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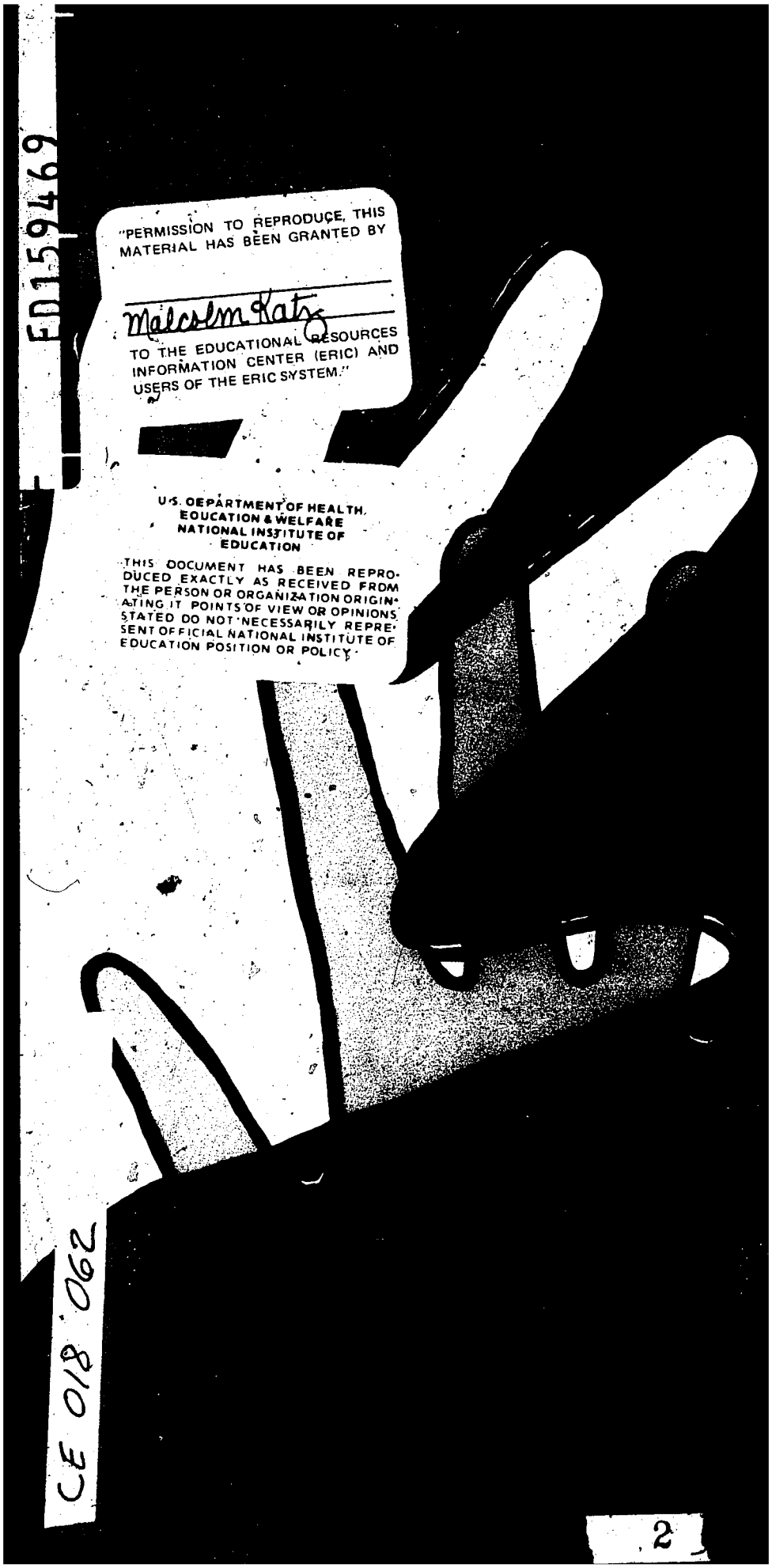
ABSTRACT

One of three documents presenting performance objectives for prevocational courses, this document contains performance objectives for courses in industrial arts including general industrial arts, manufacturing and construction, graphic communications, and power and energy. (The other two documents present performance objectives for prevocational courses in business, CE 018 864, and home economics, CE 018 863.) Career education and safety components are integrated into each set of performance objectives. The career education aspects included are skills in mathematics, reading and language arts, self awareness, occupational skills, exploration, consumer education, and decision making. Each set of objectives is identified by a course designation, and four columns of information are used to present the content of each objective: conditions, performance, criteria, and instructional resources. One hundred and twenty-eight performance objectives for prevocational industrial arts courses are included in this document. (BM)



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MICHIGAN DEPARTMENT OF EDUCATION
LANSING, MICHIGAN

During the 1976-77 school year, performance objectives for prevocational courses in home economics, business and industrial arts education were developed under the direction of the Vocational-Technical Education Service staff—Sherry Anderson, Mary Brown and Gerald Briggs. The following courses were identified for the development of performance objectives:

HOME ECONOMICS—Food and Nutrition, Human Growth and Relationships, Clothing and Textiles, and Housing and Home Management

BUSINESS EDUCATION—General Business and Beginning Typing

INDUSTRIAL ARTS—General, Manufacturing/Construction, Graphic Communications, and Power and Energy

Career Education and Safety components were identified and integrated into each set of performance objectives. The Career Education aspects of the performance objectives included mathematics skills, reading and language arts skills, self awareness, occupational skills, exploration, consumer and decision-making skills.

Local teaching personnel were identified by program area to serve as performance objectives writing team members. Writing team selection criteria included a working knowledge of Competency Based Education, experience in teaching the courses being addressed, and representation from various locations across the State. The writing teams met in November, 1976, and February, 1977, to develop a tentative draft of performance objectives. Subsequently, the tentative drafts were reviewed by committees of teacher educators, vocational administrators, and high school and junior high school teachers. In addition, the materials were sent to and reviewed by junior high school teachers in every Career Education Planning District in the State. The writing teams considered the recommendations of the various review committees and individual reviews and formulated a final set of objectives.

It seems entirely appropriate for me to express, for the State Board of Education and myself, our appreciation to all of the individuals and organized groups who have expended countless hours and much energy to bring this project to fruition. In particular I would like to thank Dr. Emmett Mason, Central Michigan University, for without his contribution of the Career Education and Safety components this project could not have been possible.

John W. Porter

JOHN W. PORTER
Superintendent of
Public Instruction

June, 1978

PREVOCATIONAL PERFORMANCE OBJECTIVES DEVELOPMENT PROJECT DEFINITIONS

Overview

A performance objective is a description of what a learner should be able to do when he/she has learned a skill or acquired certain understandings.

Several characteristics of these objectives must be understood to be adequately utilized:

1. Minimum: these objectives represent the considered opinion of the writers, after completion of a structured review, as to the minimum skills and understandings necessary upon completion of the courses.

2. Recommended: these objectives are those which the particular writing team recommends to the Vocational-Technical Education Service and, in turn, the Vocational-Technical Education Service to the Local Educational Agencies for their consideration as reasonable minimum learner objectives.

3. Terminal: these objectives describe only those significant performances which are to be mastered by the end of the courses. It is likely that each of these terminal objectives contains several enabling objectives which are assumed to be necessary to achieve the terminal objective.

4. Grading/Passing: the decision as to what grade a student will earn for achieving some, all, or in excess of the minimum performance objectives is a Local Educational Agency decision. Some districts choose to include factors other than the achievement of objectives as the basis for assigning grades. It is not the intent here to suggest that this practice must change as a result of performance objectives. It is also recognized that, many factors may affect the decision as to whether credit for a course should be assigned to a particular student who may achieve less than the minimum objectives of the course.

Format

1. Each set of objectives is identified by a course designation. The course designations are considered to be those most often used by Local Educational Agencies for the specific course content included.

2. Each set of objectives begins with the standard statement, "Upon completion of this course, students will have the following skills and understandings as measured by teacher-made objective referenced test (ORT's), unless otherwise indicated:". In order to avoid unnecessary duplication, this statement is presented as a constant, but it is to be interpreted as part of each subsequent objective.

3. The decision as to the sequence or priority of performance objectives within a given course designation is a Local Educational Agency decision.

   Note: Industrial Arts Performance Objectives/The performance objective considered to be applicable to all Industrial Arts courses are numbered 1 through 51 and 85 through 128. Specific Industrial Arts performance objectives for skill development are numbered as follows:

   52-70 Manufacturing/Construction
   71-78 Graphic Communications
   79-84 Power and Energy

4. Four columns of information are used to present the content of each objective:

   a. Conditions: a description of the environment (materials, supplies, etc.) in which the student will perform at the time of evaluation.

   b. Performance: an observable, measurable description of what the student will do.

   c. Criteria: a description of the quantitative and qualitative standards against which the performance is to be measured.

   d. Instructional Resources: this column is provided for teacher notes regarding instructional supplies, tools, equipment, techniques, etc. for each performance objective.

For further information, write to:

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June, 1978

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RECOMMENDED MINIMUM PREVOCATIONAL PERFORMANCE OBJECTIVES

Prevocational Designation: Industrial Arts*

Upon completion of this course, students will have the following skills and understandings as measured by teacher-made objective referenced tests (ORT's), unless otherwise indicated:

	Conditions	Performance	Criteria	Instructional Resources
1.	Given a 12" U.S. scale, and a 30 CM scale	the student will identify ten described increments on each scale	with a success of 70% on each scale.	
2.	Given a 12" U.S. ruler and 30 CM metric ruler and 10 measurable objects	the student will measure 10 objects	so well that 7/10 are measured to the nearest 1/16" or 1/2 mm.	
3.	Given a 0 - 1" micrometer and a 0 - 2.54 CM metric micrometer	the studeht will measure ten different size objects	with a success of 70% with each instrument.	
4.	Given the formulas for area, volume, board feet, circumference and 10 problems	the student will calculate	for 7/10 problems correctly.	
5.	Given a knowledge of (1) resistance, (2) current, and (3) voltage and the equation for Ohms Law	the student will compute the missing factor	for 7/10 problems correctly.	
6.	Given unit cost and number of units for 10 problems	the student will calculate the cost of materials	for 7/10 problems correctly.	
7.	Given a list of fractions, decimals, and conversion charts (metric, decimal, and fractional equivalence)	the student will convert equivalent valves	with 70% accuracy.	
8.	Given project assignments and measuring equipment	the student will add, subtract, divide, and multiply	necessary to design layout and assemble projects.	
9.	Given a drawing assignment	the student will add, subtract, divide, and multiply	as necessary to center and layout the drawing assignments.	
10.	Given a list of subject matter terms	the student will (1) write, or (2) match the correct definition.	with an accuracy of 70%.	
11.	Given symbols or abbreviation representative of subject area	the student will identify correctly	with an accuracy of 70%.	
12.	Given a reading assignment related to subject matter (i.e. blueprints, schematics, texts, instructional manuals)	the student will identify important points of the assignment	and list them according to teacher/student established criteria.	
13.	Given a list of terms appropriate to area	the student will spell	with an accuracy of 70%.	
14.	Given a plan sheet and choice of projects	the student will complete the planning sheet	to teacher/student established criteria.	
15.	After appropriate research	the student will write a report	to teacher/student established criteria.	
16.	Given a choice of industrial related topics	the student will give oral class	to teacher/student established criteria.	

*See Project Definition

	Conditions	Performance	Criteria	Instructional Resources
17.	Given a list of visual or verbal instructions (example - service manuals)	the student will perform those instructions	so they are in the correct sequence and the task is completed.	
18.	Given a list of industrial related careers	the student will identify individual interests	by writing a career report of choice.	
19.	Given a list of occupational and leisure time activities	the student will identify those that are primarily leisure time and those that are occupational	with 70% accuracy.	
20.	After having achieved successful experiences	the student will list these	in terms of how they will increase any avocation interests they may have.	
21.	Given appropriate time and materials	the student will describe which industrial related or career areas interest the student most	and list three reasons why.	
22.	After appropriate time in class	the student will describe how peer groups affect his/her interests and values and explain the importance of this affect	did or did not describe.	
23.	After evaluating individual likes and dislikes related to industry and discussing them with a classmate	the student will, in written form, compare and contrast his or her feelings to those of the classmate	did or did not list.	
24.	After having completed any product	the student will verbally or write a brief report on what was gained in the experience, and given a second chance how to improve his/her work	so that the student recognizes any strengths and weaknesses and how to improve oneself.	
25.	Given a variety of teacher provided completed projects	the student will determine and list those items which create pride in work	so the student will be able to relate this to their own work.	
26.	Given paper and pencil	the student will write 10 acceptable shop behaviors	which apply to physical shop setting.	
27.	Given lab and classroom responsibilities	the student will demonstrate positive social behavior	by getting along with others in carrying out those responsibilities.	
28.	Given appropriate time and materials	the student will inventory their perspective of school, and personal attributes	and list five ways in which these may affect life roles.	
29.	Given a list of positive and negative individual social behaviors	the student will distinguish between the positive and negative behaviors	and explain their rationale for their choices.	
30.	Given a list of personality traits	the student will list five he or she thinks are most socially rewarding	did or did not list.	
31.	After having achieving a degree of success at performing an activity	the student will assist a classmate in performing the same activity	so the repetitivity performance reinforces learning and increases willingness to assist others.	

	Conditions	Performance	Criteria	Instructional Resource
32.	Given the experience in working together	the student is to determine and list the advantages of cooperation and working together	minimum of five.	
33.	Given information on how well he or she does on specific industrial skills	the student will identify those which he or she thinks require further development and improvement	did or did not identify minimum of three areas.	
34.	Given the Design Analysis Method and plan sheet	the student will design and complete plan sheet for a project.	check and ok completed plan sheet.	
35.	Given essentials, elements of inputs, and components of industry	the student will identify and explain	pass written test 70%.	
36.	Given a mass production project and use of equipment	the student will participate in the development of and the production of a product	as observed by students participating in the final process.	
37.	Given a project assignment and available tools and equipment	the student will design, plan, and construct project	check and ok plan sheet and grade completed project by instruction.	
38.	Given various tools and equipment	the student will maintain and care for tools and equipment	did or did not do.	
39.	Given a list of ten raw materials	the student will identify the industries that are involved in processing the raw materials	with 70% accuracy.	
40.	Given the appropriate instruction, materials and equipment	the student will cast materials	so the casting is complete.	
41.	Given a display of hand tools	the student will identify	with 70% correct identification.	
42.	After having been shown a variety of different power hand tools	the student will visually identify them	with 70% accuracy.	
43.	Given the appropriate drawing, templets, instruction, drawing equipment and materials	the student will layout the size and shape of a project	so that they are within an accuracy of 1/16" of drawing dimensions.	
44.	Given materials for shop skills such as driving nails, pulling nails, sawing, filing, abrading, polishing, and chiseling, etc.	the student will demonstrate the correct usage of tools	according to safe practices.	
45.	Given assorted mechanical fasteners	the student will be able to explain correct usage	pass written test 70%.	
46.	Given a repair and/or refinish project assignment	the student will repair and/or refinish a project	grade finished project	
47.	Given a list of solvents	the student will identify their correct use	pass written test 100%.	
48.	Given the instruction, materials and buffer	the student will polish or finish the material	to the teacher/student approval.	
49.	Given a list of abrasive materials	the student will identify	pass written test 70%.	

	Conditions	Performance	Criteria	Instructional Resources
50.	Given abrasive materials	the student will follow proper abrading techniques	final sketches should be final and uniform.	
51.	Using information on making assemblies or finished products	the student will name products in the classroom that have been combined by mixing, coating, bonding and mechanical fastening	7/10 products named.	
52.	Given a display of twenty-five different woodworking hand tools	the student will identify, and write their correct names	with 70% accuracy.	
53.	Given the following portable electric tools: electric drill, belt sander, finishing sander, router, sabre saw, and skill saw	the student will identify	five out of six correctly.	
54.	Given the following woodworking machines: radial arm saw, jointer, planer and table saw	the student will identify machine adjustments, uses and safety	pass written test 70% for each machine.	
55.	Given a list of lumber processing steps	the student will identify and explain	pass written test 70%.	
56.	Given the following building materials: solid lumber, plywood, veneer, hardboard, particle board, and plastic laminates	the student will identify and explain use of each	pass written test 70% for each material.	
57.	Given twelve wood samples	the student will identify deciduous or coniferous samples	identify ten out of twelve correctly.	
58.	Given the following wood joints: butt, dado, miter, dowel, lap, rabbit, mortise and tennon	the student will identify	pass written test 70%.	
59.	Given the seven basic finishing steps: bleaching, paste wood filler, stain, sealer, finished coats, rubbing down and waxing	the student will identify	pass written test 70%.	
60.	Given the following finishing methods: brushing, wiping, spraying, dipping and folling	the student will identify	pass written test 70%.	
61.	Given the following woodworking machines: band saw, drill press, scroll saw, belt disc sander, and wood lathe	the student will identify machine, adjustment, and safety	pass written test 70% for each machine (100% for safety).	
62.	Given a display of twenty-five different metalworking hand tools	the student will identify and write their correct names	identify twenty out of twenty-five correctly.	
63.	Given sheetmetal working machines: (a) squaring shear, (b) drill press, (c) box and pan break, and (d) spot welder	students will apply to a project construction	quality appropriate to grade level and maturity.	
64.	Given a list and sample of various kinds of metal materials	the student will identify these materials	with 70% accuracy.	
65.	Given presentation on combining practices of mixing, coating, bonding and mechanical fastening	the student will identify the practice	with 70% accuracy.	

Conditions	Performance	Criteria	Instructional Resources
66. Given the necessary instruction and demonstration on heat treating and forging	the student will correctly duplicate and/or explain the process	did or did not do.	
67. Given the necessary instructions and demonstration in "raming a mold", (sand casting)	the student will correctly duplicate and/or explain the process	did or did not do.	
68. After having been shown a variety of plastic forming equipment	the student will identify	with 70% accuracy.	
69. Given ten hand tools for plastics	the student will be able to identify	for seven out of ten tools.	
70. After having been shown a variety of different power equipment as relates to plastics	the student will identify	with 70% accuracy.	
71. Given the following drawing equipment: T-square, 45° and 30°-60° triangle, protractor, architect or mechanical scale, compass, divider and template, french curve, parallel bar, drafting machine, pencils (2H, 4H, H, HB), erasers, tape, drawing paper, and erasing shield	the student will identify, explain and correctly use	pass written test by 70%.	
72. Given the following alphabet of lines: object line, hidden line, center line, center point, break line, cutting plane line, leader, and section line	the student will identify and correctly sketch	pass written test by 70%.	
73. Given the dimensioning rules	the student will identify and explain the basic dimension rules	pass written test by 70%.	
74. Given blueprint materials	the student will run off blueprints or reproduce drawing copies	grade blueprint copy.	
75. Given sketching problems	the student will draw five problems in isometric, five oblique, five orthographic, and five perspective	with less than four errors for each problem.	
76. Given problems, paper, pencil and drawing equipment	the student will draw five perspective, five isometric, five obliques, five orthographics, five sections, and surface developments	for four of the five in each area.	
77. Given the opportunity to work with the four basic graphic processes: relief, intaglio, lithograph, silkscreen	the student will identify each	with 70% accuracy.	
78. Given appropriate instruction	the student will take, develop and enlarge a black and white picture	did or did not do.	
79. Given necessary instruction	the student will identify four sources of energy (i.e. oil, gas, wind)	and rank them in order of availability and abundance.	

Conditions	Performance	Criteria	Instructional Resources
80. Given instruction on the five simple machines	the student will list and state two applications for each	minimum of ten.	
81. Given opportunity to disassemble a small reciprocating engine	the student will visually identify basic parts of that engine	minimum of five.	
82. Given necessary instruction and various types of internal combustion engines (i.e. wankle and opposed piston)	the student will open, seeing each, identify the engine type	did or did not do.	
83. Given the instruction, equipment and experiments	the student will develop an awareness of generation of electricity, control of electricity, circuitry, uses or applications of electricity	with 70% accuracy.	
84. Given the instruction, material and hand tools	the student will complete a simple wiring circuit (i.e. wire a lamp)	so the product works properly and safely.	
85. Given a list of twenty-five industries	the student will determine and identify those that produce goods versus those that perform services	with 70% accuracy.	
86. After having identified interest areas and given a list of occupations related to an industrial area	the student will list and explain from the list which he or she is most interested in	minimum of five.	
87. Given the presentation by a speaker or appropriate media material on labor unions	the student will listen, observe and list benefits, gains and responsibilities of the union	five benefits and five responsibilities.	
88. Given five occupations related to an industrial area	the student will list additional occupations which are dependent upon their existence	minimum of four.	
89. Given appropriate time and materials	the student will list factors influencing job markets related to industrial areas and write an example of each	minimum of five.	
90. After examining future job markets	the student will identify job families related to industrial areas in which there will be an employment increase within the next five years	minimum of three.	
91. Given necessary information from books, pamphlets, and newspapers	the student will identify education requirements	minimum of seven.	
92. Given books, pamphlets, and newspapers	the student will list working conditions	mimimum of five.	
93. Given appropriate information from books, pamphlets, and newspapers	the student will list salaries and benefits	minimum of five occupations.	
94. Given appropriate time and materials	the student will list occupations that are directly related to subject areas	minimum of ten occupations.	

Conditions	Performance	Criteria	Instructional Resources
95. Given the personnel management of the element of industry	the student will define hiring, training, working, advancing, and retiring	does or does not do.	
96. After having accumulated several editions of the local newspapers "HELP WANTED" sections	the student will list those occupations that repeat in the Want Ads	in a four week period.	
97. Given an employment application	the student will complete the form as necessary for the job openings	all appropriate blanks are completed.	
98. Given appropriate resource material	the student will be able to trace products from raw material to manufacturer to marketing	all major steps will be identified.	
99. Given a weeks period of time	the student will note T.V., newspaper, magazine and radio, by a log, the amount of space in print and/or time spent in advertisement	so they can explain the significance of advertisement in marketing.	
100. After a teacher directed discussion	the student will write one paragraph on wholesale and retail purchasing and its affect on prices	did or did not do.	
101. Given a list of consumable products	the student will identify the vendor which can supply the products	with 70% accuracy.	
102. Given two products by different manufacturers	the student will determine which is better by quality, functions and price	as observed by written report.	
103. Given two product pamphlets by different manufacturers	the student will determine which has better warranty	select best warranty.	
104. Given a problem concerning the purchase of a piece of equipment	the student will consider different methods of financing	so they will realize a savings by the comparison.	
105. Given a film on ecology (resources)	the student will explain conservation of resources	pass written test 70%.	
106. After discussion of conservation of material	the student will list ways to conserve materials	mimimum of five.	
107. Given a list of ten consumable products needed	the student will determine which are least ecologically destructible (pollution, energy saving, and wasteful)	minimum of seven.	
108. Given the five steps in problem solving	the student will explain the five steps of Design Analysis Method	pass written test 70%.	
109. Given the Design Analysis Method and a problem	the student will follow through the five steps	in reaching a solution to the problem given.	
110. Given a plan sheet and product assignment	the student will complete the four parts of a plan sheet	check and ok plan sheet for projects.	
111. Given students ambitions	the student will determine a list of careers which may suit them	list five careers.	

Conditions	Performance	Criteria	Instructional Resources
112. Given the career interest, course descriptions and counselor	the student will research, discuss, and consider course selections	so they are able to make choices relative to interest, vocational or avocational.	
113. Given the local vocational programs	the student will identify the two which most closely match his/her occupational goals	name two programs.	
114. After having listened to a safety lecture on appropriate material to cover the area in which is being taught.	the student will take a safety exam made up by the instructor in charge (fitting the area of Industrial Education being taught).	and pass by a minimum of 85%.	
115. Given proper verbal instruction, visual demonstrations, and reading appropriate literature for each power woodworking machine to be used by the student	the student will be tested either (1) by written exam, (2) verbal testing, or (3) visually demonstrating a safe and correct method of use for each power machine	to a satisfaction of 80% by the instructor in charge on the written portion, and 100% on the verbal and/or demonstration.	
116. Given proper verbal instruction, visual demonstrations, and reading appropriate literature for each power woodworking hand tool to be used by the student in the setting he/she will be working in	the student will (1) take a safety exam, (2) demonstrate proper usage, and (3) verbally recite the safety precaution necessary for the safe use of these items	to a satisfaction of a minimum of 80% on the written portion, and 100% on the verbal and demonstration prior to use.	
117. Given proper verbal instructions, visual demonstrations, and read appropriate literature for each metal working power machine the student will be using during the course	the student will (1) take an exam; (2) verbally express the safety precautions, and (3) demonstrate the correct use of all items concerned	with a minimum of 80% on the written exam, and 100% on the verbal and demonstration prior to use.	
118. Given proper verbal instructions, visual demonstrations, and reading appropriate literature for the safe and proper use of the Arc Welder	the student will (1) take a written exam, (2) give verbal safety instructions, and (3) demonstrate the proper use of the equipment and set-up sequence	with a minimum of 80% on the written exam, and 100% on the verbal and demonstration of usage prior to use.	
119. Given proper verbal instructions, visual demonstrations, and reading appropriate literature for the safe use of gas equipment	the student will (1) take a written exam, (2) give verbal safety instructions, and (3) demonstrate the proper safe use of the equipment	with a minimum of 80% on the written exam, and 100% on the verbal and demonstration prior to use.	
120. Given verbal instructions, and a visual demonstration on the proper use of all required safety equipment	the student will (1) take a written exam, (2) give verbal instructions for the correct and proper use for all safety equipment, and all work areas concerned, and (3) demonstrate correct adjusting and wearing of all safety equipment	with a minimum of 80% on the written exam, and 100% on the verbal and demonstration of usage of all appropriate safety equipment and apparel.	
121. Given a school shop or work station which requires eye protection	the student will wear approved eye protection	eye protection in place at all times.	
122. Given a sharp hand tool and appropriate material	the student will use the tool	so that there is no personal injury.	

Conditions	Performance	Criteria	Instructional Resources
123. Given a test over general safety	the student will write answers in longhand and sign with a legal signature	100% of the answers will be acceptable.	
124. Given a power tool and appropriate material	the student will operate the tool at an appropriate skill level	so that no damage is done to the power tool and no personal injury occurs.	
125. Given a safety test over one or more power tools	the student will write answers in longhand and sign a legal signature.	100% of the answers will be acceptable.	
126. Given a scrambled list of safe procedures for a process or tool operation	the student will rearrange the list into a logical safe list	the rearranged list will match the teacher's key.	
127. Given a shop situation which requires safety clothes	the student will wear safety clothes	as specified by MIOSHA or accepted occupational standards.	
128. Given a shop situation	the student will point out or explain the fire equipment and fire exits or routes	all key equipment, exits, and routes must be included.	

*The performance objectives considered to be applicable to all Industrial Arts courses are numbered 1 through 51 and 85 through 128. Specific Industrial Arts performance objectives for skill development are numbered as follows:

52-70 Manufacturing/Construction
71-78 Graphic Communications
79-84 Power and Energy

MICHIGAN STATE BOARD OF EDUCATION

STATEMENT OF ASSURANCE OF COMPLIANCE WITH FEDERAL LAW

The Michigan State Board of Education hereby agrees that it will comply with Federal laws prohibiting discrimination and with all requirements imposed by or pursuant to regulations of the U.S. Department of Health, Education and Welfare. Therefore, it shall be the policy of the Michigan State Board of Education that no person on the basis of race, color, religion, national origin or ancestry, age, sex, or marital status shall be discriminated against, excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any federally funded program or activity for which the Michigan State Board of Education is responsible or for which it receives federal financial assistance from the Department of Health, Education and Welfare. This policy of non-discrimination shall also apply to otherwise qualified handicapped individuals.