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## Identify Competencies for Teachers of the "World of Transportation" in Industrial Arts

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IDENTIFY COMPETENCIES FOR TEACHERS  
OF THE "WORLD OF TRANSPORTATION" IN INDUSTRIAL ARTS

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A Research Paper  
Presented to  
the Faculty of the Graduate School  
Old Dominion University

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science, Secondary Education

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by  
James Alexander Roth

July 1976

Abstract

Title of Research Paper: "Identify Competencies for Teachers of 'The World of Transportation' in Industrial Arts"

James Alexander Roth, Master of Science, 1976

Research directed by: Mr. David I. Joyner

Industrial Arts Department

Old Dominion University

Graduate Advisor

This research paper is an investigation of one method of identifying and determining the suitability of competencies required of a teacher who teaches the Industrial Arts subject: "The World of Transportation." This is an orientation and exploration course for junior high school students.

A previously completed but as yet unapproved curriculum, with teacher responsibilities or competencies delineated, was mailed to all teachers of the subject, and all teachers of the related high school course, "Power and Transportation" in the state of Virginia.

A Likert Scale was used to determine the teachers' reception to the competencies. From the scores received, a mean was computed for each of the 94 items which make up the curriculum.

Results were that respondents were in "Strong Agreement" with the curriculum committee on only 6 items; they were "Undecided" on only one item; rejected as unsatisfactory only one item; while in "Close Agreement" with 86 items. I consider that amount of support a plaudit to the professional judgment of the curriculum committee.

Since the method chosen appears to be effective as an aid in determining teacher competencies to teach a course, it is recommended that future proposed curricula be subjected to similar teacher evaluation not for

just teacher competencies but for content, applicability, and suitability to age group.

This research paper was prepared by James A. Roth under the direction of the Instructor in Education 536, Problems in Education, and the Industrial Arts Department graduate advisor.

Date \_\_\_\_\_

Approved by:

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Mr. David I. Joyner  
Industrial Arts Department  
Graduate Advisor  
Old Dominion University

Date \_\_\_\_\_

Approved by:

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## Chapter 1

### INTRODUCTION

During the years of 1972-74, the Virginia State Department of Education issued Standards of Quality and Objectives for Public Schools in Virginia (Standards 1972-74). The vocational standard states: "Each school division shall provide, either within the division or on a regional basis, training for employment by students to enter the world of work ...."

The Implementation Manual amplifies the meaning of vocational education to include occupational awareness activities, orientation and exploration experiences, and specific occupational training. (Vocational 1973).

The Industrial Arts Education Service, Division of Vocational Education, Virginia State Department of Education, designed seven courses to meet the orientation and exploration phase of vocational education. These courses are:

Exploring Technology 8461

Modern Industry and Technology 8462

American Industry 8463

The World of Construction 8431

The World of Manufacturing 8425

The World of Communications 8415

The World of Transportation 8445

The industrial arts orientation and exploration programs are designed to meet the following two major purposes:

A. To assist individuals in the making of informed and

meaningful occupational choices in industry and technology.

In order to accomplish or facilitate this purpose the following provide:

1. occupational information and instruction pertaining to a range of occupations, including training requirements, working conditions, salaries or wages, and other relevant information; and
  2. exploratory experiences in laboratories, and observations in business or industry to acquaint students with jobs in the occupations included in this purpose; and
  3. guidance and counseling for students to assist them in making informed and meaningful choices in selected occupational fields; or
- B. Prepare individuals for enrollment in advanced or highly skilled vocational and technical education programs. In order to accomplish or facilitate this purpose the orientation and exploration programs provide:
1. individuals with occupational information and exploratory experience to meet the specific requirements for enrollment in such programs, and
  2. occupational information and exploratory experience directly relate to current practices in industry.
- (Vocational 1973).

The World of Transportation Course is described as follows:

"The World of Transportation is an introduction to the transportation career cluster to assist students in the making of informed



and meaningful occupational choices."

Students study, analyze, build, and service actual and model energy, power, and transportation systems. They are provided occupational information and instruction and practical shop or laboratory experiences to familiarize them with jobs available, skills needed and levels of work responsibility in the transportation career cluster.

The course is for grade levels nine and ten. The course length is thirty-six weeks. (Vocational, 1973).

During the summers of 1974 and 1975, committees appointed by the Supervisor of Industrial Arts Education, State of Virginia, met at Norfolk, Virginia, and devised a curriculum for "The World of Transportation". The 1975 version is now being prepared for submission to the Virginia State Department of Education for approval. This study will be based on that proposed report. (World, 1975).

#### I PROBLEM

Colleges and Universities in Virginia preparing teachers for teaching Industrial Arts and specifically "The World of Transportation", need to know the competencies required of these future teachers in order to ensure that the college curriculum is pertinent and complete. The members of the curriculum committee, who produced the curriculum for "The World of Transportation" and teachers in Virginia who are presently teaching the subject, or closely related subjects in high schools, also have this need to know.

It is, therefore, the purpose of this study to determine and list those competencies for evaluation by those concerned. Upon completion of this review, the report will be submitted to the Virginia State Board of Education, for information and routing to other interested educators as desired.

## II. SCOPE

This study will be limited to a compilation of the competencies required of the teachers in the State of Virginia who teach "The World of Transportation". It is anticipated that the list generated in this study will provide a "base" on which other educators may build as the needs of the course demand, and as mistakes and shortcomings of this list become apparent. It is recognized that teacher competencies will change with the development of new technology of transportation, fuels, and methods of maintenance, service, and repair of transportation machinery and related hardware.

## III. ASSUMPTIONS AND LIMITATIONS

Research of the ERIC system, and card files in the library of Old Dominion University, as well as queries of various educators in local educational institutions have yielded no indication of other research on this subject. It must therefore be assumed that, at the present, no other similiar study exists. This study will be limited to the contents and objectives of the curriculum report as presently written. No effort will be made to include teaching competencies in other than the technical area of the subject, that is, no academic competencies will be considered.

## IV. SIGNIFICANCE

This study should prove of value to schools preparing Industrial Arts Teachers for their initial degree, for teachers presently teaching the subject, and for experienced teachers about to teach the subject for the first time. It should advise these readers of the competencies, skills, and general knowledge that they will need to be effective teachers of the subject.

## V. SIGNIFICANCE

The following definitions are provided for the terms used in this study:

COMPETENCY competence. Sufficient means for one's needs or for a comfortable existence. Ability, skill, fitness. (Webster 1957).

Teacher competency can be grouped into three categories: structuring, process competencies, and supportive competencies. (Bottoms, 1975).

INDUSTRIAL ARTS A guiding definition. Industrial Arts is the study of technology. It provides the student with opportunities for:

experiencing technology---through research, experiment, design, invention, construction, and operation using ideas, materials, tools, processes, products, and energies;

learning about technology---its origin, development, advance, and impact on man, environment and culture; its technical, social, economic, occupational, cultural, recreational nature, influences, and outcomes; its consequences for the individual as a citizen, consumer, and worker. (Industrial Arts Guide, 1972).

TECHNOLOGY What technology is. Technology is the many-faceted phenomenon in materials created and advanced by man to free himself from enslavement by nature; when undisciplined, however, it may enslave its creator. Following are several characteristics which identify the phenomenon. Each characteristic, as a concept, has a role

in the curriculum.

TECHNOLOGY is the material culture.

TECHNOLOGY is man gaining advantage over nature.

TECHNOLOGY is man creating his own environment on earth, in air, in space, and in and on the sea.

TECHNOLOGY is man creating his own culture.

TECHNOLOGY is man expressing himself with materials, tools, machines, and energies.

TECHNOLOGY is man making himself.

TECHNOLOGY is man at work producing goods and services; at the same time it is man finding ways to minimize, simplify, and eliminate work.

TECHNOLOGY is man creating his own leisure. (Industrial Arts Guide, 1972).

## Chapter 2

### REVIEW OF THE LITERATURE

Research of current literature indicates several considerations in preparing today's youth for their entrance into maturity and a successful, happy life. In recent years a lot of emphasis has been placed on career goals. (Marland, 1972). Who is to bear what portion of the responsibility for career education of our youth is still being determined with the emphasis being shifted from one area to another and from one type of school to the other.

The emphasis of this study must focus on industrial arts. Maley says, "With all the growth in man's sophistication and the marvels of this technology, there is an ever increasing need for our schools to face up to the problems of a society that doubles its population in a short span of years; that gathers major segments of its people in sprawling megacities; that increasingly disturbs the ecology of life; that demands mobility, communication wonders, increasing amounts of power, and physical comfort; and a society that sees its environment undergo additional erosion year by year. I am convinced that the area of the school best suited for a necessary new role is industrial arts, because of its past interests, activities, and concerns as compared to the remainder of the school." (Maley, 1970).

It should be noted here that, in the writer's opinion, only a fine, sometimes fuzzy line separates where industrial arts leaves off in education and vocational education commences. It does not seem too important who imparts the teaching to the students as long as the material is learned. There is therefore no discrimination in this study as to where ideas are derived. If they seem appropriate for selection of teacher competencies for teaching "The World of Transportation", then they will be utilized

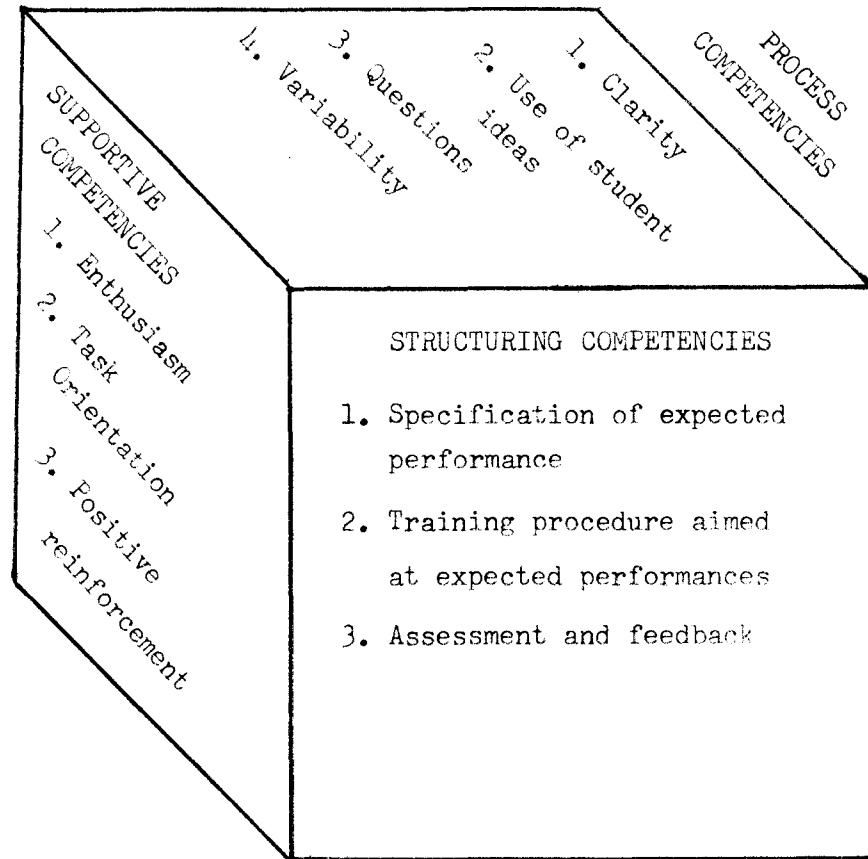
to the maximum.

If we accept that industrial arts is to bear a heavy load in preparing our youth to cope with a world in which technology continues to expand and become increasingly complex, then we must ensure that teachers have the competencies to teach the subjects. How then do we determine these required competencies?

Doctor Angelo C. Gillie writes, "We have yet to discover a Moses of vocational education, one whose touch of divinity can present us with tablets, with true competencies engraved upon them. In lieu of a Moses, we need competencies based on a sound research. Unless we can establish validated competencies, the movement will degenerate into an exchange of negotiating slogans between contending force in vocational education. In that event, preservice and inservice education could, in my opinion, become politicized and deprofessionalized." (Gillie, 1974).

Gillie goes on to say, "Replacement of current inservice and pre-service vocational teacher education with a series of competency-based alternatives should be viewed with caution." Doctor Gillie advocates establishment of state wide vocational teacher education committees with representation for professional teacher groups, state departments, and the universities with symbolic representation of students, parents and business-industry sector. These committees would then study specific areas to see if certain measurable components could be separated out of value laden elements. (Gillie, 1974).

Doctor Gene Bottoms developed a box structure which represents various teacher competencies that facilitate student learning. Since these factors will be considered in this study, the structure is reproduced herewith. (Bottoms, 1975).



Research has failed to reveal a specific methodology for determination of teacher competencies in a particular subject area such as "The World of Transportation". With due consideration to the research previously mentioned, the decision was made to utilize a recently revised curriculum report on the subject as a base on which to derive competencies teachers would be required to possess in order to teach the subject. (Curriculum, 1975).

## Chapter 3

### THE RESEARCH METHOD AND PROCEDURES

#### THE DESIGN

This study is a descriptive research based on the curriculum report developed for "The World of Transportation". A brief description of that report follows.

The curriculum report was based on four clusters that apply to the technology of transportation:

- A. Mechanics and Kinematics
- B. Thermal Power
- C. Fluid Power
- D. Electrical Power

Each of the clusters are considered separately as a part of the report. The various items that make up a cluster are then treated separately in six columns as follows:

Column 1. CONTENT A brief topical description of the unit of teaching.

Column 2. OBJECTIVE A standard behavioural objective.

Column 3. TEACHER RESPONSIBILITY A brief description of how the teacher is to present the material required to teach the content topic.

Column 4. STUDENT INVOLVEMENT A brief description of what the student is expected to do to assist in his learning the material.

Column 5. EQUIPMENT Teaching aides including teaching media, demonstrators, cut aways, experimental kits, slides etc.



Column 6. RESOURCES Bibliography of texts, test manuals, any reference material associated with teaching the content topic.

To derive the competencies required of a teacher to teach the course, an analysis was made of each topic in the curriculum content, in the objectives, and the teacher's responsibility, here treated as a teacher's competence, in presenting the information including the use of the equipment involved.

#### INSTRUMENTATION

Instrumentation consisted of a tabulation/questionnaire based on a Likert-type scale. The tabulation consisted of four columns with the Likert-type scale beneath as shown below:

1. TOPIC
2. BEHAVIORAL OBJECTIVE
3. TEACHER COMPETENCY
4. LICKERT TYPE SCALE SCORE

<u>STRONG AGREEMENT</u>	<u>AGREEMENT</u>	<u>UNDECIDED</u>	<u>DISAGREE</u>	<u>STRONGLY DISAGREE</u>
+2	+1	0	-1	-2

The questionnaire contained blank pages in back of each section which permitted interrogatees to submit alternate competencies, recommendations or other appropriate comment coded to the numbered topics in the questionnaire. These items were used to add to, modify, or replace competencies rejected by the Likert process.

Appendix B is a sample questionnaire demonstrating the format used. It has an additional column added to reflect the mean of the Likert scores assigned by the respondents.

## SAMPLING

Sampling consisted of sending copies of the questionnaire to all teachers of "The World of Transportation", and to teachers of the closely related subject, "Power and Transportation" which is taught in the high schools throughout the state of Virginia.

## DATA COLLECTION

Questionnaires were mailed to the teachers, addressed to their schools since their home addresses were not available, the first week in June 1976. Address labels for return, and postage was included. The teachers were re-requested to return the questionnaires within two weeks. Telephone follow-up was used in an effort to increase the percentage of return. Due to the summer vacation several persons could not be contacted.

## Data Analysis

Items in the questionnaire were numbered consecutively by sections. On receipt of the completed questionnaires, numbers from the Likert Scale were computed for the mean of each numbered item. Each numbered competency with a mean of +1, or higher, was considered valid for retention. Those with a mean 0 were noted with a recommendation for deletion or change. Those with a mean of - 1 were deleted.

Appendix A is a copy of the cover letter which was sent to the teachers explaining the questionnaire and how to mark the Likert Scale.

Appendix B is a copy of the questionnaire. Teachers' competencies to teach "The World of Transportation" are scored as a mean of the Likert Scores assigned by the teachers. Comments and recommended changes are included at the bottom of each page.

## CHAPTER IV

### FINDINGS AND RESULTS

#### I. ANALYSIS OF THE RETURNED DATA AND FINDINGS

The mean of the Likert scores assigned by respondents for each teacher competency are recorded in the last column of the "Curriculum Report, 1975," Appendix B. There were a total of 94 competencies considered for teaching "The World of Transportation." Concurrence with the curriculum committee's selections of competencies was very high. While there were only 6 of the items that received the 2.0 mark of "Strong Agreement", 86 of the items received marks of 1.385, or above, indicating that the respondents were well satisfied with the selections. Only one item was marked as "Undecided", and only one was rejected, attesting to the high quality of work completed by the curriculum committee.

Teachers' comments and recommendations concerning individual items of the curriculum have been added to the bottom of each page of the "Curriculum Report, 1975," Appendix B.

It was of genuine interest to the writer, a teacher of "Power and Transportation" to analyze the responses to the questionnaire. I formed several opinions as a result of this analysis.

A teacher must possess competencies in several fields to be qualified to teach "The World of Transportation" in the schools in the state of Virginia. Some of these are:

A. A broad knowledge of the principles of Physics. He must have skills in performing demonstrations which are closely related to physics experiments.

B. Knowledge of the broad area, but also in-depth knowledge of internal

and external combustion engines. This includes knowledge of nomenclature of parts, methods of operation, theory of design, service and repair. He must be familiar with the tools and have the skills to use them. He must be thoroughly familiar with all the systems that are required to make the engines operate for examples, the lubrication and ignition systems. Above all, as with every course of instruction, he must know how to put this information into a form that can be understood by teenage students.

C. An in-depth knowledge of Fluid Power with the competencies similiar to those itemized above for engines.

D. A broad knowledge of electricity and electronics, especially to those theories and applications to vehicle ignition, magnetoes, generators, starters, etc.

E. Knowledge of metal fastening. This includes the hardware, how to use it, methods of removing broken bolts, studs and screws, but also the processes of soldering, brazing, welding, and riveting.

F. To the above must be added what is probably most difficult to teach, the "art" of trouble-shooting in any of the above areas.

I concluded that this is probably one of the more complex subjects and possibly one of the most difficult subjects to teach of all those in Industrial Arts. Colleges and universities preparing teachers to teach "The World of Transportation" and related subjects, are faced with a formidable job in preparing their course of instruction. This is so because the curriculum must contain all the facets of instruction which prospective teachers need to help in acquiring all the competencies required to teach the subject.

## CHAPTER V

### SUMMARY AND RECOMMENDATIONS

#### I. SUMMARY

Teachers of "The World of Transportation" in the junior high high schools, and of "Power and Transportation" in the high schools, of Virginia were asked to consider the "Content", "Objectives", and "Teacher Responsibility" changed to "Teacher Competency", in a curriculum report prepared by a curriculum committee appointed by the State Board of Education for the State of Virginia. The purpose of the review was only to identify the competencies for teachers of one of the Industrial Arts Subjects, "The World of Transportation."

A Likert scoring system was used to indicate the respondents' "Strong Agreement", "Agreement", "Undecided", "Disagreement", or "Strong Disagreement" with the curriculum Committee's choices of teachers' competencies. In addition, "Comments and Recommended Changes" from the respondents were added to the bottom of each page of the curriculum report. The scores from the respondents were averaged to determine the mean score for each of the 94 items in the curriculum. These means were recorded in the last column of each page of the questionnaire report, Appendix B, of this report.

While respondents were in complete agreement with the committee on only 6 of the selections, they were undecided on only one item, and rejected only one. The respondents were well pleased with the remaining 86 items, indicating that the curriculum committee had done a fine professional job in the curriculum design and the choice of teacher responsibilities or competencies.

## II. RECOMMENDATIONS

The method used for this research appears to be one effective way in which to determine teacher competencies for one course, that is, by having a well qualified committee prepare the curriculum, detailing their ideas. The completed curriculum in unapproved form can be considered by teachers in the field who are teaching or expect to teach the course to determine if the competencies are valid, complete and within reason. After consideration of the teachers' recommendations, the curriculum can be written "in the smooth" and forwarded to the State Board of Education for approval and promulgation. It is therefore recommended that this system be considered for use in future curriculum construction.

Since teachers in the field are interested in curriculum content, it is further recommended that they be allowed to make contributions to that content in a similiar manner to the procedure for selecting competencies. As one teacher noted concerning this specific curriculum, it was obviously written by "eggheads" rather than teachers who would have to teach it, because the content was too detailed and too deep for the junior high school students. Without judging that for validity, the point appears well taken. Curriculum committees must keep in mind the age group to which the course will be taught and keep it practical. Input to curriculums from teachers in the field would assist in this "leveling" content to applicability or suitability to students.

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APPENDIX B

THE WORLD OF TRANSPORTATION

A CURRICULUM REPORT 1975



SECTION I

MECHANICS AND KINEMATICS

STRONG AGREEMENT+ 2	AGREEMENT +1	UNDECIDED 0	DISAGREE -1	STRONGLY DISAGREE -2
CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT	
I. Introduction	1. State in his own words the 4 parts of a mechanical power system.  2. List the basic types of motion.	1. Define the following parts of a mechanical power system: a. Input b. Control c. Transmission d. Output  2. Define the following types of motion: a. Reciprocating b. Rotary c. Linear	1.615	
II. Safety while working with mechanical power systems.	1. Students discuss safety rules as applied to use of hand and power tools.	1. Explain the necessity for safety rules. 2. List and discuss safety rules and their application to the use of hand and power tools.	1.615	
III. Occupations associated with the field of mechanical power.	1. List as many occupations as possible related to the field of mechanical power.	1. Lead discussion of various occupations in the mechanical power field.	1.385	
IV. Basic Machines	1. Discuss the historical development and applications of the 6 Basic Machines.  2. List the 6 Basic Machines  3. Define what mechanical advantage is, and give its basic formula.  4. Work simple mechanical advantage problems	1. List and describe the 6 Basic Machines. 2. Define mechanical advantage and give its basic formula.  3. Illustrate simple mechanical advantage problems by using the formula.	1.692	
			1.615	
			1.538	

RECOMMENDED CHANGES OR COMMENTS

1. Several teachers commented on the importance of stressing safety.
2. Some desired that teachers bring simple machines into laboratory and demonstrate each separately.
3. Regarding Item III, above, several teachers questioned the teaching of occupations to the 8th, 9th, and 10th grade students. Students at this age do not yet seem to want to think about what they will have to do to make a living and are therefore not receptive to this information.

STRONG  
AGREEMENT +2

AGREEMENT  
+1

UNDECIDED  
0

DISAGREE  
- 1

STRONGLY  
DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
V. Control Devices	1. State in his own words the 3 types of control changes.	1. Define the following control changes: a. On-Off Switching	1.615
	2. List the 4 basic control devices and give an example of where it would be used.	b. direction c. speed and force 2. List and give an example of each of the following control devices: a. Gears b. Pulleys c. Clutches d. Couplings	1.846
VI. Transmission Devices	1. State in his own words the 3 devices used to transmit power.	1. Define the following: a. transmission b. friction	1.769
	2. List an example where each Transmission Device would be used.	2. List and discuss the devices used to transmit power. a. Solid shafts b. Cables c. Belts	1.538
		3. Give an example where each transmission device would be used.	1.615

## RECOMMENDED CHANGES OR COMMENTS

- In regard to VI above, one teacher suggested including chains, liquid, and pneumatic transmission systems as for example as used on vehicle braking systems.
- Assigned scores indicate most were content with the competencies on this page.

SECTION II

THERMAL POWER  
THEORY AND PRACTICE

STRONG AGREEMENT + 2    AGREEMENT +1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE -2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
I. Introduction to Internal Combustion Engines and External Combustion Engines	The student should be able to:	1. Discuss historical development of I.C. and E.C. engines	1.385
A. Basic measurements	1. Explain the Historical Development.	2. Demonstrate safe practices in the use of:	1.923
1. English	2. Use tools and equipment related to small engines.	a. fuels	
2. metric	3. Operate small engines safely.	b. hand tools	
B. Math conversion techniques.		c. machines	
		d operation of small engines.	
		3. Discuss measurement standards of:	1.615
		a. English	
		b. metric	
II. Safety			
III. Basic principles of operation- Internal combustion Engines		1. Demonstrate different types of engines in laboratory.	2.0
A. Operating Principles		2. Operate different engines emphasizing the obvious differences	2.0
		3. Present films, slides, or other visual media emphasizing specific details.	1.923
		4. Demonstrate engine principles with sectional engine.	1.769
		5. Demonstrate how to disassemble engines.	2.0

## RECOMMENDED CHANGES OR COMMENTS

- In I. above one teacher commented that he found the students rapidly lost interest if he taught too much on the history of engines and gave this item a low score.
- In III above, one recommendation was to, "Demonstrate methods of inspecting engine parts. How to take measurements for wear for out-of-round, clearances, etc."

STRONG AGREEMENT + 2    AGREEMENT +1    UNDECIDED 0    DISAGREE - 1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
B. Engine Systems	1. Identify and Explain the operation of: a. Fuel system b. Ignition system c. Cooling system d. Lubrication system e. Mechanical system f. Starting system	1. Show different types of fuel systems and their application.	1.769
1. Fuel System a. Fuel b. Fuel stowage and safety practices. c. Carburetor d. Fuel tank	2. The student should be able to a. Identify the different types of fuel for engine applications	2. Discuss and Demonstrate the different types of carburetors and explain the physical differences.	1.846
	3. Identify 3 different types of small engine carburetors.	3. Discuss stowage and safety practices when handling fuels.	2.0
	1. Explain how the gravity fuel-feed system operates	4. Compare gravity system with the mechanical pump feed system.	1.692
C. Ignition System	1. Identify and explain the function of: a. Armature type magneto 1 Breaker Points 2 Condenser 3 Flywheel b. Capacitive Discharge 1. Condenser 2. Diode 3. Reluctor	1. Discuss and Demonstrate the operation of the magneto ignition system.	1.538
		2. Discuss and Demonstrate the operation of the C.D. ignition system.	1.308
		3. Demonstrate how to test and analyze ignition components.	1.692
	2. Explain timing	4. Demonstrate the application and technique of using: a. thickness gauge	1.692

RECOMMENDED CHANGES OR COMMENTS

1. Under B above, a recommendation that Emission Control System be covered.
2. Add a competency to the ignition system instruction, that, the standard battery, coil, distributor, spark plug system.
3. A comment that carburetor parts (nomenclature) and a description of their function should be added to B 1.

STRONG AGREEMENT + 2    AGREEMENT +1    UNDECIDED 0    DISAGREE - 1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
<p>C. Ignition Systems (cont)</p>	<p>3. Set-up ignition to specifications. 4. Perform diagnostic analysis on complete ignition system.</p>	<p>4. (cont.) b. continuity tester c. Spark analyzer 5. Perform ignition tune-up.</p>	<p>1.846</p>
<p>D. Cooling system 1. Air cooled 2. Water cooled</p>	<p>1. Identify cooling system parts. 2. Explain function of cooling system components.</p>	<p>1. Identify and explain cooling system components. 2. Compare air-cooled with water cooled system.</p>	<p>1.846 2.0</p>
<p>E. Lubrication 1. Lubricants 2. Splash and slinger lubrication systems. 3. Pressure lubrication systems.</p>	<p>1. State the effects of friction. 2. List the types of engine lubricating oils and their applications. 3. Identify the types of lubrication systems.</p>	<p>1. Demonstrate the effects of friction. 2. Identify the various grades of motor oil. 3. Identify and explain internal lubrication.</p>	<p>1.769 1.923 1.769</p>
<p>F. Starting Systems 1. Rope rewind 2. Rope recoil 3. Electric starting motors</p>	<p>1. The student will be able to explain the operation of the basic engine starting techniques.</p>	<p>1. Disassemble and demonstrate the operation of: a. Rope b. Recoil c. Electrical systems. 2. Demonstrate schematic and starter components. 3. Perform continuity test on electrical system.</p>	<p>1.692 1.769 1.538</p>

RECOMMENDED CHANGES OR COMMENTS

1. No comments on this page, however, this page might be the place to include teachers competency in removing engine flywheels, pulleys, and lawnmower blade adapters.
2. A section is needed on identification and use of bolts, nuts, screws etc. How to remove and repair broken bolts, studs, etc, including use of heli-coils.

STRONG AGREEMENT + 2    AGREEMENT +1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE -2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
<p>G. Engine overhaul procedure</p> <ol style="list-style-type: none"> <li>1. Disassembly</li> <li>2. Inspection</li> <li>3. Engine Measurements</li> <li>4. Reassembly</li> <li>5. Operate and adjust</li> <li>6. Testing</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify problems with ignition systems.</li> <li>2. Measure crankshaft bearing and camshaft diameters.</li> <li>3. Locate carburetor restrictions, set float level, and adjust mixture.</li> <li>4. Replace and set-up ignition systems to specifications.</li> <li>5. Assemble engine in the proper sequence.</li> <li>6. Identify problems in the mechanical system.</li> <li>7. Perform operating adjustments.</li> <li>8. Be able to relate the definitions of the terms:               <ol style="list-style-type: none"> <li>a. horsepower</li> <li>b. torque to engine performance.</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Present demonstrations on the use of special engine measurement tools and equipment, e.g.               <ol style="list-style-type: none"> <li>a. Dynamometer</li> <li>b. Ignition test equipment</li> <li>c. Telescoping measurement tools</li> <li>d. Plastigage</li> <li>e. Small hole gage</li> <li>f. Special engine tools.</li> </ol> </li> </ol>	1.769

RECOMMENDED CHANGES OR COMMENTS

NONE



SECTION III

FLUID POWER

STRONG AGREEMENT + 2    AGREEMENT + 1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE -2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
<p>I. Safety and Accident Prevention</p> <p>A. Where appropriate this is a continuing process throughout the entire study of fluid power.</p> <p>B. The safety aspect of each component will be discussed and reviewed as applicable.</p>			
<p>II. Occupations associated with the Field of Fluid Power.</p> <p>A. Related occupations should become a part of each presentation.</p>			
<p>III. Introduction</p>	<p>1. List ten applications for fluid power systems.</p> <p>2. Briefly trace the major historical developments in the field of fluid power.</p> <p>3. List ten occupations associated with the field of fluid power.</p> <p>4. List the basic job entry requirements for five labor and five management jobs.</p>	<p>1. Define the following terms:</p> <p>a. hydraulics</p> <p>b. pneumatics</p> <p>c. fluids</p> <p>d. liquids</p> <p>2. Discuss the contributions of the following:</p> <p>a. Archimedes</p> <p>b. Leonardo daVinci</p> <p>c. Evangelista Torricelli</p> <p>d. Blaise' Pascal</p> <p>e. Joseph Brahmah</p> <p>f. W.C.Armstrong</p> <p>g. Daniel Bernoulli</p> <p>h. CharlesLaw</p>	<p>1.615</p> <p>1.0</p> <p>1.846</p>

RECOMMENDED CHANGES OR COMMENTS

- The undecided "1" mark on this page refers to the objection to some to teaching history. I would not recommend change to the item.
- One teacher was not at all in favor of teaching peoples' name in connection with the Physics principles involved, I do not accept this.

STRONG AGREEMENT + 2    AGREEMENT +1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
		3. Discuss practical applications for fluid power systems.	1.846
		4. Relate the names of companies that manufacture fluid power components.	.069
		5. List 3 advantages and 3 disadvantages of fluid power systems.	1.615
		6. Discuss the nature of jobs associated with fluid power.	1.769
		7. Relate the educational requirements for job entry into these fields.	1.538
<p>IV. Identification of Basic Fluid Power Components:</p> <p>A. Identification of component parts is a continuing process.</p> <p>B. Relate the name and function of each component at the appropriate time.</p>	<p>1. Identify and name the basic fluid power components</p> <p>2. List the functions of the basic components of a fluid power system.</p>	<p>1. Identify and describe the basic function of the following components:</p> <p>a. single acting cylinder</p> <p>b. double acting cylinder</p> <p>c. relief valve</p> <p>d. pump</p> <p>e. flow control valve</p> <p>f. reservoir</p> <p>g. motor</p> <p>h. gauges</p>	1.615

RECOMMENDED CHANGES OR COMMENTS

- Item 4 above received the only "strongly disagree" mark. I agree and recommend this item be deleted as having little value particularly to junior high school students.
- I feel that this section in fluid power is too broad and too much in-depth for a junior high school subject, unless the teacher intends to introduce and "lightly brush".

STRONG AGREEMENT + 2      AGREEMENT +1      UNDECIDED 0      DISAGREE -1      STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
<p>V. Basic Principles of Fluid Power</p>	<p>1. Explain the basic principles of fluid power.</p>	<p>i. check valve j. hose, couplers k. flow meter l. sequence valve m. accumulators n. regulators o. pressure tanks</p>	
		<p>1. Define and explain Pascal's Law</p>	<p>1.846</p>
		<p>2. Relate the basic characteristics of liquids and gases.</p>	<p>1.923</p>
		<p>3. Define, demonstrate, and give the formula for the following measuring concepts: a. atmospheric pressure b. pressure c. force d. area e. work f. power g. horsepower h. torque i. volume</p>	<p>1.692</p>
		<p>4. Define the difference between an open and a closed fluid system.</p>	<p>1.692</p>
		<p>5. Relate the 2 basic principles of flow in hydraulic systems.</p>	<p>1.769</p>
<p>6. Relate the basic principles of air flow.</p>	<p>1.692</p>		

RECOMMENDED CHANGES OR COMMENTS

1. Note 2, previous page applies to this page.

STRONG AGREEMENT + 2    AGREEMENT + 1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
		7. Evaluate problems and results of students' lab activities.	1.692
		8. Evaluate student progress.	1.932
		9. Provide a structured out-line for the student to follow for lab activity.	1.615
	1. The student should be able to define several of the basic compressers used to compress air.	1. Explain the different types of compressors: a. vane pump b. piston pump c. centrifugal pump d. lobe pump e. diaphragm	1.461
VI. Fluid Power Symbols	1. Identify the basic fluid power symbols. 2. Construct fluid power circuit from a schematic diagram and make it work.	1. Relate the importance of the following graphic symbols and their use: a. straight line 1. working line (solid) 2. pilot line (long dashes) 3. drain line (short dashes) 4. Flexible line (arc with one short sphere on each end). b. rotating components 1. circle 2. solid triangles	1.538

RECOMMENDED CHANGES OR COMMENTS

1. My opinion, too indepth and too detailed for students in this age group.

STRONG AGREEMENT +2    AGREEMENT +1    UNDECIDED 0    DISAGREE -1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
VII. Introduction to control valves	1. Identify and state the purpose of the 3 basic types of control valves. 2. List 3 practical applications for each control valves. 3. Describe the operation of the 3 basic types of control valves.	c. cylinders d. valves e. reservoir tank compressor  2. Develop a handout that shows all the pertinent symbols.  3. Disseminate drawings of 4 fluid power circuits. (use picture diagrams)  4. Evaluate progress of students' schematic drawings.	      1.769  1.692  1.846
		1. Discuss and relate the purpose of the following directional control valves: a. check valve (one-way valve). b. Reversing valve (four way valve). c. Flow control	1.846
		2 Provide a lab activity with schematic diagrams for basic control valve.	1.769
		3. Evaluate student lab activities.	1.692

## RECOMMENDED CHANGES OR COMMENTS

1. Previous comments this subject area apply.

STRONG AGREEMENT +2    AGREEMENT +1    UNDECIDED 0    DISAGREE - 1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
VIII. Fluid Power Actuators	1. Name the 2 types of actuators.	1. Define actuators and state their purpose.	1.769
	2. Describe the basic operating principles of the two types of a actuators.	a. linear b. rotary	1.846
	3. List 3 applications for for each type of actuator.	2. Relate the types of actuators: a. linear or cylinders b. rotary or motor	1.769
		3. Explain the basic operating principles of the following cylinder actuators: a. ram type b. standard double acting c. double rod cylinder	1.846
		4. Explain the basic operating principles of the following rotary actuators: a. gear motor b. vane motor	1.692
		5. Design hydraulic or pneumatic circuits using schematic diagrams for the basic type of actuator.	

RECOMMENDED CHANGES OR COMMENTS

1. Previous comments this subject area apply.

STRONG AGREEMENT +2    AGREEMENT +1    UNDECIDED 0    DISAGREE - 1    STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
VIII. Fluid Power Actuators (cont.)		6. Evaluate student activities.	1.769
		7. Provide a lab activity utilizing the basic actuator.	1.769
		8. Provide forms for recording experimental data.	1.769
IX. Fluid Power Pumps	1. List 2 purposes for fluid power pumps.	1. Define and give the purpose for fluid power pumps.	1.769
	2. Compare the operation of fluid motors to fluid pumps.	2. Relate the difference in the 2 types of pumps: a. Positive displacement	1.692
	3. List 3 applications for each type of pump.	b. Non-positive displacement pumps.	1.615
		3. Relate the purpose and basic operating principle of the fluid pumps or compressors: a. impeller b. axial	1.615
	4. Relate the purpose and the operating principle of the fluid pumps: a. Vane type rotary b. balanced vane pumps	1.615	

RECOMMENDED CHANGES OR COMMENTS

1. Too much emphasis on hydraulics in this type of course.



STRONG AGREEMENT +2

AGREEMENT +1

UNDECIDED 0

DISAGREE -1

STRONGLY DISAGREE - 2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
IX. Fluid Power Pumps (cont.)		5. Design hydraulic or pneumatic circuits using schmentic diagrams for each type of pump or compressor.  6. Provide lab activity utilizing each type of pump.  7. Provide forms for recording experimental data.  8. Evaluate student lab activity.	1.615        1.461        1.846        1.769
X. Properties of hydraulic fluids.	1. List 3 purposes for hydraulic fluids.  2 List 6 quality requirements for hydraulic fluids.  3. List the properties of compressed gases.	1. Relate the 4 primary purposes of hydraulic fluids.  2. Discuss the quality requirements of hydraulic fluids.  3. Relate the basic storage and filtering of compressed air.	1.692        1.538        1.538

## RECOMMENDED CHANGES OR COMMENTS

1. Previous comments this area apply.

STRONG AGREEMENT +2

AGREEMENT +1

UNDECIDED 0

DISAGREE - 1

STRONGLY DISAGREE -2

CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT
XI. Fluid Filtration in Hydraulic Circuits	<ol style="list-style-type: none"> <li>1. Define the unit for measuring filtered particles.</li> <li>2. Differentiate between a filter and a strainer.</li> <li>3. List 5 reasons that depict the importance of cleanliness in care of hydraulic and pneumatic circuits.</li> <li>4. Inspect and do minor maintenance on filter systems of fluid systems.</li> </ol>	<ol style="list-style-type: none"> <li>1. Relate the importance of filtering and cleanliness.</li> <li>2. Define the following terms:               <ol style="list-style-type: none"> <li>a. strainer</li> <li>b. filter</li> </ol> </li> <li>3. Define the unit for measuring filtered size particles.</li> <li>4. State the types of filtered elements.</li> <li>5. Define the filter and drying system of a pneumatic system.</li> </ol>	<p>1.692</p> <p>1.692</p> <p>1.692</p> <p>1.615</p> <p>1.461</p>

## RECOMMENDED CHANGES OR COMMENTS

1. Previous comments this area apply.

SECTION IV

ELECTRICAL POWER

STRONG AGREEMENT + 2	AGREEMENT +1	UNDECIDED 0	DISAGREE - 1	STRONGLY DISAGREE - 2
CONTENT	OBJECTIVE	TEACHER COMPETENCY	MEAN LIKERT	
I. Electron Theory A. Basic Principles B. Matter C. Atomic Structure	The student shall: 1. Study the work of men that contributed to the development of early concepts in electricity. 2. Develop an understanding of the basic principles of electricity. 3. Develop an understanding of the composition of matter. 4. Develop an understanding of the structure of the atom and how it relates to the development of electrical energy. 5. Be able to identify and construct the three basic electric circuits. 6. Develop an understanding of how AC and DC current is developed and the most effective utilization of each. 7. To be able to safely use basic test equipment in ascertaining the various units of electrical energy. 8. Identify occupational fields in electricity that apply to transportation.	1. Through the use of transparencies, film strips, models, and textbook, explain the "electron theory".          2. Provide the students with materials that may be utilized to construct various circuits. 3. Provide students with adequate safety information so as to enable them to perform experiments safely.	1.923          1.846   2.0	

## RECOMMENDED CHANGES OR COMMENTS

- No provision for teaching theory of "magnetism", "transformer theory". Without these, students cannot understand magneto action, or coils in ignition. In that respect this part of the course overlaps that of I.C. engines.

STRONG AGREEMENT + 2	AGREEMENT + 1	UNDECIDED 0	DISAGREE - 1	STRONGLY DISAGREE - 2	
CONTENT	OBJECTIVE			TEACHER COMPETENCY	MEAN LIKERT
<p>II. Automotive Electricity</p> <p>A. Ignition System</p> <p>1. Primary Circuit</p> <p>2. Secondary Circuit</p> <p>3. Magneto Ignition</p> <p>4. Electronic Ignition</p> <p>B. Charging System</p> <p>1. Generator System</p> <p>2. Alternating System</p> <p>C. Starting System</p> <p>D. Horns, lights, relays, and other electrical circuits.</p>	<p>1. Be familiar with and demonstrate good safety habits in the use of tools and equipment.</p> <p>2. Be able to identify components of various systems.</p> <p>3. Be able to relate how the components function in a complete electrical system.</p> <p>4. Be able to identify problems that are typical of Auto Electrical Systems.</p> <p>5. To set-up systems to specifications using all necessary equipment and manuals.</p> <p>6. Be able to properly select and use equipment and diagnostic procedures in trouble shooting the various systems.</p>			<p>1. Utilize slides, transparencies, movies, and information sheets to explain how automotive electrical systems function.</p> <p>2. To organize electrical components for students to examine and analyze.</p> <p>3. To organize test engines on which students can perform diagnostic operations.</p>	<p>1.846</p> <p>1.769</p> <p>1.846</p>

## RECOMMENDED CHANGES OR COMMENTS

1. No criticism regarding this page, except one comment on insertion of instruction on "solenoids" here.

STRONG AGREEMENT +2	AGREEMENT +1	UNDECIDED 0	DISAGREE - 1	STRONG DISAGREEMENT -2
<p style="text-align: center;">CONTENT</p> <p>III. Electric Motors</p> <p>A. Motor Action</p> <ol style="list-style-type: none"> <li>1. Attraction</li> <li>2. Repulsion</li> <li>3. EMF</li> </ol> <p>B. Motor Types</p> <ol style="list-style-type: none"> <li>1. Split Phase</li> <li>2. Permanent split phase</li> <li>3. Repulsion start-induction run</li> <li>4. Capacitor-start induction run.</li> <li>5. Capacitor start-capacitor run</li> <li>6. Shaded pole</li> <li>7. Poly-phase</li> <li>8. Universal motor</li> </ol>	<p style="text-align: center;">OBJECTIVES</p> <ol style="list-style-type: none"> <li>1. Relate an understanding of the respective terms that apply to specific conceptual motor theories</li> <li>2. Explain how AC and DC motors operate.</li> <li>3. Explain and identify basic electric types by interpretation of data found on motor name-plates.</li> <li>4. Perform minor electric motor repairs as well as alternator-generator repairs.</li> <li>5. Become safety conscious in the manner he works with electricity.</li> </ol>	<p style="text-align: center;">TEACHER COMPETENCY</p> <ol style="list-style-type: none"> <li>1. Provide demonstrations on the basic types of electric motors.</li> <li>2. Provide equipment for accomplishing student activities.</li> <li>3. Provide safety instructions for all activity.</li> </ol>	<p style="text-align: center;">MEAN LIKERT</p> <p>1.923</p> <p>1.923</p> <p>1.923</p>	

RECOMMENDED CHANGES OR COMMENTS

1. No comment.