A COMPARATIVE STUDY BETWEEN TRADITIONAL WOOD SHOP AND AN EXPERIMENTAL PRODUCTION SHOP CLASS

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PRODUCTION SHOP CLASS

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DEDICATION

I would like to dedicate this work to my late father, Mr. Frank Kenneth Coates, who did not live to see its completion but knew it would be. Without his guidance and encouragement, I would not have reached this level of education. What success I might achieve I owe a great deal of credit to him.

Frank Kenneth Coates, Jr.

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CHAPTER I

INTRODUCTION

High school industrial arts or manual training, as it was originally referred to, began in America in 1880 in the city of St. Louis. Its objective was instruction in mathematics, drawing, and basic phases of high school English, and instruction and practice in the use of tools. Early public and private education in America was limited to the arts and intellectual pursuits. However, some educators believed that formal training in manual manipulations coupled with some intellectual work would be beneficial.

Manual training was accepted as a viable facet of education and began to grow through the industrial heart of our young developing country. Over the years the manual training movement has undergone changes in philosophy, scope, and title to parallel our changing society.

During the ensuing years a number of circumstances have affected the position of industrial arts education in relation to ideology. Technological advances, unions and their apprenticeship programs, the availability of college education to more students, the Vocational Education Act and the resulting vocational-technical schools have, in part, changed the high school industrial arts curriculum from vocational to more of an avocational program.

The status of the industrial arts curriculum, however, is not completely resolved. Any time two or more industrial arts teachers get together, the discussion will become centered on "How are you teaching it?" or "Is there a better way?" The introduction and successes of the "World of" curriculums in the junior high school industrial arts programs substantiate the desire to find what the best is.

Statement of the Problem

In order to provide high school students with the best preparation for their future, their curriculum must not only be relevant to them but to the society into which they are about to merge. Industrial leaders feel that high school graduates are not, but should be, prepared for production line work through the industrial arts curriculum. Industrial arts instructors are concerned with justifying the use of funds for their programs and the quality of learnable, usable instruction. Last, but the least of the problems, is the appeal of the programs to the student.

Purpose of the Experimental Class

The purpose of this experimental class was to ascertain the benefits to be derived from instructing a high school woodworking class through the production approach as opposed to the traditional method. It is the intent of the author to determine whether the production method will accomplish everything normally taught plus several areas not covered in the traditional approach. These additional educational areas will be more thoroughly investigated in the review of the literature.

Hypothesis

The general hypothesis for this study is that production shop work will increase the relevance of the program and the performance and interest of the students.

More specifically, it is believed that this study will substantiate the following statements:

1. Production shop work as opposed to individualized projects is more relevant to today's industrialized society, therefore, it will be of more value to the students in career planning.
2. Students will continue to absorb the usual amount of information of an academic nature but will also gain knowledge of industrial procedures, group cooperation, and leadership to improve their overall academic and social performance.
3. The interest level of the students will be higher due to the different approach to the task from the standard "do your own work" project.

Definition of Terms

Traditional Method: The widely practiced discipline of having each student in the woodworking class select an individual project to work on by himself.

Production Method: Structuring a woodworking class much the same as an industry; then selecting a single item to develop and build, in mass, on an assembly line concept.

CHAPTER II

REVIEW OF THE LITERATURE

The review of literature concerning classes in production shop is limited due to the fact that the results of these classes is seldom mentioned. Production shop is not a new educational program. Actually, it is a very old concept and there are quite a number of old textbooks describing production shop class set-ups. They offer suggestions on how to organize and operate a production class and the positive qualities the students will gain. What is missing is literature on the results of production shop classes. It is obvious that there have been many production shop classes operated but very few are available as studies. It should be acknowledged that there is no concensus on the benefits of such a curriculum in the literature reviewed.

Although there was not a lot of material to study that was a direct result of operating a production shop class, there is ample commentary supporting and urging a move to a more industrialized industrial arts curriculum. Not all of the early writings were totally in favor of the production shop method.

One example of presenting both sides of the argument was found in a 1946 teacher education textbook where Ericson presented production shopwork as a teaching tool.[1]

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[1]Ericson, Emanual E., Teaching the Industrial Arts, The Manual Arts Press, Peoria, Illinois, 1946, pp. 120-122.

In Ericson's presentation, he dealt strictly with the classroom shop work and its corresponding industrial positions when listing the benefits of the curriculum. He states:

> ...advantages of production shop work are that it is a method of industry, puts drive into the work, raises standards of workmanship, cooperation is developed, discovers and develops managerial ability, provides an opportunity to inferior workmen.[2]

This would appear to solve many of the problems encountered in trying to offer the most beneficial curriculum to the students. Ericson, however, counters by saying there are also disadvantages and they are:

> ...takes away the feeling of individual responsibility, produces loafers, kills interest, students are exploited, and it makes teaching difficult.[3]

At this point the aspiring teacher probably gives up the idea because the negative aspects are just as detrimental to the development of the student as the advantages are beneficial.

In 1949, Alfred Kahler and Ernest Hamburger suggested that an analysis of the jobs and industries that constitute our economy should be the determining factor as to what type of vocational programs are offered. The authors warn against placing too much importance on occupational education designed to serve the future.[4]

Due to a realization that few of the total number of students would ever receive a degree, public schools became more conscious of

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[2]Ibid.

[3]Ibid.

[4]Kahler, Alfred and Ernest Hamburger, Education for an Industrial Age, Cornell University Press, Ithaca, New York, 1949, p. 24.

practical or "paycheck" education. Where else but industrial arts would be the most likely area to place the new emphasis, which was reflected in federal legislation, expansion of state services, and unprecedented enrollment in industrial arts and vocational programs. Academic education is geared for college preparatory work. Can we afford a school system designed for a minority of the students?[5]

In trying to tie industrial arts education in with industry itself, M. J. Ruley had this to say:

> ...great industrial progress has brought about many changes in educational programs in this country, especially in industrial arts, because industry has become a basic element of culture, and because a prime purpose of industrial arts has become to provide youth with a greater understanding of industry.
>
> Industrial arts education, along with vocational education, is receiving more and more attention from educators these days with about 75 percent of U.S. secondary schools offering industrial arts courses, taught by some 40,000 teachers to approximately 4.5 million students.[6]

Here again is another author relating how industry has, in the past, and will continue to affect educational programs. This author also feels that Mr. Ruley is admonishing the curriculum planners to listen to the voice of industry state its need when planning industrial arts course offerings. For the public schools to provide usable workers for the job market, the schools must know what skills and traits are desired by industry and the best place to discover that is from industry itself.

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[5]Larson, Milton E., Teaching Related Subjects in Trade and Industrial and Technical Education, Charles E. Merrill Publishing Co., Columbus, Ohio, 1972, p. 3.

[6]Ruley, M. J., Leadership Through Supervision in Industrial Education, McKnight and McKnight, Bloomington, Illinois, 1971, p. 201.

A frequent shortcoming of education is that it teaches little relevance to everyday life, work, personal interactions, decision-making and common transactions which make up everyone's day-to-day existence. These facets of life are simple enough to talk about and yet rather difficult to incorporate into a classroom learning situation. In searching for a framework in which to incorporate both industrial needs and areas relevant to life into a classroom format, the production shop approach appears to be the best suited.

In the introduction, this author mentioned a junior high school curriculum experiment, and to show further development, an ERIC search revealed a published report on a production shop class in elementary school. Many of the desirable qualities of a course of study discussed previously were reported to have been achieved in this experimental class. The document reports:

> ...students engage in learning experiences intended to acquaint them with wood construction and mass production. In addition to developing carpentry skills, students learn the safe use of tools, equipment, and materials. In addition, students learn general work-related skills and gain understandings that concern task planning, interpersonal relations, individual and group work methods, applied mathematics, and decision making. Students consider alternate occupations related to wood construction knowledge, not so much to encourage them to seek careers in wood construction but to help them recognize the variety of occupational options created by job experience.[7]

The previous report related how the production shop approach had been utilized in an elementary school industrial arts class to produce toy boats for kindergarten students in an Ohio school district. The

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[7]The Center for Vocational Education, Making Toys Through Teamwork, The Ohio State University, Columbus, Ohio, (Published ERIC Document), 1974, p. 1.

class covered every aspect of industry from design through prototype, testing, company organization, mass production, and customer appeal.

In another ERIC report, the author discovered a course outline for production shop instruction approved by the Georgia State Department of Education. During the years 1965 through 1970, a university graduate class, with the aid of nineteen high school and junior high school shop teachers, organized an eighth and ninth grade woods program based on the production method.

Consistent with the rest of the literature reviewed, there was no report on the success of the curriculum after public school application. However, after studying lesson guides this author believes the Georgia program over-emphasizes the structure and whys of the industrial world and short-changes the student in "hands-on", meaningful shop work.

The ERIC document states:

> Students at the beginning of a new experience are usually eager and excited about the things they are to learn. Getting each student involved in activity as soon as possible will help to develop his interest in the subject. For these reasons mass production of a product is desirable during the first week students are in class. The instructor should have all necessary materials, tools, jigs and fixtures for the product and all machines ready.[8]

After advising the instructors to mass produce a product the first week, they warn them to avoid any machine or tool processes for safety reasons. Safety measures are certainly necessary; but what is left for the students to do or gain if the instructor does it all? It would appear that this program could very easily evolve into a classroom-centered curriculum with an occasional "field trip" into the shop.

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[8]Georgia State Department of Education, Manufacturing, Industrial Arts for Middle Grades (ERIC Document, VT 016 268), 1971, p. 6.

This evaluation is based on a review of the lesson plans proposed, which seem to minimize shop work and emphasize classroom instruction.

This classroom centering is opposed by another author's recommendation. Jarvis Baillargeon recommends that seventy-five percent of total class time be available for meaningful student "hands-on" activities. He goes on to say that industrial arts must remain activity-centered, and activities must be purposeful and lead to desired and identified end performance. The problem arises in making intelligent decisions from among the many course possibilities. Baillargeon asserts that our courses be end-oriented rather than means-oriented. That is to say we should determine a set of goals and then develop a plan of activity to reach them instead of developing the course outline without specific reasons for planning any particular activity.[9]

As the name "industrial arts" implies, one of our generally accepted goals is to develop insight and understanding of industry and manufacturing processes. The question is, "Can this goal be best achieved through the use of a production shop class?" This author believes that it can.

There are several variations on how to operate a production shop class. The selection of a method should rest with the instructor and be dependent upon the circumstances involving the school, students, and local needs. A complete description of how the experimental class was organized is provided in Chapter Three.

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[9]Baillargeon, Jarvis, Secondary Industrial Arts, An Instructional Planning Guide (ERIC Document VT 101 223), 1973.

CHAPTER III

METHODOLOGY

The principal goal of this research is to ascertain which of the two teaching methods previously defined for high school wood shop provides the most desirable results. Those results, as stated in the hypothesis, are highest academic achievement, cooperation in social and work efforts, and enthusiasm for the course in general.

To make a comparison, there must be at least two dissimilar methods of completing the same task. Since like most shop instructors, this author had been instructed and taught by the traditional method only, it was first necessary to develop a course outline for a production shop class without prior knowledge of the method.

Development of the Instrument

To gain information on how production shop classes were run, the author studied a number of texts in the Oklahoma State University library for information on how others have been done, then set out to develop an approach of his own.

Since the author teaches two classes of first-year machine woodworking, it was decided to use one class as the experimental group and the other class as the control group. There is a certain amount of information regarding machine operation, safety regulations and general shop procedures that must be given to all students, so there

were no changes in certain portions of the instruction. When the control class selected individualized projects to develop and complete, the experimental class was divided into two-man design and research teams to develop rough plans and cost estimates to submit to "the company" for acceptance as a new project.

The class was permitted to select one of three options in regard to project disposition. They could build, as a class, the same number of projects as students, divide the cost and each have a project to keep; or build several pieces for sale to the general public; or build several to go to the instructor with him paying the costs of materials.

After acceptance of the project by class vote, each student was assigned a part of the project to draw complete plans, compile a bill of materials and work out a flow chart. The students elected from among themselves a shop supervisor, production foreman, accountant, two inspectors, and a finish foreman to be in charge or responsible for the various phases of the production.

All work assignments, whether directly or indirectly related to production, were made by the shop supervisor and/or production foreman on a "work order." Man hours and material costs were recorded on the work orders and then tabulated by the accountant. Production costs and total man hours are items necessary for a real company to establish a product price that provides a profit. The inspectors were to check all precision operations for adherance to specifications before passing the piece on to the next operation. The finish foreman was to organize and oversee the staining and finishing work.

The results of this research were evaluated through the comparison of examination scores between experimental and control class participants, instructor's observations, and a student survey form.

Selection of the Subjects

The author had no control over selection of subjects other than to ascertain which of the two classes would participate as the experimental class. This research project involved thirteen male high school students, twelve classified as sophomores and one as a junior. All participants had completed at least one school year of woodshop prior to this research. Eleven of the students had received their year of instruction at the school in which they are currently enrolled under the same instructor.

Students enrolled in one of the two classes according to which would fit their schedule the best. No attempt was made to redistribute the students according to grade point average or any other criteria. The author discussed his intent with both classes before selecting the experimental class in hopes one class would be totally in favor. Opposition and favor was expressed by both classes, therefore, the author chose the larger of the two classes to work under the production shop method.

Limitations of the Study

The author sees two major limitations to consider when evaluating this research; the number of subjects and the geographical area where the experimental class was conducted. As with any survey or experiment, the larger the population polled or number of participants involved,

the more valid the results. The author acknowledges the limited scope of the research due to the small number of subjects but was unable to alter the circumstances. When evaluating the results of this research the reader is requested to remember that there were only thirteen participants.

Another limitation, although indirect, was the locality in which the research was conducted. This comparative study was set up to be conducted in the public high school in the community of Beaver, Oklahoma. Beaver is a small rural community in an agricultural state where the youth are not generally industrially oriented. Part of the purpose or "advantage" of production shop is the introduction of the students to the methods of industry. If the students do not view industry as a potential career field, then there is a good chance the students will lose interest in preparing for it once the novelty wears off.

There are also various other limitations that would have an effect on the results of this or any other similar experimental class. Those other factors are such things as the various methods of teaching production shop, the students themselves, and the instructor, any of which could affect the outcome.

As stated in previous chapters this author aspired to show that a production system woodworking class would be of more benefit and interest to the students. Accomplishing that general hypothesis would indicate a need to further our study of production shop as the primary instructional tool in woodworking classes. Due to the objectives of most woodworking classes, a maximum of hands-on experience and a minimum of theory, neither an experimental nor a traditional shop class will yield volumes of statistics to support or reject educational

theories. Just as a portion of a shop students' grade is subjective, based on the instructor's observations of the student's attitudes, work habits, and conduct, a portion of the results of this study is based on teacher observation. To facilitate the recording of these observations and the consistency of them, this author devised a form which could be used in any industrial arts class. The teacher's observation sheet will be referred to later in this chapter and a copy is contained in the appendix. Also in the appendix are copies of the examinations given to both classes during the school year and the student critique form completed by the experimental class at the end of the project.

Comparisons between the two classes in the area of academic achievement were done by comparing examination and assignment results. During the year, thirteen letter grades were given for tests and assignments that were used in the analysis. By studying these results this writer hoped to show whether or not the production shop method had shown a tendency to improve academic achievement. Because of the relationship between achieving success and interest in the task, higher scholastic performance could also indicate improved interest in the learning situation.

The final method of evaluation used was the student survey form. When developing or implementing new educational programs the students' preferences are frequently ignored. It is this author's opinion that although students frequently look for the easiest way rather than what is best for them, they should be consulted concerning their classes. People generally resist change when given the opportunity and if they continue to resist after the change has been in effect, then perhaps

the change is not beneficial. Regardless of what educational experts might believe is a good educational program, if the students are not interested, they will not gain the potential benefits of the program. This is not to say they should be consulted prior to implementation of the program or that their opinions should be strictly adherred to, only that they should be considered.

Administration of the Questionnaires

The student survey form questionnaire was given to each student in the production shop class. The students were given some class time plus the opportunity to complete at home and turn in the next day. Instructions were given to answer each question completely and honestly. In an effort to avoid grade induced, biased answers the participants were asked not to sign the completed surveys.

To record student progress, an observation sheet was used to grade four areas of attitude, enthusiasm, work accuracy, interpersonal relations, and acceptance of responsibility. Grades were recorded at two-week intervals throughout the entire year. The performance level of the students in these four categories was based on the experiences of the previous four years of teaching this particular level of high school woodworking.

CHAPTER IV

RESULTS

It has been stated in a previous chapter that a principal aim of this experimental class was to ascertain to what extent woodworking classes might be improved through the implementation of the production shopwork method. It is the purpose of this chapter to present the results of the study.

The following is a chronological review of the progress of the production shop class as it was recorded on the observation sheet. The selection of the project and organizational structure of the class was presented in Chapter Three. A complete description of the project will be found at the end of this chapter.

During the first four weeks of school, the course of study covered general woodworking information relating to careers, lumber species, machines and safety. The only attribute really observable during this period was enthusiasm and it graded good or above average. During the next four weeks the class began the designing, drawing of plans, selection of supervisors and overall planning of the project. Enthusiasm was at its peak in this time frame and was graded as excellent. Work accuracy, interpersonal relations, and acceptance of responsibility came under observation at this time and were also rated as excellent.

By the end of the first nine weeks the lumber had been laid out, rough cut to length, surfaced, and glued together. At this point in

the project all four areas of the project began to grade down. The grading of enthusiasm can best be reported step-by-step rather than week-by-week. At the start of each new procedure enthusiasm would increase from average for the class to good, then as the tedium of the process enveloped the students the enthusiasm would diminish. The procedures of hand planing and sanding created the largest and longest enthusiasm decline; and the squaring of parts was the most frustrating. Not until the last nine weeks or week number 27 did the enthusiasm grade return to excellent. When the class began the assembling of the projects and the piles of parts took a shape and form the enthusiasm improved. Enthusiasm continued to rate high through the rest of the project with the exception of two students who got bogged down on the finish sanding. This is approximately the same enthusiasm pattern exhibited by the class working in the traditional approach.

Work accuracy, as one would suspect, turned out to be more of an individual quality than a class quality. In the early stages of paper work and layout rough cutting all students graded good to excellent. During planing, squaring, cutting joints, and lathe duplication, work accuracy declined to average for some, to fair and poor for others. It is this writer's belief that work accuracy is a reflection of the individual's overall work and study habits and not a result of the particular task undertaken. The project and its parts were the very essence of simplicity, yet several times the students failed to meet specifications or even get very close on some pieces. It is apparent that these students had not previously been required to work to specifications and duplicate their work to make it interchangable. Some of the students strove for high standards of workmanship while others were

ready to settle for any level of quality, which is the same situation observable in any traditional class.

During the conceptual stages of this project the area of interpersonal relations was considered to be a potential problem area. In the traditional class each student works for himself by himself; however, in the experimental class the students had to work together on a common goal with members of the class in supervisory capacities. Personality conflicts, peer group differences and individual idiosyncrasies could all have a negative effect on the outcome of the project. Throughout the entire year interpersonal relations graded good to excellent in the production class. The only problem arose when the students realized the mistakes of a couple of students were going to cost them money for additional materials. Interpersonal relations of the traditional class graded good to excellent.

The acceptance of responsibility in the production class began as very excellent and tapered off to average during the year. At the start of the project the two supervisors would work up the job sheets at home overnight. As the newness wore off, job sheets were not made until asked for. The inspectors never did demand the quality of work they should have. Consequently the products did not fit well at assembly time. The student selected as accountant did a good job of keeping a record of material costs and time involved. The accountant was given the privilege of completing his work at his convenience and would periodically take time to catch up on book work. For the class as a whole, the responsibility grade started as an A and dropped to a C. The acceptance of responsibility remained at an A or B level throughout the year for the traditional class. However it should be pointed out again

that these students were responsible for no one other than themselves.

Academic performance by the two classes was rated by comparing test grades, homework completion and grades. On each test or assignment the grades of the entire class were averaged in both classes to get a comparison between the two. After averaging each grade an average was figured for the entire course. The production shop class averaged 76.6 and the traditional shop class averaged 69.6. This comparison alone would seem to substantiate the hypothesis that the production shop would improve academic performance. However, it should be pointed out that of the six students in the traditional class, three of them were classified as slow learners and learning handicapped by the school counselor's office. To further illustrate the point, of the 15 tests taken collectively by the three, only one test was a passing grade. On the other hand, the average score on the same tests for the other three was 88. In the area of written homework assignments, all students in the production class turned in all four papers; while in the traditional class an exact half of the papers due from the three slow learners were not turned in. It appears to this writer that no accurate comparison on academic performance can be drawn under these conditions.

The final area of evaluation is the student's opinion of the production shop format. Using the student survey form, on question number one, four answered that they did enjoy the production class; three did not. The reason they cited for not liking it was that they did not get to work on their own project. Four of the seven said they would rather have been in the other class. To the question of learning more or less, five felt they learned more and two didn't know.

When asked what areas they might have learned more, six listed different areas such as mass production in general, working together, and the planning stages. Three listed an area they felt they learned less in and one of those was significant enough to mention. He felt he wanted to know that he could build his own project by himself.

Suggestions on question number six included: making a smaller project, making individuals pay for their mistakes, making everybody work harder. One student followed his suggestion by stating when you are not working on your own project it doesn't mean as much to you. The consensus improvement with no limitations was to have larger production type machines. All participants agreed that they had gained an expanded knowledge of manufacturing processes. In regard to the question about a career in industry, four stated that they already had a different career in mind and this project did not change it. Two students said they were turned against industry because it seemed that it would be boring. One boy wrote that he now favored industry as a possible career field.

The next question asked if they would like to be in another production shop class to which six answered no for the same reason--that being that they all wanted to build their own project as a matter of pride and responsibility. One student said that he enjoyed the project. The last question asked what was your general opinion of the experiment. The answers were as varied as the students for different reasons. The feelings ran from "terrible" to "it was fine." One student probably summed up the classes overall feeling when he wrote, "it was fair but not great."

The Project

Since the nature of the project itself could have a bearing on the outcome of the study the object to be produced should be described. The class chose a rather large utility storage item usually referred to as a home entertainment center. Its overall dimensions were 60 x 18 x 40. It consisted of a top and bottom piece, a vertical center divider and two outside dividers set in from the end to allow storage on the ends of the bottom. A stationary shelf 18 x 18 was set between two dividers and two adjustable shelves were set to go between the center and other divider. The adjustable shelves measured 18 x 18 also. A decorative rail was placed at the back of the top and another at the front of the bottom. The whole unit set atop four six inch turned legs. The color of stain was optional with each individual and all units were finished with sprayed lacquer.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The intent of this study was to ascertain to what extent the quality of high school woodworking classes could be upgraded by employing the production shop method of instruction rather than the individualized project method. An experimental class in production shop was devised to run concurrently with a traditional shop class of approximately the same size and the same grade level. The hypothesis stated that the production shop class would increase the relevance of a shop class and the performance and interest of the students. A teacher observation record, student grades, and a "student survey form" were used to determine the success of the experiment.

As the name implies, production shop is organized around the same principles as mass production in industry. The reason for putting a school class on this type of operational structure is to give students an insight into the world of manufacturing. There are many different ways to operate a production class and no material was found to show one method superior to another. This author's experimental class was organized in the following manner. The students studied the materials covering safety, machines, woods technology, planing procedures, and construction techniques as would any woodwork class at this level. In addition lessons on design research, prototype development, plant organizational structure, mass production techniques, work orders, and material

flow charts were given to the production class. A project to be mass produced was selected by the class from the plans presented by the various design teams. Members of the class were elected to various job titles and responsibilities for the duration of the production run. The rest of the year was spent producing the parts and assembling the final product to completion including a finish. The total cost was divided equally between the students and each received a finished project.

The project was successfully completed; however the results did not support the hypothesis. The results of the teacher observation sheet did not show the production students to perform above the control class in the areas of enthusiasm, work accuracy, interpersonal relations, and acceptance of responsibility. In fact, in the area of enthusiasm, the experimental class graded below the other for approximately half of the course. In academic performance no accurate comparison could be made due to the limited learning abilities of half of the control class. When comparing the grades of both classes, all of the students, the experimental class averaged a full seven percentage points above the other. If the grades of the three exceptional students are not included the traditional class averaged twelve percentage points above the production class. The results of the "student survey form" are reviewed fully in Chapter Four. The general attitude of the students toward the class could be summarized as accepting the program but not wanting to do it again. As was stated earlier, there are several methods of conducting a production class and perhaps a different method would have yielded more positive results.

Conclusions

After conducting the experimental production shop class for the 1976-77 school year and reviewing the results of the aforementioned class, the following conclusions can be drawn. A production shop class is not necessarily more relevant to our work society as was reflected in the answers to question number nine on the student survey. Six out of seven stated they planned careers in non-industrial fields.

A production shop class does not in itself increase student interest as shown by the enthusiasm grade and the student survey form.

Production shop class cannot be shown to improve academic performance as reflected in the examination and assignment grades.

No general conclusions can be drawn as to whether this author's findings agreed or disagreed in total with those presented in Chapter Two. No consensus of benefits or disadvantages was presented and the results of this study substantiate some and disagree with others.

Recommendations

In view of the results of this study, the following recommendations are made:

1. Before the potential value of production shop can be discarded the study should be repeated with larger classes, smaller project and totally random classes.
2. That under normal or average educational situations production shop class should not be substituted for the traditional class.

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APPENDIXES

Beaver High School Production Shop

Student Survey Form

1. Did you enjoy the production shop class?

2. Would you rather have been in the other class?

3. Do you feel you learned more or less than the other class?

4. In what areas, if any, do you feel you learned more?

5. In what areas, if any, do you feel you learned less?

6. What could have been done differently (within our power) to make it a better class?

7. With no limitations, what could have been done differently to make it a better class?

8. Do you feel you have an increased knowledge and understanding of manufacturing processes?

9. Did this class change your ideas, either for or against, about a possible career in industry? If so, how?

10. Would you like to be in another production class or would you rather build your own project by yourself? Why?

11. What is your general opinion of the experiment?

INSTRUCTOR'S OBSERVATION SHEET

Attributes		Weeks	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34	35-36
ENTHUSIASM	Brent																			
Key:	Brock																			
A - Excellent B - Good	Coy																			
C - Average D - Fair	Darrold																			
F - Poor	Elvis																			
	Kenneth																			
	Ned																			
WORK ACCURACY	Brent																			
	Brock																			
	Coy																			
	Darrold																			
	Elvis																			
	Kenneth																			
	Ned																			

Attributes		Weeks	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-39	31-32	33-34	35-36
INTERPERSONAL RELATIONS	Brent																			
	Brock																			
	Coy																			
	Darrold																			
	Elvis																			
	Kenneth																			
	Ned																			
ACCEPTANCE OF RESPONSIBILITY	Brent																			
	Brock																			
	Coy																			
	Darrold																			
	Elvis																			
	Kenneth																			
	Ned																			

Shop II SAFETY TEST

Name_____

1. A coat or jacket should be worn in shop: a. only on cold days; b. when operating machines; c. to keep your clothes clean; d. never.

2. It's alright to leave a machine running: a. if you're coming right back; b. someone else is wanting to use it; c. never; d. you don't want someone else to get it.

3. A good clean-up is important because: a. the instructor says so; b. it keeps students busy; c. a dirty shop is a hazard; d. the teacher is too lazy to clean it himself.

4. All adjustments on machines are made: a. before turning it on; b. before it reaches full RPM; c. after it reaches full RPM: d. by the teacher.

5. Running, playing, and throwing things in the shop are okay: a. once in awhile; b. never; c. when everybody does it; d. on Fridays only.

6. The air hose can be used to: a. goose your buddy; b. make your hair stand on end; c. shoot nails; d. clean your project.

7. When ripping narrow stock use: a. a push stick; b. a push shoe; c. one or two fingers carefully; d. hammer in a nail to hold onto.

8. When operating a table saw, stand: a. directly behind; b. slightly to the right; c. directly in front; d. slightly to the left of the blade.

9. When sawing 3/4 inch stock on a table saw the blade height should be: a. 1 1/4 inch; b. 7/8 inch; c. 5/8 inch; d. all the way up.

10. Operate Radial Arm saw with: a. your right hand; b. your left hand; c. both hands; d. depends on whether you're left or right handed.

11. Leave Radial Arm saw: a. off with blade spinning; b. off at the front of arm; c. off at back of arm with blade spinning; d. off at back of arm with blade stopped.

12. When crosscutting on Radial Arm, stock should be: a. held firmly against fence; b. held in the middle of table; c. not held because of danger; d. none of these.

13. When jointing a face use: a. a push stick; b. a feather board; c. a push shoe; d. let someone else do it.

14. To operate a jointer, stand: a. beside infeed table; b. beside outfeed table; c. behind infeed table; d. behind outfeed table.

15. The jointer guard can be held open when cutting: a. to watch knives cut; b. to check depth of cut; c. to check direction of rotation; d. never.

16. Surfacing two boards of different thickness together may result in: a. no problem at all; b. serious kickback; c. thin board being cut too deep; d. none of these.

17. When operating a surfacer, stand: a. directly in front of machine; b. to the left of machine; c. to the right of machine; d. makes no difference.

18. Looking into surfacer while board passes through could result in a trip to the: a. morgue; b. hospital; c. classroom; d. all of these.

19. If the chip exhaust becomes clogged while cutting, clean it with: a. your hand; b. a screwdriver; c. a board; d. stop it to clean it.

20. The upper guide of the bandsaw should be set approximately: a. 1 inch; b. 1/2 inch; c. 1/4 inch; d. 0 inch; above the stock to be cut.

21. The most dangerous place to stand around a bandsaw is: a. to the right; b. to the left; c. in front; d. behind.

22. The most dangerous machine in the shop is the: a. Shaper, b. Jointer, c. Table Saw; d. Band Saw.

23. Most machine accidents happen on the: a. Shaper; b. Jointer; c. Table Saw; d. Band Saw.

24. Tool Rest on the lathe should be set: a. 1/2 inch above center; b. 1/2 inch below center; c. 1/8 inch above center; d. 1/8 inch below center.

25. What is the key to operating shop machines safely?

Shop II 1st NINE WEEKS TEST

Name_____

1. For furniture to be useful, attractive, and convenient it must be

_____.

2. What 3 basic materials are used in the construction of furniture?

1.
2.
3.

3. What are the 3 main parts of a tree?

1.
2.
3.

4. What are the 2 basic classes of trees?

1.
2.

5. Name 6 hardwoods we keep in the shop.

1.
2.
3.
4.
5.
6.

6. Name 2 softwoods we keep.

1.
2.

7. When a tree is first cut down it contains from _____ to _____ percent moisture.

8. What is the best method of drying lumber for furniture?_____

9. Changes in humidity will affect the _____content of furniture.

10. The most common lumber defect is _____.

11. What is the formula for figuring BF?

12. After you've made a rough sketch or obtained a photo of what you're going to build, you then make a _____ _____.

13. Your next step will be to make a _____ of _____.

14. After your lumber has been rough cut to length on the _____ _____ saw, you run a _____ _____ and _____ _____ on the _____ to eliminate warp before running it through the _____.

15. For edge glueing we use _____ clamps.

16. A glue joint should be allowed to dry for _____.

17. Name 8 kinds of joints.

    1.
    2.
    3.
    4.
    5.
    6.
    7.
    8.

18. Furniture pieces intended for storage are called _____.

19. The ideal machine for cutting blind or stop dadoes is the _____.

20. On power saws do the teeth rotate toward or away from the operator?

21. The width of cut the blade makes is known as _____.

22. Feeding a board across a jointer too fast results in _____.

23. The _____ table of a jointer must be correctly set to insure a proper cut.

24. The size of the surfacer is determined by the _____.

25. If you wanted to mitre a picture frame on the table saw you would use a _____ _____ to help make the cut.

26. When ripping narrow stock use a _____ _____.

27. To cut a lot of pieces to the same length you clamp on a _____ _____.

28. A soft aluminum cover around a table saw blade is called a _____.

29. To cut a taper on the table saw you need a _____ _____.

30. The size of a band saw is determined by the _____.

31. The rubber rim on a band saw wheel is called a _____ and the process of making the blade run centered on this rim is called _____.

32. _____ _____ are made to relieve tension on the blade during long or tight arcs.

33. The most dangerous machine in the shop is the _____.

34. Our shaper uses the _____ _____ shaper cutter.

35. When shaping an edge on a square table you shape the _____ first.

36. How many board feet are in each of these:

1.	75 inches long	9 inches wide	1 inch thick
2.	9 feet long	9 inches wide	1 inch thick
3.	52 inches long	3 1/2 inches wide	2 inches thick
4.	5 feet long	7 inches wide	1 inch thick, 3 boards
5.	2 feet long	2 feet wide	2 inches thick

37. Define the following:

FAS
T&G
RW&L
SND
OSU

38. What is the most widely used wood for cedar chests?_____

Shop II PLYWOOD UNIT

Name_____

1. Plywood has the following strong points (one wrong): a. greatly prized by the average consumer; b. great strength; c. low warping and checking; d. changes little from moisture.

2. Plywood consists of layers of _____ and/or wood glued together under pressure.

3. The best outside veneer is called the _____veneer and the opposite side the _____ veneer.

4. Another name for layer is _____.

5. The innermost layer is called the _____.

6. Plywood is made in three different ways. Match left to right:

A. particle-board core	strips of lumber glued together_____
B. veneer core	core made of wood composition material_____
C. lumber core	core made of thick wood veneer_____

7. Veneers for plywood are cut from the trunk of a tree by_____ principal methods.

8. Most veneers are cut by the _____ method.

9. The adhesives used in making plywood determine where it can be used. T or F

10. The front and back of a piece of plywood can have different grades. T or F

11. Interior-type softwood plywood may be used outdoors. T or F

12. Two of the grooves on a sheet of plywood paneling match what standard construction measurement?

13. The best base for plastic laminates is_____ .

14. A common name for hardboard is _____ and it is used a great deal for _____.

15. Hardboard is less stable than solid wood or plywood. T or F

16. Particle board is made by combining waste wood particles with _____.

17. Particle board, hardboard, and plywood are usually manufactured in panels measuring _____ feet by _____ feet and are sold by the panel or the _____ (unit of measure).

18. Glueing layers of veneer together in different directions (direction of grain 90° out of phase) is called_____.

19. Hardboard and particle board can be worked with standard woodworking tools. T or F

20. Abe Lincoln made his famous Gettsyburg Address in what city?

Shop II NINE WEEKS QUIZ

Name_____

1. All adjustments on the circular saw are made: a. while the machine is coasting; b. by the teacher; c. while machine is at a dead stop; or d. while power is on.

2. When tailing off stock on the circular saw, the helper must: a. support stock underneath but not grasp it; b. pick up all tailings that might cause an accident; c. use a brush when cleaning up tailings; d. hold the stock and pull gently.

3. At the completion of each cut, the radial arm saw blade must be: a. returned to its position behind the guide fence; b. removed and placed in its proper place; c. rotated below guide fence; or d. left at a point nearest to the operator.

4. It is best to set upper saw guide of the band saw: a. when power is off and saw is coasting; b. 1/4 inch or less above the stock; c. tight against the stock; d. 1/2 inch or more above stock.

5. It is best to set lathe tool rest so it is: a. in slight contact with the stock, thus reducing clatter; b. below and to right of center; c. the same width as the lathe tool being used; d. 1/4 inch or less from stock.

6. When starting lathe for beginning operation, you should use: a. the highest speed; b. the lowest speed; c. any belt or gear ratio; d. a tool rest with a 3:1 ratio.

7. For safety purposes it is wise to limit your depth of cut when jointing an edge to: a. 1/8 inch; b. 1/4 inch; c. 3/16 inch; d. none of these.

8. Depth of cut on a jointer is adjusted: a. after machine has reached full RPM; b. before turning on machine; c. either; d. neither.

9. Kickback on jointer is caused by: a. dull knives; b. too deep a cut; c. knives of uneven height; d. all of these.

10. Trial cuts on the shaper are made with scraps that are the same: a. kind of wood; b. same thickness; c. both of these; d. it doesn't make any difference.

11. When shaping feed the stock: a. against the direction of rotation; b. with the rotation; c. always from the operator's right; d. it doesn't make any difference.

12. When operating surfacer you should stand: a. behind the machine; b. in the area painted red; c. in front of the machine, provided you have someone to tail it off; d. in an upright position and to one side of the machine.

13. Stock to be run through the planer must have a minimum length:
a. determined by depth of cut; b. determined by width of lumber;
c. equal to or greater than the distance between feed rollers;
d. 15 inches.

14. Before changing bits or cutters or making adjustments on the router, you should make sure: a. the electric end is disconnected from the power source; b. other students are at a safe distance;
c. to turn blades by hand; d. one hand is free.

15. Before plugging in the portable electric drill, you should:
a. remove the drill bit; b. check the armature; c. make sure the switch is off; d. disconnect the ground wire.

16. Touching moving belts or pulleys may: a. cut off a finger or hand;
b. get belts out of adjustment; c. get grease on your hand.

17. The war of 1812 was fought in: a. 1776; b. 1913; c. 1895;
d. none of these.

Shop II SEMESTER TEST

Name_____

1. Name 5 main parts of the jointer.

   1.
   2.
   3.
   4.
   5.

2. How is the size of a jointer determined?

3. What controls the depth of cut (jointer)?

4. What determines the size of a bandsaw?

5. How do you fold a bandsaw blade for storage?

6. Which type of table saw do we have, universal or variety?

7. What determines the size of a circular saw.

8. Which machine is considered the most dangerous in the shop?

9. What determines the size of a surfacer?

10. Name 4 parts of the lathe.

    1.
    2.
    3.
    4.

11. What is a push shoe used for?

12. How is lumber measured and sold?

13. How is plywood measured and sold?

14. How is moulding measured and sold?

15. Name 2 ways to dry or season lumber.

    1.
    2.

16. Name 6 hardwoods.

    1.
    2.
    3.
    4.
    5.
    6.

17. Name the 3 kinds of clamps we have in our shop.

    1.
    2.
    3.

18. Name 3 softwoods.

    1.
    2.
    3.

19. What makes the best base for plastic laminates?

20. Name 5 kinds of joints.

    1.
    2.
    3.
    4.
    5.

21. Name 2 common types of plywood construction.

    1.
    2.

22. Give 2 reasons why plywood is better than solid for large surfaces.

    1.
    2.

23. What is the difference between furniture labeled solid walnut and genuine walnut?

24. What material is replacing wood for decorative carvings?

25. What is the formula for figuring board feet?

26. List what you have done this semester and what grade you expect for it.

Shop II LATHE AND PORTABLE POWER TOOLS

Name_____

1. Only the _____ should stand near the lathe when it is in operation.

2. Keep the _____ as close to the work as possible at all times.

3. Never use a(n) _____ on the inside of bowls when faceplate turnings.

4. Name 3 common measuring tools used by the wood turner.

   1.
   2.
   3.

5. The_____ is used for rough cutting on the lathe.

6. A finish of shellac and alcohol commonly applied to turned parts is called _____.

7. After cutting a groove with a parting tool, use a(n)_____ to cut a shoulder.

8. Smooth or finish straight turning is done with a(n)_____.

9. A router can be used to cut a rabbet. T or F

10. The shape of a decorative edge can be changed by moving the _____ up or down in the base.

11. When making a cut on a straight edge, feed the router from _____ to _____.

12. When cutting on circular stock, feed in a _____direction.

13. Cutting an internal opening without first drilling a hole is called _____.

14. Saber saws are used for irregular cutting only. T or F

15. _____ can be cut using the guide as a radius arm.

16. For cutting thin plywood you should use a _____(fine) (coarse) toothed blade.

17. A variable speed electric drill can be used as a screwdriver. T or F

18. The most common sizes of electric hand drills are the _____ and _____ inch.

19. The one common material you do not attempt to drill through is _____.

20. Portable power saws should reach full RPM before beginning to cut. T or F

21. The saw blade should clear the bottom of the work by _____ inch.

22. Miter cuts and ripping can be done freehand with this saw. T or F

23. Circles can be cut with this saw by using the guide as a radius arm. T or F

24. To make a(n) _____ cut the shoe is tilted to the desired angle after loosening the wing nut.

25. The size of a belt sander is determined by the _____ and _____.

26. The arrow printed on a sanding belt should always point to the front of the sander. T or F

27. Making the belt run centered on the sander is called _____.

28. The size of a pad sander is determined by _____.

29. When operating an orbital sander a(n) _____ amount of pressure is used.

30. The belt sander should be operated across the face of the board from left to right and back to left. T or F

31. To unplug a portable power tool you grasp the cord firmly behind the machine and jerk the cord from the receptacle. T of F

Shop II FINISH TEST

Name_____

1. A fine finish on furniture improves the _____ and increases the _____.

2. Before a piece can be finished all surfaces and edges must be well _____.

3. Excess glue should be removed with sandpaper only, before finishing. T or F

4. Slight dents can be raised by putting water on it. T or F

5. Large dents and holes can be filled with a varnish stick. T or F

6. Water Putty, Plastic Wood, and Sawdust and glue are all acceptable fillers. T or F

7. Plastic Wood should be sanded immediately before it gets too hard. T or F

8. Remove machine marks by sanding across the grain. T or F

9. Surfaces may be dusted with an alcohol moistened rag just prior to finishing. T or F

10. Always use a sanding block when sanding flat surfaces. T or F

11. Four types of abrasives are used in woodworking. T or F

12. "Wet or Dry" sandpaper is used for rough sanding. T or F

13. There are three (3) methods of grading sandpaper. T or F

14. The first step in many blond finishes to to bleach the wood. T or F

15. A washcoat will prevent the wood from absorbing excessive oil from the filler. T or F

16. Woods like cherry, birch, maple, and cedar should be filled. T or F

17. Fillers add color and close the pores of the wood. T or F

18. Sealer is applied over varnish or lacquer to seal and waterproof it. T or F

19. Lacquer can be sprayed but it is more satisfactory brushed on. T or F

20. Most finishes are sanded between every coat of finish. T or F

21. Pumice Stone and Rotten Stone are used as abrasives on finishes. T or F

22. A one-inch brush is considered best for most finishing procedures. T or F

23. Turpentine is refined from oil. T or F

24. Wood may be bleached to achieve a blond finish. T or F

25. The two most common stains are oil and spirit. T or F

26. Oil stain should be allowed to dry 24 hours before proceding. T or F

27. Water stain raises the grain so you need to sponge the surface with water. T or F

28. Filler is used to smooth out the surface of open grained wood. T or F

29. Spattering is done to simulate flyspecks. T or F

30. Distressing is done to make furniture Spanish Style. T or F

31. It is best to varnish when the temperature is about 50^{o}. T or F

32. The term "4 pount cut" refers to a piece of walnut cut so that it weighs 4 pounts. T or F

33. Shellac is a very desirable finish although it is not waterproof. T or F

34. You apply varnish with and across the grain then finish with the grain. T or F

35. Lacquer is the best top coat finishing material available for furniture. T or F

36. Lacquer should be brushed on because it dries slowly. T or F

37. Pumice stone and rotten stone may be used in place of stain. T or F

38. Wax is used for protection against moisture and to give it a luster. T or F

39. A brush that is to be used again soon can be set on the bottom of a can with solvent in it. T or F

40. The name of our text book is "Advanced Woodwork and Furniture Making" by J. L. Feirer and G. Hutchings. T or F

Shop II FINAL

Name_____

True or False: Indicate your answer by writing T or F preceding the question.

1. Willow heartwood is dark and makes a good substitute for Walnut.
2. Air drying of lumber is the most popular method because it's more controllable.
3. Warp may be removed from a board by running it through a surfacer.
4. Plastic is being widely used as a wood substitute by the furniture industry.
5. Thin sheets of wood are glued together in odd numbers of layers to make plywood.
6. Two common types of plywood construction are thick sheets and thin sheets.
7. Particle Board makes the best base for plastic laminates.
8. Tables and chairs are referred to as case goods by furniture makers.
9. The letters FAS mean "Fine and Solid" to the furniture maker.
10. RGH means the lumber has not been surfaced at all.
11. Moulding and trim is measured by the linear foot.
12. The size of a bandsaw is determined by the diameter of its wheels.
13. Our table saw is a 25-inch saw because that is the maximum width it can rip.
14. A push-stick is used to crosscut narrow stock.
15. Plywood is measured and sold by the board foot.
16. A solid Walnut furniture piece probably has some plywood in it.
17. Since plywood doesn't shrink or warp easily, it is sometimes better for large surfaces than solid wood.
18. The depth of cut on a jointer is regulated by the infeed table.

True or False (continued)

19. The size of the jointer is determined by the length of the tables.

20. The formula for figuring board feet is $\frac{L \times T}{12}$.

21. Frame and Panel construction is widely used in case-good construction.

22. After the last coat of finish the project should be rubbed with an abrasive compound.

23. The three methods of rough sawing lumber are quarter, half, and rift sawn.

24. Our table saws are variety saws because they have only one arbor.

25. Spirit stain is considered the best for general shop use.

26. Name six hardwoods in our shop:

1. 3. 5.
2. 4. 6.

27. Name two softwoods in our shop.

1. 2.

28. What determines the size of a surfacer?

29. What machine would you use to cut a blind dado?

30. Name six common types of joints.

1. 3. 5.
2. 4. 6.

31. What three types of clamps do we have in the shop?

1. 2. 3.

32. Name the two basic types of turning on the lathe.

1. 2.

33. Name the three operations performed by a Screw-Mate.

1. 2. 3.

34. Name five operations that can be done on the radial-arm saw.

1. 3. 5.
2. 4.

35. Name the four kinds of warp.

1. 2. 3. 4.

36. What should be used to clean brushes used to apply Deft and other lacquer base finishes?

37. Which type of finish has the highest sheen: gloss, semi-gloss, or satin?

38. What is the term for the amount of wood cut away by the width of the saw?

39. Give two of the books six reasons why wood is the most popular material for furniture.

1.
2.

40. Before work on a project can start name two things that should be done first.

1.
2.

41. Compute the answer to the following board feet problems.

1.	85 inches long	5 inches wide	1 inch thick
2.	4 feet	6 inches	2 inches
3.	125 inches	3 inches	1 inch
4.	11 feet	8 inches	1 inch
5.	12 inches	1 foot	2 inches

42. Match the kinds of wood with the numbers on the boards.

Walnut	Fir	1.	7.
Willow	Particle Board	2.	8.
Cedar	Oak	3.	9.
Ash	Mahogany	4.	10.
Pecan	Cherry	5.	11.
Birch	Solid-Core Plywood	6.	12.

43. Name these tools.

1.	7.	13.
2.	8.	14.
3.	9.	15.
4.	10.	16.
5.	11.	17.
6.	12.	18.

44. Bonus: (5 points): Name your text and its author.

VITA

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