CERAMICS AS AN EXPERIENCE AREA
IN THE INDUSTRIAL ARTS PROGRAM

by

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CHAPTER I
INTRODUCTION

Definition of Ceramics

The Encyclopaedia Britannica, under "Pottery and Porcelain" gives the following definitions: "The word pottery in its widest sense includes all objects fashioned from clay and then hardened by fire; ...... 'Ceramics' or 'Keramics' ...... is a general term for the study of the art of pottery. It is adopted for this purpose both in French (ceramique)* and in German (Keramic)." (9, p.338)

Class of Ceramic Products Studied

The type of pottery with which this study is concerned is that which might be called "Art Craft Pottery." It is made by forming the clay into the desired shape, figure, or hollow vessel, firing it, applying glaze to the surface or surfaces to be so treated, and firing again. The first fire matures

* Underlined words are in italics in the original.
or vitrifies the clay, the second fuses the particles of glaze which, in suspension in water, have been applied by brushing, dipping, or spraying.

Statement of the Problem

The purpose of this study is to evaluate the validity of "Ceramics" as an experience area in the industrial arts curricula of Oregon high schools.

Limitations of This Study

This study will be confined to a consideration of ceramics as an experience area in the industrial arts curricula of the high schools of Oregon.

Consideration of the subject for use in the industrial arts curricula means that it will be studied only as a part of the general education of the pupil. This study is not concerned with vocational training in the ceramic industry except in the guidance function of the industrial arts program.
Method of Evaluation

The evaluation will be made by examining the subject from the viewpoint of the recognized objectives of the industrial arts program in the high school. Following a statement of each objective, ceramics will be discussed regarding its adaptability to the achievement of that objective.

In addition to the discussion of its possibilities with reference to the objectives of industrial arts, ceramics will be considered also with regard to two factors important in the selection of industrial arts shop subjects. These factors are: the desirability of increasing the number of experience areas and media in industrial arts (15, p.46) (16, p.3); and the necessity to provide for co-educational opportunity in the shop program. (15, p. 48) (16, p.17)

Discussions of these topics with reference to ceramics will follow the discussions of the objectives.

This method of evaluation is used with the thought that if the subject offers suitable opportunities for attaining the industrial arts objectives and fits the needs for expansion of that activity, it (ceramics) is a valid experience area in that field.
Industrial Arts Objectives Selected for This Study

The objectives of industrial arts programs have been compiled and discussed by many individuals and groups of individuals. They have been stated in many ways and divided into varying numbers of aims. The variation, however, is mainly one of arrangement or grouping and of different ways of expressing the same ideas. Some are as old as industrial education itself; some are very recent.

For the purposes of this study, the objectives formulated by a National Committee for the Industrial Arts Division of the American Vocational Association have been taken as the "standard" objectives. These are stated as follows:

1. Interest in Industry.--To develop in each pupil an active interest in industrial life and in the methods and problems of production and exchange.

2. Appreciation and Use.--To develop in each pupil the appreciation of good design and workmanship, and the ability to select, care for, and use industrial products wisely.

3. Self-discipline and Initiative.--To develop in each pupil the habits of self-reliance, self-discipline, and resourcefulness in meeting practical situations.

4. Cooperative attitudes.--To develop in each pupil a readiness to assist others and to join happily in group undertakings.
5. Health and Safety.--To develop in each pupil desirable attitudes and practices with respect to health and safety.

6. Interest in Achievement.--To develop in each pupil a feeling of pride in his ability to do useful things and to develop worthy leisure-time interests.

7. Orderly Performance.--To develop in each pupil the habit of an orderly, complete, and efficient performance of any task.

8. Drawing and Design.--To develop in each pupil an understanding of drawings, and the ability to express ideas by means of drawing.

9. Shop Skills and Knowledge.--To develop in each pupil a measure of skill in the use of common tools and machines, and an understanding of the problems involved in common types of construction and repair. (1, p. 51)

It should be noted that these objectives were formulated by a National Committee for the Industrial Arts Division of the American Vocational Association.

The association is devoted to the interests of industrial education. Industrial education includes two well-defined phases of secondary school activity: i.e., industrial arts, that phase concerned with the general education of the pupil, and vocational education, which is concerned with the pupil's preparation for a specific vocation.

The aims or objectives in these two definite phases of industrial education are also well defined. All the objectives of the vocational phase point to
the pupil's participation in industry. The objectives of the industrial arts division point toward a well rounded knowledge of industry as part of the general education of the individual.

The members of the committee which formulated the objectives of industrial arts education are all nationally known industrial educators, many of whom have been instrumental in defining the functions of the two divisions of industrial education in the schools of this nation. (1, p.2)
CHAPTER II
HISTORY OF INDUSTRIAL ARTS CERAMICS

Oregon

According to George B. Cox, Professor of Industrial Arts Education at Oregon State College, there is practically no history of ceramics as an industrial arts experience area in the high schools of the state of Oregon.

Many factors probably contribute to this condition. The first one, and without too much doubt the strongest contributor, is the small amount of ceramics manufacturing in this state. In the past industrial arts has largely followed tradition by considering first woodworking, then metalworking in one form or another, as the most desirable areas in which to meet the current objectives of the industrial or manual phases of education. Not too many years ago the name "Manual Training" had a strong connotation toward what we now call Vocational Training or Vocational Education. For this reason any digression from the conventional woodworking or metalworking in school shops tended to follow the trend of the commerce and industry of the community concerned. It is easy to
understand that the state's one stoneware plant and a few small brickyards exerted little influence toward an interest in ceramics as a school subject.

A very little school activity in the pottery field has taken place in the art departments of Portland high schools and in four institutions of higher education: Oregon State College, the University of Oregon, Reed College, and Lewis and Clarke College. Only recently have the Portland high schools made any move toward providing kilns for their art departments.

The ceramics program at the University of Oregon has been in operation in the art school for many years but the university provides few teachers for the industrial arts programs in the high schools of the state.

Oregon State College, while contributing most of the industrial arts teachers to those same high schools, has provided only sporadic activity in the ceramic field, in the art department, and no activity at all in the industrial arts department. Pottery was taught in the Art Department from the school year 1914-1915 (14, p.324) to 1932, then discontinued until 1937. Instruction was resumed on a limited scale in 1937 when green-ware was taken to Portland for firing and glazing, because the kerosene kiln
previously used had been ruined in moving from one building to another. A new electrically fired kiln was built in 1940 and used until 1942 when its nichrome elements, irreplaceable at that time, burned out. Pottery instruction was resumed in 1947-1948, after new element wire became available and was installed. This brief history accounts for the second contributing factor in point of importance—the lack of teachers.

The Oregon State Course of Study for Industrial Arts, published by the State Department of Education in 1937 suggests ceramics for the secondary schools under the heading "General Crafts" (6, p.71), but to the present no school has seen fit to include ceramics in a program.

Early Developments in the United States

The earliest instruction in ceramics in the United States was undoubtedly carried on under the apprenticeship system because potteries were small establishments catering to the needs of a town or a group of towns located near a source of suitable clay. Bricks were probably the first products considered, the pottery in use then being imported from Europe.
Research for the Williamsburg Restoration uncovered the fact that the capitol building at Williamsburg was built of brick dug and fired at the building site.

Formal schooling in ceramic processes and products was mentioned by Lockwood (4, p. 178) in connection with the New Harmony school in Indiana, in 1826. A report on a survey of instruction in juvenile reformatories (4, p. 249) shows that inmates in Maine were receiving instruction in brick and tile making in 1867. The Hampton Normal and Industrial Institute (4, p. 245) added brick making one year after its opening in 1868. In 1869 a School of Design (4, p. 406), now part of the Cincinnati Museum Association, opened with ceramics as part of the original course of instruction.

The New Harmony and the Cincinnati schools were probably influenced by the location of clay beds and local industry. Their work is described as "pottery" (4, p. 178) and "the art industries--ceramics,…….." (4, p. 406) respectively. The others are described definitely as brick and tile making projects.

Since that time the objectives of industrial arts have become more closely allied with those of general education. The 1937 publication of the Oregon State Course of Study for Industrial Arts in Secondary
Schools cites the present-day place of industrial arts as an instrument of general education, showing it as a study of industry rather than wholly as a preparation for participation in industry. In that course of study Cox (6, p.8) wrote as follows:

Science is a desirable asset to the secondary school program of this scientific age, not so much for vocational training as for creating a background by which young people can interpret scientific advancement and appreciate the contributions of scientists. In like manner industrial arts is an asset to the secondary school program in an industrial era. Both industrial arts and science serve the aims of general education; both are concerned with giving to the masses the insights and appreciations necessary to an understanding of the problems of industry and science.

The three vital elements in present-day civilization are science, industry, and the social-economic structure. The development of modern youth would be one-sided in the absence of an opportunity for a general background and some training in each of these three elements.

With the change of objectives of industrial arts and increased communication facilities it is no longer necessary for industrial arts to confine its activities and experience areas to the limits prescribed by local interests in industry or to local sources of supply. In fact, under the newer objectives, it might be considered advantageous to expand beyond the fields represented by local industry so as to provide a picture
of industry in other parts of the country and other parts of the world.

Clay supply is no longer a problem of local deposits. Schools and manufacturers ship blended clay in hundred-pound sacks hundreds of miles at no great expense so that interest and activity in ceramics have spread regardless of the presence or absence of nearby sources of suitable clay and of centers of industrial activity in that field.
CHAPTER III
CERAMICS ACTIVITIES OF THE SCHOOL SHOP VS. THE OBJECTIVES OF INDUSTRIAL ARTS

In this chapter the assumed contribution of ceramics as a shop subject will be weighed against the salient points of the accepted objectives of industrial arts as previously cited. Under the heading of each separate objective, the contributions possible to derive from activities and experiences in ceramics will be presented and discussed.

Interest in Industry

The ceramics instructor might proceed in a number of different directions in developing interest in industry within his pupils. Probably his best approach would employ the pedagogical practices of proceeding from the known and familiar in the pupil's experience, to the unknown and the unfamiliar.

For that reason, he or she could include in the informational material of the course a thorough examination of the products of the ceramics industry. Again proceeding from the known to the unknown, the starting point could be the familiar objects of
the home: brick, tile, dishes, plumbing and electrical fixtures.

From this beginning the discussion can lead toward the physical properties of ceramic materials in their finished states. The discussion could include: durability under exposure to weather, heat, scouring, and water; beauty and the durability of color and finish in comparison to paints and metals; insulating value in electrical fixtures; refractory value in the control of heat; weakness under a bending stress; strength under a compression stress; impermeability to water under certain conditions. In short, the discussions could include all the useful properties of ceramic products, and mention such methods of application as bricklaying and tile setting.

The school shop methods of forming clay; slip casting, building, throwing, and pressing provide the pupil with sufficient background to understand an explanation of some of the commercial methods of production. Slip casting is used in the manufacture of many commercial products with a slight change in the plaster molds used, to speed production. Press molding is sufficiently similar to jiggering to enable the teacher to bridge the gap with sketching and lecture.
Demonstrations and manipulation of the clay should raise some questions among the pupils as to its origin. Where was it obtained? What makes it plastic? Is it used just as it was dug up? Will all natural clay make pottery? If not, what refinement is necessary? Are there suitable clay deposits in Oregon? What is the difference between white clay bodies and red clay bodies?

The answers to these questions can be an introduction to the chemistry and geography of ceramics in Oregon, the nation, and the world. They can also lead to a discussion of other forces that govern the location of certain industries. Why is the pottery industry so well developed in Ohio? In France? What is the distinguishing characteristic of the pottery from each of those locations? What is the source of the clay which is used in the school shop?

The business of distribution can be studied on a tangible base by tracing the course of a sack of Kentucky ball clay from pit to consumer.

Suppose the pupil likes his work in clay to such an extent that he wishes to know the employment opportunities. The shop teacher can then assume his very important role in the guidance pattern.
The ceramic industry offers employment at three different levels just as other industries do. On the professional level we find the ceramic chemist and the ceramic engineer. For the would-be entrepreneur, we find opportunity in a manufacturing endeavor that can be started on nearly any scale, depending on the wishes or capital of the participant. For the laborer there is work at any level of skill or ability from the clay mixer to the caster; from the sponger and trimmer, to decorator, to designer.

The pupil's vocabulary can be increased by a whole new set of words. Pottery, porcelain, glaze, slip paint, may become something more than a meaningless gibberish uttered by a glib-tongued clerk.

Appreciation and Use

One of the most important functions of industrial-arts work is the development of "consumer literacy" and the sense of esthetic values. Pupils should be led to distinguish between the bizarre effects that prevail for a time and the quieter designs and constructions that are more clearly based upon simplicity, adaptability, proportion, and harmony. They should be taught to be discriminating in the selection and use of what they may purchase, the many common things that vary so much in kind, cost, and permanence. (1, p.53)

The above statement is so appropriate regarding pottery on the market today that it is quoted directly.
"To develop in each pupil the appreciation of good design and workmanship and the ability to select, care for and use industrial products wisely" (1, p.53) covers a very large field. This objective can be met partly in the pottery laboratory, as in other industrial arts areas, by giving the pupil the opportunity to attempt the production of a good piece of pottery designed for a certain purpose. That experience, however, will not meet this objective fully. But it will present difficulties and problems of design, production, and materials so concretely that the "receptive mind"—that entity which is so necessary to efficient learning—should be thoroughly established. The making of a simple, small pottery bowl will contribute immediately to all the points covered in the objective stated at the opening of this paragraph.

A typical first project, a slip-cast round bowl for soup, cereal, or flowers will illustrate. First there is "good design" to consider. If it is to be table-ware, there should be no sharp corners inside. It should be stable, so it should have a large enough foot to achieve that characteristic. Its intended use will govern its size and the relation of height to diameter, to obtain the desired volume. Then a clay "core" is built up and turned to the
desired outside shape of the bowl. Plaster is cast around this core to make a mold for the actual pottery pieces. The mold must then be cleaned and trimmed and a quantity of clay mixed and strained for "slip." The bowl is slip-cast, design again governing thickness. It is then sponged inside and out, signed, and allowed to dry. A final trimming of any sharp corners with sandpaper leaves it ready for the biscuit fire. Workmanship in sponging, trimming, and sanding will all show in the finished piece.

After the first fire, its intended use must be considered in the selection of glaze, portions to be glazed, and the colors to be used. The second firing fuses the glaze and the piece is finished.

After the pupil's first experience with design he should lend an avid ear to discussions of that subject. Commercial design and studio design can be compared and discussed. All the problems that influence design will bring to mind all the various grades of pottery.

The teacher, at this point, can discuss the grades of pottery with relation to the characteristics that place a piece in one class or another. Volume, method of manufacture, and decoration all govern the cost and quality of the product. Examples of
table-ware can be discussed with regard to design, shape, finish, decoration, probable method of glazing and firing and the influence of these items as they affect price.

Variety and gift-store "knick-knacks" can be compared to the so-called "decorator's pieces" as to design, workmanship, decoration, probable method of manufacture, materials, and volume of production as these items affect price. Method of distribution in volume manufacturing as it affects the quality of the pottery is interesting and enlightening. Comparison of items shipped long distances by the dozen or gross will show they are made much thinner than the decorator's pieces mainly to reduce shipping costs. This practice is abandoned when the ware is large and the volume is sufficiently great to warrant carload shipments. In this type of product durability is important and there is little danger of exceeding the car load weight limits.

Glaze and decorative treatments are important from the utility viewpoint also. In the discussion of possible glazes the difference in porosity of various glazes should be pointed out. Matt glazes, being more porous than gloss glazes, should be avoided in table-ware. Likewise "crazing" should be
pointed out and explained. "Slip decorated" pieces in which the slip has been painted in too thick a coat should be avoided in ware that is to be washed and all-over glaze is necessary in ware that will be immersed in the dishpan because of the absorbent qualities of unglazed bisque.

A discussion of the foregoing subjects, based on the pupil's laboratory experience can add materially to his or her intelligence in selection of ceramic ware for decoration or utility in the home.

Precautions in the use of ceramic products will be brought out in the handling of bisque and finished ware around the laboratory. Too rapid cooling of ware in unpacking the kiln can cause crazing in the glaze. The same results occur when low-fired ware is used in the oven.

The pupil can learn that all ceramic ware is not waterproof and that precautions must be taken on this account when decorative vessels are used to hold flowers on fine furniture.

The pupil learns, too, that glaze is brittle. Indiscriminate piling of dishes can chip or rub dull spots in an otherwise beautiful glaze, and enamel on range tops, refrigerator linings, steel bathtubs,
sinks, and cooking utensils can be permanently marred by rough handling or by contact with harsh abrasives.

**Self-discipline and Initiative**

"To develop in each pupil the habits of self-reliance, self-discipline, and resourcefulness in meeting practical situations." (1, p.54)

Self-reliance in the individual can be the result of having solved a problem, or having completed a job successfully. The individual feels that if he did it once, he can do it again. The industrial arts department places the pupil face to face with a problem in the form of a shop project and leads him to its successful completion. Each project completed, then, builds up the self-reliance of the individual if the projects are properly graded to introduce new "how to" items or skills in each successive problem. Failure along the way, if it means a great loss, can produce the opposite effect; the greater the loss, the greater the effect.

In the pottery laboratory, the course of study should be built up to lead the pupil through the skills readily learned to those of a more difficult nature, and finally to the application of all the skills on
the more difficult projects involving a combination of operations.

Pottery projects have a particular advantage that fits them for the development of self-reliance. It lies in the fact that failure in an operation does not mean a great loss of time and material, hence there is no great opposite effect in the development of the desired self-reliance. It has another advantage on the positive side, in that many projects can be turned out in a semester. The greater the number of graded projects completed and skills mastered, the more pronounced is the development of self-reliance. If kiln facilities are insufficient to complete all projects, the pupil can exercise critical judgment in selecting the number he is allowed to fire.

In some ways, the potter's craft is a hard task master. The work is not hard or disagreeable but the pottery project, once it is started, demands reasonably consistent attention right up to the point where it is ready for its first firing. The demand is due to the moisture content of the clay. When a piece is pressed, poured, thrown, or modelled it contains enough moisture for plasticity sufficient to the method employed. Then it must be finished. Sponging, trimming, turning, and carving can each be
done most efficiently only at certain stages of drying. If the appropriate operation is to be delayed, the drying operation must be delayed to conform. All of this takes attention. Perhaps five minutes a day will suffice for a single piece but that five minutes is essential. This leads to an enforced attention to detail. The pupil must discipline himself to attend to those details as they need attention, and the process goes on day after day, long enough and persistent enough to establish a habit.

In conjunction with the details involved in making pottery projects there is the need for keeping the equipment clean and in its proper place. The task is not long or arduous if it is attended to while the clay is fresh. If the clay is allowed to harden, the picture changes. Then too, there is the experience of needing a tool in the course of an operation, finding it dirty where a classmate has used and left it, and having to stop everything to clean it up before proceeding with the job at hand. After an experience or two of this sort, whether intentional or not on the part of the classmate, any normally intelligent individual should see the need for sufficient self-discipline to perform duties as they need to be performed. The pupils themselves aid the teacher in instructing
those who are slow in developing cooperation and attention to detail.

In the development of resourcefulness, pottery offers the same opportunities as other crafts or industrial art areas. There is enough freedom to the operations necessary to the completion of a pottery piece for the pupil to develop an individual technique. Some potters find sanding the dry piece the best method of finishing, others like to do all they can possibly do with the sponge when the piece is very moist; still others pay more attention to the leather-hard clay in the trimming operation. Each pupil should be encouraged to solve his own problem in determining which is the best technique for him to use.

Design presents an immediate problem to the new potter. Small variations from the design suggested for even the first problem should be required and complete digression within stated limits encouraged.

Successful solutions on the part of the pupil, to even simple problems, will lead to self-confidence in his later attack on greater problems of design and technique.

Resourcefulness, like self-reliance, is built partly on a background of success. Success in one venture leads to other ventures. An intelligent and
open-minded attack on a problem is a good start to another success. The potter’s craft can provide the problem; the teacher, the guidance. The pupil can taste the fruits of his problem-solving by developing that ability to analyze a problem in the light of past experience, equipment at hand and results desired, which is resourcefulness.

Cooperative Attitudes

In the pottery laboratory there are countless opportunities for demonstration of the advantages of cooperation among all the pupils using the space and equipment. In fact, unless there is cooperation among all the participants in the ceramics program the program cannot be successful. That fact is one of the first that should be explained to the pupils.

Notice for example, the materials used in the laboratory. There are usually three or more kinds of clay in use. If they become mixed, the results can easily be disastrous. It is common practice, where molding is part of the work program, to keep a separate bin of modeling clay for making clay cores. This is usually composed of the tag ends of odd lots of clay whose origin is doubtful, or it may be ordinary
modelling clay. At any rate it is not useful potter's clay of known characteristics. Everyone in the classes uses it for building cores, sealing around molds, and centering bats on the wheel. It is probably off color because of its heterogeneous origin. If it is mixed with the pottery clay and turns up in a piece of pottery it will not show up till the piece is fired. Then it is too late! If only one person in the class is careless, he or she can do great damage, with no assurance whatever that the carelessness will not hit directly home.

In molding, this same modelling clay is used for making cores and sealing the fence around the core when the plaster mold is cast. In cleaning up, after the plaster is cast, the presence of slopped-over plaster invariably leads to bits of plaster becoming imbedded in the modelling clay. Unless this clay is cut away from the rest and set aside to be mixed later with water and strained to remove such foreign matter, it can cause trouble for everyone. There is nothing more exasperating, when sponging or turning a core that has been very carefully shaped and almost finished, than uncovering a bit of plaster carelessly imbedded in the clay. The piece must be cut out, the
hole filled in with soft clay and water, and probably left to dry some time before the turning can proceed.

Turnings from cores, being finely cut and lying in the open tray around the wheel, dry out a certain amount before the wheel is cleaned up at the end of the job. It is important that these scraps be wet down and worked up into a ball before being put back in the bin. It all takes a few minutes but if they are returned to the bin improperly tempered there would very shortly be no usable modelling clay. The few minutes necessary for each pupil to properly care for his own scraps are very few indeed compared to the time required to work up a ball of modelling clay from a full pan of half dry chips.

Care and cleaning of the common tools of the laboratory, such as strainers, knives, modelling tools, tables, molding equipment, plaster bats, and wheels is another responsibility which pays tangible dividends to all participants in the program when properly assumed.

It should not be necessary to force these responsibilities upon the pupils because in the course of an hour's work in the laboratory every pupil working will profit by mutual cooperation in at least a dozen ways of which he or she can see concrete evidence in clean equipment and properly handled supplies, particularly,
after the necessity for such care has been properly emphasized by the teacher.

Still further development of cooperative attitudes comes with glazing, the one activity in pottery making which can be done more efficiently on a production line basis than by other methods. When spraying glaze it is more efficient to spray all the pieces requiring red gloss while the spray gun is loaded with red gloss than to have each individual pupil cleaning and loading the gun with each separate color he may wish to use. A team of from three to six people can profit in this community activity, by the experience of working together for the good of the whole group.

The individual pupil, each in his turn, can be assigned the task of helping to stack the kiln. If advanced and beginning pupils are all in the same class, one from each class can be assigned to the task of stacking or watching the kiln when it is fired. When beginning and advanced pupils are working in the laboratory at the same time the spirit of cooperation can be increased by encouraging the more experienced to help the beginners, perhaps even by pairing off the class.
Respect for other's property is engendered by the fact that it is seldom feasible to provide sufficient locker space to hold all the projects that may be under way, in their various stages of completion. It is necessary to use community drying space, a community rack for storage of green ware ready for firing and another such place for ware waiting for glaze firing. Each must learn to keep his hands off his classmate's work if he expects his classmate to do the same. When storage space becomes crowded the need for efficient use of the community space should be emphasized. In fact there are very few activities in the pottery class in which the pupils are not dependent upon their classmates for the utmost in cooperation. Each is highly vulnerable to the results of carelessness on the part of his classmates, and each is constantly in a position to assume one or more of the community responsibilities.

Health and Safety

There are few hazards in the pottery laboratory by which the industrial arts teacher can teach safety with regard to the equipment involved, as he can in other shop areas. The two points of danger
are in respect to glaze. The need for a respirator in spraying glaze must be emphasized, although it is doubtful that the pupil in the high school program would inhale sufficient glaze particles in his brief contact to do any harm. The respirator, however, can be demonstrated to good advantage in connection with this activity. The need for sanitation with respect to respirators can be readily shown and the respirator itself can be set aside in favor of a damp cloth to be tied over the pupil's nose and mouth for the short time he will be working at the spray table. These cloths can be furnished by the pupil and will provide a practical solution to an otherwise troublesome problem.

The need for grinding occasional spots of glaze which run to the foot of a piece of pottery in the glaze firing can be met with a carborundum hand stone. If, however, a power grinder is used, the usual precautions regarding the use of goggles should be presented.

Power pottery wheels offer few hazards to the operator. The precautions regarding loose sleeves, ties, and hair, similar to those applying to the wood lathe or drill press should be presented. The pupil
will learn quickly to keep these items confined because of the hazard they present to the successful completion of his project.

Interest in Achievement

"To develop in each pupil a feeling of pride in his ability to do useful things and to develop worthy leisure-time interests." (1, p. 56)

In order to develop pride in his ability to do useful things one must first have the opportunity to do those things. The industrial arts department of the school presents that opportunity. The pottery teacher in the industrial arts program is in a position to help the pupil earn the fruits of his industry and imagination many times in a semester.

Good workmanship is a sufficient excuse for honest pride in any line of work; woodworking, blacksmithing, or ditch digging. In many activities the finer details of the work are out of sight in the finished product. For example, the mortises and tenons joining the chair rails to the legs, or a neatly countersunk screwhead or rivet on the back of an iron lamp bracket. In the well done pottery project all the evidence of skill is on the surface.
to be admired. By the assignment of carefully graded projects the instructor can guide the pupil to successful completion right from the beginning.

The medium in pottery work is such that failure on one process does not require the scrapping of the whole semester's work. If a cast piece is ruined in the sponging or in removal from the mold, the piece can be thrown back in the scrap bin or saved for building or throwing and the mold cast again with the loss of only one period's work. If the defective piece is the result of poor finishing, poorly strained clay or improper handling, the pieces can be thrown back without a great loss. This characteristic of the craft is a benefit to the pupil in making a project of which he can be proud because he can start over any time his lack of experience leads him astray.

While the potter's craft may be used as a vehicle to arouse the interest and increase the knowledge of the pupil in the ceramic industry in particular and in industry in general, the school laboratory products usually lie in the decorative field. Even the simplest bowl form, glazed with the commonest of gloss glazes becomes a thing of beauty to its maker. The fact that it has his monogram, name, or initials inscribed irrevocably in the clay
to show who made it lends an even greater urge to excel.

The mastery of a new medium is another source of pride to the beginner. While everyone handles and uses ceramic ware every day, few people know how to make it. The project excites greater admiration at home because of that fact. The resulting pride and admiration bolster the young potter's self confidence and urge him to greater efforts.

As a developer of "worthy leisure-time interests" (1, p.56) the pottery program can be compared favorably with the other industrial arts crafts. Barth in his thesis, "The Industrial Arts as Adapted to Leisure Occupation," (3, p.51) lists pottery as one of the manipulative activities in fitting it into his classification of hobby activities.

Manipulative hobbies such as woodworking, metalworking, stonecutting, jewelry-making, and repairing of various sorts are pursued at various levels with tools of the simplest types, or with equipment which matches that of industry. They can be concerned with an elaborate plan for bettering the products of industry, obtaining products which the participant could not otherwise afford, or they may have no plan at all—just plain puttering. Pottery is adaptable to the
various levels of skill, equipment, and desires of the individual.

Some home potters buy or beg a piece of moist clay from a brick or tile works, carve on it with a tableknife and take their art contributions back to the brick kiln to be fired. This level of activity certainly involves a minimum of space and equipment and the execution of a different flower pot or jardiniere can be accomplished for the price of a movie ticket.

Some pottery studios sell potter's clay to individuals for home modelling, casting, or sculpture and then fire and glaze the piece in the studio kiln. A pottery manufacturer with a sympathetic foreman did this type of thing for individuals and schools before World War II, with satisfactory results. In fact, the pottery classes of Oregon State College operated through such a courtesy from 1937 to 1940. The greenware was produced from stoneware and flowerpot clays in the Art Department laboratory and taken back to Portland for firing and glazing. The Oregon Ceramic Studio in Portland has been working in this manner with home potters since 1938.

A Southern California pottery establishment has gone a step ahead—or back, according to personal
opinion--by selling cast pieces to be taken home for slip paint decoration, and brought back for firing and glazing.

The home potter can buy blended clay of various kinds and colors, with glazes to fit, from many manufacturers. He may then proceed to make all types of pottery within the limits of his skill, imagination, and equipment. He can even obtain the materials for blending his own clay and glazes without too great an expenditure. Some potters get their greatest thrill out of developing their own glazes; others are interested in form and work to that end in table-ware, decorative vessels, or sculpture.

Cost of equipment is not prohibitive compared to the equipment used in other hobbies. A recent catalog (18, p.19) shows electric kilns of 1360 cubic inch capacity priced at eighty-seven dollars and fifty cents ($87.50), and another of 2574 cubic inch capacity at one hundred eighty-seven dollars and fifty cents ($187.50), both f.o.b. Sacramento, California. Some potters build their own kilns at considerably lower prices.

Oregon potters of the hobby class are fortunate in having a plentiful and relatively cheap supply of electricity available for heating their kilns. This
method of heating requires no flues or pipe lines such as are needed for oil or gas-fired kilns. Many of the smaller kilns have less than 2000 watt capacity so they may be plugged in at an ordinary outlet without additional wiring.

Potter's wheels too, can be built or bought at prices well within the reach of the average home craftsman. A good kick wheel can be built from worn-out automobile parts with a minimum of help from the local welding or machine shop and with very little ingenuity on the part of the builder. Discarded sewing machine stands can be used in the treadle type wheels.

Orderly Performance

Pottery is an ideal craft for demonstrating the advantages of and a need for an orderly job plan. Success in the pottery laboratory requires an orderly procedure and daily attention to details up to the biscuit fire. After that the ceramic project is durable enough to be stored with just reasonable care until it is prepared for the glaze fire.

The minute details in the potter's operations are extremely important to success. Until the pupil
has thoroughly learned the essential steps in preparing
clay for casting or throwing, in preparing a core for
casting a mold, or sponging and trimming a nearly fin-
ished piece, he should be required to use a check list
of steps in the operating procedure.

It is the method used in business and industry
to check the progress of jobs requiring many detailed
operations. The journeyman craftsman carries the
check list in his head or goes through the standard
procedure by force of habit. The successful hobby
craftsman may check his job mentally or physically;
the manufacturer uses job routing cards; the person-
nel manager, a questionnaire; and even the boy on the
service station grease rack has his "chek-chart."
Few are the activities which would not be more ef-
ficiently performed by the use of a job plan. The
school shops and the pottery laboratory are logical
places to start the pupil in the use of this aid to
orderly performance.

Pottery work is particularly exacting in this
respect. Slip-clay should be prepared in advance of
casting, for a few days of aging. It must be strained
and mixed to proper consistency to avoid lumps and
bubbles in the cast piece. The casting must be
watched closely to obtain the proper thickness and
trimmed around the edge before shrinking starts in order to avoid uneven edges. The inside of a bowl should be sponged to a smooth surface shortly after casting, while the clay is very plastic.

Briefly, the pottery project needs attention at many definite stages in its development. It cannot be hurried and if it is to be retarded it must be wrapped in damp cloths and rubber or plastic sheeting to retain proper moisture content for the next operation. The throwing and building processes are as exacting as, if not more so than, the casting process. The pupil is forced to do his work in an orderly manner to achieve a reasonable degree of success.

The instructor can do much toward the development of this habit of orderly performance by setting an example in his conduct of the class. He should post the course of study in the form of project assignments for the full semester, with a job plan for the first project only, where it is readily accessible to all the pupils. With the instructor's job plan for the first project for an example, the pupil should make a job plan for each separate succeeding project as he attacks it. The job plan should contain all the details of the job starting with the intended use for which the piece is designed and ending with the
glaze treatment, water-proofing, shale, and wax if necessary.

The pupil, by the middle of the semester at the latest, should be encouraged to make an over-all plan for the balance of the projects assigned. At this time he should have enough experience to roughly estimate some of the time elements involved.

The activity in the pottery class is such that efficient accomplishment requires overlapping of projects after the initial project. Wetness of the clay, glazing of biscuit, and meeting the firing schedule frequently require that a job be set aside for a day or two. The over-all plan would enable the pupil to proceed to the next project or even to a later one in its preliminary stages, without loss of time.

In the development of a project, the pupil should have in mind all the characteristics he is trying to obtain or achieve. Because part of his reward is the grade he receives, he should be given a clear understanding of the criteria upon which his project will be judged. In other words a picture of the grading method employed by the instructor should be present as an incentive.
The points by which the instructor grades the project can be explained in the course of the discussions mentioned under the first objectives, in grades, types, and styles of pottery. This, at the same time, will give the pupil some background for developing the ability to criticize his own projects, an ability quite necessary to the craftsman in any line of work.

Drawing and Design

The pottery course can contribute more to development of ability to design than it can to the drawing ability of a pupil. There is seldom use for mechanical drawing and freehand drawing will nearly always be used in designing efforts.

Pottery vessels are designed in profile, presenting the same problems as wood turning design. Like in wood turning design, occasional mechanical problems find their way into the picture as in lamp bases, but the mechanical considerations are so few that the pottery craft contributes little to the pupil's development in that direction.
Practice in freehand drawing in expression of ideas should, however, be encouraged at every opportunity and can be used very effectively.

Even though pottery projects develop rapidly and any number of ideas can be expressed in a semester's time, the pupil should sketch the piece he proposes to make so that obvious discrepancies in form, size, and structure can be ironed out before time is spent in execution. The ability to express ideas on paper is just as valuable to the potter in this respect as it is to any other craftsman. In round vessels, because of their symmetry about the vertical axis, there is an advantage in carrying the pencil design to a piece of folded paper and scissors before working up the clay.

Considerable practice in freehand drawing is in store for the pupil who goes in for slip or underglaze painting. This can be worked out on paper and transferred to soft clay by simply laying the paper on the "leather hard" clay and tracing the lines with a pencil or stylus, tracing on the dry clay with carbon paper or tracing around a stencil-like paper pattern. Line drawings on paper are necessary for the less experienced in all kinds of surface decoration. Both types of painting can be done directly with the brush, however incised surface designs,
modelled designs, sgraffito, and irregular shapes, even though executed directly in the clay, represent a form of drawing too.

The experience in the pottery area, while contributing some to the drawing ability of the individual makes its greatest contribution in the field of pure design and consequently as an outlet for the creative impulses.

Mere discussion of good design will not suffice. The articles produced in the school shop may be of approved form and quality, but they will be of insufficient number and type to afford adequate basis for generalization. There must be controlled observation with reference to lines, spacing, symmetry, setting, usefulness, strength, color, and similar factors. (1, p.58)

The study of pottery design can do much toward development of esthetic judgment, however, development of design ability requires the development of a background on which to build ideas. One way to develop that background is to establish direct contact with results of various treatments growing out of one's own industry and thought. The potter's clays and glazes provide a plastic medium for expression of form, and his glazes, a palette of colors that can provide means of expression for all but the widest imagination.

As previously stated, a failure in technique does not mean the loss of hours and days of work and
materials. Likewise a failure to achieve the desired results in design can be remedied, sometimes with only a few strokes of the modelling tool and certainly with no more loss than the time from modelling clay bin to plaster mold, or clay bin to the actual piece.

The molding process provides a means of quickly forming a piece a day, if desired, on which to experiment with texture and color. The molded pieces can be changed in shape by reforming the casting while it is still plastic, on the wheel in the case of round shapes, or by hand in the case of irregular shapes.

Modelling a core for casting a figure provides another outlet for design ability and duplication in a durable and beautiful medium. Sculptors make a model in clay before carving their stone. The potter can duplicate his model much more easily than the sculptor can cast his in metal or execute it in stone.

The foregoing is only a beginning in the creative possibilities of pottery. After the potter has worked his clay to his latest idea in form he has an almost unlimited choice of colors and textures in paints and glazes for its finish. There are slip-paint colors and values to be used on the greenware, underglaze colors to be applied to the biscuit, and clear glaze to bring out the hidden beauties of both. In gloss
glazes there are solid, opaque glazes for pure color, thin transparent glazes to cover and still reveal incised patterns in the clay itself, matt glazes for a velvety texture, and crystalline, rhutile and a wide variety of mineral and salt glazes for varied textures, colors, and effects.

These characteristics of the potter's art, while better adapted to the art studio than the industrial arts shop, furnish an interesting and motivating background against which other objectives of industrial arts can be exploited.

Shop Skills and Knowledge

There are many skills to be developed and there is much knowledge to be accumulated in the process of learning how to make pottery. Whether or not they contribute much to the development of skills in other crafts and in home mechanics is dependent upon the individual's ability to transfer that skill and knowledge to his work with other materials.

There are four common operations in pottery work that are closely similar to operations in other crafts. Core turning, for instance, is very much like turning wood or metal in many respects. The
tools are all scraping tools and the axis is vertical instead of horizontal but the problem of making a smooth cut concentric to the axis is still present. It is actually more difficult for the beginner to master those problems in clay than in wood because the tools are not so highly specialized for pottery as they are for wood and metal turning. The rests are not as steady, the tools not as rigid, and the vertical axis is definitely strange to anyone accustomed to an ordinary lathe. The principles involved in cutting the material remain the same. Chatter frequently results from attempting to use too wide a tool surface in contact with the work. It can be avoided by the use of a machinist's trick of cutting down the tool surface by using a different shape of cutting tool, a different section of the cutting edge, or shifting the rest to obtain a shearing angle on the scraping blade. Most beginners have to be cautioned, too, against the attempt to rough cut with too wide a blade. Because of the flimsy arrangement of rest and tool the wide tool will just follow the surface of the clay, resulting in an eccentric shape.

Plaster pouring is practically the cement pouring operation. Forming materials are, of course, much more flexible and adaptable to the pottery laboratory
job but the action of pouring a liquid mass into a specially arranged container and allowing it to harden to the shape of that container is essentially the same as that employed in pouring the foundation of a house.

The small amount of sanding the potter does is just like any other sanding operation. The final truing of the foot or base of a bowl, and the removal of the sharp corners with sandpaper require the same skills as the same operation in woodworking and the sharp corners are broken for the same reason as in woodworking—the finish has a tendency to run off them.

The spraying of glaze, when that method of application is used, is essentially the same as spraying paint or other finish materials. One uses the same brushing motion of the gun and watches for evidence of excessive moisture on the surface.

The skill required in building by the coil method might be transferred to the job of applying putty in glazing a window. Experience in patching the lining of the kiln with refractory cement might help the home mechanic patch a plaster wall or a hole in a flue. They have some relation to bricklaying problems but very slight.
Other than those operations mentioned, the potter's operations have little similarity to those of other crafts. There is occasional use for an oil can, screwdriver, or Crescent wrench in the maintenance of a home-made wheel and the hinges on the door of the kiln, but generally the potter's main work is done with his hands.

Painting in the decorative processes has little relationship to ordinary wood or metal finishing, and except for the surfaces adaptable to the use of air brush, spray gun, or dipping, are best done with a simple Jap brush rather than a paint brush. The square and rule are used to test a piece occasionally for some semblance of adherence to the limits of symmetry and size but do not assume the importance in the potter's life that they do in the lives of other craftsmen.

The skill of the potter then, lies essentially in his ability to shape a lump of clay with his two bare hands and a few hand tools no more complicated than a knife and fork. The equipment simply adds to the finish and volume of his work.

The knowledge to be gained in the course of a semester's work in pottery is varied. Aside from the discussions mentioned previously in this study there are many things to be learned by observation of the
pottery process.

The pottery student can get a new conception of heat and temperatures by observing the action of the kiln. Whether the kiln is fired by gas, oil, or electricity it provides a means of illustrating heat, combustion, and insulation and a color picture of the figure, $1800^\circ$ F.

Center of gravity becomes a definite problem and assumes new meaning in considering the design of a tall vessel or a figure in the width of the base or foot to be used. Mechanical advantage in lever and fulcrum can be illustrated to advantage in the use of the turning tool and its position on the arm rest. Capillary attraction is amply demonstrated in the slipcasting process and shrinkage becomes a real problem as moisture is absorbed from the finished clay piece by the plaster bat on which it was built or set, or evaporates in the dryer surrounding air.

From the standpoint of information and skills, then the pottery class can be tied in with the science class and the other shops of the industrial arts department.
Need for Expansion

The first of the two important considerations beyond the objectives to be discussed is the trend toward increasing the number of experience areas in industrial arts. The discussion may be effectively opened by the opinions of two authorities in the general and industrial education fields.

In an address upon the occasion of receiving the Laureate Award of Epsilon Pi Tau in 1940, William H. Johnson, then Superintendent of Schools in Chicago, expressed his views on "the place of industrial arts in a modern program of education" (10, p.7) under the subtitle "Content of the Industrial Arts Laboratory Course" in part in the following quotation:

The industrial arts laboratory course is divided into eight large instructional areas as follows: planning, metal work, transportation, housing, ceramics, textiles, graphic arts, and electricity. Each one of these instructional areas encompasses a large section of the trade and industrial world. For example, the graphic arts include printing, bookbinding, paper making, illustrating and photography; ceramics includes brickwork, glass, cement, pottery and plastics; transportation includes aeronautics, waterway, railway, and automotive; planning includes sketching, drafting, blueprinting, designing, engineering, tracing, and checking; housing includes masonry, carpentry, cabinet making, plumbing, heating, plastering, and decorating; metal includes machine work, molding, pattern making and structural steel working; textiles includes
preparation, spinning, weaving, and dyeing; and electricity includes power and communication.

This statement was made regarding industrial arts for ninth grade boys. Mr. Johnson goes on to explain that the time devoted to the above course of study was two periods per day through two semesters. Obviously, the time per subject must be short. The statement is not quoted for a discussion of the depth of study into each field. It is included here to show the breadth of activity considered necessary in one of the nation's larger city school systems. The same speaker went on to say, "These eight instructional areas were selected after an extensive study by a committee composed of high school principals and industrial arts teachers." (10, p.7)

It would seem that in Chicago many varied activities are considered necessary to a pupil's view of industry.

Maris M. Proffitt, Specialist in Industrial Education, United States Office of Education, writing on industrial arts in American schools under the subtitle "The Media of Industrial Arts Experiences" made the following statement:

To confine one's efforts to a narrow field of materials is out of step with the
rapidly expanding field of industrial materials in use at the present time.

Furthermore, the media of industrial arts should not be confined to materials. Consideration must also be given to the tools and machines by which materials are modified, and the power by which these machines are operated. Scaled and dimensioned drawings provide a language of form and dimension so accurate and unchangeable that there can be no chance for difference in interpretation. Printing provides the means for economical preservation and dissemination of knowledge. Electricity is a force without which our modern civilization could not exist. Ceramics is one of our largest industries and involves many mechanical processes. Textiles and foods furnish the base of large industrial organizations. If we accept a broad definition of industrial arts as a study of industries and industrial practices then all of the above, and more should be included. (15, p.45)

The same author, in a 1940 publication of the same agency regarding the content of industrial arts curricula, under the subtitle "A Trend Toward a Broadened Program of Activities," says (16, p.3):

There is an ever-growing tendency to increase the number of shop activities included in industrial arts. It is interesting to look over the literature of the past few years and find that instead of one or two shop activities formerly offered in a school, the number may be as many as seven. This broader field of offerings appeals to more pupils. It subserves variety in pupil interests and makes possible self-expression which is a fundamental principle in industrial arts education—in a wide range of desirable media. The increase in the number of shop activities is complemental to the increase in industrial activities and in kinds of construction materials—for example,
plastics--which the pupils observe in the world about them and which motivate their interests for enriched experiences. Ceramics is finding a firm foothold in the industrial arts program.

The foregoing statements all emphasize a need for additions to the areas of experience provided by the industrial arts departments in the high schools of this country. They were selected from recent publications by known authorities in the field of general education, not industrial arts alone. Both authors include ceramics in their lists of desirable areas.

In other words, the experience area provided in the pottery laboratory is not new to the high schools of the country as a whole and its inclusion in those curricula in which it has not appeared before is in line with a trend toward expansion of the industrial arts facilities.

The areas mentioned are active fields of industry selected to acquaint the coming citizen with industry as a whole. The ceramics industry in this country in the past has been established in those areas where suitable clay deposits were found, suitability including volume, color, and the necessary chemical and physical characteristics for the product to be manufactured. They were established before the growth of our present efficient communication systems.
ceramic products require small amounts of raw materials and the cost of the raw materials is but a small percentage of the total cost of the finished piece. Briefly, the industry is no longer confined to certain small areas in the United States.

This condition, coupled with the curtailment of importation from Europe during the recent World War has enhanced the industry in the interests of the industrial world and the consumer alike. Since the ceramic industry is a growing entity in world economy, it is worthy of even more interest in the industrial education field than when these authoritative statements were written. A statement to this effect by Glenn H. Lukens, head of the Ceramics Department of the University of Southern California published in 1946 in the magazine "Craft Horizons," is quoted in part as follows:

American pottery is an exceedingly live subject in this country today. Tap almost anyone on the shoulder and you'll get an opinion on it--vague, flattering, critical, or explosive. A spark may flame into a controversy. This is being "in the news".

The war has put American ceramics in the news, but it hasn't removed in any permanent sense the hurdles of the past. (12, p.10-11)

The "hurdles of the past" mentioned by Mr. Lukens were, (1) a merchandising set-up for imported pottery and (2) a dependence on traditional design of
the foreign pottery previously imported. The inclusion of pottery in high school curricula on a wider scale could broaden the experience of the pupil to include an industry that can easily become more important in this country's economy than it has ever been before.

Co-education in Industrial Arts

The second consideration in selection of industrial arts experience areas, other than that afforded by the recognized objectives, is that of co-education in the industrial arts program. Again, the discussion can be opened with quotations from the same author and the same bulletins: Maris M. Proffitt in Bulletin 1937, No. 34, printed in 1938, and Pamphlet No. 93, printed in 1940. (15, p.49)

Among the industrial arts activities that may be organized for instruction in accordance with the interests and abilities of junior high school pupils, including both girls and boys, the following may be mentioned:

Electricity, with special reference to its use in the home. Woodwork and wood finishing, with special reference to the use and care of wood products in the home. Elementary work in clay, including projects in pottery. (15, p.49)

The second quotation from Proffitt is under the subtitle "A Trend Toward a Keener Realization of the Value of Industrial Arts for Girls."
Leaders in industrial arts education keenly regret that they cannot report a strong trend in practice toward providing industrial arts work for girls. It is a fact, however, that there is a growing consciousness on the part of educational leaders that industrial arts ought to be extended to girls in accordance with its values for the realization of educational objectives of first importance. One of the retarding factors in the extension of industrial arts opportunities is the reluctance—partly but not wholly due to administrative problems involved—of school administrators and also industrial arts teachers to reorganize school programs so that girls may be accommodated in a satisfactory program of activities in industrial arts.

Regardless of the fact that these adverse conditions generally obtain, there are in some schools examples of special activities— in addition to those general ones included on the junior high school level—that may be expected to set future patterns of development that will have significance for girls. Among such activities are:

(e) Ceramics. Design and manipulative work in the creation of useful and ornamental articles from clay, have always and do now offer a challenge to self-expression. The work can be made highly educational with reference to desirable pupil outcomes. (16, p.17-18)

The Chicago superintendent (10, p.5) mentions the inclusion of the girls in a "Home Mechanics Laboratory" for grades six, seven, and eight but says nothing in this source of girls in the senior high school shops.

There are few activities in the pottery laboratory in which the girls cannot participate and there need be none. Lifting a large mold full of
slip can be a feat of strength, too much of a feat for girls, but large molds should be rare exceptions in the high school pottery classes, for three reasons. First, the pupils can gain more experience by making more of the smaller projects than they can by making a few large pieces. Second, the large pieces take up too much kiln and shelf space to be practical in the school shop. Third, large pieces, particularly shallow ones, should be pressed rather than slip cast.

The equipment of the pottery laboratory is not dangerous or complicated and certainly presents no problem of safety that would endanger the girls in spite of their presumed lack of mechanical ability.

Many of the processes involving greenware in its various stages of drying are more suited to a girl's hands than to a boy's. Many production shops prefer women for trimming, sponging, decorating, and glazing light pieces, for their deftness and ability to handle the ware in its plastic and fragile condition without breakage loss.

In adult groups interested in ceramics, more women than men can be found indulging their creative urges in night school classes or home studios.

Certainly there is no difference between the sexes regarding "desirable pupil outcomes." (16, p.18)
In fact, regarding appreciation and use, a knowledge of ceramics should be more useful to the girl than to the boy in later life, because most of the pottery in the home is bought and handled by the feminine side of the family.

Since much of our pottery is bought and used by the women, a keener appreciation of good design on the part of more members of the feminine population should help to raise the quality of the ceramic products manufactured in this country.
CHAPTER V
SUMMARY AND RECOMMENDATIONS

Summary

The subject of ceramics has been discussed with reference to the objectives of industrial arts, with the purpose of determining its suitability or adaptability as a vehicle by which to achieve those objectives.

The discussion of the objective called "Interest in Industry" brings out the fact that information on products of industry, manufacturing methods, physical properties of the materials used, sources of raw materials, distribution, and employment can be conveyed on a background of the pupil's experiences in the school pottery laboratory. The pupil's vocabulary, regarding characteristics of several articles of every day use in the home, can be increased.

The second objective, "Appreciation and Use," can be achieved in the potter's craft, by experience in attempting to meet the requirements of design and execution and by the direct presentation of information on design, care, and use of ceramic products,
aided by the background of that experience in the shop or laboratory.

The third objective, "Self-discipline and Initiative," self-reliance, discipline and resourcefulness can be built up in the pupil by a development of those qualities through attention to detail in the completion of a project and by leading him to the successful completion of a number of useful and decorative projects.

In meeting the requirements of the fourth objective, "Cooperative Attitudes," work in the pottery laboratory presents to the pupil daily the advantages and tangible results of community endeavor and the assumption of group and individual responsibilities.

In respect to the development of proper attitudes toward "Health and Safety," the fifth objective, the few precautions to be taken in the pottery laboratory do not contribute greatly to the over-all health and safety program of the school or the individual. The aims in the health and safety program usually extend beyond the limits of the shop or laboratory. There is nothing inherent in the pottery program to prevent the ceramics teacher's participation in the promotion of proper attitudes to health and safety outside this particular program.
In promotion of "Interest in Achievement," the ceramics course can provide a great many opportunities for the completion of projects in a new medium and interest the pupil in greater achievement in school, industry, or avocation.

The potter's craft, like all other crafts, can be used as a means of showing the necessity for "Orderly Performance" in the completion of a task and will do much toward the establishment of orderly work habits.

Toward the "Drawing and Design" objective, the pottery course can furnish ample opportunity for training in self-expression through freehand drawing, form, and color. Esthetic judgment can be developed and the course can be set up to furnish any desired amount of outlet for creative effort.

Possible contribution to the "Shop Skills and Knowledge" objective is in the direction of manual dexterity. Few operations in pottery involve skills similar to those of other crafts. The knowledge gained would be largely confined to the potter's craft and the ceramic industry.

Introduction of pottery in Oregon high school industrial arts programs would fit in with the trend toward inclusion of new media and wider industrial
knowledge in that it would give the pupil a contact with an industrial pursuit outside of the usual industrial activities of this state. Such a contact with the ceramic industry could lead to commercial use of more of the ceramic materials available in this area and stimulate greater industrial development in the form of a new class of ceramic production in this section of the country.

There need be no activity in the pottery laboratory which could not be performed by girls as well as boys, making at least this portion of the industrial arts program adaptable to co-education.

Recommendations

Because the subject of ceramics appears adaptable as a medium for the achievement of the industrial arts objectives, its inclusion in the training of industrial arts teachers is recommended, either in a proposed Ceramic Engineering program or in the art department program, or both.

It is further recommended that the industrial arts personnel of this state be encouraged to take advantage of this medium for the achievement of their educational objectives.
BIBLIOGRAPHY


APPENDIX A

Glossary of Ceramic Terms Used in This Study
Bat: A slab of plaster, round, square, or rectangular in shape and one inch or more in thickness. These slabs or bats are used in the pottery laboratory for absorbent surfaces on which to work or dry clay, as bases on which to build or throw pieces, as a convenient surface on which to turn freshly molded pieces out of the molds.

Biscuit: or Bisque is the term applied to once-fired and unglazed pottery. It is the matured clay body without the finish produced by glazing.

Brushing: see Glaze: Application of

Building: The term applied to the shaping of clay into a piece of pottery by joining slabs or coils of plastic clay to obtain the desired shape. The coils, or slabs, are put together in the proper relative positions and welded with water and a modelling tool to achieve the effect of a solid piece.

Burning: see Firing

Carving: see Incising

Casting: The process of shaping the clay piece by pouring a thin mixture of clay into a plaster mold. See Slip-casting.

Clay Body: The name applied to the clay itself. It is used in reference to the characteristics of a particular variety of natural clay or a particular blend: i.e., porosity, shrinkage, maturing temperature, color, etc. Porcelain bodies are usually called pastes.

Core: As used in this study, the term applied to a shape of clay about which a plaster mold is cast. It is usually an inverted positive of the pottery piece to be produced in the mold.

Crazing: A defect in glaze. It is usually a network of fine cracks on the surface of the glaze caused by excessive shrinkage of the cooling glaze in relation to the shrinkage of the clay body.
Dipping: see Glaze: Application of

Electric Wheel: A potter's wheel turned by an electric motor. See Wheel.

Firing: The process of heating the pottery in a suitable kiln to the maturing temperature of the clay body or glaze. Most pottery is fired twice. The first firing matures the clay body and the second matures the glaze. The temperatures for both firings are not necessarily the same.

Foot: A raised ridge or a projection on the bottom of a piece. It is the point that the pottery piece sits on and must be designed to achieve stability in the finished piece.

Glaze: Application of

Brushing: The operation of applying glaze by painting with a brush. This method is used in places where dipping or spraying are not practical because of limited areas to be covered, or because of glazes previously applied.

Dipping: The operation of applying glaze by immersing the whole piece in a suitable volume of glaze to achieve total and dense coverage at one operation. It is the method used wherever possible in industry. The dipping method is not practical for the school laboratory because of the volume of glaze required and the necessity for accurate timing of the immersion.

Spraying: The operation of applying glaze with a spray gun or air brush. It is probably the most practical method for school use, because it enables the beginning potter to achieve good results with a minimum of experience. The thickness of the glaze can be tested at easy stages until the right thickness is obtained.
Glaze: Kinds of

Gloss: A glaze that produces a hard glassy surface. Gloss glazes may be opaque or transparent depending upon the chemical characteristics of the glaze base and the coloring oxides used. The base of the glaze is a mixture of ingredients that will produce glass to fit the clay body. The colors are obtained by the addition of finely ground mineral oxide particles. The particles of glaze materials are applied in suspension in water. The glaze fire melts them and fuses them to the biscuit.

Matt: A glaze that produces a matt or grainy surface. It is achieved by the use of ingredients that do not flow as readily as those in the base of the gloss glaze and a thicker application of the glaze materials.

Crystalline: A glaze having a crystalline appearance on the surface.

Rutile: A glaze composition which produces odd mossy or mottled effects.

Greenware: Unfired pottery. The pieces are very fragile and require very careful handling until they have been biscuit fired.

Incising: The process of cutting a design into the surface of the clay. It may consist of cutting a line pattern or go as far cutting away a background for low relief.

Jiggering: A commercial process for the forming of clay by pressing the moist clay into molds. It is used on hollow vessels that have a wide opening. This process produces a more dense and uniform product than the casting process.

Kiln: The oven used for the firing of clay products. Kilns are heated in many ways, the fuel or heat used governing their construction.Basically they are chambers capable of attaining the
heat required to mature the clay or glaze to be fired.

Kick Wheel: The potter's wheel arranged to be propelled by a kicking motion of the potter's foot. See Wheel.

Lawning: The process of straining or sieving usually applied to glaze. The process gets its name from the cloth—lawn, used to form the screen of the strainer or sieve.

Leather Hard: A descriptive term used to designate a degree of plasticity in the moist clay. The clay piece at this point is usually firm enough to stand by itself but still capable of taking up enough moisture to allow minor changes in shape. It can be incised or turned cleanly.

Modelling: The process of shaping the clay by hand in the production of embossed surface decoration, irregular shaped vessels, or figures. It can be applied to work on a piece of pottery or to the shaping of the core for the making of a plaster mold.

Mold: A plaster of Paris vessel cast around a clay core which was an inverted positive of the article to be produced. The clay walls of the mold are usually at least an inch and a quarter in thickness to absorb the moisture from the slip used in the casting process. Molds may be made up of as many sections as necessary to allow proper drawing of the desired casting.

Packing: A term sometimes used instead of "stacking" in reference to the process of placing ware in the kiln for firing. See Stacking.

Painting: The process of applying a material with a brush. This term is usually used in speaking of the application of slip colors on greenware and with respect to the use of over-glaze enamels. See Slip Painting.

Plaster: Basically plaster of Paris. Many ceramic supply houses now manufacture or sell casting plasters particularly for potters. Many
potters mix additional ingredients to the plaster depending on the use to which it is to be put. It is used for molds, bats, and the tops of wheels.

Porcelain: A high-fired, vitreous, white body. It is ceramic but technically not pottery.

Pouring: The process of slip casting. See Slip Casting.

Power Wheel: A potter's wheel turned by means other than manual. The term means today an electric wheel. See Wheel.

Pressing: A casting process. Some molds are not adaptable to casting with the liquid slip because of their size, the complexity of the shape involved, or shallowness. These molds are then cast with a plastic clay which is pressed to the surfaces of the mold in sheets of suitable thickness. In the case of a mold for a figure, the parts--legs, arms, body, and head--may be cast separately by pressing and then assembled by carefully fusing the parts together with slip. The process has the advantage of producing a more dense casting, requiring less drying time, involving less danger to the casting from shrinkage. Low bowls and plates can be trimmed inside immediately and dried with little danger of excessive warping.

Rutile: See Glaze: Kinds of

Sanding: The process of trimming with sandpaper. Most trimming is done with modelling tools, knives, or sponges while the clay is still in a plastic condition but there are frequently a few trimming operations that can be done best after the piece is dry. Sharp edges can be rubbed down and the foot of a piece can be levelled more easily at this time than earlier.

Sgraffito: A type of surface and color decoration. It is produced by coating the greenware with colored clay or slip and then scratching the desired decoration, usually a line design,
through that coating. The finished article has the all-over color of the slip and the design in the color of the original clay body.

Shale: A paint pigment used to color the foot of a piece after glaze firing. This is a reddish-brown powder, very finely ground, that can be rubbed into the unglazed biscuit around the foot of a finished piece. It is frequently used to accentuate the minute crevices caused by crazing to produce an antique crackled effect.

Signing: The process of scratching in or painting on the signature of the maker. It is customary to sign all pieces of the class of work discussed in this study.

Slip: The thin mixture of clay used for casting and slip painting. It consists of the clay body in suspension in water. The dry clay powder is added to water and allowed to soak and age until thoroughly mixed, usually a day or two. It is then strained once or twice through a coarse strainer and allowed to stand again until some of the excess water can be drawn off to leave a mixture of the approximate consistency of thin cream. It is strained again through a fine strainer, approximately forty mesh, and is ready for casting.

Slip Casting: The process of shaping the clay piece by casting with slip. With the slip properly strained and the mold dry, the slip is poured into the mold until it is standing above the surface of the mold and the mold is filled completely up to the top edge. This is allowed to stand until the level of the clay sinks, when it is again filled to the top. The shrinkage is due to the water from the slip soaking into the plaster of the mold. As this absorption of the water continues the clay gathers on the sides and bottom of the mold. The thickness of the deposit is tested from time to time until the desired thickness is deposited. The remaining liquid clay in the center of the mold is then poured back into the slip container and the mold propped
up in an inverted position to drain and dry until it is no longer shiny. The mold is then turned right side up and the top edge of the casting trimmed off sharp against the top edge of the mold. After proper sponging, drying, and shrinking, the casting can be turned out of the mold for further finishing.

**Slip Painting:** The process of decorating with colored slip on the greenware. Colored oxides are mixed with clay of the same body as that to which the paint is to be applied and water added to a painting consistency. The design is executed on the green piece and fired as biscuit. The piece is then glazed transparent.

**Sponging:** Part of the process of finishing greenware. It consists of smoothing the surface of the piece with a damp sponge. Sponging may be done at any time from pouring to firing. The inside of a bowl can be sponged to good advantage before the piece is turned out of the mold. The outside is sponged as soon as the piece is hard enough to be turned out of the mold. Any surfaces that have required sanding can be sponged to remove loose clay and dull the scratches left by the sandpaper.

**Stacking:** The process of placing greenware or biscuit in the kiln for firing. Greenware may be stacked very closely, small pieces nested in the large ones and piled to the top of the kiln. Biscuit ware must be stacked separately in the glaze fire to keep the pieces from being fused together with the glaze as it matures.

**Straining:** The process, sometimes called "lawning" or "sieving" of working clay or glaze through a screen. In working with clay, the process is used to remove air bubbles, lumps of clay, and foreign matter from the slip. In glaze, it is used to remove coarse materials and foreign matter. It is essential that glaze particles be of a certain fineness. Use of proper meshes of screens or lawns makes accurate grading possible.
Throwing: The process of forming hollow vessels on the wheel. The process probably gets its name from the first operation, that of throwing the ball of clay to the surface of the wheel with sufficient force to make it stick to that surface.

Treadle Wheel: A potter's wheel turned by means of a foot treadle similar to that on a sewing machine. See Wheel.

Turning: The process of scraping the surface of a clay piece on the wheel to make true and concentric. The process is used in making cores for molds of round vessels, and for trimming cast, thrown, or built pieces.

Turning Tools: Cutting tools used for the turning process. They are shaped so that the blade scrapes the surface of the piece being turned.

Underglaze Color: Coloring materials applied to biscuit ware. The coloring materials are used raw and are sometimes hardened on (low fired) before the glaze is applied. Underglaze color is distinguished from slip painting in that it is applied to the biscuit ware and is fused to the body by the glaze, whereas slip painted color is applied to the greenware, mixed with clay of the body and becomes a part of the biscuit.

Waterproofing: The process of applying a waterproofing solution to pottery on which the glaze is not tight. It is necessary on some low-fired clay bodies because of the excessive porosity inherent in low-fired bodies.

Wax: Ordinary floor or furniture wax used to remove some of the abrasive characteristics of ware that is not glazed on the foot. It may be used to produce a low luster on pieces that have been only partially glazed.

Wheel: The potter's wheel. The potter's wheel is basically a lathe with a vertical spindle, the wheel resembling the disc of a phonograph. The disc on which the piece is worked is
usually made of plaster, though some potters prefer metal. Various methods of propulsion have been and are used. The kick wheel is used in two different forms. One form has a large disc and flywheel on the lower end of the shaft near the floor in such a position that the potter, sitting on a seat or bench can propel it by kicking sideways with his toes on the horizontal surface of the wheel. Another form of the kick wheel has a crank in the vertical spindle connected by a connecting rod to a foot pedal or bar swinging in a horizontal plane. The treadle wheel commonly used is mounted on a sewing machine stand with the wheel belted to the drive wheel of the sewing machine. Electric wheels are driven by electric motors geared down to low speed necessary for successful throwing.