output from the Frequencies program. The first page is the aggregated population, N=43; the second and third pages show similar data but one page is for the rural and the other page is for the urban sub-populations respectively.

Also included in this appendix is the Table of Number of Skill vs Valid Percent and Graph of Number of Skills vs Valid Percent that show the number of skills at varying valid percent scores.

SPSS^X Frequencies

24 MAR 88 SPSS-X RELEASE 2.2 FOR IBM/MTS
11:16:04 University of Alberta

EXP

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	8	18.6	18.6	18.6
	2	15	34.9	34.9	53.5
	3	7	16.3	16.3	69.8
	4	7	16.3	16.3	86.0
	5	6	14.0	14.0	100.0
	TOTAL	43	100.0	100.0	

VALID CASES 43 MISSING CASES 0

- -

JURIS

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	26	60.5	60.5	60.5
	2	17	39.5	39.5	100.0
	TOTAL	43	100.0	100.0	

VALID CASES 43 MISSING CASES 0

- -

BED

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	10	23.3	23.3	23.3
	2	33	76.7	76.7	100.0
	TOTAL	43	100.0	100.0	

VALID CASES 43 MISSING CASES 0

SPSS^{X} Frequencies

JURIS: 1

EXP

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	4	15.4	15.4	15.4
	2	10	38.5	38.5	53.8
	3	5	19.2	19.2	73.1
	4	5	19.2	19.2	92.3
	5	2	7.7	7.7	100.0
	TOTAL	26	100.0	100.0	

VALID CASES 26 MISSING CASES 0

- -

JURIS

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	26	100.0	100.0	100.0
	TOTAL	26	100.0	100.0	

VALID CASES 26 MISSING CASES 0

- -

BED

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	7	26.9	26.9	26.9
	2	19	73.1	73.1	100.0
	TOTAL	26	100.0	100.0	

VALID CASES 26 MISSING CASES 0

SPSS^{X} Frequencies

JURIS: 2

EXP

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	4	23.5	23.5	23.5
	2	5	29.4	29.4	52.9
	3	2	11.8	11.8	64.7
	4	2	11.8	11.8	76.5
	5	4	23.5	23.5	100.0
	TOTAL	17	100.0	100.0	

VALID CASES 17 MISSING CASES 0

JURIS

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	2	17	100.0	100.0	100.0
	TOTAL	17	100.0	100.0	

VALID CASES 17 MISSING CASES 0

BED

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	3	17.6	17.6	17.6
	2	14	82.4	82.4	100.0
	TOTAL	17	100.0	100.0	

VALID CASES 17 MISSING CASES 0

A cut-off value had to be established for which the researcher could determine if a skill was considered generic by the research population. To arrive at such a value, a comparison was made between the activity (skill) and the valid percent for the question "do you considered the skill to be generic; yes or no".

Through a review of all valid percent entries from the data analysis, a table and a graph of Number of Skills vs Valid Percent was created.

The table was developed to show a complement of percent values ranging from forty to one-hundred. These percent values indicate the proportion of respondents required to define a particular skill as being generic. Under each percent heading is the number of skills within each of the Materials Technologies which would be classified as generic for the cut-off percent values shown. For example, there were nine earth activities (skills) that were found to be generic if 40% of the respondents were required in order to define a skill as being generic, whereas only 4 activities (skills) would be considered generic if 60% of respondents were required to so indicate.

The values from the table were used to plot the graph which show the number of skills at each valid percent. The value, 65%, was chosen by the researcher as the cut-off value to determine the psychomotor generic skills that were used for this study. As an example, in the earths area, the activity "Plan procedure" was rated to be generic by 90% of the study's population, while "Make a case for a mold" was rated by the research cohort to be only 40% generic. Using these values, "Plan procedure" would be considered generic while "Make a case for a mold" would not.

Table of Number Of Skills vs Valid Percent

Valid Percent	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
	9	7	5	4	4	4	2	2	2	1	1	0	0
	19	16	12	11	9	10	6	5	3	1	0	0	0
	24	22	21	20	18	16	15	14	10	9	6	2	0
	19	18	17	16	16	16	13	12	11	10	7	5	0
	49	47	44	43	41	40	28	24	20	17	12	5	2
Total	120	110	99	94	88	86	64	57	46	38	26	12	2

Graph of Number of Skills vs Valid Percent