

A COMPARISON OF INADEQUACIES OF INSTRUCTIONAL SPACE OF
PUBLIC SECONDARY VOCATIONAL AUTOMOTIVE MECHANICS LABORATORIES IN
VIRGINIA VOCATIONAL TECHNICAL CENTERS AND COMPREHENSIVE HIGH SCHOOLS
AS PERCEIVED BY AUTOMOTIVE MECHANICS TEACHERS

by

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Dedicated to my wife, ,
for her continuous support and unflagging encouragement.

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Chapter 1

INTRODUCTION

The 1963 Vocational Education Act (Congress, 1968:13) was the first federal legislation which authorized grants for construction and operation of area and residential vocational schools, and for various ancillary services and activities. This Act provided the basic support for the extensive construction of vocational industrial education facilities throughout the United States from 1964 to the present.

Sixty-six secondary vocational industrial education facilities have been constructed in Virginia since 1963, utilizing the aforementioned support. Some of these facilities were attached to existing high school or vocational school buildings, but a substantial number were constructed as separate area vocational centers. The federal, state and local monies used to construct these vocational facilities totaled nearly \$70,000,000 (Virginia, 1976:1-14).

Continued expansion of vocational facilities, as projected through 1980 by the Trade and Industrial Education Service (Virginia, 1975:1-9), indicated plans for constructing nine new facilities or additions to existing facilities in 1976, five in 1977 and ten in 1980. The projected rate of expansion from 1976 to 1980 was approximately the same as was experienced from 1963 to 1976.

The projected rate for expansion of vocational facilities

did not take into account the restraining effects of the 1973 oil embargo. The full effect of the embargo was not felt until 1975, which was followed by increased levels of inflation and unemployment. Fiscal restraint was then applied by the President and by Congress, to both the inflationary and recessionary trends in the economy. Extensive reductions were made in appropriations for education, including cuts in funds originally earmarked for vocational facilities (Burkett, 1975:14).

With decreased federal support came a corresponding decrease in state and local funding. State and local governmental agencies had no alternative but to curtail expansion of programs, reduce services and cut expenditures for capital improvements.

The decrease in funding combined with curtailed expansion and reduced services has induced citizens, educators, and governments to reevaluate all existing and proposed educational programs. New priorities were established, with those expenditures considered as less essential being reduced in scope or eliminated entirely.

NEED FOR THE STUDY

Public dissatisfaction with the quality of education along with pressures from within the profession have brought the concept of accountability to the forefront in recent years. These factors combined with a weakened economy, student unrest, fewer resources and an increased interest in the worth of the individual have resulted in an increased interest in accountability. Concern for

accountability in education is becoming increasingly emphatic as a vocal public expresses dismay over quality at a time when fewer resources are available.

Vocational education will certainly be required to evaluate its achievements in light of this new accountability thrust. The planning process for program initiation and operation will require that measurable objectives be delineated along with a time line for achievement of such goals. The public is entitled to a periodic accounting of vocational programs. Of this Burkett states:

The concept of accountability, if implemented in all its ramifications, will spell success or failure for public school vocational education in the minds of the taxpayers (Burkett, 1975:9).

Both program accountability and facility accountability are required to provide optimum instruction to students. It is not possible to provide optimum instruction if either the provision for the program or for the facility is deficient.

It is interesting to note that no mention is made of accountability in The Standards of Quality for Trade and Industrial Education Programs for Public Schools in Virginia (1973:1-121). It should not be concluded, however, that accountability of vocational facilities is no longer a public issue. Many millions of dollars have been and will continue to be expended for the construction of vocational facilities. Certainly the public is entitled to accountability of such expenditures in terms of the degree to which stated goals are achieved.

STATEMENT OF THE PROBLEM

The largest amount of space in any vocational facility is devoted to laboratory training facilities. Care in planning, construction, and utilization of this laboratory space is of utmost importance to the total vocational program. The degree to which the teaching learning environment is considered to be sufficient depends largely upon the use of sound principles of planning.

Vocational facilities in Virginia are of two major types: (1) Vocational facilities constructed apart from other structures, identified as vocational technical centers; (2) Vocational facilities constructed as an integral part of a high school facility, identified as comprehensive high schools.

A review of the Standards of Quality for Trade and Industrial Education Programs for Public Schools in Virginia (1973:1-121) revealed that no provision was made for the evaluation of vocational facilities, nor was there any information indicating which type of facility was most adequate. Although detailed criteria were provided for many categories of vocational education, the vital area of laboratory facility adequacy was not mentioned.

The paucity of recent information on adequate laboratory space and the complete absence of such criteria in the Standards of Quality for Trade and Industrial Education Programs for Public Schools in Virginia (1973:1-121) have encouraged this researcher to investigate the quantity and quality of instructional space in automotive mechanics laboratories.

As a concomitant part of the study, an investigation was designed to compare the inadequacies of laboratories in vocational technical center facilities with the inadequacies of laboratories in comprehensive high schools. Observation indicates that there is stronger support for providing adequate facilities in vocational technical centers where the administrator has an adequate background in facility planning and needs. Usually the comprehensive high school is administered by an academic principal who does not perceive such needs with the same degree of importance.

PURPOSE OF THE STUDY

The purpose of this study was to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and comprehensive high schools, based upon the perceptions of automotive mechanics teachers.

The study was designed to answer the following general questions:

1. What are the inadequacies, in rank order, of the instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools as perceived by teachers in these two types of schools?
2. What is the relationship between the rankings of in-

adequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories in vocational technical centers and by teachers in comprehensive high schools?

3. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers housed in oldest facilities (top half) and by those teachers housed in newest facilities (bottom half)?
4. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most teaching experience (top half) and by those teachers possessing the least teaching experience (bottom half)?
5. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most trade experience (top half) and by those teachers possessing the least trade experience (bottom half)?
6. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories

by teachers possessing the largest class size (top half) and by those teachers possessing the smallest class size (bottom half)?

7. What other factors contribute to inadequate instructional space in automotive mechanics laboratories?

LIMITATIONS OF THE STUDY

The study included the following limitations:

1. Teachers were asked to rank inadequacies regardless of the condition of their own facility. Because the inadequacy of these facilities may vary it is possible that the results may be influenced by this variable.
2. Teachers participating in this study were high school automotive mechanics teachers.
3. Only laboratory space in the automotive mechanics facility was included in this study.

ASSUMPTIONS OF THE STUDY

The study included the following assumptions:

1. It was assumed that the automotive mechanics teachers included in the study were the most competent persons available to evaluate the adequacy of the automotive mechanics laboratory.
2. It was assumed that a laboratory, considered to be desirable from a teaching-learning situation standpoint, was an ade-

quate facility.

DEFINITION OF TERMS

The following definitions pertain to terminology used in this study:

Adequate. Equal to the requirement or occasion; fully sufficient, suitable or fit (Barnhart, 1968:15).

Auxiliary areas. Additional space within the main laboratory used to supplement the main laboratory space and designed to increase the effectiveness of the total facilities (Schmitt, 1968:3).

Auxiliary rooms. Additional space outside of the main laboratory in the form of separate rooms, used to supplement the main laboratory space and designed to increase the effectiveness of the total facilities (Schmitt, 1968:3).

Laboratory or Shop. The major open space designed to house the principal equipment used primarily to implement the technical aspects of the program; area generally free from enclosed partitions and of sufficient size to accommodate the space needs of all students in class (Schmitt, 1968:3).

Vocational Industrial Education. Instruction which is planned to develop basic manipulative skills, safety judgment, technical knowledge, and related occupational information for the purpose of fitting persons for initial employment in industrial occupations and upgrading or retraining workers employed in industry. Also known as Trade and Industrial Education (Virginia, 1973:115).

Vocational Industrial Education Instructor. A teacher employed by a school division for the purpose of imparting trade skills and knowledge to youths in a public school setting (Swartz, 1974:14).

Work station. Any equipped area where a student can pursue some phase of class activity (Brown, 1969:50).

Years of teaching experience. Periods of employment in the teaching profession at a public or private secondary school, college, or university. Operationally defined, a year of teaching experience is the successful completion of a nine, ten, eleven, or twelve month contract period for instructional services (Swartz, 1974:14).

Years of trade experience. Operationally defined as calendar years of employment beyond the normal learning period (apprenticeship) for a given trade in either a commercial or industrial establishment, or government service (Swartz, 1974:14).

SUMMARY

The purpose of this study was to identify and to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and in comprehensive high schools based upon the perceptions of automotive mechanics teachers. In addition, it was also intended to determine the relationships of the rank orders of inadequacies

compared with the variables of (1) age of the facility, (2) amount of teaching experience, (3) amount of trade experience, and (4) class size.

The study was limited in its scope to analyzing the instructional space of automotive mechanics laboratories in Virginia. The teachings participating in this study were full time high school automotive mechanics teachers.

Chapter 2

REVIEW OF RELATED LITERATURE

The purpose of this study was to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in vocational technical centers with comprehensive high schools based upon the perceptions of automotive mechanics teachers. The basic approach to this problem was to request automotive mechanics teachers to identify and to rank the components of their respective laboratories which were considered to be inadequate. This information was the basis for recommendations set forth to remedy the identified inadequacies.

A preliminary review of related literature revealed that: (1) there is a paucity of information on laboratory inadequacies and (2) no distinction was made between laboratory facilities designed for vocational technical centers and for comprehensive high schools. There was, however, much information available describing adequate laboratory facilities. Therefore, the review of related literature focuses upon the question: "What considerations are involved in determining whether laboratory space is adequate/desirable?"

What is considered an adequate/desirable laboratory is actually determined by local officials, based upon local needs and conditions. There are, however, factors which are common to all automotive mechanics laboratory facilities. For organizational purposes,

these factors shall be grouped into two major sections: (1) Instructional Considerations and (2) Physical Considerations.

Neither section has been given priority inasmuch as the content of each is dependent upon the other.

Only two actual studies are cited in the literature. The remainder of this review has been derived from the opinions of well known laboratory planning authors and architects.

INSTRUCTIONAL CONSIDERATIONS

Philosophy of Education

Several studies of instructional considerations for laboratory planning are found in the literature. Meckley has done extensive work in this area. According to Meckley (1972:71), a philosophy of education is the most basic instructional consideration. It is this philosophy, he says, which determines the type, quantity and quality of education which is provided by a school. Meckley indicates that the philosophy of the school must be compatible with the prevailing views of the majority of the community. It is his viewpoint that a function of the school is to develop a sound philosophy through active participation in the social, economic and political life of the community. Each institution has the responsibility to determine the educational philosophy which will furnish the foundation for educational program planning. It is from a thoroughly planned educational philosophy that specific program objectives can be derived.

It should be noted that Meckley feels that the philosophy of the school should reflect the attitude of the community. Another point of view is represented by Butts (1976:12). Butts is of the opinion that the professional educators, acting in concert with other members of the community, should provide progressive leadership in establishing the educational philosophy for the community. The educational program would then be designed to implement the stated philosophy.

Educational Objectives

Educational objectives, according to Mager (1962:3), are often identified as goals or outcomes of the educational program. An objective describes the desired educational outcome consistent with the school's philosophy. Mager defined an objective as:

An intent communicated by a statement describing a proposed change in a learner--a statement of what the learner is to be like when he has successfully completed a learning experience (1962:3).

Mager (1962:3-5) indicates that it is a precisely stated educational objective which describes the behavior to be expected of the student and acts as a measure of his achievement. From these stated educational objectives he concludes it is possible to determine the specific instructional and learning activities which will be required to meet these objectives.

Instructional Activities

Meckley (1972:74) points out that the instructional and learning activities being planned should be designed to meet the

educational objectives of the program. He further suggests that it is these instructional and learning activities which should determine the quantity and quality of the physical facilities to be provided. Obviously the size and shape of the facility is determined by the type of learning activity required to meet the educational objectives. The amount of time which students devote to these activities, and the number and kind of students to use the facility also are criteria needed to determine facility needs.

Students To Be Served

The aforementioned factors were expanded upon by Nerden who commented:

The size determination of the various laboratories and shops is governed by the use planned for the facility throughout the day and evening (1968:51).

He points out that the use planned for the facility includes the identification and description of the students to be served in this facility. When one is in the process of identifying and describing the students who are to use the facility, Nerden (1968:51-52) feels that it is necessary to consider: (1) full-time students, (2) part-time (out of school) students, (3) adult students (4) the age or grade level of these students, (5) determination of disadvantaged or handicapped student status, and (6) the maximum number of regular day and/or evening students to be served. Consideration of the number and type of students to be served and the diversity of these groups require facilities which are sufficiently flexible to meet

varying needs.

Flexible Facilities

Planning facilities which are both adequate for today's needs and sufficiently flexible to meet future needs is a highly important consideration. Dobrovolny (1970:T.E.1) emphasized this point when he stated, "Perhaps the most important theme in planning is that of flexibility." Campbell (1974:32) is supportive of this concept when he states: "Facilities must be planned which are flexible, easily expandible and easily adaptable." According to Campbell (1974:32), these facilities should have movable walls, overhead utilities, and be easily and inexpensively adaptable and convertible to future change. In addition, facilities should be located on a site which permits easy expansion. It is a flexible facility which meets the aforementioned requirements and provides an adequate number of work stations to meet changing needs.

Work Stations

Brown (1969:50) discusses capacity in relation to student enrollment. By providing enough capacity to avoid unnecessary restrictions of activities and waste of a student's time, he indicates, requires more work stations (planned over-capacity) than there will be total students in a given class. Planned over-capacity is, therefore, desirable. The amount of over-capacity which may be included varies among the types of training facilities. Well-designed laboratories, he indicates, should provide the number of

work stations that falls in the range of 150 to 250 percent of maximum class size. The importance of planning sufficient laboratory space cannot be stressed enough. Of this Brown states:

Where enough space has been provided, the possibilities for good organization and management are unlimited. An inadequate amount of floor space always precludes true excellence (1969:50).

Supervision of Laboratory Area

Brown (1969:77) discusses the need for good administrative planning of laboratories. Planning, in addition to providing sufficient laboratory space, must also provide facilities which are easily supervised. He recommended that laboratories planned for easy supervision should be rectangular and without visual obstruction, thus a teacher is able to give close supervision to an entire main work area from any point in the room. Auxiliary areas in which students work regularly, he says, are to be separated from main work areas by transparent partitions. The planning of auxiliary areas could be considered an integral part of laboratory planning and equal in importance to any other aspect of it. An instructor must be able to supervise a class from any point in his laboratory.

Supervision of Auxiliary Areas

Another consideration is the problem of supervising auxiliary areas. Weaver (1955:28-35) feels that supervision of auxiliary areas should include such areas as an instruction area, a demonstration area and a planning area in addition to the main laboratory area. Each facility should make provision for each of these auxiliary

areas. The instruction area, according to Weaver, may be a separate classroom or an area set aside within the main laboratory. This instruction area must (1) provide seats for all students, (2) be convenient to the main work area, and (3) be easily supervised from any point in the laboratory. He feels that the demonstration area may be located within the main laboratory or within the classroom. The demonstration area may be designed to accommodate the entire class or a small group. This area must be convenient to the main work area and be easily supervised. He feels that the planning area may be located either within the main laboratory or within the classroom. The planning area may be designed to accommodate the entire class or a small group. This area must be convenient to the main work area and be easily supervised. Weaver notes that a laboratory may include all three of the aforementioned auxiliary areas or all three may be combined into one area.

The teacher's office was another auxiliary area which elicited comment from Weaver (1955:35-43). He discussed the need for the teacher's office to (1) be convenient to the main work area and (2) be provided with transparent partitions which enable the instructor to have clear visibility of the entire laboratory and classroom. Although it is best for the teacher's office to be a separate room, there are other alternatives. According to Weaver, one possibility is to locate an office area somewhere in the classroom. A less desirable alternative is to plan an office area in the

main laboratory. In any event, the teacher must be supplied with sufficient space to accommodate at least the following pieces of equipment: desk, swivel chair, side chair, file cabinet, book case and storage cabinet.

Experience of Teacher

According to the findings of a recent study by Arcy (1974), utilization of laboratory space was affected by the amount of teaching and occupational experience of the teacher. Arcy found that teachers who indicate an adequacy of laboratory space also possess a greater amount of teaching and occupational experience. He also reported that most teachers felt that their previous teaching and occupational experience helped them in planning the best utilization of classroom space. Arcy concluded: "The more teaching and occupational experience a teacher has, the greater the benefit as applied to planning and utilization of instructional space" (Arcy, 1974:116).

PHYSICAL CONSIDERATIONS

Floor Space

Wagner (1966) indicates that the most important physical consideration for a vocational facility is the laboratory itself. Within the laboratory the most important physical consideration he says is the amount of floor space available for instruction. Of this he stated:

Total floor area will vary for a particular shop and depends upon the age of the students, level and type of work, methods

of instruction, type of shop organization, and class size (Wagner, 1966:11).

These general requirements are further supplemented by Finsterback who suggested:

Provision for safety is a necessary and separate element of design in school shops which is entitled to maximum consideration. For this reason, adequate space is essential (1973:9).

Finsterback (1973:9) suggested further that adequate space prevented overcrowding of machines, benches, and students. Adequate space provided for safety zones around machines, a wide aisle around the perimeter of the room and transverse aisles for crossing the room, and a large, free space for student work.

The correct amount of floor space, according to Brown (1964: 98-100) may be determined by (1) ascertaining the size of each piece of equipment to be located in the laboratory, (2) estimating the amount of space needed for student and teacher movement and (3) calculating the amount of space required for each auxiliary area to be included within the main laboratory.

Weaver (1955:35) recommended that the allocation of floor space include: (1) the area required for each machine, (2) the overhead space required for the work to be done, (3) the space required for each work bench or table, (4) the floor space required for the assembly of large projects, (5) the floor space required for the teacher's office, (6) the floor space required to accommodate student activities, teacher demonstrations and shop lectures, (7) the floor space required for lanes of travel, (8) the floor space required for special use rooms, (9) the floor space required for

storage of raw materials and supplies, and (10) the space required for storage of tools, portable equipment and students' clothes.

Shape of Laboratory

Prakken (1973:20) feels that the shape of the laboratory is a very important consideration in good planning. The shape of the main work area exerts a great deal of influence on the organization of equipment, laboratory administration, safety planning, utilization of natural light, and accoustical design. The only fully effective shape is a rectangular one. The ratio of width to length usually recommended was 1 to 2, $1\frac{1}{2}$ to 2 or 2 to 3.

Floor Covering

According to Feirer (1953:8) the amount of floor space and the shape of the floor space are more effectively utilized with an appropriate floor covering. Feirer feels that the flooring should be appropriate to the activity and should also be (1) low cost, (2) easily maintained, (3) designed to provide easy installation of equipment, (4) fire proof, (5) easy to clean, (6) easy to repair, (7) strong, and (8) resistant to the elements.

Equipment and Benches

The amount and type of equipment was another factor which elicited comment from Feirer (1953:21). He discussed the effect of amount and type of equipment on the quantity of laboratory space made available. He suggests that the selection of major pieces of equipment must be guided by (1) the objectives of the course,

(2) the age and grade level of the students, (3) the size of the class, (4) the available space, (5) frequency of use, (6) usefulness of the machine, and (7) mobility of equipment. Feirer points out that the equipment must be placed to facilitate a logical flow of work. He indicates further that the aforementioned criteria also apply to the selection and location of benches in the vocational laboratory.

Storage Space

Ketcham (1973:227-229) points out that the type of planned storage area has an effect upon the amount of laboratory space which is available for instruction. Storage must be provided for (1) tools, (2) materials, (3) equipment, and (4) student clothing. He discussed the need for storage to be planned (1) within the laboratory, (2) within special use rooms adjacent to the laboratory, or (3) outside of the laboratory. Although outside storage is frequently utilized for vocational programs such as automotive mechanics, auto body repair, and building trades, such storage is frequently overlooked when planning new facilities. Adequate storage should be provided to meet the needs of morning, afternoon and evening classes.

Aisle Space

Finsterback (1973:9) discussed the need to provide sufficient aisle space to enable safe movement of students in the laboratory. Space must be provided, according to Finsterback, for (1) safety

zones around machines, (2) a wide aisle of travel around the perimeter of the room and (3) transverse aisles for crossing the room. Prakken (1973:34) recommended that "spacing between benches and other work stations should be at least three feet--if possible, four feet."

Ceiling Height

Ceiling height is of critical importance in planning. Brown (1969:90) emphasizes this point when he states: "Adequate ceiling height helps to ensure a good teaching-learning environment." Heat, odors, and dust become much more concentrated in rooms that have low ceilings. Appropriate ceiling heights are generally determined by course objectives. The height of a ceiling, he states, will vary from room to room. The ceiling must be of sufficient height to enable various instructional activities to be carried out. Brown emphasizes caution, however, that the ceiling height must be no greater than is absolutely necessary, in order to conserve fuel and light.

Interior Lighting

The purpose of interior lighting for school laboratories, according to Prakken (1973) is to provide good visual conditions for the educational tasks involved. He indicates that light may be provided by natural light and/or by electric lights. The type of lighting selected depends upon the job to be done. The level of illumination is determined by both need and practicality. Concerning

the amount of natural light which must be provided, Prakken suggested:

Shop lighting is judged by the ratio of the area of glass to the area of floor. A working ratio of five to one is recommended. It is important that natural light is not cut off by low window tops. Windows should be as close to the ceiling as possible (1973:19).

Boyd (1973:24-26) points out that the amount of indirect lighting is determined by the tasks being performed in the laboratory. Illumination levels are recommended in accordance with the nature of the various tasks. Care should be taken, he cautions, not to introduce glare with increased levels of illumination.

Influence of Sound

Gilliland (1973:27-29) discusses the influence of sound on the use of laboratory space. He points out that sound can influence student productivity, morale, absenteeism, and efficiency. Sound can be controlled in floors, walls and ceilings by utilizing various acoustical materials.

Another point of view is provided by Brown (1969:135-140) who suggests that sound may also be controlled by eliminating reverberation at the source. He feels that laboratories should be large enough and ceilings high enough to minimize concentration of noise. Long narrow rooms are conducive to producing reverberations. Brown adds that equipment should be selected carefully. Generally, the better the quality of equipment, the less noise will be produced. Also, machines should be purchased which are no larger than required

to function effectively. Finally, good maintenance in the laboratory keeps noise to a minimum.

Use of Color

The effects of color in vocational education laboratories was studied by Lytle (1973). He found that "controlled use of color will expand the use of laboratory facilities." Lytle reported:

Industry credits improvement of employee morale, elimination of work accidents, and increased productivity to color--engineered plants. Why? Because visibility means safety. Safety means increased production. Increased production means more money (1973:30).

Lytle (1973:30-32) reported further that more learning is inherent in the improvement of the shop environment through the use of light and color. He indicates further that the design of the laboratory could be improved significantly by the skillful application of color. Used properly, it can (1) control the reflection of light, (2) reduce fatigue, (3) produce useful optical illusions, (4) create certain psychological effects, (5) improve laboratory appearance, (6) promote safety, and (7) serve as a continuous source of information. For most students, adequate use of color results in (1) greater total learning, (2) the development of more efficient work habits, (3) better self-discipline, (4) decreased eye strain and general muscular fatigue, (5) fewer accidents, (6) improved workmanship, and (7) the acquisition of better house-keeping habits.

Ventilation

Hughes (1973:45-48) found that laboratory space is more fully utilized with the removal of hazardous fumes and dusts. He emphasized that for health reasons dusts, fumes, vapors and gasses must be removed from the laboratory atmosphere. Removal of these air contaminants is accomplished through local exhaust systems or through general ventilation. Local exhaust systems carry off an air contaminant by trapping it near or at its source. General ventilation systems let the contaminant spread throughout the laboratory area, diluting it with volumes of air from outside, through the process of circulation. General ventilation of the laboratory contributes to the comfort, efficiency and health of the students and teacher.

Entrances and Exits

According to Duenk (1974:16) the use of laboratory space may be restricted because of inadequate entrances and exits. All laboratories should have at least two exits. Vocational laboratories such as automotive mechanics, auto body repair, masonry, bricklaying, carpentry and building trades need additional overhead doors. Duenk points out that these laboratories must have (1) one double door to the hallway, (2) one single door to the outside, and (3) at least three overhead doors for an automotive mechanics and auto body repair laboratories. The overhead doors must be of sufficient number, height and width to meet the objectives of the course. Duenk concludes by suggesting that a sufficient number of doors, of appropriate size,

properly located, will also contribute to (1) a more efficient use of laboratory space, (2) more efficient use of student-teacher time and (3) a higher level of safety.

SUMMARY

The review of related literature revealed many factors which influence the utilization of laboratory space. These factors were grouped into two sections: (1) Instructional Considerations and (2) Physical Considerations.

Instructional considerations which have influence on the utilization of laboratory space included: (1) philosophy of education, (2) educational objectives, (3) instructional activities, (4) number of students, (5) flexibility of the laboratory, (6) number of work stations, (7) teacher supervision, (8) provision for classroom area, (9) provision for demonstration area, (10) provision for planning area, (11) provision for teacher's office, and (12) the teaching-occupational experience of the teacher. Additional considerations which have influence on the utilization of laboratory space included: (1) total floor space, (2) shape of the laboratory, (3) floor covering, (4) open work area, (5) equipment, (6) work space, (7) benches, (8) storage, (9) aisles, (10) ceiling height, (11) lighting, (12) sound, (13) color, (14) exhaust and ventilation systems, and (15) doors.

Chapter 3

METHODOLOGY

In this chapter, the sample population, the development of the research instrument, procedures for the collection of data, and the methods of data analysis are considered.

SAMPLING METHODOLOGY

Automotive mechanics programs offered in the secondary schools of Virginia employ a total of one hundred full-time teachers. The entire group was utilized in this study. The teachers were alphabetized by last name and numbered consecutively. Twenty teachers were then randomly selected for the pre-survey using Kerlinger's Table of Random Numbers (1973:714-717). All one hundred teachers were utilized to gather data for the survey. A sample size of eighty from a population of one hundred was considered adequate by Krejcie (1970:607-610).

INSTRUMENTATION

Pre-Survey

A pre-survey (see Appendix A) was designed by this researcher to identify inadequacies of instructional space in automotive mechanics laboratories. Each of the twenty teachers was requested to identify the five most inadequate features directly affecting the utilization of instructional space in his automotive mechanics lab-

oratory. A listing of teacher responses was then prepared. A copy of this list was mailed to selected experts (see Appendix B) to elicit additional suggestions. The fifteen most common inadequacies were identified by tallying the responses of the twenty teachers and selected experts. Each of the fifteen inadequacies was then edited for utilization in the survey.

Survey

The survey instrument (see Appendix B) was designed by this researcher to rank the inadequate features identified by the teachers in the pre-survey. The fifteen most common inadequacies were identified by tallying the responses of the twenty teachers and selected experts. One statement of inadequacy was then typed upon a 3 x 5 card. This procedure was repeated until each of the fifteen stated inadequacies were typed upon fifteen separate 3 x 5 cards. One set of fifteen 3 x 5 cards was then prepared for each of the one hundred teachers participating in this study.

Each of the one hundred teachers was requested to sort and rank the fifteen identified inadequacies. The teachers were instructed to rank the fifteen cards according to the degree of inadequacy. The most serious inadequacy was placed on top and the least serious inadequacy was placed on the bottom. These teachers were also requested to provide additional information on a separate sheet (see Appendix B) including (1) age of facility, (2) number of years teaching experience, (3) number of years trade experience, (4) class size

and (5) identification of other factors contributing to inadequate instructional space in their respective laboratories.

DATA COLLECTION

The survey instrument (see Appendix C) and cover letter (see Appendix C) describing the purpose of the study were mailed to one-hundred vocational automotive mechanics teachers in Virginia. The survey was conducted by mail and sent to the place of employment of each of the respondents. The individual packets contained a cover letter, directions, fifteen cards, request for additional information and a stamped self-addressed return envelope. Each packet was coded for easy identification upon return.

Two weeks were allowed for response before follow-up procedures were initiated. At this time, a follow-up packet (coded second request) and cover letter (see Appendix C) were mailed to all teachers who had not returned the completed packets. Two weeks later postal cards (see Appendix D) were mailed to those teachers who had still not responded. If the postal card reminder failed to elicit a response after one week, it was followed by a telephone call (placed directly) to the teacher. A minimum return rate of 60 percent was considered to be acceptable (Kerlinger, 1973:414).

ANALYSIS OF THE DATA

Packets of ranked cards were returned by the respondents.

The order of inadequacies given was recorded for each of the fifteen items. Next, rank values were placed on data cards corresponding to the various inadequacies being studied. The data were coded according to the type of school (1) vocational technical center or (2) comprehensive high school. Information concerning age of facility, teaching experience, trade experience and class size was entered directly on each card. Means of age of facility, teaching experience, trade experience, and class size were then calculated. Comparison of rank orders of inadequacies made by automotive mechanics teachers classified by age of facility, teaching experience, trade experience and class size was then conducted. The correlational method utilized in this study was the Spearman Rank-Order Correlation Coefficient (Downie and Heath, 1974:116). The decision concerning the closeness of relationship was determined from Downie and Heath's Table of Levels of Significance (1974:314) using the .05 level of significance. A listing, including frequency count, was then made of other factors suggested by teachers that contribute to inadequate instructional space in automotive mechanics laboratories.

SUMMARY

The purpose of this study was to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in vocational technical centers and in comprehensive high schools based upon the perceptions of automotive mechanics

teachers.

One hundred full-time teachers were utilized in this study. Twenty teachers were selected for the pre-survey and all one hundred teachers were utilized to gather data for the survey. Inadequacies of instructional space were identified by teachers in the pre-survey. The fifteen most common inadequacies were selected through an analysis of the responses received in the pre-survey. The fifteen inadequacies selected were then placed upon 3 x 5 cards. A packet of fifteen cards including a cover letter, directions and a self-addressed stamped envelope was mailed to each of the one hundred teachers. Teachers were requested to sort and rank the fifteen cards according to the severity of the inadequacy.

Packets of ranked cards were returned by the respondents. A comparison of rank orders of inadequacies made by automotive mechanics teachers classified by age of facility, teaching experience, trade experience and class size was then conducted. The Spearman Rank-Order Correlation Coefficient method was utilized in this study.

A listing and frequency count was then made of other factors suggested by teachers which contribute to inadequate instructional space in automotive mechanics laboratories.

Chapter 4

PRESENTATION AND ANALYSIS OF THE DATA

INTRODUCTION

The purpose of this study was to compare the inadequacies of instructional space among public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and comprehensive high schools. In addition, relationships of the rank orders of inadequacies were compared with the variables of (1) age of facility, (2) amount of teaching experience, (3) amount of trade experience, and (4) class size.

The general questions presented in Chapter 1 form the organization for the data presentation which follows. The questions are presented in the same order as were given in Chapter 1. The statistical information relevant to each question is presented in the tables. Raw scores and general demographic information on all subjects included in this study are found in Appendix E. Conclusions resulting from this study are presented in Chapter 5. This chapter is divided into three sections: (1) a discussion of the respondents, (2) analysis of the data, and (3) summary.

RESPONDENTS

Pre-survey. Twenty vocational automotive mechanics teachers were randomly selected to participate in the pre-survey of laboratory

space needs. Eighteen teachers responded to the questionnaire. Two teachers indicated that they could not participate in the study because of a local school policy restricting participation in research studies. A 90 percent return by teachers was achieved. The exclusion of the two responses previously referred to gave a usable return of 80 percent. For a summary of returns please refer to Table 1.

Selected experts. A listing of the fifteen most common inadequacies suggested by the twenty randomly selected teachers was forwarded to a panel of experts (see Appendix B) to elicit additional suggestions. The fifteen inadequacies selected for the survey are listed on Table 2.

Survey. The entire group of 100 vocational automotive mechanics teachers in Virginia were selected to participate in the survey. Ninety-three teachers responded to the questionnaire. Three teachers stated that they could not participate in the study because of a local school policy restricting participation in research studies. Two teachers indicated that they did not feel able to participate in the study because of their recent appointments. Two other teachers declined to participate because they were assigned to teach disadvantaged students rather than regular vocational students. With the exclusion of the seven respondents previously referred to, a usable return of 86 percent was achieved. For a summary of returns please refer to Table 3.

Table 1

Summary of Pre-Survey Questionnaires Mailed and
Number and Percentages Returned by Subgroups

Subgroup--Teachers	Number Mailed	Number Returned	Percentage Returned
Vocational-Technical Centers	10	9	90%
Comprehensive High Schools	10	9	90%
Totals	20	18	90%

Table 2
Order of Inadequacies and Rank Values

Rank Value	Inadequacy	Item
1	Inadequate location of classroom.	a
2	Inadequate storage space.	b
3	Inadequate flexibility of laboratory space due to installation of equipment.	c
4	Inadequate location of restrooms and showers	d
5	Inadequate work space.	e
6	Inadequate classroom space.	f
7	Inadequate training aids.	g
8	Inadequate visual aid equipment.	h
9	Inadequate space allotted for doors.	i
10	Inadequate number of work stations.	j
11	Inadequate work bench space.	k
12	Inadequate amount of tools and equipment.	l
13	Inadequate ventilation.	m
14	Inadequate number of electrical outlets	n
15	Inadequate modern equipment	o

Table 3

Summary of Questionnaires Mailed and Number and Percentages Returned by Subgroups

Subgroup-Teachers	Number Mailed	Number Returned	Percentage Returned %
Vocational Technical Centers	45	42	93%
Comprehensive High Schools	55	51	93%
Totals	100	93	93%

ANALYSIS OF DATA

The following questions were studied:

General Question 1. What are the inadequacies, in rank order, of the instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools as perceived by teachers in these two types of schools?

The descriptive statistics necessary to provide data for the analysis of question 1 are presented in Table 4. The rank order of inadequacies of instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools are shown in Table 4. The total value points, mean value, and rank are provided for each of the two types of schools studied.

Tables 5 and 6 show the rank order of inadequacies of instructional space in descending order, from most important to least important. Table 5 lists the rank order of inadequacies of instructional space in automotive mechanics laboratories in vocational-technical centers. Table 6 lists the rank order of inadequacies of instructional space in automotive mechanics laboratories in comprehensive high schools.

General Question 2. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories in vocational-technical centers and by teachers in comprehensive

Table 4

Rank Order of Inadequacies of Instructional Space in Automotive
Mechanics Laboratories in Vocational Technical Centers
and in Comprehensive High Schools

Inadequacy	VTC			CHS		
	Total Value Points	Mean	Rank	Total Value Points	Mean	Rank
a	189	5.108	1	299	6.102	1
b	255	6.892	2	321	6.551	3
c	283	7.649	5	317	6.469	2
d	275	7.432	3	393	8.020	7
e	285	7.703	6	394	8.041	8
f	313	8.459	10	401	8.184	10
g	337	9.108	13	364	7.429	4
h	315	8.514	11	428	8.735	12
i	303	8.189	9	448	9.143	13
j	279	7.541	4	367	7.499	5
k	294	7.946	7	396	8.082	9
l	331	8.946	12	383	7.816	6
m	342	9.243	15	465	9.499	14
n	341	9.216	14	493	10.061	15
o	298	8.054	8	411	8.388	11

Table 5

Rank Order of Inadequacies of Instructional Space in Automotive
Mechanics Laboratories in Vocational Technical Centers--
Descending Order

Rank Value	Inadequacy	Item
1	Inadequate location of classroom	a
2	Inadequate storage space	b
3	Inadequate location of restrooms and showers	d
4	Inadequate number of work stations	j
5	Inadequate flexibility of laboratory space due to installation of equipment	c
6	Inadequate work space	e
7	Inadequate work bench space	k
8	Inadequate modern equipment	o
9	Inadequate space allotted for doors	i
10	Inadequate classroom space	f
11	Inadequate visual aid equipment	h
12	Inadequate amount of tools and equipment	l
13	Inadequate training aids	g
14	Inadequate number of electrical outlets	n
15	Inadequate ventilation	m

Table 6

Rank Order of Inadequacies of Instructional Space in Automotive
Mechanics Laboratories in Comprehensive High Schools--
Descending Order

Rank Value	Inadequacy	Item
1	Inadequate location of classroom	a
2	Inadequate flexibility of laboratory space due to installation of equipment	c
3	Inadequate storage space	b
4	Inadequate training aids	g
5	Inadequate number of work stations	j
6	Inadequate amount of tools and equipment	l
7	Inadequate location of restrooms and showers	d
8	Inadequate work space	e
9	Inadequate work bench space	k
10	Inadequate classroom space	f
11	Inadequate modern equipment	o
12	Inadequate visual aid equipment	h
13	Inadequate space allotted for doors	i
14	Inadequate ventilation	m
15	Inadequate number of electrical outlets	n

high schools?

The descriptive statistics necessary to provide data for the analysis of question 2 are presented in Table 7. Table 7 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method (ρ) was applied to the data. ρ (p) was found to equal .679. This value of .679 with $N-2$ degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers in vocational technical centers and in comprehensive high schools.

Figure 1 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by the automotive mechanics teachers.

General Question 3. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers housed in oldest facilities and by those teachers housed in newest facilities?

The descriptive statistics necessary to provide data for the analysis of question 3 are presented in Tables 8, 9 and 10. Table 8

Table 7

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.108	6.102	1	1	0	0
b	6.892	6.551	2	3	1	1
c	7.649	6.469	5	2	3	9
d	7.432	8.020	3	7	4	16
e	7.703	8.041	6	8	2	4
f	8.459	8.184	10	10	0	0
g	9.108	7.429	13	4	9	81
h	8.514	8.735	11	12	1	1
i	8.189	9.143	9	13	4	16
j	7.541	7.499	4	5	1	1
k	7.946	8.082	7	9	2	4
l	8.946	7.816	12	6	6	36
m	9.243	9.499	15	14	1	1
n	9.216	10.061	14	15	1	1
o	8.054	8.388	8	11	3	9

$$p=1 - \frac{6 \sum D^2}{N(N^2-1)} = .679$$

$$\sum D^2=180$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

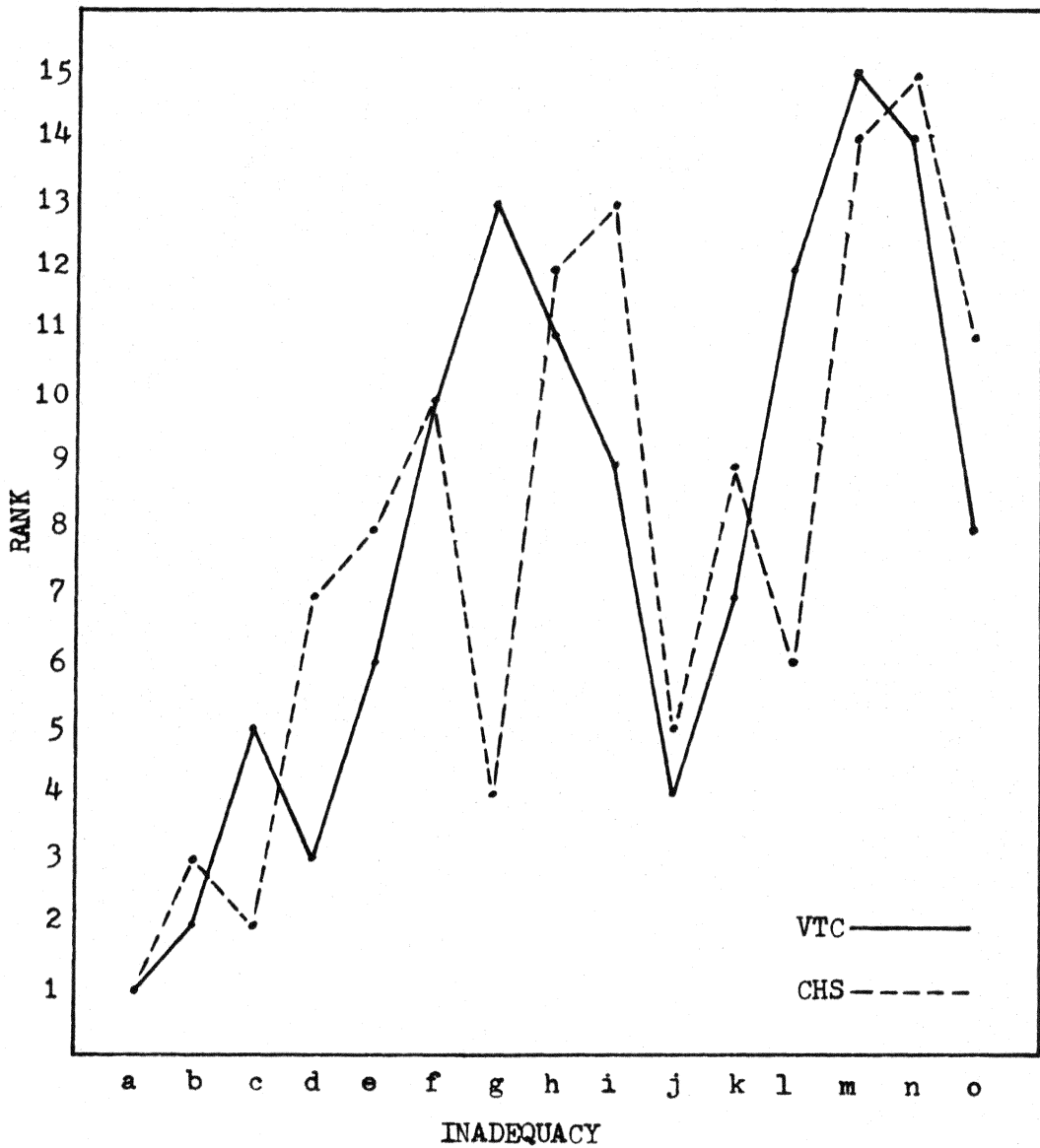


Figure 1

Comparison of Rankings of Inadequacies--Vocational
 Technical Centers and Comprehensive
 High Schools

Table 8

Rank Order of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers Housed in Oldest Facilities and by Teachers Housed in Newest Facilities in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	VTC				CHS			
	Mean +	Rank	Mean -	Rank	Mean +	Rank	Mean -	Rank
a	5.875	1	4.897	1	6.929	4	5.771	1
b	6.250	2	7.069	2	5.429	1	7.000	4
c	6.625	3	7.931	6.5	5.643	2	6.800	2
d	7.625	7	7.379	3.5	9.143	11	7.857	8
e	7.250	5	7.828	5	8.071	7.5	8.057	10
f	8.625	11	8.414	10	10.143	15	7.400	5
g	10.875	15	8.621	12	5.929	3	8.029	9
h	7.500	6	8.793	13	8.071	7.5	9.000	12
i	8.000	8.5	8.241	8	7.143	6	9.943	14
j	8.125	10	7.379	3.5	7.071	5	7.657	6
k	8.000	8.5	7.931	6.5	8.929	10	7.714	7
l	10.250	14	8.586	11	10.000	13.5	6.943	3
m	8.875	12	9.345	15	10.000	13.5	9.286	13
n	9.250	13	9.207	14	9.214	12	10.400	15
o	6.875	4	8.379	9	8.286	9	8.429	11

lists the rank order of inadequacies of instructional space in automotive mechanics laboratories by teachers housed in oldest facilities and by teachers housed in newest facilities in vocational technical centers and in comprehensive high schools. The oldest facilities are identified as Mean + and the newest facilities are identified as Mean -.

Table 9 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers housed in oldest facilities in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .540. This value of .540 with $N-2$ degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers housed in oldest facilities in vocational technical centers and in comprehensive high schools.

Figure 2 illustrates the comparisons of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by the automotive mechanics teachers housed in oldest facilities.

Table 10 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers housed in newest facilities in vocational technical centers and in

Table 9

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers Housed in Oldest Facilities in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.875	6.929	1	4	3	9
b	6.250	5.429	2	1	1	1
c	6.625	5.643	3	2	1	1
d	7.625	9.143	7	11	4	16
e	7.250	8.071	5	7.5	2.5	6.25
f	8.625	10.143	11	15	4	16
g	10.875	5.929	15	3	12	144
h	7.500	8.071	6	7.5	1.5	2.25
i	8.000	7.143	8.5	6	2.5	6.25
j	8.125	7.071	10	5	5	25
k	8.000	8.929	8.5	10	1.5	2.25
l	10.250	10.000	14	13.5	0.5	0.25
m	8.875	10.000	12	13.5	1.5	2.25
n	9.250	9.214	13	12	1	1
o	6.875	8.286	4	9	5	25

$$p = 1 - \frac{6 \sum D^2}{N(N^2-1)} = .540$$

$$\sum D^2 = 257.5$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

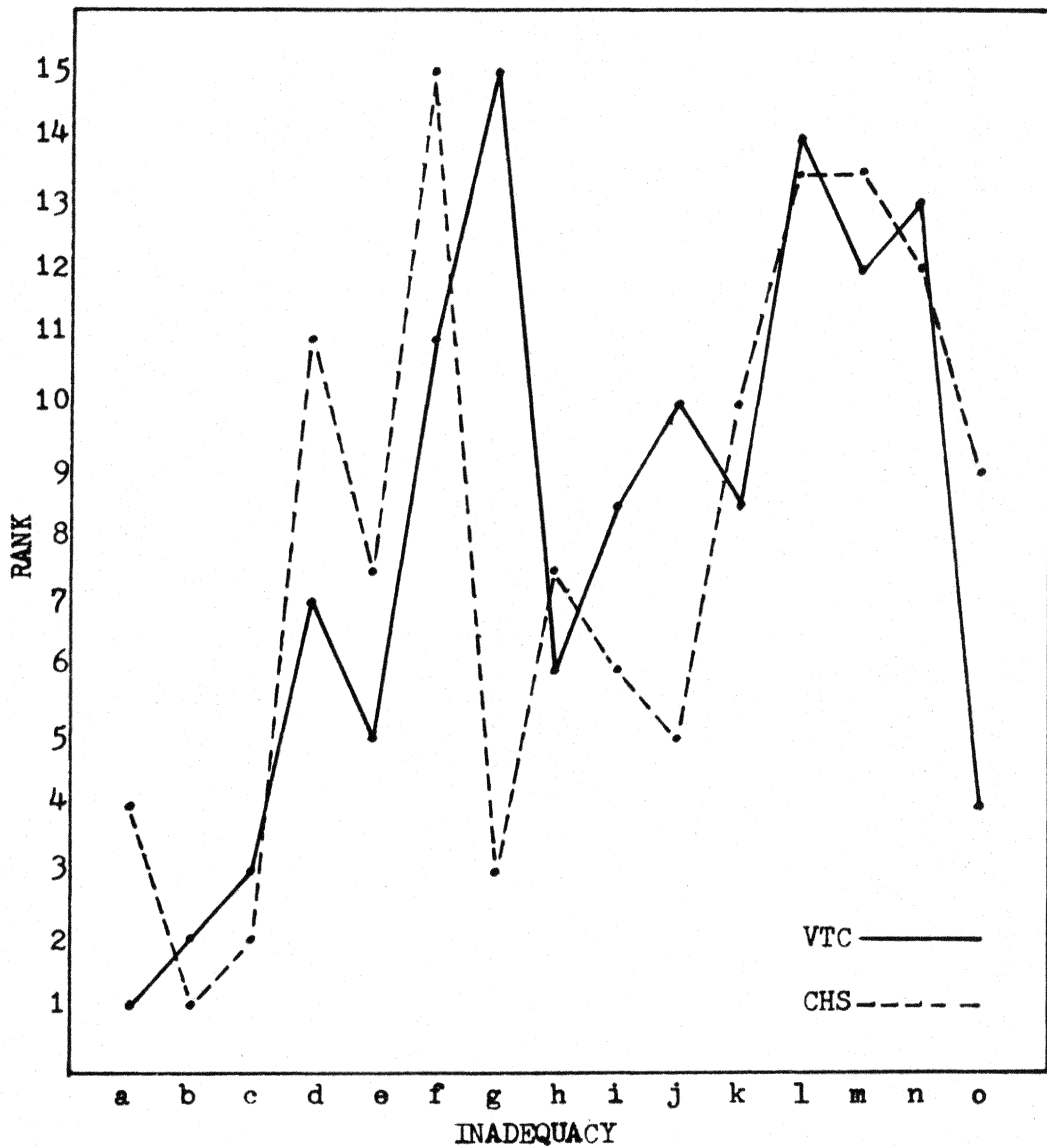


Figure 2

Comparison of Rankings of Inadequacies--Oldest
 Vocational Technical Centers and
 Comprehensive High Schools

Table 10

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers Housed in Newest Facilities in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	4.897	5.771	1	1	0	0
b	7.069	7.000	2	4	2	4
c	7.931	6.800	6.5	2	4.5	20.25
d	7.379	7.857	3.5	8	4.5	20.25
e	7.828	8.057	5	10	5	25
f	8.414	7.400	10	5	5	25
g	8.621	8.029	12	9	3	9
h	8.793	9.000	13	12	1	1
i	8.241	9.943	8	14	6	36
j	7.379	7.657	3.5	6	2.5	6.25
k	7.931	7.714	6.5	7	0.5	0.25
l	8.586	6.943	11	3	8	64
m	9.345	9.286	15	13	2	4
n	9.207	10.400	14	15	1	1
o	8.379	8.429	9	11	2	4

$$\sum D^2 = 220$$

$$p = 1 - \frac{6 \sum D^2}{N(N^2-1)} = .607$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .607. This value of .607 with N-2 degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers housed in newest facilities in vocational technical centers and in comprehensive high schools.

Figure 3 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by the automotive mechanics teachers housed in newest facilities.

General Question 4. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most teaching experience and by those teachers possessing the least teaching experience?

The descriptive statistics necessary to provide data for the analysis of question 4 are presented in Tables 11, 12, and 13. Table 11 lists the rank order of inadequacies of instructional space in automotive mechanics laboratories by teachers with most teaching experience and by teachers with least teaching experience in vocational technical centers and in comprehensive high schools. The teachers with most teaching experience are identified Mean + and

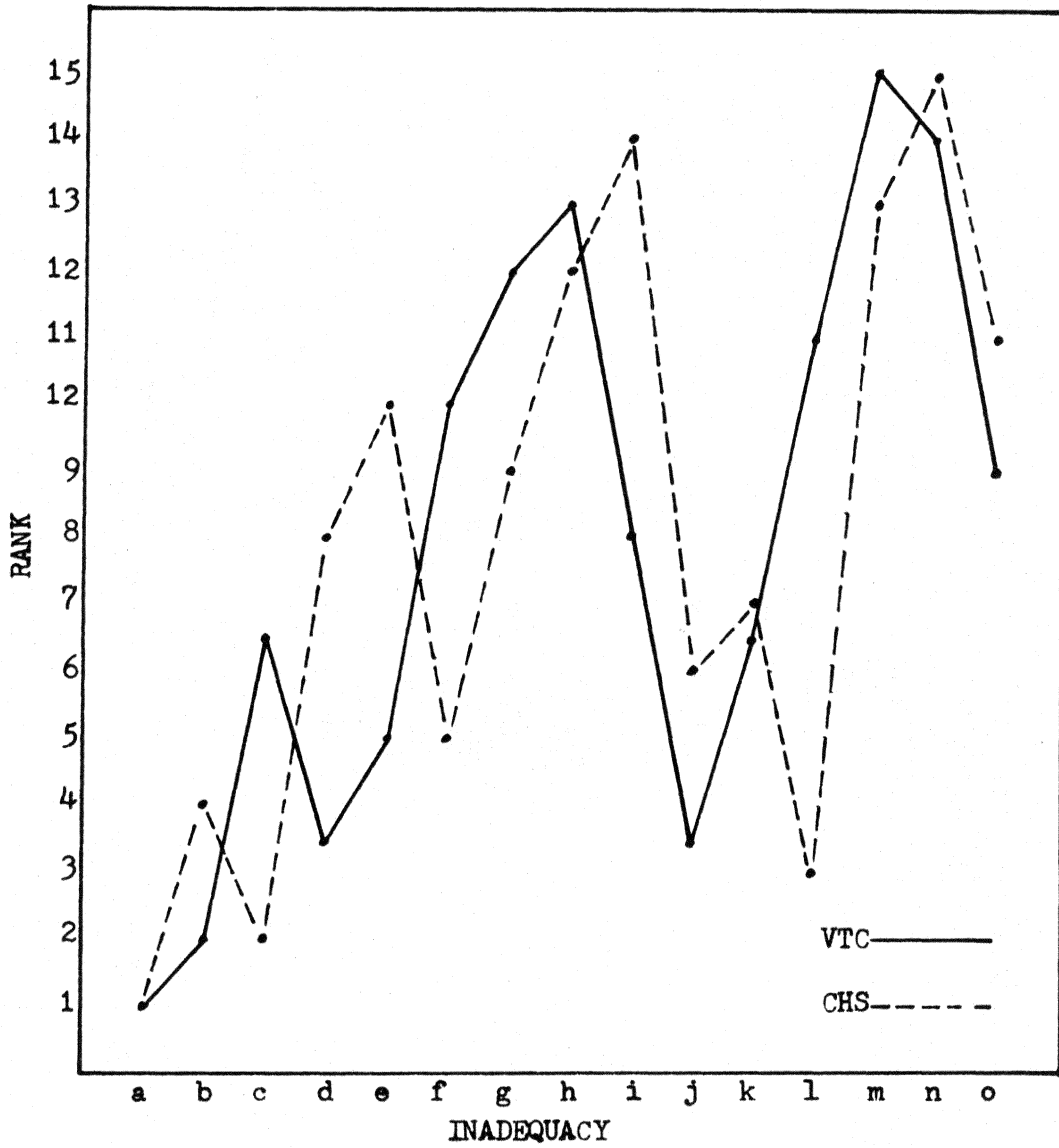


Figure 3

Comparison of Rankings of Inadequacies--Newest
Vocational Technical Centers and
Comprehensive High Schools

Table 11

Rank Order of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Most Teaching Experience and by Teachers with Least Teaching Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	VTC				CHS			
	Mean +	Rank	Mean -	Rank	Mean +	Rank	Mean -	Rank
a	4.545	1	5.346	1	5.105	1	6.733	3
b	5.727	2	7.385	3	6.737	4	6.433	1
c	7.545	6.5	7.692	7	6.316	2	6.567	2
d	7.636	8	7.346	2	8.947	13	7.433	5
e	6.636	4	8.154	8	8.053	8	8.067	7.5
f	8.818	11	8.308	11	8.316	10.5	8.100	9.5
g	9.273	12	9.038	13	7.684	5	7.267	4
h	6.455	3	9.385	15	8.316	10.5	9.000	13
i	8.000	9	8.269	9.5	8.895	12	9.300	14
j	7.455	5	7.577	5	6.526	3	8.100	9.5
k	8.636	10	7.654	6	8.053	8	8.067	7.5
l	12.364	15	7.500	4	7.947	6	7.733	6
m	9.455	13	9.154	14	10.684	15	8.733	12
n	9.909	14	8.923	12	10.368	14	9.867	15
o	7.545	6.5	8.269	9.5	8.053	8	8.600	11

the teachers with least teaching experience Mean -.

Table 12 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with most teaching experience in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .509. This value of .509 with N-2 degrees of freedom was not significant at the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is not a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers with most teaching experience in vocational technical centers and in comprehensive high schools.

Figure 4 illustrates the comparisons of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by automotive mechanics teachers with the most teaching experience.

Table 13 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with least teaching experience in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .658. This value of .658 with N-2 degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between

Table 12

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Most Teaching Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	4.545	5.105	1	1	0	0
b	5.727	6.737	2	4	2	4
c	7.545	6.316	6.5	2	4.5	20.25
d	7.636	8.947	8	13	5	25
e	6.636	8.053	4	8	4	16
f	8.818	8.316	11	10.5	0.5	0.25
g	9.273	7.684	12	5	7	49
h	6.455	8.316	3	10.5	7.5	56.25
i	8.000	8.895	9	12	3	9
j	7.455	6.526	5	3	2	4
k	8.636	8.053	10	8	2	4
l	12.364	7.947	15	6	9	81
m	9.455	10.684	13	15	2	4
n	9.909	10.368	14	14	0	0
o	7.545	8.053	6.5	8	1.5	2.25

$$\Sigma D^2 = 275$$

$$p = 1 - \frac{6 \Sigma D^2}{N(N^2-1)} = .509$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

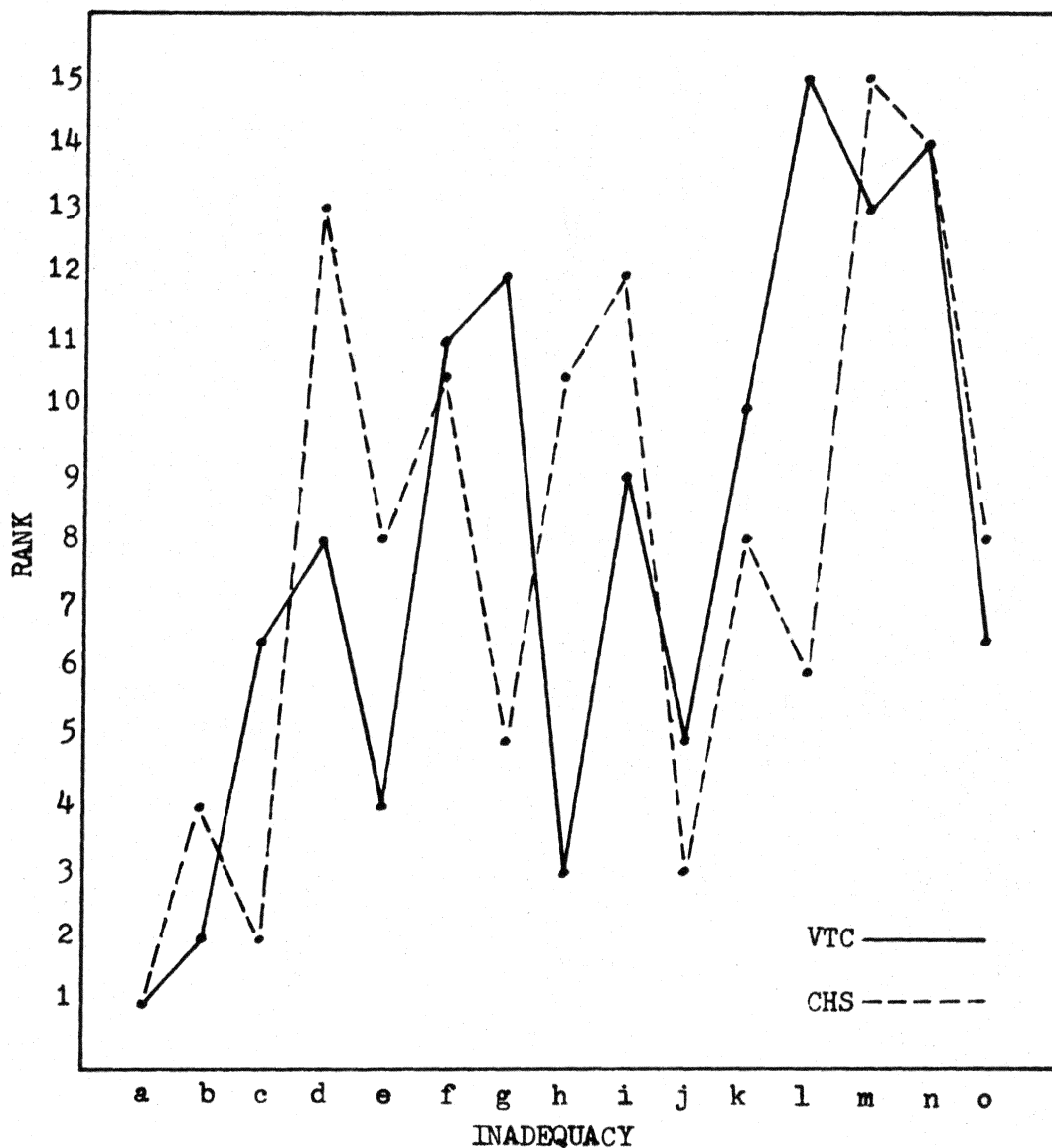


Figure 4

Comparison of Rankings of Inadequacies--Teachers With Most Teaching Experience in Vocational Technical Centers and Comprehensive High Schools

Table 13

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Least Teaching Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.346	6.733	1	3	2	4
b	7.385	6.433	3	1	2	4
c	7.692	6.567	7	2	5	25
d	7.346	7.433	2	5	3	9
e	8.154	8.067	8	7.5	0.5	0.25
f	8.308	8.100	11	9.5	1.5	2.25
g	9.038	7.267	13	4	9	81
h	9.385	9.000	15	13	2	4
i	8.269	9.300	9.5	14	4.5	20.25
j	7.577	8.100	5	9.5	4.5	20.25
k	7.654	8.067	6	7.5	1.5	2.25
l	7.500	7.733	4	6	2	4
m	9.154	8.733	14	12	2	4
n	8.923	9.867	12	15	3	9
o	8.269	8.600	9.5	11	1.5	2.25

$$p = 1 - \frac{6 \sum D^2}{N(N^2-1)} = .658$$

$$\sum D^2 = 191.50$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

the rankings of inadequacies as seen by automotive mechanics teachers with least teaching experience in vocational technical centers and in comprehensive high schools.

Figure 5 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by automotive mechanics teachers with least teaching experience.

General Question 5. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most trade experience and by those teachers possessing the least trade experience?

The descriptive statistics necessary to provide data for the analysis of question 5 are presented in Tables 14, 15, and 16. Table 14 lists the rank order of inadequacies of instructional space in automotive mechanics laboratories by teachers with most trade experience and by teachers with least trade experience in vocational technical centers and in comprehensive high schools. The teachers with most trade experience are identified Mean + and the teachers with least trade experience Mean -.

Table 15 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with most trade experience in vocational technical centers and in

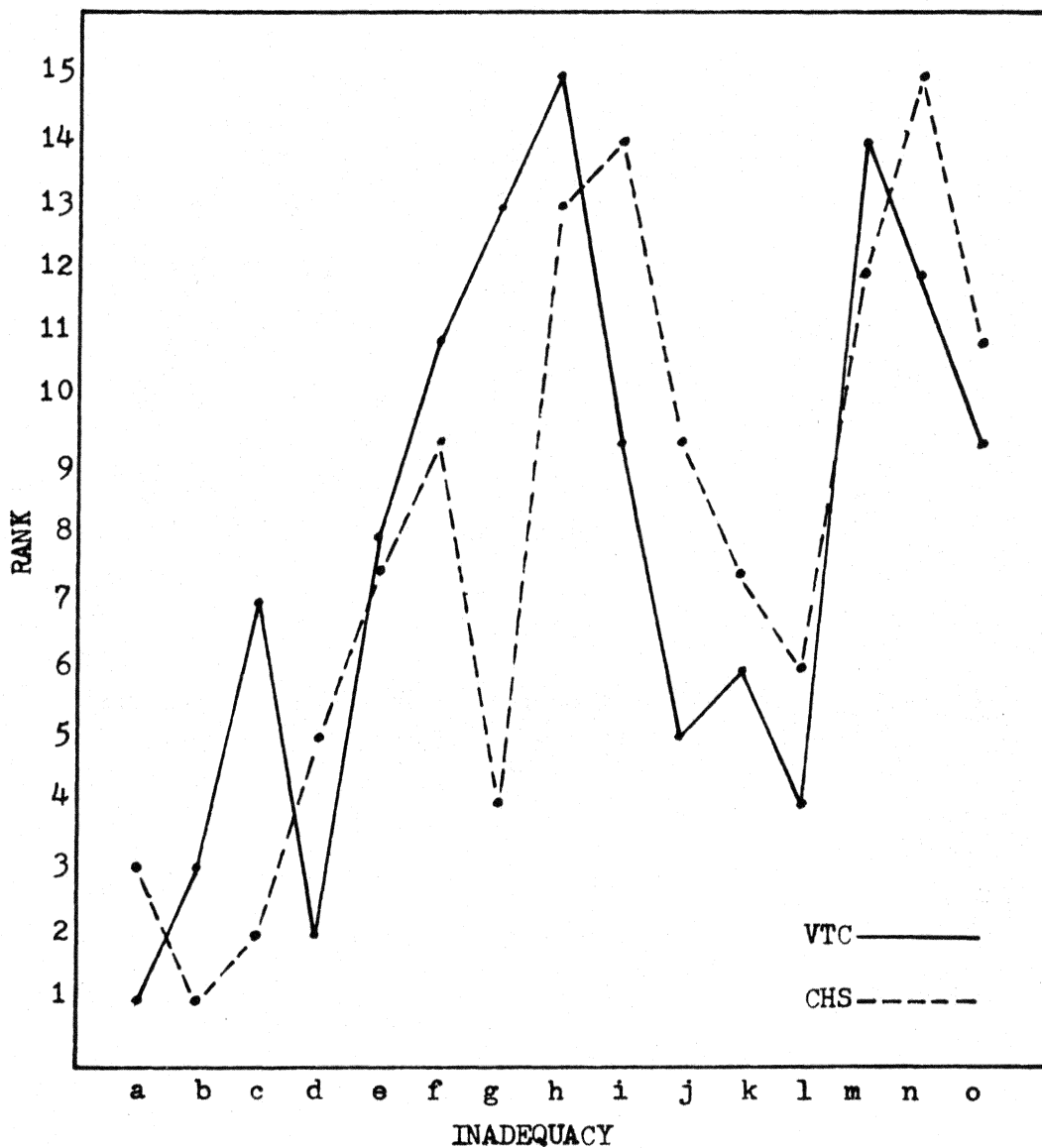


Figure 5

Comparison of Rankings of Inadequacies--Teachers With Least Teaching Experience in Vocational Technical Centers and Comprehensive High Schools

Table 14

Rank Order of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Most Trade Experience and by Teachers with Least Trade Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	VTC				CHS			
	Mean +	Rank	Mean -	Rank	Mean +	Rank	Mean -	Rank
a	5.190	1	5.000	1	6.350	2	5.931	2
b	5.667	2	8.500	11	6.150	1	6.828	3
c	8.095	7	7.063	3	7.350	6	5.862	1
d	7.857	6	6.875	2	8.650	10	7.586	5
e	7.286	3	8.250	8	9.000	11	7.414	4
f	8.429	10	8.500	11	7.800	8	8.448	10
g	8.381	8.5	10.063	15	6.650	3	7.966	7
h	8.619	11	8.375	9	9.100	12	8.483	11
i	8.381	8.5	7.938	6	7.850	9	10.035	15
j	7.524	4	7.563	5	6.700	4	8.034	8
k	7.819	5	8.125	7	7.200	5	8.655	12
l	9.048	13	8.813	13	7.450	7	8.069	9
m	9.190	14	9.313	14	10.450	15	8.828	13
n	9.762	15	8.500	11	10.150	14	10.000	14
o	8.762	12	7.125	4	9.150	13	7.862	6

Table 15

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Most Trade Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.190	6.350	1	2	1	1
b	5.667	6.150	2	1	1	1
c	8.095	7.350	7	6	1	1
d	7.857	8.650	6	10	4	16
e	7.286	9.000	3	11	8	64
f	8.429	7.800	10	8	2	4
g	8.381	6.650	8.5	3	5.5	30.25
h	8.619	9.100	11	12	1	1
i	8.381	7.850	8.5	9	0.5	0.25
j	7.524	6.700	4	4	0	0
k	7.819	7.200	5	5	0	0
l	9.048	7.450	13	7	6	36
m	9.190	10.450	14	15	1	1
n	9.762	10.150	15	14	1	1
o	8.762	9.150	12	13	1	1

$$\Sigma D^2 = 157.5$$

$$p = 1 - \frac{6 \Sigma D^2}{N(N^2-1)} = .719$$

N=the number of pairs

p=rho, the rank-order correlation coefficient

comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .719. This value of .719 with N-2 degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers with most trade experience in vocational technical centers and in comprehensive high schools.

Figure 6 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by automotive mechanics teachers with most trade experience.

Table 16 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with least trade experience in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to be equal to .450. This value of .450 with N-2 degrees of freedom was not significant at the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is not a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers with least trade experience in vocational technical centers and in comprehensive high schools.

Figure 7 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high

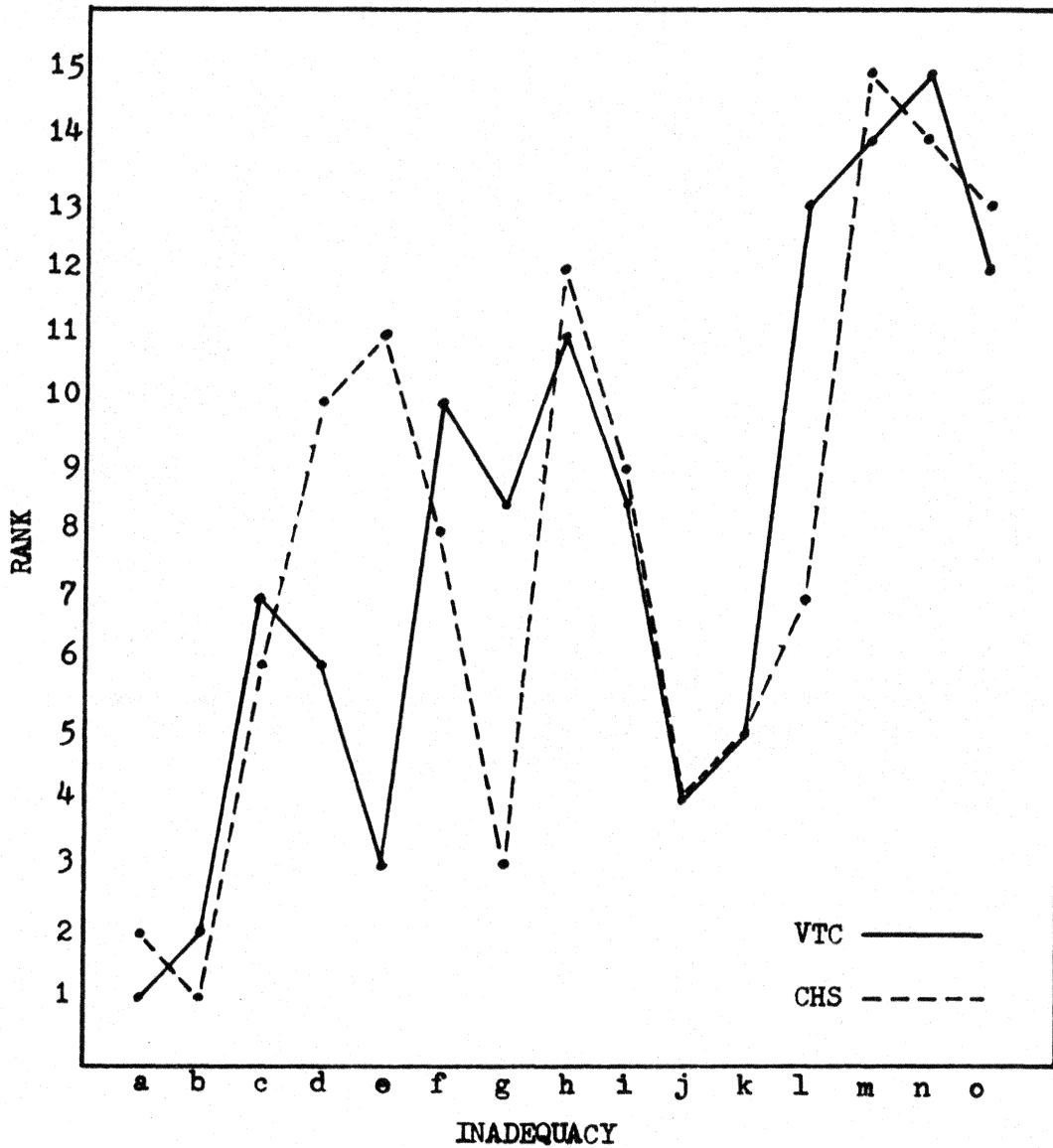


Figure 6

Comparison of Rankings of Inadequacies--Teachers With Most Trade Experience in Vocational Technical Centers and Comprehensive High Schools

Table 16

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Least Trade Experience in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.000	5.931	1	2	1	1
b	8.500	6.828	11	3	8	64
c	7.063	5.828	3	1	2	4
d	6.875	7.586	2	5	3	9
e	8.250	7.414	8	4	4	16
f	8.500	8.448	11	10	1	1
g	10.063	7.966	15	7	8	64
h	8.375	8.483	9	11	2	4
i	7.938	10.035	6	15	9	81
j	7.563	8.034	5	8	3	9
k	8.125	8.655	7	12	5	25
l	8.813	8.069	13	9	4	16
m	9.313	8.828	14	13	1	1
n	8.500	10.000	11	14	3	9
o	7.125	7.862	4	6	2	4

$$p = 1 - \frac{6 \sum D^2}{N(N^2 - 1)} = .450$$

$$\sum D^2 = 308$$

N = the number of pairs

p = rho, the rank-order correlation coefficient

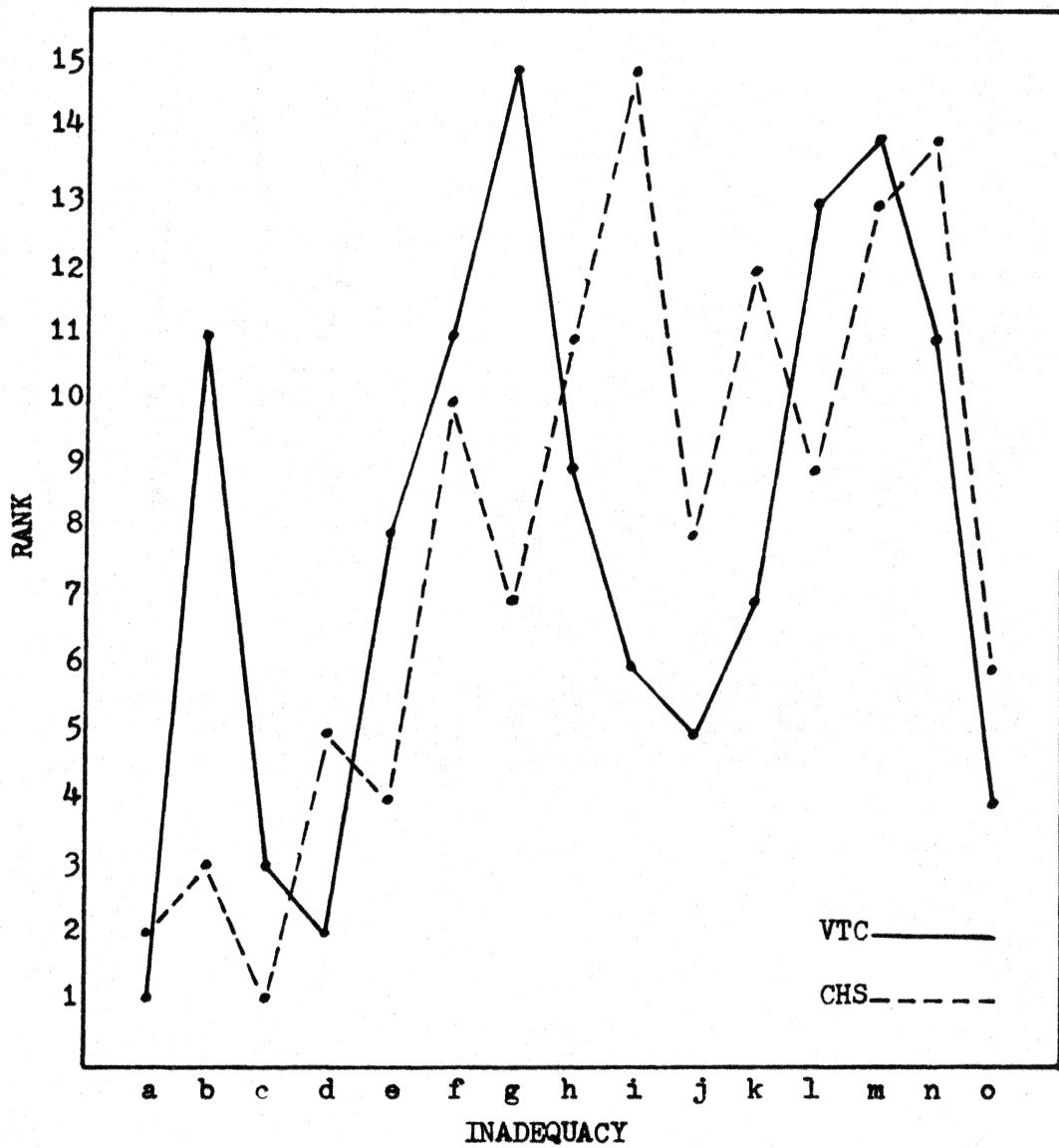


Figure 7

Comparison of Rankings of Inadequacies--Teachers with Least Trade Experience in Vocational Technical Centers and Comprehensive High Schools

schools as seen by automotive mechanics teachers with least trade experience.

General Question 6. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the largest class size and by teachers possessing the smallest class size?

The descriptive statistics necessary to provide data for the analysis of question 6 are presented in Tables 17, 18, and 19.

Table 17 lists the rank order of inadequacies of instructional space in automotive mechanics laboratories by teachers with large class size and by teachers with small class size in vocational technical centers and in comprehensive high schools. The teachers with large class size are identified Mean + and the teachers with small class size Mean -.

Table 18 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with large class size in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .598. This value of .598 with N-2 degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers with large

Table 17

Rank Order of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Large Class Size and by Teachers with Small Class Size in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	VTC				CHS			
	Mean +	Rank	Mean -	Rank	Mean +	Rank	Mean -	Rank
a	4.500	1	5.478	1	6.842	2.5	5.633	1
b	5.643	2	7.652	5	6.737	1	6.433	3
c	7.286	4	7.870	6	6.842	2.5	6.233	2
d	8.214	8.5	6.957	2	8.842	12	7.500	5
e	6.571	3	8.391	11	8.316	10	7.900	8
f	9.143	12	8.043	10	9.211	13	7.533	6
g	7.643	6	10.000	15	7.158	4	7.567	7
h	7.929	7	8.870	13	8.211	9	9.067	12
i	8.643	11	7.913	7	7.737	8	10.033	14
j	7.429	5	7.609	3.5	8.421	11	6.900	4
k	8.500	10	7.609	3.5	7.474	7	8.433	10
l	10.571	15	7.957	8.5	7.421	6	8.067	9
m	10.071	14	8.739	12	10.211	15	9.033	11
n	9.643	13	8.957	14	9.316	14	10.533	15
o	8.214	8.5	7.957	8.5	7.263	5	9.100	13

Table 18

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Large Class Size in Vocational Technical High Centers and in Comprehensive High Schools

Inadequacies	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	4.500	6.842	1	2.5	1.5	2.25
b	5.643	6.737	2	1	1	1
c	7.286	6.842	4	2.5	1.5	2.25
d	8.214	8.842	8.5	12	3.5	12.25
e	6.571	8.316	3	10	7	49
f	9.143	9.211	12	13	1	1
g	7.643	7.158	6	4	2	4
h	7.929	8.211	7	9	2	4
i	8.643	7.737	11	8	3	9
j	7.429	8.421	5	11	6	36
k	8.500	7.474	10	7	3	9
l	10.571	7.421	15	6	9	81
m	10.071	10.211	14	15	1	1
n	9.643	9.316	13	14	1	1
o	8.214	7.263	8.5	5	3.5	12.25

$$p = 1 - \frac{6 \sum D^2}{N(N^2-1)} = .598$$

$$\sum D^2 = 225$$

N=the number of pairs

p=rho, the rank-order correlation coefficient

class size in vocational technical centers and in comprehensive high schools.

Figure 8 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by automotive mechanics teachers with large class size.

Table 19 lists a comparison of rankings of inadequacies of instructional space in automotive mechanics laboratories by teachers with small class size in vocational technical centers and in comprehensive high schools. The Spearman rank-order correlation coefficient method was applied to the data. Rho was found to equal .584. This value of .584 with N-2 degrees of freedom was significant beyond the 5 percent level ($p_{.05} = .514$ for a df of 13). The data provide evidence that there is a significant relationship between the rankings of inadequacies as seen by automotive mechanics teachers with small class size in vocational technical centers and in comprehensive high schools.

Figure 9 illustrates the comparison of rankings of inadequacies of vocational technical centers and comprehensive high schools as seen by automotive mechanics teachers with small class size.

General Question 7. What other factors contribute to inadequate instructional space in automotive mechanics laboratories?

Vocational automotive mechanics teachers were requested to

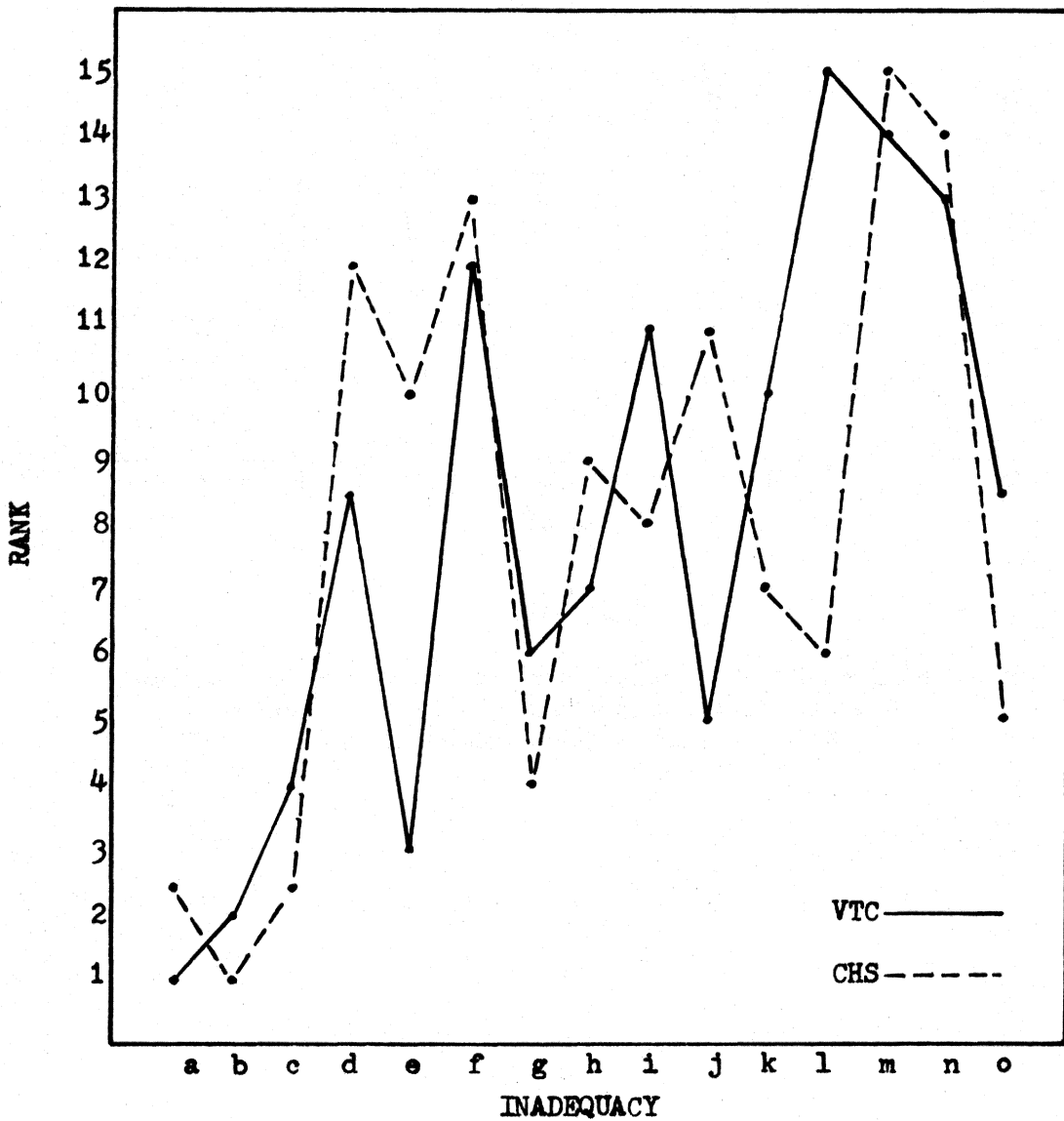


Figure 8

Comparison of Rankings of Inadequacies--Teachers With Large Class Size in Vocational Technical Centers and in Comprehensive High Schools

Table 19

Comparison of Rankings of Inadequacies of Instructional Space in Automotive Mechanics Laboratories by Teachers with Small Class Size in Vocational Technical Centers and in Comprehensive High Schools

Inadequacy	Mean VTC	Mean CHS	Rank VTC	Rank CHS	D	D ²
a	5.478	5.633	1	1	0	0
b	7.652	6.433	5	3	2	4
c	7.870	6.233	6	2	4	16
d	6.957	7.500	2	5	3	9
e	8.391	7.900	11	8	3	9
f	8.043	7.533	10	6	4	16
g	10.000	7.567	15	7	8	64
h	8.870	9.067	13	12	1	1
i	7.913	10.033	7	14	7	49
j	7.609	6.900	3.5	4	0.5	0.25
k	7.609	8.433	3.5	10	6.5	42.25
l	7.957	8.067	8.5	9	0.5	0.25
m	8.739	9.033	12	11	1	1
n	8.957	10.533	14	15	1	1
o	7.957	9.100	8.5	13	4.5	20.25

$$\sum D^2 = 233$$

$$p = 1 - \frac{6 \sum D^2}{N(N^2-1)} = .584$$

N=the number of pairs

p = rho, the rank-order correlation coefficient

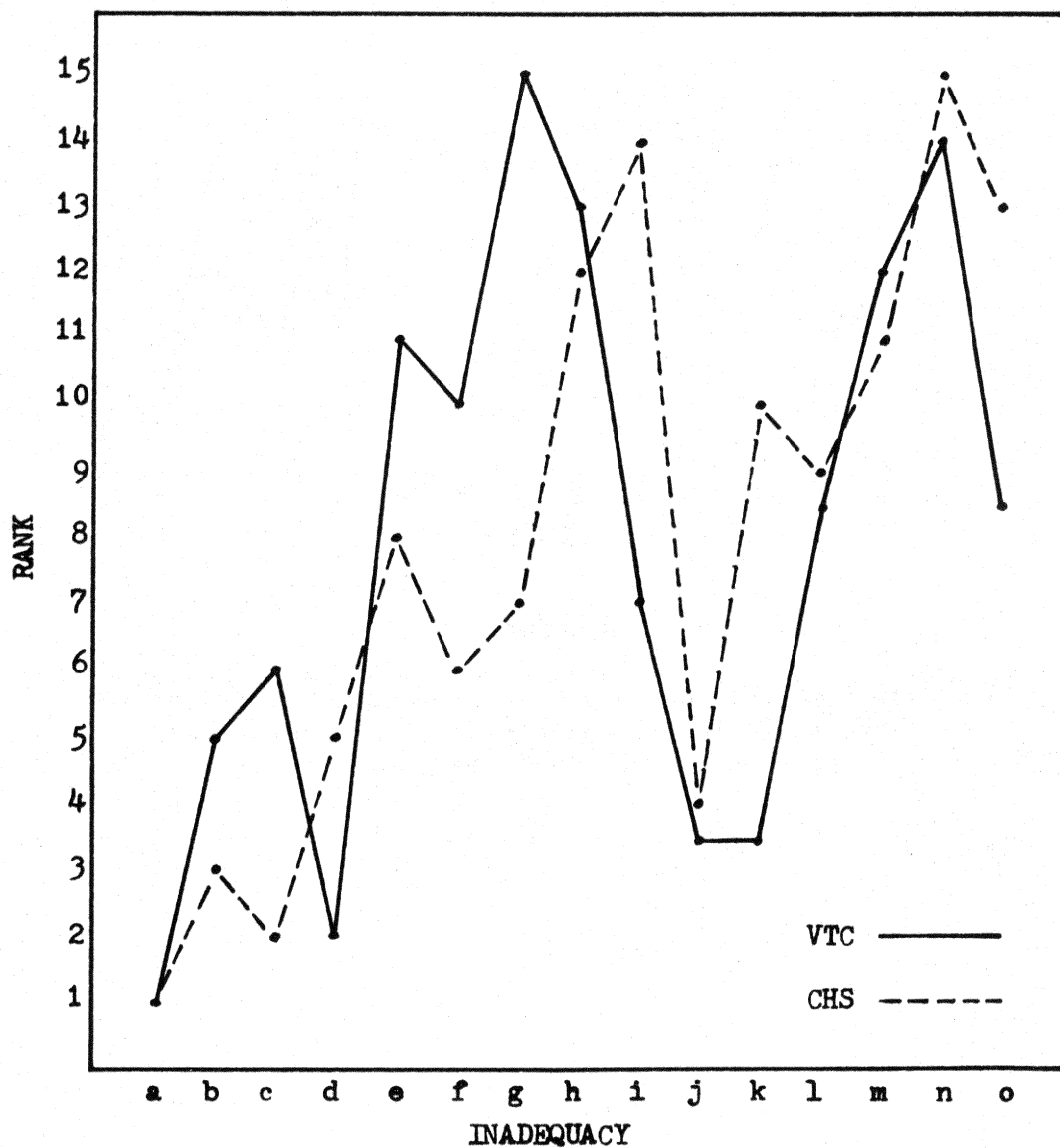


Figure 9

Comparison of Rankings of Inadequacies--Teachers With Small Class Size in Vocational Technical Centers and in Comprehensive High Schools

list other factors, in addition to the fifteen factors, which contributed to inadequate instructional space in their respective laboratories. Summaries of these responses are provided in Tables 20 and 21. Table 20 lists other factors which contribute to inadequate instructional space in automotive mechanics laboratories in vocational technical centers. Table 21 lists other factors which contribute to inadequate instructional space in automotive mechanics laboratories in comprehensive high schools.

SUMMARY

The purpose of this study was to compare the inadequacies of instructional space among public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and comprehensive high schools. In addition, relationships of the rank orders of inadequacies were compared with the variables of (1) age of facility, (2) amount of teaching experience, (3) amount of trade experience, and (4) class size.

The analysis of the data is presented in the order given to the General Questions in Chapter 1. Analysis of the data revealed:

1. The inadequacies, in rank order, of the instructional space in automotive mechanics laboratories by type of school are:
 - a. Vocational Technical Centers: location of classroom, storage space, location of restrooms and showers, number of work stations, flexibility of laboratory space due

Table 20

List of Other Factors Which Contribute to Inadequate Instructional Space in Automotive Mechanics Laboratories in Vocational Technical Centers

Other Factors	Number of Respondents
1. Inadequate space due to too many students being assigned to the laboratory.	3
2. Inadequate lighting.	3
3. Inadequate provision for special equipment such as lifts, overhead crane and air outlets.	3
4. Inadequate provision for male and female locker rooms.	2
5. Inadequate fenced parking area for outside storage of automobiles.	2
6. Inadequate provision for adult education, special education, manpower training classes and school bus repair, who must use the same facilities.	2
7. Inadequate floor space for automobiles in the laboratory.	2
8. Inadequate space for water and steam wash rack inside the laboratory.	2
9. Inadequate floor drains.	2
10. Inadequate location of stock room.	1
11. Inadequate control of access to the laboratory.	1
12. Inadequate heating.	1
13. Inadequate location of office.	1
14. Inadequate provision for grease disposal.	1
15. Inadequate provision for chemical storage.	1

Table 20--continued

Other Factors	Number of Respondents
16. Inadequate tool room space.	1
17. Inadequate provision for electric motors on overhead doors.	1
18. Inadequate provision for noise control.	1
19. Inadequate storage space for visual aids.	1
20. Inadequate provision for safe access to storage loft.	1

Table 21

List of Other Factors Which Contribute to Inadequate Instructional
Space in Automotive Mechanics Laboratories in Comprehensive
High Schools

Other Factors	Number of Respondents
1. Inadequate fenced parking area for outside storage of automobiles.	7
2. Inadequate budgetary provision for maintenance of equipment.	6
3. Inadequate budgetary provision for up-dating equipment.	6
4. Inadequate provision for special equipment such as dynamometer, air lifts, chain hoist, metric tools and air outlets.	5
5. Inadequate provision for storage of chemicals, kerosene, used oil and mock-up engines.	4
6. Inadequate space due to too many students being assigned to the laboratory.	3
7. Inadequate location of office.	2
8. Inadequate lighting.	2
9. Inadequate provision for safe access to storage loft.	2
10. Inadequate space for steam-cleaning inside the laboratory.	1
11. Inadequate budgetary provision for maintenance of facilities.	1
12. Inadequate budgetary provision for expendable items.	1
13. Inadequate budgetary provision for field trips.	1
14. Inadequate heating.	1

Table 21--continued

Other Factors	Number of Respondents
15. Inadequate space provided for a grease and oil change service area.	1
16. Inadequate provision for female restrooms and locker space.	1
17. Inadequate provision for noise control (air compressor, exhaust fans, water heaters, furnace).	1
18. Inadequate location of floor chains.	1
19. Inadequate location of tool room.	1
20. Inadequate provision for safety (air and electrical outlets protruding from floor).	1
21. Inadequate provision for showers-male and female.	1
22. Inadequate provision for student hand tools.	1
23. Inadequate provision for hot and cold running water.	1
24. Inadequate provision made for instructor's rest room.	1

to installation of equipment, work space, work bench space, modern equipment, doors, classroom space, visual aid equipment, amount of tools and equipment, training aids, number of electrical outlets and ventilation (Table 5).

- b. Comprehensive High Schools: location of classroom, flexibility of laboratory space due to installation of equipment, storage space, training aids, number of work stations, amount of tools and equipment, location of rest-rooms and showers, work space, work bench space, classroom space, modern equipment, visual aid equipment, doors, ventilation and number of electrical outlets (Table 6).
2. There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers in vocational technical centers and in comprehensive high schools.
 3. There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers housed in oldest facilities in vocational technical centers and in comprehensive high schools.

There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers housed in newest facilities in vocational technical centers and in comprehensive high schools.
 4. There is not a significant relationship between the rankings of inadequacies by automotive mechanics teachers with most

teaching experience in vocational technical centers and in comprehensive high schools.

There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers with least teaching experience in vocational technical centers and in comprehensive high schools.

5. There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers with most trade experience in vocational technical centers and in comprehensive high schools.

There is not a significant relationship between the rankings of inadequacies by automotive mechanics teachers with least trade experience in vocational technical centers and in comprehensive high schools.

6. There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers with large class size in vocational technical centers and in comprehensive high schools.

There is a significant relationship between the rankings of inadequacies by automotive mechanics teachers with small class size in vocational technical centers and in comprehensive high schools.

7. Other factors which contribute to inadequate instructional space in automotive mechanics laboratories are listed by type of school:

- a. Vocational Technical Centers: too many students, lighting, special equipment, male and female locker rooms, fenced parking area for outside storage of automobiles, provision for other classes who must share the same facilities, floor space for automobiles, space for water and steam wash rack inside, and floor drains (Table 20).
- b. Comprehensive High Schools: fenced parking area for outside storage of automobiles; budget for maintenance of equipment; budget for up-dating equipment; special equipment; storage of chemicals, kerosene, used oil and mock-up engines; location of office; lighting; and safe access to storage loft (Table 21).

Chapter 5

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

SUMMARY

Purpose

The purpose of this study has been to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and comprehensive high schools, based upon the perceptions of automotive mechanics teachers.

The following seven general questions were used to carry out the purpose of the study:

1. What are the inadequacies, in rank order, of the instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools as perceived by teachers in these two types of schools?
2. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories in vocational technical centers and by teachers in comprehensive high schools?

3. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers housed in oldest facilities and by those teachers housed in newest facilities?
4. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most teaching experience and by those teachers possessing the least teaching experience?
5. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most trade experience and by those teachers possessing the least trade experience?
6. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the largest class size and by those teachers possessing the smallest class size?
7. What other factors contribute to inadequate instructional space in automotive mechanics laboratories?

Methodology

Automotive mechanics programs offered in the secondary schools of Virginia employ a total of 100 full-time teachers.

The entire group was utilized in this study. The process of collecting the required data involved three steps: (1) the pre-survey; (2) polling a jury of experts; and (3) the survey.

The pre-survey was designed to identify the inadequacies of instructional space in automotive mechanics laboratories. Twenty automotive mechanics teachers were randomly selected from the total population. Each of the twenty teachers was asked to identify the five most inadequate features directly affecting the utilization of instructional space in his automotive mechanics laboratory. A listing of teacher responses was then prepared and the fifteen highest ranking responses were selected for mailing to the jury of experts.

The fifteen most common inadequacies suggested by the twenty randomly selected automotive mechanics teachers were then presented to the jury of experts for the purpose of soliciting additional comments and suggestions. The comments and suggestions were then reviewed, resulting in a final edited list of fifteen inadequacies.

The survey instrument consisted of a cover letter, directions and fifteen 3x5 cards. Each card contained one statement of inadequacy. Each of the 100 teachers in the total population was requested to sort and rank the fifteen cards. Teachers were also requested to provide additional information including (1) age of facility, (2) years teaching experience, (3) years trade experience, (4) class size and (5) identification of other factors contributing to inadequate instructional space in their respective laboratories.

Packets of ranked cards were returned by the respondents. The order of inadequacies given was recorded for each of the fifteen items. Rank values were then placed on data cards corresponding to the various inadequacies being studied. The data were coded according to the type of school (1) vocational technical center or (2) comprehensive high school. Information concerning age of facility, teaching experience, trade experience and class size was entered directly on each card. Means of age of facility, teaching experience, trade experience, and class size were then calculated. Comparisons of rank orders of inadequacies made by automotive mechanics teachers as classified by (1) age of facility, (2) teaching experience, (3) trade experience and (4) class size, were then conducted. The Spearman Rank-Order Correlation Coefficient method was utilized in this study to determine correlations. The closeness of relationship was determined using the .05 level of significance. A listing and frequency count was made of other factors which contribute to inadequate instructional space in automotive mechanics laboratories as perceived by teachers.

This study was conducted within the confines of the following limitations:

1. Teachers were asked to rank inadequacies regardless of the condition of their own facility. Because the inadequacy of these facilities may vary it is possible that the results may be influenced by this variable.
2. Teachers participating in this study were high school automotive mechanics teachers.

3. Only laboratory space in the automotive mechanics facility was included in this study.

Summary of Data

The computation of means, ranking of items and the Spearman Rank-Order Correlation Coefficient were utilized in the data analysis which provided answers to each of the general questions. The analysis for Question 1 involved the computation of means and ranking of items. A rank order of the inadequacies of instructional space in automotive mechanics laboratories by type of school were:

- a. Vocational Technical Centers: location of classroom, storage space, location of restrooms and showers, number of work stations, flexibility of laboratory space due to installation of equipment, work space, work bench space, modern equipment, doors, classroom space, visual aid equipment, amount of tools and equipment, training aids, number of electrical outlets and ventilation.
- b. Comprehensive High Schools: location of classroom, flexibility of laboratory space due to installation of equipment, storage space, training aids, number of work stations, amount of tools and equipment, location of restrooms and showers, work space, work bench space, classroom space, modern equipment, visual aid equipment, doors, ventilation and number of electrical outlets.

For question 2, use of the Spearman Rank-Order Correlation Coefficient revealed that there is a significant relationship between the rankings of inadequacies by automotive mechanics teachers in vocational technical centers and in comprehensive high schools.

The Spearman Rank-Order Correlation Coefficient did reveal a significant relationship between the rankings of inadequacies by automotive mechanics teachers housed in oldest facilities in voca-

tional technical centers and in comprehensive high schools. A similar finding was found for teachers housed in newest facilities.

When the Spearman Rank-Order Correlation Coefficient was applied to question 4 it was indicated that there is not a significant relationship between the rankings of inadequacies by automotive mechanics teachers with most teaching experience in vocational technical centers and in comprehensive high schools. There was, however, a significant relationship between rankings of inadequacies by teachers with least teaching experience.

An analysis of question 5, utilizing the Spearman Rank-Order Correlation Coefficient revealed a significant relationship among the rankings of inadequacies by automotive mechanics teachers with most trade experience. However, the reverse was found to be true when teachers with least trade experience were analyzed.

Use of the Spearman Rank-Order Correlation Coefficient for question 6 revealed that there is a significant relationship between the rankings of inadequacies by automotive mechanic teachers with large class size in vocational technical centers and in comprehensive high schools. A significant relationship also exists between the rankings of inadequacies by teachers with small class size.

The final question suggested other factors which contributed to inadequate instructional space in automotive mechanics laboratories. These inadequacies are listed in descending order by type of school:

- a. Vocational Technical Centers: too many students, lighting, special equipment, male and female locker rooms, fenced parking area for outside storage of automobiles, provision for other classes who must share the same facility, floor space for automobiles, space for water and steam wash rack inside, and floor drains.
- b. Comprehensive High Schools: fenced parking area for outside storage of automobiles; budget for maintenance of equipment; budget for up-dating equipment; special equipment; storage of chemicals, kerosene, used oil and mock-up engines; too many students; location of office; lighting; and safe access to storage loft

CONCLUSIONS

Based upon the findings of this study, the following conclusions are offered:

1. The inadequacies, in rank order, of the instructional space in automotive mechanics laboratories are listed by type of school below:

Vocational Technical Centers

- a. Inadequate location of classrooms.
- b. Inadequate storage space.
- c. Inadequate location of restrooms and showers.
- d. Inadequate number of work stations.
- e. Inadequate flexibility of laboratory space due to installation of equipment.
- f. Inadequate work space.
- g. Inadequate work bench space.
- h. Inadequate modern equipment.
- i. Inadequate space allotted for doors.

- j. Inadequate classroom space.
- k. Inadequate visual aid equipment.
- l. Inadequate amount of tools and equipment.
- m. Inadequate training aids.
- n. Inadequate number of electrical outlets.
- o. Inadequate ventilation.

Comprehensive High Schools

- a. Inadequate location of classroom.
 - b. Inadequate flexibility of laboratory space due to installation of equipment.
 - c. Inadequate storage space.
 - d. Inadequate training aids.
 - e. Inadequate number of work stations.
 - f. Inadequate amount of tools and equipment.
 - g. Inadequate location of restrooms and showers.
 - h. Inadequate work space.
 - i. Inadequate work bench space.
 - j. Inadequate classroom space.
 - k. Inadequate modern equipment.
 - l. Inadequate visual aid equipment.
 - m. Inadequate space allotted for doors.
 - n. Inadequate ventilation.
 - o. Inadequate number of electrical outlets.
2. The rankings of inadequacies by automotive mechanics teachers

in vocational technical centers and in comprehensive high schools are similar.

3. The rankings of inadequacies by automotive mechanics teachers housed in oldest facilities and by those teachers housed in newest facilities are substantially the same in vocational technical centers and in comprehensive high schools.
4. The rankings of inadequacies by automotive mechanics teachers with most teaching experience in vocational technical centers and in comprehensive high schools are dissimilar. Whereas, the rankings of inadequacies by teachers with least teaching experience are similar in both types of schools.
5. The rankings of inadequacies by automotive mechanics teachers with most trade experience in vocational technical centers and in comprehensive high schools are very similar. However, no such similarity was noted among the rankings of inadequacies by teachers with least trade experience.
6. The rankings of inadequacies by automotive mechanics teachers with large class size and by those teachers with small class size in vocational technical centers and in comprehensive high schools are similar.
7. Other factors which contribute to inadequate instructional space in automotive mechanics laboratories are listed by type of school below:

Vocational Technical Centers

- a. Too many students.

- b. Inadequate lighting.
- c. Inadequate special equipment.
- d. Inadequate male and female locker rooms.
- e. Inadequate fenced parking area for outside storage of automobiles.
- f. Inadequate provision for other classes who must share the same facility.
- g. Inadequate floor space for automobiles.
- h. Inadequate space for water and steam wash rack inside.
- i. Inadequate floor drains.

Comprehensive High Schools

- a. Inadequate fenced parking area for outside storage of automobiles.
- b. Inadequate budgetary allowance for maintenance of equipment.
- c. Inadequate budgetary allowance for up-dating equipment.
- d. Inadequate special equipment.
- e. Inadequate provision for storage of chemicals, kerosene, used oil, and mock-up engines.
- f. Too many students.
- g. Inadequate location of office.
- h. Inadequate lighting.
- i. Inadequate safe access to storage loft.

The preceding conclusions reveal that the rankings of inadequacies by automotive mechanics teachers in vocational technical centers and in comprehensive high schools are similar in the following areas:

1. rankings of inadequacies.
2. teachers housed in oldest facilities.
3. teachers housed in newest facilities.
4. teachers with least teaching experience.
5. teachers with most trade experience.
6. teachers with large class size.
7. teachers with small class size.

The rankings are dissimilar in the following areas:

1. teachers with most teaching experience.
2. teachers with least trade experience.

Several characteristics of programs of instruction and teacher quality were not separated out in this study. Such confounding characteristics included a change in philosophy of teaching and program differences resulting from years of experience gained at each type of school. Therefore, because these characteristics were not identified, it is possible that these variables may have influenced the results pertaining to program similarity between the two types of schools.

IMPLICATIONS

1. The high rate of response to this study suggests a high level of interest among automotive mechanics teachers in laboratory space considerations.
2. The fact that very few differences were found between the ratings of inadequacies by automotive mechanics teachers in

vocational technical centers and in comprehensive high schools suggest that one type of laboratory situation is not superior to the other.

3. Even though most automotive mechanics facilities were constructed within the past twelve years, inadequacies of instructional space continues to be a problem. This implies that laboratory planning procedures should be improved.
4. Certain inadequacies, though ranked on the lower end of the scale, were still considered to be important in the total planning process, therefore all inadequacies should receive consideration during the planning process.
5. An examination of the inadequacies of instructional space reveals that the largest number of inadequacies (thirty-four) are related to planning. The next largest number (twelve) are related to budgetary limitations. The smallest number of inadequacies (three) are due to administrative problems. This implies: (a) budgetary limitations are not of primary importance and (b) improved planning and administrative procedures could improve thirty-seven out of the forty-nine inadequacies.
6. A review of the demographic data revealed that thirty teachers were classified as possessing the most teaching experience and forty-five teachers were classified as possessing the least trade experience. Of the aforementioned

groups of teachers, fourteen were identified as being the same teachers who possessed the most teaching experience and least trade experience.

From the foregoing it appears that one-half of the teachers possessing the most teaching experience also possess the least trade experience. One-third of the teachers possessing the least trade experience also possess the most teaching experience. This implies that it is difficult, but not impossible, for teachers to possess both, a large amount of teaching experience and also a large amount of trade experience.

7. A further analysis of other factors which contribute to inadequate instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools revealed that inadequate provision was made for (a) space requirements, (b) budgetary requirements and (c) special use items or areas. This implies that improved planning should result in fewer inadequacies of instructional space in automotive mechanics laboratories.

RECOMMENDATIONS

1. Because of the apparent expertise of automotive mechanics teachers in laboratory planning, and because of the evidenced inadequacies of the facilities, automotive mechanics teachers should become more involved in the planning of these facil-

ities.

2. As there appears to be very little difference between vocational technical centers and comprehensive high schools in facility inadequacies, assumptions should no longer be made that vocational technical center automotive mechanics laboratories are more adequate than those in comprehensive high schools.
3. Research should be conducted to determine why there appears to be a difference in ratings of inadequacies between automotive mechanics teachers with most teaching experience in vocational technical centers and those in comprehensive high schools.
4. Research should be conducted to determine why there appears to be a difference in ratings of inadequacies between automotive mechanics teachers with least trade experience in vocational technical centers and those in comprehensive high schools.
5. Research should be conducted to identify the inadequacies of instructional space which exists in automotive mechanics facilities. Priorities should be determined and a check list developed for use by planners of new facilities.
6. Because the inadequacies of instructional space in automotive mechanics laboratories are primarily caused by insufficient planning, it is recommended that improved planning procedures be developed and implemented.

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APPENDIX A

PRE-SURVEY

September 10, 1976

Dear Mr.

Would you please take a few moments to help me with a research study? In your opinion, what are the five (5) most inadequate features directly affecting the utilization of instructional space in your automotive mechanics laboratory?

Would you please place your response on the enclosed 3 x 5 card, insert the card in the stamped, addressed envelope and mail at your earliest convenience. Please be assured that your responses will be held in confidence.

This study has been approved by Lester G. Duenk, Professor and Program Leader of Vocational Industrial Education at the Virginia Polytechnic Institute and State University and by _____, Jr., Assistant Supervisor of Vocational Education, State Department of Education.

Thank you very much for your assistance.

Sincerely,

Richard N. Cilley

Enclosures

- 1 stamped-addressed envelope
- 1 card 3 x 5

Card 3 x 5

The five (5) most inadequate features directly affecting the utilization of instructional space in my automotive mechanics laboratory are:

1. _____
2. _____
3. _____
4. _____
5. _____

APPENDIX B

SELECTED EXPERTS

Selected Experts

Mr. George A. Eanes, Jr.
Assistant Supervisor of Vocational Education
State Department of Education
Richmond, Virginia 23216

Mr. George W. Swartz
Supervisor for Local and Regional Planning
State Department of Education
Richmond, Virginia 23216

Mr. William P. Vaughan
State Supervisor
Trade and Industrial Education
State Department of Education
Richmond, Virginia 23216

APPENDIX C

SURVEY INSTRUMENT

Dear Mr.

I am conducting a research study to determine which are the most inadequate features directly affecting the utilization of instructional space in your automotive mechanics laboratory. This information will be utilized to improve present and future laboratory facilities.

Because of your experience in vocational education, you have been recommended as a resource person to participate in this study. Would you please take a few minutes to consider the following question:

What are the most inadequate features directly affecting the utilization of instructional space in your automotive mechanics laboratory?

Would you please follow the directions and return the materials in the stamped, addressed envelope and mail at your earliest convenience. Please be assured that your responses will be held in confidence.

This study has been approved by Lester G. Duenk, Professor and Program Leader of Vocational Industrial Education at the Virginia Polytechnic Institute and State University and by _____, Assistant Supervisor of Vocational Education, State Department of Education.

If you should have any questions, please telephone me at _____.
. Thank you very much for your assistance.

Sincerely,

Richard N. Cilley

Enclosures
Directions
15 Cards 3 x 5
1 stamped-addressed envelope

Directions

Would you please:

1. Review the fifteen statements of inadequacy (suggested by other automotive mechanics teachers in Virginia) which are typed on the fifteen 3 x 5 cards. Consider ranking these cards as such inadequacies might apply to your own laboratory situation.
2. Sort and rank these fifteen 3 x 5 cards by placing them in order with the most serious inadequate feature on top, the second most serious inadequate feature next, etc., until the least serious feature is placed on the bottom. Place a rubber band around the cards.

What other factors, in addition to the fifteen already reviewed, contribute to inadequate instructional space in your automotive mechanics laboratory?

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

3. Provide the following information:

- a) What is the age (number of years) of your automotive mechanics facility? _____
- b) How many years have you been teaching automotive mechanics? _____
- c) How many years of full time trade experience do you have as an automotive mechanic? _____
- d) How many students are enrolled in each class which you teach? (If you teach more than two classes, list other enrollments.)

Morning	_____
Afternoon	_____
Other	_____

4. Place this sheet and the 15 ranked cards in the stamped addressed envelope and mail at your earliest convenience.

THANK YOU

15 Cards (3 x 5) with selected statement of inadequacy

1. Inadequate location of classroom.
2. Inadequate storage space.
3. Inadequate flexibility of laboratory space due to installation of equipment.
4. Inadequate location of restrooms and showers.
5. Inadequate work space.
6. Inadequate classroom space.
7. Inadequate training aids.
8. Inadequate visual aid equipment.
9. Inadequate space allotted for doors.
10. Inadequate number of work stations.
11. Inadequate work bench space.
12. Inadequate amount of tools and equipment.
13. Inadequate ventilation.
14. Inadequate number of electrical outlets.
15. Inadequate modern equipment.

APPENDIX D

POSTAL CARD

October, 1976

Dear Mr.

Your help is needed! Most of the results are in. Your response is needed to identify the most inadequate features directly affecting the utilization of instructional space in your automotive mechanics laboratory. Would you please return the material today?

Thank you for your assistance.

Sincerely,

Richard N. Cilley

APPENDIX E.

DEMOGRAPHIC DATA

**AGE OF FACILITIES
VOCATIONAL TECHNICAL CENTERS**

<u>Teacher</u>	<u>Age</u>	<u>Teacher</u>	<u>Age</u>	<u>Teacher</u>	<u>Age</u>
5	11	29	30	64	7
6	4	31	10	65	7
7	5	35	41	66	9
8	10	36	8	67	30
9	5	45	9	71	10
11	2	46	5	79	5
15	8	51	13	82	13
17	4	52	6	83	8
19	2	57	9	88	5
21	6	59	8	90	3
24	9	60	5	91	8
26	25	62	23	93	5
				<u>99</u>	<u>8</u>
				Total	376
					M = 10.162

YEARS OF TEACHING EXPERIENCE
 VOCATIONAL TECHNICAL CENTERS

<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>
5	5	29	23	64	4
6	27	31	13	65	5
7	2	35	30	66	9
8	4	36	16	67	9
9	5	45	9	71	5
11	2	46	6	79	5
15	10	51	6	82	14
17	0	52	3	83	4
19	8	57	6	88	8
21	6	59	8	90	15
24	8	60	5	91	11
26	19	62	6	93	12
				<u>99</u>	<u>8</u>
				Total	336
				M =	9.081

YEARS OF TRADE EXPERIENCE
VOCATIONAL TECHNICAL CENTERS

<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>
5	21	29	7	64	25
6	33	31	33	65	3
7	20	35	11	66	18
8	25	36	20	67	24
9	21	45	6	71	25
11	5	46	25	79	25
15	14	51	3	82	23
17	22	52	22	83	14
19	12	57	30	88	5
21	16	59	28	90	0
24	18	60	25	91	15
26	27	62	30	93	20
				<u>99</u>	<u>10</u>
				Total	681
				M	= 18.405

CLASS SIZE
VOCATIONAL TECHNICAL CENTERS

<u>Teacher</u>	<u>Class</u>	<u>Teacher</u>	<u>Class</u>	<u>Teacher</u>	<u>Class</u>
5	37	29	25	64	27
6	40	31	39	65	42
7	34	35	22	66	33
8	42	36	44	67	32
9	36	45	27	71	45
11	33	46	38	79	35
15	33	51	28	82	28
17	33	52	46	83	33
19	32	57	34	88	33
21	30	59	31	90	40
24	29	60	30	91	43
26	34	62	24	93	41
				<u>99</u>	<u>26</u>
				Total	1259
				M =	34.027

AGE OF FACILITIES
COMPREHENSIVE HIGH SCHOOLS

<u>Teacher</u>	<u>Age</u>	<u>Teacher</u>	<u>Age</u>	<u>Teacher</u>	<u>Age</u>
1	6	33	26	69	6
2	3	37	7	72	9
3	10	38	13	74	3
4	3	39	6	76	2
10	3	40	12	77	2
12	5	43	4	78	4
13	4	44	10	84	3
14	2	48	1	85	3
16	4	49	3	86	4
18	2	50	3	87	2
20	5	53	3	89	2
22	6	54	4	92	5
27	5	55	15	94	11
28	2	58	15	95	5
30	4	61	12	97	1
32	8	68	12	98	2
				<u>100</u>	<u>13</u>
				Total	295
				M =	6.020

YEARS OF TEACHING EXPERIENCE
COMPREHENSIVE HIGH SCHOOLS

<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>
1	9	33	26	69	2
2	3	37	9	72	3
3	10	38	7	74	5
4	3	39	6	76	11
10	2	40	12	77	2
12	12	43	4	78	7
13	9	44	6	84	3
14	2	48	6	85	12
16	11	49	2	86	14
18	3	50	3	87	2
20	17	53	3	89	2
22	7	54	9	92	5
27	5	55	5	94	5
28	6	58	2	95	5
30	4	61	7	97	1
32	8	68	12	98	1
				<u>100</u>	<u>5</u>

Total 315

M. = 6.429

YEARS OF TRADE EXPERIENCE
COMPREHENSIVE HIGH SCHOOLS

<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>	<u>Teacher</u>	<u>Years</u>
1	25	33	26	69	3
2	22	37	13	72	0
3	20	38	4	74	9
4	18	39	26	76	20
10	9	40	18	77	15
12	26	43	25	78	30
13	10	44	13	84	13
14	11	48	5	85	15
16	5	49	10	86	40
18	25	50	17	87	15
20	20	53	26	89	6
22	12	54	4	92	11
27	30	55	5	94	6
28	12	58	15	95	14
30	17	61	8	97	3
32	12	68	31	98	5
				<u>100</u>	<u>17</u>
				Total	742
				M =	15.143

CLASS SIZE
COMPREHENSIVE HIGH SCHOOLS

<u>Teacher</u>	<u>Class</u>	<u>Teacher</u>	<u>Class</u>	<u>Teacher</u>	<u>Class</u>
1	33	33	32	69	70
2	25	37	24	72	40
3	31	38	54	74	55
4	42	39	36	76	38
10	36	40	47	77	30
12	29	43	26	78	27
13	35	44	37	84	28
14	39	48	40	85	47
16	34	49	13	86	26
18	28	50	31	87	30
20	40	53	34	89	34
22	35	54	61	92	32
27	40	55	24	94	29
28	47	58	64	95	44
30	34	61	50	97	36
32	31	68	26	98	24
				<u>100</u>	<u>46</u>

Total 1794

M = 36.612

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS IN VOCATIONAL TECHNICAL CENTERS

Item	Teacher																		
	5	6	7	8	9	11	15	17	19	21	24	26	29	31	35	36	45	46	51
a	1	12	13	6	4	15	2	12	7	1	2	1	5	2	5	2	2	6	6
b	2	7	7	1	1	12	14	14	1	6	14	4	2	1	10	1	8	15	14
c	4	15	15	2	15	4	5	11	5	10	12	14	11	8	3	7	7	5	10
d	6	8	2	3	3	8	1	15	6	5	15	9	10	7	11	13	1	14	11
e	5	2	12	15	6	7	12	7	12	11	4	6	13	4	7	9	10	8	1
f	15	5	8	13	5	11	6	3	11	12	3	15	3	15	2	4	6	11	5
g	10	11	6	9	7	5	11	2	9	15	5	13	7	5	13	10	11	7	9
h	12	10	11	5	11	10	4	10	10	14	11	3	8	3	12	5	5	10	2
i	8	9	10	12	10	3	7	6	8	3	9	7	9	12	9	3	4	12	4
j	7	4	5	14	2	14	8	8	3	4	10	2	1	10	14	11	12	2	12
k	14	3	9	8	9	13	13	4	2	2	1	11	6	11	6	14	15	3	15
l	3	13	1	11	13	6	15	5	4	13	6	12	12	14	15	12	13	13	13
m	11	14	4	10	12	1	3	1	15	9	7	5	14	13	4	6	9	4	8
n	13	1	14	7	14	2	10	9	14	8	8	10	15	6	8	8	14	9	7
o	9	6	3	4	8	9	9	13	13	7	13	8	4	9	1	15	3	1	3

Item	Teacher																	
	52	57	59	60	62	64	65	66	67	71	79	82	83	88	90	91	93	99
a	1	3	2	2	9	1	2	5	15	1	10	5	2	10	5	10	1	1
b	5	5	14	5	2	2	15	2	12	6	5	4	7	11	11	3	6	6
c	10	12	7	11	1	5	3	13	7	5	11	3	8	5	10	5	2	2
d	11	7	8	10	4	10	12	4	8	13	2	2	1	7	2	11	10	5
e	3	8	3	7	12	11	5	8	13	15	1	1	12	6	12	2	5	10
f	2	15	4	8	13	3	14	11	2	7	4	14	11	8	15	7	11	11
g	4	13	1	6	10	15	4	14	14	4	15	11	14	12	3	15	3	14
h	14	10	13	3	8	12	7	12	5	11	7	10	15	13	7	1	8	3
i	6	11	11	1	7	6	8	6	11	10	8	9	13	15	8	8	7	13
j	7	2	6	15	11	8	11	10	10	9	3	8	4	1	6	4	14	7
k	8	6	10	9	3	7	10	7	3	2	12	6	10	9	4	9	12	8
l	12	1	5	4	6	9	9	3	6	14	6	15	3	4	1	12	15	12
m	9	14	15	12	15	13	13	15	1	3	14	13	5	3	14	14	4	15
n	15	9	12	13	5	14	6	1	4	8	9	12	6	2	13	13	13	9
o	13	4	9	14	14	4	1	9	9	12	13	7	9	14	9	6	9	4

Item	Total	Mean	Rank
a	189	5.108	1
b	255	6.892	2
c	283	7.649	5
d	275	7.432	3
e	285	7.703	6
f	313	8.459	10
g	337	9.108	13
h	315	8.514	11
i	303	8.189	9
j	279	7.541	4
k	294	7.946	7
l	331	8.946	12
m	342	9.243	15
n	341	9.216	14
o	298	8.054	8

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS HOUSED IN OLDEST FACILITIES IN
VOCATIONAL TECHNICAL CENTERS

Item	Teacher								Total	N=8 Mean	Rank
	5	26	29	35	51	62	67	82			
a	1	1	5	5	6	9	15	5	47	5.875	1
b	2	4	2	10	14	2	12	4	50	6.250	2
c	4	14	11	3	10	1	7	3	53	6.625	3
d	6	9	10	11	11	4	8	2	61	7.625	7
e	5	6	13	7	1	12	13	1	58	7.250	5
f	15	15	3	2	5	13	2	14	69	8.625	11
g	10	13	7	13	9	10	14	11	87	10.875	15
h	12	3	8	12	2	8	5	10	60	7.500	6
i	8	7	9	9	4	7	11	9	64	8.000	8.5
j	7	2	1	14	12	11	10	8	65	8.125	10
k	14	11	6	6	15	3	3	6	64	8.000	8.5
l	3	12	12	15	13	6	6	15	82	10.250	14
m	11	5	14	4	8	15	1	13	71	8.875	12
n	13	10	15	8	7	5	4	12	74	9.250	13
o	9	8	4	1	3	14	9	7	55	6.875	4

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS HOUSED IN NEWEST FACILITIES IN
VOCATIONAL TECHNICAL CENTERS

Item	Teacher																		
	6	7	8	9	11	15	17	19	21	24	31	36	45	46	52	57	59	60	64
a	12	13	6	4	15	2	12	7	1	2	2	2	2	2	6	1	3	2	1
b	7	7	1	1	12	14	14	1	6	14	1	1	8	15	5	5	14	5	2
c	15	15	2	15	4	5	11	5	10	12	8	7	7	5	10	12	7	11	5
d	8	2	3	3	8	1	15	6	5	15	7	13	1	14	11	7	8	10	10
e	2	12	15	6	7	12	7	12	11	4	4	9	10	8	3	7	11	5	8
f	5	8	13	5	11	6	3	11	12	3	15	4	6	11	2	15	4	8	3
g	11	6	9	7	5	11	2	9	15	5	5	10	11	7	4	13	1	6	15
h	10	11	5	11	10	4	10	10	14	11	3	5	5	10	14	10	13	3	12
i	9	10	12	10	3	7	6	8	3	9	12	3	4	12	6	11	11	1	6
j	4	5	14	2	14	8	8	3	4	10	10	11	12	2	7	2	6	15	8
k	3	9	8	9	13	13	4	2	2	1	11	14	15	3	8	6	10	9	7
l	13	1	11	13	6	15	5	4	13	6	14	12	13	13	12	1	5	4	9
m	14	4	10	12	1	3	1	15	9	7	13	6	9	4	9	14	15	12	13
n	1	14	7	14	2	10	9	14	8	8	6	8	14	9	15	9	12	13	14
o	6	3	4	8	9	9	13	13	7	13	9	15	3	1	13	4	9	14	4

Item	Teacher											Total	N=29 Mean	Rank
	65	66	71	79	83	88	90	91	93	99	99			
a	2	5	1	10	2	10	5	10	1	1	1	142	4.897	1
b	15	2	6	5	7	11	11	3	6	6	6	205	7.069	2
c	3	13	5	11	8	5	10	5	2	2	2	230	7.931	6.5
d	12	4	13	2	1	7	2	11	10	5	5	214	7.379	3.5
e	5	8	15	1	12	6	12	2	5	10	10	227	7.828	5
f	14	11	7	4	11	8	15	7	11	11	11	244	8.414	10
g	4	14	4	15	14	12	3	15	3	14	14	250	8.621	12
h	7	12	11	7	15	13	7	1	8	3	3	255	8.793	13
i	8	6	10	8	13	15	8	8	7	13	13	239	8.241	8
j	11	10	9	3	4	1	6	4	14	7	7	214	7.379	3.5
k	10	7	2	12	10	9	4	9	12	8	8	230	7.931	6.5
l	9	3	14	6	3	4	1	12	15	12	12	249	8.586	11
m	13	15	3	14	5	3	14	14	4	15	15	271	9.345	15
n	6	1	8	9	6	2	13	13	13	9	9	267	9.207	14
o	1	9	12	13	9	14	9	6	9	4	4	243	8.379	9

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH MOST TEACHING EXPERIENCE IN VOCATIONAL TECHNICAL CENTERS

Item	Teacher														Total	Mean	Rank
	6	15	31	36	90	91	93	26	29	35	82	82	82	82			
a	12	2	2	2	5	10	1	1	5	5	5	5	5	50	4.545	1	
b	7	14	1	1	11	3	6	4	2	10	4	4	4	63	5.727	2	
c	15	5	8	7	10	5	2	14	11	3	3	3	3	83	7.545	6.5	
d	8	1	7	13	2	11	10	9	10	11	2	2	2	84	7.636	8	
e	2	12	4	9	12	2	5	6	13	7	1	1	1	73	6.636	4	
f	5	6	15	4	15	7	11	15	3	2	14	14	14	97	8.818	11	
g	11	11	5	10	3	15	3	13	7	13	11	11	11	102	9.273	12	
h	10	4	3	5	7	1	8	3	8	12	10	10	10	71	6.455	3	
i	9	7	12	3	8	8	7	7	9	9	9	9	9	88	8.000	9	
j	4	8	10	11	6	4	14	2	1	14	8	8	8	82	7.455	5	
k	3	13	11	14	4	9	12	11	6	6	6	6	6	95	8.636	10	
l	13	15	14	12	1	12	15	12	12	15	15	15	15	136	12.364	15	
m	14	3	13	6	14	14	4	5	14	4	13	13	13	104	9.455	13	
n	1	10	6	8	13	13	13	10	15	8	12	12	12	109	9.909	14	
o	6	9	9	15	9	6	9	8	4	1	7	7	7	83	7.545	6.5	

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LEAST TEACHING EXPERIENCE IN VOCATIONAL TECHNICAL CENTERS

Item	Teacher																		
	7	8	9	11	17	19	21	24	45	46	52	57	59	60	64	65	66	71	79
a	13	6	4	15	12	7	1	2	2	6	1	3	2	2	1	2	5	1	10
b	7	1	1	12	14	1	6	14	8	15	5	5	14	5	2	15	2	6	5
c	15	2	15	4	11	5	10	12	7	5	10	12	7	11	5	3	13	5	11
d	2	3	3	8	15	6	5	15	1	14	11	7	8	10	10	12	4	13	2
e	12	15	6	7	7	12	11	4	10	8	3	8	3	7	11	5	8	15	1
f	8	13	5	11	3	11	12	3	6	11	2	15	4	8	3	14	11	7	4
g	6	9	7	5	2	9	15	5	11	7	4	13	1	6	15	4	14	4	15
h	11	5	11	10	10	10	14	11	5	10	14	10	13	3	12	7	12	11	7
i	10	12	10	3	6	8	3	9	4	12	6	11	11	1	6	8	6	10	8
j	5	14	2	14	8	3	4	10	12	2	7	2	6	15	8	11	10	9	3
k	9	8	9	13	4	2	2	1	15	3	8	6	10	9	7	10	7	2	12
l	1	11	13	6	5	4	13	6	13	13	12	1	5	4	9	9	3	14	6
m	4	10	12	1	1	15	9	7	9	4	9	14	15	12	13	13	15	3	14
n	14	7	14	2	9	14	8	8	14	9	15	9	12	13	14	6	1	8	9
o	3	4	8	9	13	13	7	13	3	1	13	4	9	14	4	1	9	12	13

Item	Teacher										Total	N=26 Mean	Rank
	83	88	99	5	51	62	67						
a	2	10	1	1	6	9	15				139	5.346	1
b	7	11	6	2	14	2	12				192	7.385	3
c	8	5	2	4	10	1	7				200	7.692	7
d	1	7	5	6	11	4	8				191	7.346	2
e	12	6	10	5	1	12	13				212	8.154	8
f	11	8	11	15	5	13	2				216	8.308	11
g	14	12	14	10	9	10	14				235	9.038	13
h	15	13	3	12	2	8	5				244	9.385	15
i	13	15	13	8	4	7	11				215	8.269	9.5
j	4	1	7	7	12	11	10				197	7.577	5
k	10	9	8	14	15	3	3				199	7.654	6
l	3	4	12	3	13	6	6				195	7.500	4
m	5	3	15	11	8	15	1				238	9.154	14
n	6	2	9	13	7	5	4				232	8.923	12
o	9	14	4	9	3	14	9				215	8.269	9.5

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH MOST TRADE EXPERIENCE IN VOCATIONAL TECHNICAL CENTERS

Item	Teacher																		
	7	8	9	17	46	52	57	59	60	64	71	79	5	62	67	6	31	36	93
a	13	6	4	12	6	1	3	2	2	1	1	10	1	9	15	12	2	2	1
b	7	1	1	14	15	5	5	14	5	2	6	5	2	2	12	7	1	1	6
c	15	2	15	11	5	10	12	7	11	5	5	11	4	1	7	15	8	7	2
d	2	3	3	15	14	11	7	8	10	10	13	2	6	4	8	8	7	13	10
e	12	15	6	7	8	3	8	3	7	11	15	1	5	12	13	2	4	9	5
f	8	13	5	3	11	2	15	4	8	3	7	4	15	13	2	5	15	4	11
g	6	9	7	2	7	4	13	1	6	15	4	15	10	10	14	11	5	10	3
h	11	5	11	10	10	14	10	13	3	12	11	7	12	8	5	10	3	5	8
i	10	12	10	6	12	6	11	11	1	6	10	8	8	7	11	9	12	3	7
j	5	14	2	8	2	7	2	6	15	8	9	3	7	11	10	4	10	11	14
k	9	8	9	4	3	8	6	10	9	7	2	12	14	3	3	3	11	14	12
l	1	11	13	5	13	12	1	5	4	9	14	6	3	6	6	13	14	12	15
m	4	10	12	1	4	9	14	15	12	13	3	14	11	15	1	14	13	6	4
n	14	7	14	9	9	15	9	12	13	14	8	9	13	5	4	1	6	8	13
o	3	4	8	13	1	13	4	9	14	4	12	13	9	14	9	6	9	15	9

Item	Teacher		Total	N=21	
	26	82		Mean	Rank
a	1	5	109	5.190	1
b	4	4	119	5.667	2
c	14	3	170	8.095	7
d	9	2	165	7.857	6
e	6	1	153	7.286	3
f	15	14	177	8.429	10
g	13	11	176	8.381	8.5
h	3	10	181	8.619	11
i	7	9	176	8.381	8.5
j	2	8	158	7.524	4
k	11	6	164	7.819	5
l	12	15	190	9.048	13
m	5	13	193	9.190	14
n	10	12	205	9.762	15
o	8	7	184	8.762	12

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LEAST TRADE EXPERIENCE IN
VOCATIONAL TECHNICAL CENTERS

Item	Teacher															
	11	19	21	24	45	65	66	83	88	99	51	15	90	91	29	35
a	15	7	1	2	2	2	5	2	10	1	6	2	5	10	5	5
b	12	1	6	14	8	15	2	7	11	6	14	14	11	3	2	10
c	4	5	10	12	7	3	13	8	5	2	10	5	10	5	11	3
d	8	6	5	15	1	12	4	1	7	5	11	1	2	11	10	11
e	7	12	11	4	10	5	8	12	6	10	1	12	12	2	13	7
f	11	11	12	4	3	14	11	11	8	11	5	6	15	7	3	2
g	5	9	15	5	11	4	14	14	12	14	9	11	3	15	7	13
h	10	10	14	11	5	7	12	15	13	3	2	4	7	1	8	12
i	3	8	3	9	4	8	6	13	15	13	4	7	8	8	9	9
j	14	3	4	10	12	11	10	4	1	7	12	8	6	4	1	14
k	13	2	2	1	15	10	7	10	9	8	15	13	4	9	6	6
l	6	4	13	6	13	9	3	3	4	12	13	15	1	12	12	15
m	1	15	9	7	9	13	15	5	3	15	8	3	14	14	14	4
n	2	14	8	8	14	6	1	6	2	9	7	10	13	13	15	8
o	9	13	7	13	3	1	9	9	14	4	3	9	9	6	4	1

Item	N=16		
	Total	Mean	Rank
a	80	5.000	1
b	136	8.500	11
c	113	7.063	3
d	110	6.875	2
e	132	8.250	8
f	136	8.500	11
g	161	10.063	15
h	134	8.375	9
i	127	7.938	6
j	121	7.563	5
k	130	8.125	7
l	141	8.813	13
m	149	9.313	14
n	136	8.500	11
o	114	7.125	4

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LARGE CLASS SIZE IN
VOCATIONAL TECHNICAL CENTERS

Item	Teacher														Total	Mean	Rank
	8	9	46	52	71	79	5	6	31	36	93	65	90	91			
a	6	4	6	1	1	10	1	12	2	2	1	2	5	10	63	4.500	1
b	1	1	15	5	6	5	2	7	1	1	6	15	11	3	79	5.643	2
c	2	15	5	10	5	11	4	15	8	7	2	3	10	5	102	7.286	4
d	3	3	14	11	13	2	6	8	7	13	10	12	2	11	115	8.214	8.5
e	15	6	8	3	15	1	5	2	4	9	5	5	12	2	92	6.571	3
f	13	5	11	2	7	4	15	5	15	4	11	14	15	7	128	9.143	12
g	9	7	7	4	4	15	10	11	5	10	3	4	3	15	107	7.643	6
h	5	11	10	14	11	7	12	10	3	5	8	7	7	1	111	7.929	7
i	12	10	12	6	10	8	8	9	12	3	7	8	8	8	121	8.643	11
j	14	2	2	7	9	3	7	4	10	11	14	11	6	4	104	7.429	5
k	8	9	3	8	2	12	14	3	11	14	12	10	4	9	119	8.500	10
l	11	13	13	12	14	6	3	13	14	12	15	9	1	12	148	10.571	15
m	10	12	4	9	3	14	11	14	13	6	4	13	14	14	141	10.071	14
n	7	14	9	15	8	9	13	1	6	8	13	6	13	13	135	9.643	13
o	4	8	1	13	12	13	9	6	9	15	9	1	9	6	115	8.214	8.5

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH SMALL CLASS SIZE IN
VOCATIONAL TECHNICAL CENTERS

Item	Teacher																		
	7	17	57	59	60	64	62	67	26	82	11	19	21	24	45	66	83	88	99
a	13	12	3	2	2	1	9	15	1	5	15	7	1	2	2	5	2	10	1
b	7	14	5	14	5	2	2	12	4	4	12	1	6	14	8	2	7	11	6
c	15	11	12	7	11	5	1	7	14	3	4	5	10	12	7	13	8	5	2
d	2	15	7	8	10	10	4	8	9	2	8	6	5	15	1	4	1	7	5
e	12	7	8	3	7	11	12	13	6	1	7	12	11	4	10	8	12	6	10
f	8	3	15	4	8	3	13	2	15	14	11	11	12	3	6	11	11	8	11
g	6	2	13	1	6	15	10	14	13	11	5	9	15	5	11	14	14	12	14
h	11	10	10	13	3	12	8	5	3	10	10	10	14	11	5	12	15	13	3
i	10	6	11	11	1	6	7	11	7	9	3	8	3	9	4	6	13	15	13
j	5	8	2	6	15	8	11	10	2	8	14	3	4	10	12	10	4	1	7
k	9	4	6	10	9	7	3	3	11	6	13	2	2	1	15	7	10	9	8
l	1	5	1	5	4	9	6	6	12	15	6	4	13	6	13	3	3	4	12
m	4	1	14	15	12	13	15	1	5	13	1	15	9	7	9	15	5	3	15
n	14	9	9	12	13	14	5	4	10	12	2	14	8	8	14	1	6	2	9
o	3	13	4	9	14	4	14	9	8	7	9	13	7	13	3	9	9	14	4

Item	Teacher					Total	N=23 Mean	Rank
	51	15	29	35	35			
a	6	2	5	5	5	126	5.478	1
b	14	14	2	10	10	176	7.652	5
c	10	5	11	3	3	181	7.870	6
d	11	1	10	11	11	160	6.957	2
e	1	12	13	7	7	193	8.391	11
f	5	6	3	2	2	185	8.043	10
g	9	11	7	13	13	230	10.000	15
h	2	4	8	12	12	204	8.870	13
i	4	7	9	9	9	182	7.913	7
j	12	8	1	14	14	175	7.609	3.5
k	15	13	6	6	6	175	7.609	3.5
l	13	15	12	15	15	183	7.957	8.5
m	8	3	14	4	4	201	8.739	12
n	7	10	15	8	8	206	8.957	14
o	3	9	4	1	1	183	7.957	8.5

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS IN COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	1	2	3	4	10	12	13	14	16	18	20	22	27	28	30	32	33	37	38
a	4	1	5	12	4	5	15	14	3	14	8	2	8	7	11	1	4	1	7
b	2	2	2	8	14	15	6	7	9	2	7	12	7	2	10	2	6	6	8
c	5	3	6	7	13	8	2	1	14	10	15	8	12	8	9	6	1	2	12
d	3	6	11	11	3	4	7	6	11	13	12	7	11	3	8	15	5	13	15
e	10	4	10	10	2	12	3	10	10	9	9	6	10	6	7	3	10	14	3
f	11	5	12	9	6	2	10	5	4	11	13	11	9	1	6	7	11	4	10
g	6	10	3	6	12	3	11	12	5	12	14	10	6	5	5	4	3	8	11
h	13	11	15	5	9	11	5	15	2	15	4	5	5	5	10	4	8	13	5
i	14	15	1	4	10	10	14	11	13	7	3	15	4	9	3	10	9	3	2
j	9	13	4	3	5	7	8	13	1	6	2	13	3	15	2	12	7	5	4
k	1	12	14	2	11	14	1	9	8	5	1	1	2	14	1	11	8	12	13
l	7	14	7	1	8	1	9	3	7	1	5	4	1	11	15	5	12	11	14
m	12	9	8	15	7	13	12	8	6	8	6	3	15	12	14	14	15	10	9
n	8	7	13	14	15	9	13	2	15	4	11	9	14	13	13	13	14	15	6
o	15	8	9	13	1	6	4	4	12	3	10	14	13	4	12	9	2	9	1

Item	Teacher																		
	39	40	43	44	48	49	50	53	54	55	58	61	68	69	72	74	76	77	78
a	5	4	3	2	12	3	3	4	1	15	2	9	13	2	7	4	2	4	2
b	15	2	1	3	15	4	14	3	6	6	4	15	4	7	8	1	3	8	11
c	12	3	6	15	2	15	5	9	2	2	1	3	3	12	15	2	4	1	7
d	7	15	10	14	8	8	10	11	11	7	7	7	11	10	3	10	6	2	3
e	3	13	11	13	7	11	11	10	10	3	11	8	2	5	1	15	10	6	4
f	1	12	5	12	6	10	1	2	5	8	15	12	7	15	12	9	11	10	6
g	6	5	9	4	1	2	6	1	3	5	3	13	8	11	6	5	12	14	8
h	11	11	2	5	4	12	8	5	14	1	6	2	6	8	11	6	14	15	12
i	13	10	14	10	5	7	7	8	13	12	10	6	5	14	5	7	7	11	13
j	10	9	13	11	10	5	4	7	4	4	14	1	1	13	10	14	8	7	9
k	9	8	4	1	11	14	13	6	12	13	5	10	12	3	2	13	5	12	1
l	4	7	7	6	3	6	2	15	7	14	9	11	10	9	9	12	15	13	5
m	2	14	8	8	14	1	12	13	8	11	13	14	15	6	4	11	9	9	15
n	8	1	15	7	9	13	15	14	15	9	12	5	9	1	14	8	13	5	10
o	14	6	12	9	13	9	9	12	9	10	8	4	14	4	13	3	1	3	14

Item	Teacher															Total	N=49 Mean	Rank
	84	85	86	87	89	92	94	95	97	98	100							
a	7	7	4	4	4	2	2	2	12	7	8	8	15	299	6.102	1		
b	8	10	2	7	4	1	3	8	7	7	7	7	7	321	6.551	3		
c	3	5	14	8	1	6	2	3	2	4	8	8	8	317	6.469	2		
d	2	2	12	1	10	9	1	13	3	12	4	4	4	393	8.020	7		
e	12	3	13	2	6	5	10	2	13	15	11	11	11	394	8.041	8		
f	15	1	9	12	5	8	7	5	15	5	13	13	13	401	8.184	10		
g	14	11	8	13	9	10	8	6	5	10	2	2	2	364	7.429	4		
h	5	8	3	14	14	13	9	9	10	14	14	14	14	428	8.735	12		
i	11	14	7	15	13	3	14	10	11	13	3	3	3	448	9.143	13		
j	13	9	11	3	3	7	11	11	4	3	6	6	6	367	7.499	5		
k	4	6	15	5	7	11	5	14	12	11	12	12	12	396	8.082	9		
l	1	4	10	6	11	14	15	4	6	2	10	10	10	383	7.816	6		
m	10	15	5	9	15	4	4	12	1	6	1	1	1	465	9.499	14		
n	6	12	6	10	12	15	6	15	14	1	5	5	5	493	10.061	15		
o	9	13	1	11	8	12	13	1	9	9	9	9	9	411	8.388	11		

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS HOUSED IN OLDEST FACILITIES IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teacher														Total	Mean	Rank
	3	32	33	37	38	40	44	55	58	61	68	72	94	100			
a	5	1	4	1	7	4	2	15	2	9	13	7	12	15	97	6.929	4
b	2	2	6	6	8	2	3	6	4	15	4	8	3	7	76	5.429	1
c	6	6	1	2	12	3	15	2	1	3	3	15	2	8	79	5.643	2
d	11	15	5	13	15	15	14	7	7	7	11	3	1	4	128	9.143	11
e	10	3	10	14	3	13	13	3	11	8	2	1	10	12	113	8.071	7.5
f	12	7	11	4	10	12	12	8	15	12	7	12	7	13	142	10.143	15
g	3	4	3	8	11	5	4	5	3	13	8	6	8	2	83	5.929	3
h	15	8	13	7	5	11	5	1	6	2	6	11	9	14	113	8.071	7.5
i	1	10	9	3	2	10	10	12	10	6	5	5	14	3	100	7.143	6
j	4	12	7	5	4	9	11	4	14	1	1	10	11	6	99	7.071	5
k	14	11	8	12	13	8	1	13	5	10	12	2	5	11	125	8.929	10
l	7	5	12	11	14	7	6	14	9	11	10	9	15	10	140	10.000	13.5
m	8	14	15	10	9	14	8	11	13	14	15	4	4	1	140	10.000	13.5
n	13	13	14	15	6	1	7	9	12	5	9	14	6	5	129	9.214	12
o	9	9	2	9	1	6	9	10	8	4	14	13	13	9	116	8.286	9

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS HOUSED IN NEWEST FACILITIES IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	1	2	4	10	12	13	14	16	18	20	22	27	28	30	39	43	48	49	50
a	4	1	12	4	5	15	14	3	14	8	2	8	7	11	5	3	12	3	3
b	2	2	8	14	15	6	7	9	2	7	12	7	2	10	15	1	15	4	14
c	5	3	7	13	8	2	1	14	10	15	8	12	8	9	12	6	2	15	5
d	3	6	11	3	4	7	6	11	13	12	7	11	3	8	7	10	8	8	10
e	10	4	10	2	12	3	10	10	9	9	6	10	6	7	3	11	7	11	11
f	11	5	9	6	2	10	5	4	11	13	11	9	1	6	1	5	6	10	1
g	6	10	6	12	3	11	12	5	12	14	10	6	5	5	10	6	9	1	2
h	13	11	5	9	11	5	15	2	15	4	5	5	10	4	11	2	4	12	8
i	14	15	4	10	10	14	11	13	7	3	15	4	9	3	13	14	5	7	7
j	9	13	3	5	7	8	13	1	6	2	13	3	15	2	10	13	10	5	4
k	1	12	2	11	14	1	9	8	5	1	1	2	14	1	9	4	11	14	13
l	7	14	1	8	1	9	3	7	1	5	4	1	11	15	4	7	3	6	2
m	12	9	15	7	13	12	8	6	8	6	3	15	12	14	2	8	14	1	12
n	8	7	14	15	9	13	2	15	4	11	9	14	13	13	8	15	9	13	15
o	15	8	13	1	6	4	4	12	3	10	14	13	4	12	14	12	13	9	9

Item	Teacher															
	53	54	69	74	76	77	78	84	85	86	87	89	92	95	97	98
a	4	1	2	4	2	4	2	7	7	4	4	2	2	7	8	8
b	3	6	7	1	3	8	11	8	10	2	7	4	1	8	7	7
c	9	2	12	2	4	1	7	3	5	14	8	1	6	3	2	4
d	11	11	10	10	6	2	3	2	2	12	1	10	9	13	3	12
e	10	10	5	15	10	6	4	12	3	13	2	6	5	2	13	15
f	2	5	15	9	11	10	6	15	1	9	12	5	8	5	15	5
g	1	3	11	5	12	14	8	14	11	8	13	9	10	6	5	10
h	5	14	8	6	14	15	12	5	8	3	14	14	13	9	10	14
i	8	13	14	7	7	11	13	11	14	7	15	13	3	10	11	13
j	7	4	13	14	8	7	9	13	9	11	3	3	7	11	4	3
k	6	12	3	13	5	12	1	4	6	15	5	7	11	14	12	11
l	15	7	9	12	15	13	5	1	4	10	6	11	14	4	6	2
m	13	8	6	11	9	9	15	10	15	5	9	15	4	12	1	6
n	14	15	1	8	13	5	10	6	12	6	10	12	15	15	14	1
o	12	9	4	3	1	3	14	9	13	1	11	8	12	1	9	9

Item	Total	N=35 Mean	Rank
a	202	5.771	1
b	245	7.000	4
c	238	6.800	2
d	275	7.857	8
e	282	8.057	10
f	259	7.400	5
g	281	8.029	9
h	315	9.000	12
i	348	9.943	14
j	268	7.657	6
k	270	7.714	7
l	243	6.943	3
m	325	9.286	13
n	364	10.400	15
o	295	8.429	11

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH MOST TEACHING EXPERIENCE
IN COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
a	4	5	15	3	8	2	1	2	2	7	4	5	1	4	1	7	4	9	13
b	2	15	6	9	7	12	6	3	11	10	2	2	2	6	6	8	2	15	4
c	5	8	2	14	15	8	2	4	7	5	14	6	6	1	2	12	3	3	3
d	3	4	7	11	12	7	11	6	3	2	12	11	15	5	13	15	15	7	11
e	10	12	3	10	9	6	10	10	4	3	13	10	3	10	14	3	13	8	2
f	11	2	10	4	13	11	5	11	6	1	9	12	7	11	4	10	12	12	7
g	6	3	11	5	14	10	3	12	8	11	8	3	4	3	8	11	5	13	8
h	13	11	5	2	4	5	14	14	12	8	3	15	8	13	7	5	11	2	6
i	14	10	14	13	3	15	13	7	13	14	7	1	10	9	3	2	10	6	5
j	9	7	8	1	2	13	4	8	9	9	11	4	12	7	5	4	9	1	1
k	1	14	1	8	1	1	12	5	1	6	15	14	11	8	12	13	8	10	12
l	7	1	9	7	5	4	7	15	5	4	10	7	5	12	11	14	7	11	10
m	12	13	12	6	6	3	8	9	15	15	5	8	14	15	10	9	14	14	15
n	8	9	13	15	11	9	15	13	10	12	6	13	13	14	15	6	1	5	9
o	15	6	4	12	10	14	9	1	14	13	1	9	9	2	9	1	6	4	14

Item	Total	N=19 Mean	Rank
a	97	5.105	1
b	128	6.737	4
c	120	6.316	2
d	170	8.947	13
e	153	8.053	8
f	158	8.316	10.5
g	146	7.684	5
h	158	8.316	10.5
i	169	8.895	12
j	124	6.526	3
k	153	8.053	8
l	151	7.947	6
m	203	10.684	15
n	197	10.368	14
o	153	8.053	8

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LEAST TEACHING EXPERIENCE
IN COMPREHENSIVE HIGH SCHOOLS

ITEM	Teacher																			
	2	4	10	14	14	18	27	28	30	39	43	48	49	50	53	69	74	77	84	87
a	1	12	4	14	14	8	7	11	5	3	3	12	3	3	4	2	4	4	7	4
b	2	8	14	7	2	7	2	10	15	1	15	4	14	3	7	1	8	8	8	7
c	3	7	13	1	10	12	8	9	12	6	2	15	5	9	12	2	1	3	3	8
d	6	11	3	6	13	11	3	8	7	10	8	8	10	11	10	10	2	2	2	1
e	4	10	2	10	9	10	6	7	3	11	7	11	11	10	5	15	6	12	2	2
f	5	9	6	5	11	9	1	6	1	5	6	10	1	2	15	9	10	15	12	12
g	10	6	12	12	12	6	5	5	6	9	1	2	6	1	11	5	14	14	13	13
h	11	5	9	15	15	5	10	4	11	2	4	12	8	5	8	6	15	5	14	14
i	15	4	10	11	7	4	9	3	13	14	5	7	7	7	8	14	7	11	11	15
j	13	3	5	13	6	3	15	2	10	13	10	5	4	7	13	14	7	13	3	3
k	12	2	11	9	5	2	14	1	9	4	11	14	13	6	3	13	12	4	5	5
l	14	1	8	3	1	1	11	15	4	7	3	6	2	15	9	12	13	1	6	6
m	9	15	7	8	8	15	12	14	2	8	14	1	12	13	6	11	9	10	9	9
n	7	14	15	2	4	14	13	13	8	15	9	13	15	14	1	8	5	6	10	10
o	8	13	1	4	3	13	4	12	14	12	13	9	9	12	4	3	3	9	11	11

Item	Teacher										Total	N=30 Mean	Rank	
	89	92	95	97	98	44	55	58	72	94				100
a	2	2	7	8	8	2	15	2	7	12	15	202	6.733	3
b	4	1	8	7	7	3	6	4	8	3	7	193	6.433	1
c	1	6	3	2	4	15	2	1	15	2	8	197	6.567	2
d	10	9	13	3	12	14	7	7	3	1	4	223	7.433	5
e	6	5	2	13	15	13	3	11	1	10	12	242	8.067	7.5
f	5	8	5	15	5	12	8	15	12	7	13	243	8.100	9.5
g	9	10	6	5	10	4	5	3	6	8	2	218	7.267	4
h	14	13	9	10	14	5	1	6	11	9	14	270	9.000	13
i	13	3	10	11	13	10	12	10	5	14	3	279	9.300	14
j	3	7	11	4	3	11	4	14	10	11	6	243	8.100	9.5
k	7	11	14	12	11	1	13	5	2	5	11	242	8.067	7.5
l	11	14	4	6	2	6	14	9	9	15	10	232	7.733	6
m	15	4	12	1	6	8	11	13	4	4	1	262	8.733	12
n	12	15	15	14	1	7	9	12	14	6	5	296	9.867	15
o	8	12	1	9	9	9	10	8	13	13	9	258	8.600	11

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LEAST TRADE EXPERIENCE IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teachers																			
	13	16	22	54	85	32	37	38	61	10	14	28	48	49	69	74	77	84	87	
a	15	3	2	1	7	1	1	7	9	4	14	7	12	3	2	4	4	4	7	4
b	6	9	12	6	10	2	6	8	15	14	7	2	15	4	7	1	8	8	7	7
c	2	14	8	2	5	6	2	12	3	13	1	8	2	15	12	2	1	3	8	8
d	7	11	7	11	2	15	13	15	7	3	6	3	8	8	10	10	2	2	1	1
e	3	10	6	10	3	3	14	3	8	2	10	6	7	11	5	15	6	12	2	2
f	10	4	11	5	1	7	4	10	12	6	5	1	6	10	15	9	10	15	12	12
g	11	5	10	3	11	4	8	11	13	12	12	5	1	2	11	5	14	14	13	13
h	5	2	5	14	8	8	7	5	2	9	15	10	4	12	8	6	15	5	14	14
i	14	13	15	13	14	10	3	2	6	10	11	9	5	7	14	7	11	11	15	15
j	8	1	13	4	9	12	5	4	1	5	13	15	10	5	13	14	7	13	3	3
k	1	8	1	12	6	11	12	13	10	11	9	14	11	14	3	13	12	4	5	5
l	9	7	4	7	4	5	11	14	11	8	3	11	3	6	9	12	13	1	6	6
m	12	6	3	8	15	14	10	9	14	7	8	12	14	1	6	11	9	10	9	9
n	13	15	9	15	12	13	15	6	5	15	2	13	9	13	1	8	5	6	10	10
o	4	12	14	9	13	9	9	1	4	1	4	4	13	9	4	3	3	9	11	11

Item	Teacher														Total	N=29 Mean	Rank
	89	92	95	97	98	94	44	55	58	72	74	94	94				
a	2	2	7	8	8	2	15	2	7	12	172	5.931	2				
b	4	1	8	7	7	3	6	4	8	3	198	6.828	3				
c	1	6	3	2	4	15	2	1	15	2	170	5.862	1				
d	10	9	13	3	12	14	7	7	3	1	220	7.586	5				
e	6	5	2	13	15	13	3	11	1	10	215	7.414	4				
f	5	8	5	15	5	12	8	15	12	7	245	8.448	10				
g	9	10	6	5	10	4	5	3	6	8	231	7.966	7				
h	14	13	9	10	14	5	1	6	11	9	246	8.483	11				
i	13	3	10	11	13	10	12	10	5	14	291	10.035	15				
j	3	7	11	4	3	11	4	14	10	11	233	8.034	8				
k	7	11	14	12	11	1	13	5	2	5	251	8.655	12				
l	11	14	4	6	2	6	14	9	9	15	234	8.069	9				
m	15	4	12	1	6	8	11	13	4	4	256	8.828	13				
n	12	15	15	14	1	7	9	12	14	6	290	10.000	14				
o	8	12	1	9	9	9	10	8	13	13	228	7.862	6				

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH MOST TRADE EXPERIENCE IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
a	12	20	76	78	86	3	33	40	68	2	4	18	27	30	39	43	50	53	
b	4	5	8	2	2	4	5	4	4	13	1	12	14	8	11	5	3	4	
c	2	15	7	3	11	2	2	6	2	4	2	8	2	7	10	15	1	14	3
d	5	8	15	4	7	14	6	1	3	3	3	7	10	12	9	12	6	5	9
e	3	4	12	6	3	12	11	5	15	11	6	11	13	11	8	7	10	10	11
f	10	12	9	10	4	13	10	10	13	2	4	10	9	10	7	3	11	10	10
g	11	2	13	11	6	9	12	11	12	7	5	9	11	9	6	1	5	1	2
h	6	3	14	12	8	8	3	3	5	8	10	6	12	6	5	6	9	6	1
i	13	11	4	14	12	3	15	13	11	6	11	5	15	5	4	11	2	8	5
j	14	10	3	7	13	7	1	9	10	5	15	4	7	4	3	13	14	7	8
k	9	7	2	8	9	11	4	7	9	1	13	3	6	3	2	10	13	4	7
l	1	14	1	5	1	15	14	8	8	12	12	2	5	2	1	9	4	13	6
m	7	1	5	15	5	10	7	12	7	10	14	1	1	1	15	4	7	2	15
n	12	13	6	9	15	5	8	15	14	15	9	15	8	15	14	2	8	12	13
o	8	9	11	13	10	6	13	14	1	9	7	14	4	14	13	8	15	15	14
	15	6	10	1	14	1	9	2	6	14	8	13	3	13	12	14	12	9	12

Item	Teacher 100	Total	N=20 Mean	Rank
a	15	127	6.350	2
b	7	123	6.150	1
c	8	147	7.350	6
d	4	173	8.650	10
e	12	180	9.000	11
f	13	156	7.800	8
g	2	133	6.650	3
h	14	182	9.100	12
i	3	157	7.850	9
j	6	134	6.700	4
k	11	144	7.200	5
l	10	149	7.450	7
m	1	209	10.450	15
n	5	203	10.150	14
o	9	183	9.150	13

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH LARGE CLASS SIZE IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	54	85	38	61	14	28	48	69	74	95	44	58	72	20	76	40	4	27	100
a	1	7	7	9	14	7	12	2	4	7	2	2	7	8	2	4	12	8	15
b	6	10	8	15	7	2	15	7	1	8	3	4	8	7	3	2	8	7	7
c	2	5	12	3	1	8	2	12	2	3	15	1	15	15	4	3	7	12	8
d	11	2	15	7	6	3	8	10	10	13	14	7	3	12	6	15	11	11	4
e	10	3	3	8	10	6	7	5	15	2	13	11	1	9	10	13	10	10	12
f	5	1	10	12	5	1	6	15	9	5	12	15	12	13	11	12	9	9	13
g	3	11	11	13	12	5	1	11	5	6	4	3	6	14	12	5	6	6	2
h	14	8	5	2	15	10	4	8	6	9	5	6	11	4	14	11	5	5	14
i	13	14	2	6	11	9	5	14	7	10	10	10	5	3	7	10	4	4	3
j	4	9	4	1	13	15	10	13	14	11	11	14	10	2	8	9	3	3	6
k	12	6	13	10	9	14	11	3	13	14	1	5	2	1	5	8	2	2	11
l	7	4	14	11	3	11	3	9	12	4	6	9	9	5	15	7	1	1	10
m	8	15	9	14	8	12	14	6	11	12	8	13	4	6	9	14	15	15	1
n	15	12	6	5	2	13	9	1	8	15	7	12	14	11	13	1	14	14	5
o	9	13	1	4	4	4	13	4	3	1	9	8	13	10	1	6	13	13	9

Item	Total	Mean	Rank
a	130	6.842	2.5
b	128	6.737	1
c	130	6.842	2.5
d	168	8.842	12
e	158	8.316	10
f	175	9.211	13
g	136	7.158	4
h	156	8.211	9
i	147	7.737	8
j	160	8.421	11
k	142	7.474	7
l	141	7.421	6
m	194	10.211	15
n	177	9.316	14
o	138	7.263	5

RANK ORDER OF INADEQUACIES BY AUTOMOTIVE MECHANICS TEACHERS WITH SMALL CLASS SIZE IN
COMPREHENSIVE HIGH SCHOOLS

Item	Teacher																		
	13	16	22	32	37	10	49	77	84	87	89	92	97	98	55	94	1	12	78
a	15	3	2	1	1	4	3	4	7	4	2	2	8	8	15	12	4	5	2
b	6	9	12	2	6	14	4	8	8	7	4	1	7	7	6	3	2	15	11
c	2	14	8	6	2	13	15	1	3	8	1	6	2	4	2	2	5	8	7
d	7	11	7	15	13	3	8	2	2	1	10	9	3	12	7	1	3	4	12
e	3	10	6	3	14	2	11	6	12	2	6	5	13	15	3	10	10	12	4
f	10	4	11	7	4	6	10	10	15	12	5	8	15	5	8	7	11	2	6
g	11	5	10	4	8	12	2	14	14	13	9	10	5	10	5	8	6	3	8
h	5	2	5	8	7	9	12	15	5	14	14	13	10	14	1	9	13	11	12
i	14	13	15	10	3	10	7	11	11	15	13	3	11	13	12	14	14	10	13
j	8	1	13	12	5	5	5	7	13	3	3	7	4	3	4	11	9	7	9
k	1	8	1	11	12	11	14	12	4	5	7	11	12	11	13	5	1	14	1
l	9	7	4	5	11	8	6	13	1	6	11	14	6	2	14	15	7	1	5
m	12	6	3	14	10	7	1	9	10	9	15	4	1	6	11	4	12	13	15
n	13	15	9	13	15	15	13	5	6	10	12	15	14	1	9	6	8	9	10
o	4	12	14	9	9	1	9	3	9	11	8	12	9	9	10	13	15	6	14

Item	Teacher														Total	N=30 Mean	Rank
	86	3	33	68	2	18	30	39	43	50	53						
a	4	5	4	13	1	14	11	5	3	3	4				169	5.633	1
b	2	2	6	4	2	2	10	15	1	14	3				193	6.433	3
c	14	6	1	3	3	10	9	12	6	5	9				187	6.233	2
d	12	11	5	11	6	13	8	7	10	10	11				225	7.500	5
e	13	10	10	2	4	9	7	3	11	11	10				237	7.900	8
f	9	12	11	7	5	11	6	1	5	1	2				226	7.533	6
g	8	3	3	8	10	12	5	6	9	6	1				227	7.567	7
h	3	15	13	6	11	15	4	11	2	8	5				272	9.067	12
i	7	1	9	5	15	7	3	13	14	7	8				301	10.033	14
j	11	4	7	1	13	6	2	10	13	4	7				207	6.900	4
k	15	14	8	12	12	5	1	9	4	13	6				253	8.433	10
l	10	7	12	10	14	1	15	4	7	2	15				242	8.067	9
m	5	8	15	15	9	8	14	2	8	12	13				271	9.033	11
n	6	13	14	9	7	4	13	8	15	15	14				316	10.533	15
o	1	9	2	14	8	3	12	14	12	9	12				273	9.100	13

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A COMPARISON OF INADEQUACIES OF INSTRUCTIONAL SPACE OF
PUBLIC SECONDARY VOCATIONAL AUTOMOTIVE MECHANICS LABORATORIES IN
VIRGINIA VOCATIONAL TECHNICAL CENTERS AND COMPREHENSIVE HIGH SCHOOLS
AS PERCEIVED BY AUTOMOTIVE MECHANICS TEACHERS

by

Richard Norman Cilley

(ABSTRACT)

The purpose of this study was to compare the inadequacies of instructional space of public secondary vocational automotive mechanics laboratories in Virginia vocational technical centers and comprehensive high schools based upon the perceptions of automotive mechanics teachers. In addition, relationships of the rank orders of inadequacies were compared with the variables of (1) age of facility, (2) amount of teaching experience, (3) amount of trade experience, and (4) class size.

One hundred full-time teachers were utilized in this study. Twenty teachers were selected for the pre-survey and all one hundred teachers were utilized to gather data for the survey.

The following seven general questions were used to carry out the purpose of the study:

1. What are the inadequacies, in rank order, of the instructional space in automotive mechanics laboratories in vocational technical centers and in comprehensive high schools as perceived by teachers in these two types of schools?

2. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories in vocational technical centers and by teachers in comprehensive high schools?

3. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers housed in oldest facilities and by those teachers housed in newest facilities?

4. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most teaching experience and by those teachers possessing the least teaching experience?

5. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the most trade experience and by those teachers possessing the least trade experience?

6. What is the relationship between the rankings of inadequacies made by automotive mechanics teachers concerning instructional space in automotive mechanics laboratories by teachers possessing the largest class size and by those teachers possessing the smallest class size?

7. What other factors contribute to inadequate instructional space in automotive mechanics laboratories?

The Spearman Rank-Order Correlation Coefficient method was utilized to compare data in this study. The levels of significance were tested at the .05 level.

Based upon the findings of this study the following conclusions were reached:

The rankings of inadequacies by automotive mechanics teachers in vocational technical centers and in comprehensive high schools were similar in the following areas:

1. Rankings of inadequacies.
2. Teachers housed in oldest facilities.
3. Teachers housed in newest facilities.
4. Teachers with least teaching experience.
5. Teachers with most trade experience.
6. Teachers with large class size.
7. Teachers with small class size.

The rankings were dissimilar in the following areas:

1. Teachers with most teaching experience.
2. Teachers with least trade experience.