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Many educators believe that some change in the present program of education is in order. The problem, however, which seems to stand in the way of this advocated change is, how may it be accomplished in a natural, non-revolutionary manner.

The purpose of the study is to determine if there is an interdependence of knowledge among subject areas within the school. It is further to determine if correlation is an improvement in teaching, and if industrial arts lends itself readily to a correlated program.

The historical background endeavors to point out the educational theories of the past which tend to have a controlling influence on the prevailing methods of present education.

The study indicates the advantages of correlated teaching by examining the comments of educators concerning this type of instruction.

In Chapter IV a correlated program is suggested and is carried into detail to point out the advantages realized from this approach to teaching.

It is concluded that correlation is not a cure-all for teaching methods, but it is evident that if used with discretion it offers a step forward in the practices and procedures of teaching. There is indication, that to recommend the correlation of subjects, is to recommend better organization, cooperation, understanding, and a fuller realization of the objectives of education.

IMPROVEMENT IN THE TEACHING OF INDUSTRIAL ARTS THROUGH CORRELATION WITH OTHER AREAS IN THE HIGH SCHOOL

by

DEANE TAYLOR UPTON

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APPROVED:

[redacted]

Professor of Industrial Arts Department

In Charge of Major

[redacted]

Head of Industrial Arts Department

[redacted]

Chairman of School Graduate Committee

[redacted]

Dean of Graduate School

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CHAPTER I

INTRODUCTION AND CONSIDERATIONS

This is an age in which the activities of all people are related to and dependent upon the activities of others. A point of specialization has been reached in which the work of one individual is only a small part of the total, and each is dependent upon the work of others for the necessities as well as the luxuries of life.

In modern society education is applied in a multitude of combinations and inter-relations. Seldom is it used in isolation. The farmer of today needs to know elements of mechanics, chemistry, agriculture, economics, geology, perhaps even some of the forces involved in physics.

Subjects are tools; tools of education, tools to solve problems. Seldom is a tool used by itself. It is used in combination with others, as a saw with a square, a pencil with a straight edge, a tee square with a triangle.

The teaching of industrial arts involves the uses of some of the most important tools of industry, and can

itself be one of the most important tools of education. It is more than the reading of a blue print, the construction of a cookie cutter or the making of an end table. Rather the industrial arts work of a high school should become a laboratory for the practical application of more traditional subjects as well as a means for giving knowledge, understanding, and appreciation of industry and mechanics. The industrial arts student should find life situations requiring the use of mathematics from simple arithmetic calculations to the higher processes of mensuration and geometry. He should find practical application of English in his associations with others and in the preparation of shop themes and reports. He should learn the history and progress of man through studies of machines, materials, and inventions. The correct spelling of words becomes important as he learns the value of accuracy. Physics and chemistry become real tools as he sees the laws of motion at work, and the properties of steel changed to serve him better. Geography, art, reading, social studies, and the other subjects should become more useful and gain in importance to the student because of an opportunity to use each of these tools in a real setting, associated with real life situations which

can be made a part of the industrial arts program.

The Purpose of the Study. It is the purpose of this study to conduct an investigation to determine if there is an interdependence of knowledge among the subject areas of the high school. There is a further purpose to ascertain if, through the correlation of subject areas, an improvement in teaching will be realized. In addition, it is to determine to what extent industrial arts will lend itself to this method of instruction.

Statement of the Problem. There is considerable unrest in educational circles today which is the product of discontent with traditional education.

Dewey (7, p. 4) writes:

> The traditional scheme is, in essence, one of imposition from above and from outside. It imposes adult standards, subject-matter, and methods upon those who are only growing slowly toward maturity. The gap is so great that the required subject-matter, the methods of learning and of behaving are foreign to the existing capacities of the young.

There are some who feel that the aim of education should be for an active participation by the pupils in the development of what is taught. Others feel that this is too great a step and shun such revolutionary changes, seeking instead, a more intermediate program. Still others hold to the traditional scheme of education,

feeling that the acquisition of knowledge is sufficient in itself.

The problem originates from this feeling of dissatisfaction on the part of many educators. An endeavor has been made to offer a step toward the solution of the apparent inadequacies of the present educational program. It is hoped that the proposed solution will not be too revolutionary for those seeking the middle path and still be of sufficient stimulus, to the slow process of evolution, to satisfy those of a more progressive nature.

Sources of Data. The historical background was taken from those books dealing with the history of education as indicated in the bibliography. The study centered around those publications which dealt with all phases of education with emphasis on those dealing with the industrial arts field.

Methods Employed in the Study. An analysis of the literature on modern educational practice was made with particular emphasis upon those aspects which dealt with the correlation of subject matter.

Limitations of the Study. Due to the experimental aspects and isolated evidences of value, the correlated curriculum, largely resides as a part of the philosophy

of a number of educators. It is, therefore, subject to the ills and limitations of any philosophy, namely, that of not being proven through use.

Definition of Terms. To define correlation does not entail the mere defining of a word. It is rather the defining of a process, even perhaps, an attitude of mind. Used in an educational sense it may be defined very narrowly, as for example: the unifying of subject matter, or as Struck (23, p. 586) says, "By correlation is meant: to bring aspects of one or more subjects to bear upon those of other subjects". In contrast to this interpretation there are those who feel that correlation, in regard to the curriculum, should have a subject or group of subjects as a core. Dewey, (6, p.9) however, is not in sympathy with this feeling, and counters with the statement: "I believe that the true center of correlation on the school subjects is not science, nor literature, nor history, nor geography, but the child's own social activities." Thus is brought out the flexible disposition of the word correlation, and for this reason the term can imply a great deal or very little depending upon its interpretation. That which is understood to carry throughout the study is very aptly expressed by Vaughn and Mays (24, p.4) who say:

Correlation . . . carried into its logical and reasonable use, . . suggests the bringing in of the materials and data from the various fields of one's environment to enrich the content of a subject, to add reality and zest to undertakings, and to reinforce the impression made upon the pupils by the limited data and experiences of the classroom or shop.

CHAPTER II

HISTORICAL BACKGROUND

The word correlation was first used to express an educational philosophy by Herbart, who's approach to the selection and sequence of subjects in the curriculum was that represented by the theory of "correlation and concentration". (3, p.309) However, in reality, correlated learning was undoubtedly first used by primitive man. Everything he learned had a direct relation to application. What he learned he used immediately. He was subordinate to natural and physical laws, and as a result his margin of security was too slender to risk an education that aimed at everything but the rigid continuation of the customs and mores of his group. To primitive man the aims of education, if they existed, were probably identical with the aims of life itself. (3, p.1)

To carry the examination of correlation down through the history of education, in no place does it appear as it is defined today. However, the contributions of the many educators of history do contribute directly to the formation of the aims of modern education.

The good life (being happy) was the aim of the Greeks, but the question was whether being good and being happy were synonymous. "If the good are happy, does intelligence help us to be good?" (10, p.335) Socrates answered this in the affirmative saying that: "Virtue is knowledge, and is therefore teachable." And that "The knowledge that man especially needs is knowledge of himself." (10, p.6) Today this is spoken of as "Self-realization". With Plato, however, "It gradually dawned upon him that virtues are not isolated qualities, but are related to the totality of an individual personality and also to the world as a whole." (10, p.347) Hence, comes the idea of teaching the whole child. Aristotle, going a step farther than his teachers, endeavored to ascertain the objective or end for which everyone is striving. Drawing from the common agreement of all men, both learned and unlearned, he concluded that happiness is the one thing, the final purpose, which is universally chosen for itself alone. (10, p.409-410) What, then, is happiness and how may it be realized? These were the next questions of Aristotle and he answered them by saying: "Happiness is the activity of a complete life. . . We cannot ascribe happiness to an existence of a single day,

or to a child, or to each of the ages of life." (10,p.410) This, too, strikes a familiar note, teach for life.

Following the conquest by the Romans, Greece was reduced to a Roman province and many of the most enlightened Greeks were carried away into slavery. Due, however, to the low cultural level of the Romans in contrast to that of the Greeks, the enlightened slaves exercised an important influence upon the nation of their captors. (22, p.11)

The Romans, however, did far more than adapt and pass on the products of the genius of other people. They added original contributions of their own to the world's culture. Those products of Roman creative genius which affected the educational course of history most profoundly were: (1) the Roman Church; (2) the Latin language; (3) Latin literature; (4) Roman law; and (5) the course of study and organization of the Latin grammar schools. (10, p.518)

The outstanding educator and teacher of the Romans, Quintilian, was the first ancient educator to advocate public education against private education, and was the first Roman to deal scientifically with education. His work influenced and had an important bearing upon the later work of Herbart. (22, p.11)

With the fall of Rome at the hands of the Germanic barbarians, education ostensibly disappeared from the face of Europe. Following the Dark Ages, the next great step in the development of education, came through Dante's departure from the old practice of writing in Greek or Latin.

Streble and Morehart say that: (22, p.12)

> This was the real beginning of the rebirth of renaissance of learning. Men and movements followed fast. Among the latter are the humanistic movement, the protestant reformation, the Catholic reformation, the realistic movement, with its humanistic, social, sense, and verbal realisms as the several varieties.

John Locke stressed experience and environment as the sources of knowledge and learning. . . Applying Baconian and Newtonian conceptions of science to the study of the mind, he tried to find the natural laws of learning. His was the view that the mind was a tabula rasa upon which perceptions from the outside world are impressed. Thus, ideas, values, and knowledge have their origin in experience of the external world and of other people. (4, p.321)

"Development", according to Locke, "came only through the formation of habit through discipline." (17, p.512) The "doctrine of formal discipline" is

accredited to John Locke, and the results of this doctrine as expressed by Streble and Morehart, points to a dark period for educational theory and practice.

Recalling the movements brought about by Dante's vernacular, Streble and Morehart (22, p.12) state that:

> By the middle of the seventeenth century John Locke was laboring to generalize the findings of these several movements into the "Doctrine of formal discipline."
>
> So well did he do his work that this half truth choked the germ of life almost out of educational growth for some 250 years.
>
> By this doctrine it was believed that the mind could be whipped into a state of great keeness, and thereby be ready to cope with any and all problems, by virtue of the fact that all knowledge of what ever sort would transfer from one life situation to another, no matter how remote or unrelated, and by sheer force of mass, enable the educated man to solve all problems capable of solution . . . The doctrine of formal discipline was, up to the nineteenth century, the most definite principle or philosophical statement of what were thought to be the underlying facts of education . . . . Consider how valuable education would be if everything we learned would directly, or even indirectly, apply toward our efforts to solve any and all of our problems. . . . So potent is the desire among men for such a panacea that the ground is not entirely clear to this day, and many are there who know no other more acceptable principle.

It seems, however, from the many references read in this study, that the formal discipline doctrine was not so much a philosophy of John Locke as was it the common

practice and interpretation of the school masters of that time. Suffice it to say that, regardless of its origin, the practice of formal discipline did have an effect upon the educational theory and practice of the eighteenth century and is felt even today. (17, p.529)

The doctrine of naturalism, as propounded by Rousseau in his famous book "Emile", holds that the best learning comes from dealing with natural objects, with the manual arts, and with persons in a natural way. Learning takes place best where the child is free to develop and grow according to his natural impulses. There should be no restrictions or discipline and a setting should be provided in which the child can engage in <u>those activities</u> which interest him. (4, p.323) Learning is hampered by too great insistence upon memorizing the heralded tools of rationalism, namely, mathematics, language and books.

Butts (4, p.323) says that:

> Although it is extreme in many respects, the catchwords of naturalism (freedom, growth, interest, and activity) sound familiar to a generation acquainted with the exponents of modern "progressive" education.

Rousseau's ideas, in contrast to those of psychology, were for the most part negative and destructive. The effort of the "psychology tendency" was to state those

ideas in positive form. The "psychology tendency" is simply to clarify and develop the methods of the naturalistic movement. Education is considered as a development, or organic growth, which could be hindered or helped by the methods in which the natural capacities or activities are treated. (17, p.587)

The first exponent of the "psychology tendency", unconscious though it may have been, was Heinrich Pestalozzi. Quite unknowingly he taught very much in accordance with the laws of learning. He looked upon the child as a unity, as a composit group of moral, physical, and intellectual powers, all of which were to be developed harmoniously through education. His was the theory of proceeding from the particular to the general, from the concrete to the abstract. Pestalozzi felt that since it is nature that gives drive to life, it is the job of the teacher to adapt instruction to the individual child according to the various stages of his natural development. (4, p.436)

Here for the first time the present conception of modern education is apparent. Instruction should be adapted to the activities and interests of the child rather than imposed upon it.

By this time the important questions, who to teach, and is education a necessary part of life, had been settled. The questions which now held the center of the educational stage were those of, how best to teach, and by what methods would learning be best realized.

In the search for a logical or psychological organization of the curriculum a number of theories were advocated that more or less enjoyed popularity from time to time. However, for the great majority their popularity was short lived. Two of the most important of these schemes stemmed from the nineteenth century. One was the culture-epoch, or recapitulation, theory and the other the theory of correlation and concentration. (3, p.307) The cultural-epoch theory, in brief, as stated by Monroe (17, p.635) is that:

> . . . The stages of culture in the development of the race are paralleled by the stages of mental development of the individual, just as there is a parallel between the embryonic or ontogentic development of the individual organism and the organic or phylogenitic development of the species.

Monroe continues from this definition by saying that:

> Consequently, in order to follow the proper order in the psychological development of the child, the materials of instruction should be selected and arranged according to the stages in the cultural development of the race.

The theory of correlation and concentration, though

not related, was quite a different approach to the selection and sequence of subjects in the curriculum.

In the words of Brubacher: (3, p.310)

> The basic idea in correlation and concentration was to arrange subjects in the curriculum so that instruction in one was made to bear constantly on instruction in the others. Thus, in teaching geography it was very convenient to show its bearing on history and in teaching history to enrich it by reference to literature.

The Herbartians argued that these subjects were seldom found separate in life, out of school, so why should they not be correlated in school? (3, p.310)

Thus can be seen the theory of curriculum organization as was advocated by John Herbart.

It is interesting to note that Herbart marveled at how the student could, with each subject seemingly on a different shelf in the school, take each one down independently for a short while each day and then repeat the process day after day with as little confusion resulting as occurred. As Herbart saw the curriculum of his day, it was highly atomistic and with the great multiplication of subjects that the nineteenth century witnessed, this atomism and pluralism of the curriculum was greatly aggravated. (3, p.310)

Up to this time the curriculum had always been

conceived from the adult standpoint and with few exceptions imposed upon the child. The nineteenth century brought forth the questions whether the curriculum should be child or adult centered, and as to whether the curriculum should be composed of activities or subject matter. As can be seen through the ages the curriculum had always been conceived and organized about subject matter. "Indeed, so long had subject matter held sway that its acceptance had come to be quite uncritical." (3, p.299) Not until the child-centered or activity curricula, emerging in the late nineteenth and early twentieth centuries, was there forced a critical examination of the curriculum theory.

The reasoning or logic behind this stagnant acceptance of the curriculum stems from the feeling that the curriculum was a phase of the social heritage. "It was the stock of meanings or past problem solutions which the group prized so highly that it prescribed their learning as a condition of adult membership in the group." (3, p.310) Due to the continual increase in societies' store of meanings, which came with the passing of time, and were it not for subsequent systematic classification of these meanings into subdivisions of subject matter,

they would have become more and more unwieldly. Logic behind this classification of the whole field of knowledge, as well as the organization of each subdivision of subject matter within it stems from the theory, long held by both ancient and modern science, that objective reality had a logical structure which could be known and stated. "With such a premise it was quite reasonable to conclude that the logical organization of subject matter was more than a mere convenience of the human mind, that somehow it conformed to the stubborn facts of reality, to an invincible order in nature." (3, p.300) Thus, the curriculum was fixed in advance and because the child alone was pliable he was made to conform to it. (3, p.300)

Many there were who criticised this type of instruction, but until experimental psychology and a science of education were developed they had little if any backing for their educational theories.

The child-centered curriculum undoubtedly originated with Rousseau for he seems to be the first to subordinate the curriculum to the child. He gave attention to those drives, urgent within the child, the first claim in his selection and organization of the curriculum. This

feeling again was manifested in the theories of Froebel, who felt the goal of education was self-realization. "According to this view the curriculum was not something that originated exclusively outside of the child. On the contrary, learning started from within; it was a working from within out, a process of realizing an inner self." (3, p.301)

Brubacher (3, p.301-302) continues, saying that:

> Not all those who oriented the curriculum to the nature of the child did so out of sympathy with Froebel's idealistic philosophy. In America many arrived at such a curriculum by relying on the new dynamic, or functional, psychology of William James (1842-1910) and Edward L. Thorndike (1874-), which was just beginning to establish itself at the end of the nineteenth century. In two ways this educational psychology was enlisted in the service of a child-centered curriculum. On the one hand, positively it stated as a matter of empirical observation rather than philosophical speculation that the child at birth was organically possessed of a sizable list of instincts and impulses. The dynamic, propulsive nature of these native propensities led many educators to exactly the same conclusion as the Froebelians', that the curriculum must be fashioned to give expression to these assertive capacities . . . On the other hand, negatively it greatly discredited the old theory of learning as formal discipline, the theory that the important thing in learning was not so much the content learned as the general mental power developed.

Edward L. Thorndike was perhaps the most notable educational psychologist to turn his attention to

educational aims. It is from him that the "laws of learning" were realized. These laws are: (a) readiness, (b) exercise, (c) effect.

Strebel and Morehart (22, p.19) made the comment that:

> It must be remembered that Thorndike did not create the laws of learning. They are natural laws; they are as old as, if not older than, man. They will remain. Man must, whether or not he prefers, live with and abide by these laws.

John Dewey, (6, p.220) coming into his own in the latter part of the nineteenth century and considered the outstanding educator of the twentieth century, says, in regard to the curriculum:

> The fundamental thing is to find the types of experience that are worth having, not merely for the moment, but because of what they lead to -- the questions they raise, the problems they create, the demands for new information they suggest, the activities they invoke, the larger and expanding fields into which they continuously open.

This is the twentieth century and the concept of education has come a long way since the beginning of man. His was the complete correlation between education and life. What is the aim of education today? Is it the reconstructing of experiences? Is it the teaching for life, or as Dewey (6, p.11) expresses it, "teaching life

itself"? Is it correlated with life, with the problems of living and with a society so much more complex than that of primitive man? Very largely no!

Bonser (1, p.5) asks:

> Have we not very largely neglected in schools to give children experiences in the real activities of life and therefore failed to develop in them any connection between the things we require them to learn and the activities in which they are useful? There have been no purposes and problems which children entered into with zest because of their meaning and real value and interest to them. They have had no responsibilities of planning and carrying through activities and judging of values as is required in real life. They have had no sense of "readiness" for the assigned school work, they have no use for it, and they have taken no real satisfaction which enkindled in them a desire for further experiences on higher levels. We violate all of the laws of learning and of human nature and then wonder why children come out of the schools uneducated.

CHAPTER III

THE STUDY

A Changing Society. The education of the American frontier was of a simpler type than that sought today; one's education came through actively participating in the work and play of the family and community. Each family was a group within itself and each member of the family had an important role to play in the functioning of that group. Each child had important responsibilities in the economic enterprizes of the home. Through actual toil the child learned the relationships of the soil, climate, and human labor to the amount of food, clothing, and shelter available to the family. The children helped in the essential processes of production, from the herding of the sheep or the planting of the cotton, to the final fitting of the homespun garment; from the sowing of the seeds and the subsequent harvest, to the baking of the bread in the home oven. (21, p.129)

The education of that day consisted principally in the development of the three R's with little or no thought to socializing of the individual. Reeder (18, p.7) quotes Edwin R. Embree:

> In earlier days the task of the school was simple. Parents in the home gave children their social direction and acquainted them at first hand with the homely skills of farming, the hand trades, and homemaking. The church reinforced this home training on the side of social solidarity and of instruction in the local mores.

Thus the fitting of the child to society was not necessary because of the socializing influences in the home and community. In that day and age the community and home acted as the correlating medium.

Embree continues from Reeder (18, p.7):

> With the industrial revolution and the rapid progress of machinery and science, life became enormously complex. . . Furthermore, with labor-saving machinery the work of children was no longer needed or even permitted. Therefore children were dumped onto the schools, which have had to assume a custodial as well as an educational function. . .Thus the school has been left with a stupendous and ever-growing task and without the support (let alone the sympathetic understanding) of other social forces.

Hence, a responsibility is placed upon the schools to re-introduce the correlating opportunities which are all but absent in modern society and the homes of today. The activities of the school and of society must be presented to the child in their whole, complete, interrelated aspects.

The mere establishment of a school, however, presents

a pseudo situation. It lends itself to abstraction and incompleteness. The content is selected, separated, and segregated. Hence, it is more distant from real life, more abstract, and more difficult to learn.

Rivlin (19, p.29) states that:

> The content of the secondary school curriculum is often so far removed from the student's interests and needs that only the good nature of the students and the ingenuity of the teachers make mass acceptance of the curriculum possible---and students are not always good natured nor are teachers always ingenious.

Therefore, an effort must be made to combat these circumstances; there must be the realization of the interrelation of subject-matter and its needed reorganization.

To quote Dewey (8, p.39-40):

> . . . the intelligence needed to bring it about [the reorganization of subject-matter] is not lacking, but rather a long-time patience and a will to cooperation and coordination. . . they can undertake consecutive study of the interrelation of subjects with one another and with social bearing and application; they can contribute to a reorganization that will give direction to an aimless and divided situation.

<u>A Flexible Curriculum</u>. That the curricula of the schools of today are grossly inadequate, to meet the majority's needs, can hardly be denied. According to the

Prosser resolution (12, p.18-19):

> In the United States the people have adopted the ideal of secondary education for all youth. As this ideal is approached, the high school is called upon to serve an increasing number of youth for whom college preparation or training for skilled occupations is neither feasible nor appropriate. The practical problems connected with the provision of a suitable educational program for this increasing number are so great and the schools to date have had, comparatively, so little experience in this enterprise that the problem merits cooperative study and action by leaders in all aspects of secondary education.

Thus can be seen two points which have infinite bearing upon the organization of the present curriculum, namely; the fluctuation of society and the inadequate curriculum now in existence. It is interesting to note, however, the prevalence of that element of human nature which tends to uphold the old and view the new with fear and suspicion.

Miller and Hargreaves (16, p.170-171) point to this fact, saying:

> We have been so devoted to the sacredness of the curriculum morgue, with all manner of self-created obstacles, that we have failed to incorporate in our procedure all those gripping interests of life which appeal to our boys and girls. Whenever any part of the curriculum is deleted, the tendency is to mourn the loss of it as a mother mourns the loss of her child. There is a danger in mothering the curriculum to excess. We need to recognize the far-reaching

> significance of a boy's dominate interest. If a pupil is actually incorporating the spirit of any course or subject of the curriculum, and is finding in it a joyous release of powers, provision should be made for encouragement in that direction. It may be chemistry; it may be a language, stenography, geometry, biology, art, agriculture, or any other course. It may be radio, athletics, some real "project", dramatics, music, designing, debating. Whatever becomes the dominate interest, that should suggest a shift of emphasis in the organization of curriculum offerings and in procedure values for the particular pupil manifesting a dominate interest.

How the flexibility of the curriculum may be attained is a major problem. The problem becomes one of extreme magnitude when adoption by the existing subject-centered curriculum is considered. The ideally flexible curriculum is personified in the integrated curriculum. This requires, however, the complete breakdown of subject-matter lines, and to the minds of many, presents too revolutionary a step. The point is then offered that the correlated curriculum may well be the evolutionary step between the subject-centered curriculum and that of the integrated curriculum.

Rivlin (19, p.45) lends support by saying:

> It is a small, but important, step from the improvement of individual subjects to the correlation of subjects. Once attention is focused on the functional aspects of subject-matter rather than on the traditional content,

it is almost inevitable that teachers of related subjects should seek to coordinate their efforts.

An Approach to Correlation. Correlating subject areas may be invoked in numerous ways and under many circumstances. It may be the English teacher placing some of the words used in the industrial arts classes on the spelling list, or selecting items from industrial arts to be used as class or individual theme topics. Still further, the mathematics of the shops may be given emphasis in the mathematics classes, or again, correlating the industrial revolution in the history classes with the aspects of simple and mass production through the classes in industrial arts.

This approach to correlation may be thought of as "casual". It is carried on consciously, and does not entail the extensive organization necessitated by other methods.

In respect to teaching methods, regardless of kind, the resultant outcomes must be considered. Teaching may be generally defined as a medium for imparting information, for the development of an interest or attitude, or for the development of a particular skill. Seldom, however, are these mediums used in isolation, as for example; in the

acquisition of information, certain skills will be acquired, attitudes developed, and habits formed.

Douglass (2, p.2) points out that:

> . . . the difficulties in the way of the approach to better teaching methods, by means of an analysis of the outcomes of teaching, lies in the fact that rarely is one engaged in trying to produce a single type of outcome.

In considering how best to attain these important outcomes of the teaching process, a classification of the methods of imparting, as well as of acquiring information, may be made, namely: the reference to competent authority, and the development from facts already known. (2, p.3)

Douglass (2, p.3) states that:

> Under the first should be placed all procedures in which the learner accepts the information upon the authority of a teacher, or the printed material, and in which the major portion of the student's efforts are centered on understanding and retaining the information. Under the second heading should be placed those procedures in which the learner's efforts are centered, to a very large degree, upon deriving, deducing, or developing information.
>
> . . . . . .
>
> Among the methods which may be considered as authoritative are:
>
> 1. Telling.
> 2. Textbooks, and reference assignments.
> 3. Direct sensory presentation - visual instruction, etc.

Among the developmental methods are:

1. The deductive; that is, problem-solving method.
2. The inductive; that is, the generalizing method.
3. The Socratic-developmental method, which is a special type of the deductive method.

In many cases methods of teaching will not be so clearly defined and may partake of the nature of both classifications. As a consequence it is difficult to decide under which heading each more properly belongs.

Douglass (2, p.4) points out the comparative advantages and limitations of the two methods:

Superior points of the authoritative type of method.

1. Things can be told much more quickly than they can be developed.
2. A logical organization can be better preserved.
3. Authoritative methods may be more successfully employed by teachers of mediocre ability.
4. Degression is not so likely to occur.
5. Authoritative methods may be used in situations where it is impossible or highly impractical to use developmental methods.
6. In many instances the subject-matter is not of sufficient importance to warrant the increased expenditure of time, or is of itself of such interest and ease of understanding that authoritative methods will produce satisfactory results.

Superior points of the developmental type of method.

1. Increased vividness of presentation is likely to result from the activity involved in the development of a problem

or idea.

2. In the developing process, associations are established which promote retention and which contribute to perspective.
3. Because of the type of procedure followed, information developed --- that is, rules derived inductively --- are more completely understood.
4. If the information is forgotten, it may be reconstructed by developing again.
5. Of as great value in most instances as the information itself are the values of such by-products of the developing method as:
   a. The habit of thinking for one's self.
   b. Increased skill in thinking for one's self.
   c. Increased confidence in one's conclusions.
6. Increased interest usually accompanies the process of developing facts for one's self.
7. Developmental methods afford a better opportunity for study of the individual child and the class, their manner and methods of thinking, quality of temperaments, etc.

It is impossible, in the modern concept of education, to use either of the suggested methods to the exclusion of the other. The outstanding features of each must be used to realize the desired outcome. The actual determining of that time which is considered best will rest upon the judgement of the teacher and upon the predetermined end or outcome. Herein lies the value of that aspect of correlation, formerly referred to as "casual correlation".

It is to be understood that correlation is not a "must", it is to be used, casually or intensively, only in

so far as it aids the predetermined outcomes. A forcing of correlation has too often resulted in the breakdown of this method of teaching.

Better Teaching Versus Correlation. Because the correlated program is, for the most part, in a developmental stage it is difficult to cite in-service examples of this program. Correlation as a method of improving teaching, can, perhaps, be best determined by examining the comments of educators concerning this method of instruction.

Friese (13, p.157-158) makes the comment:

> The movement toward correlation [italics in the original quotation] (and integration in some ideal cases) has grown because: (1) A counter balance to differentiation is necessary; (2) a successful citizen in today's world cannot be solely a specialist, nor one with only a cultural education, nor yet one who is a jack-of-all trades. Relationships must be observed and studied. The industrial arts (and all practical arts and vocational education) provide an unusually large number of natural avenues of approach to the study of these relationships---- they provide correlation.

Friese (13, p.158) also says:

> Correlation brings together the elements of content necessary to the unit of learning from whatever subject matter fields in which they may be found. The learner, who is an active agent in bringing the subject matter together, gains perspective of learning by this activity.

Rivlin (19, p.45) states:

> It is a small, but important, step from the improvement of individual subjects to the correlation of subjects. Once attention is focused on the functional aspects of subject-matter rather than on the traditional content, it is almost inevitable that teachers of related subjects should seek to coordinate their efforts. How can we justify the practice of having the history teacher discuss ideas and of having the English teacher discuss how one expresses ideas? Why should the teaching of mathematics be divorced from the applications of mathematics to the solution of problems in physics and chemistry?

In support of correlation Vaughn and Mays (24, p.142) point out that: "The general, basic principle of correlation is sound . . . It is the very principle that sensible teachers have always used; namely, the study of things in their proper and natural relations." Snedden (20, p.140) though not in opposition, forcibly states:

> It is here contended that nearly all past attempts at correlation of subjects have broken down or proved relatively empty of desired effects <u>because they were not based on clear formulations of the expected objectives to be attained through the two or more subjects correlated</u>. [italics in the original quotation]

Snedden (20, p.140) continues, however, saying:

> Why not, then, work out both geography and spelling assignments or specified objectives far in advance and then so sort them that the closely related assignments will fall closely enough together to correlate? Good---it needs to be tried--we have almost no good examples.

Klapper (15, p.349-352) emphasizes the psychological soundness of correlation:

> . . . correlation finds no difficulty in justifying itself on psychological grounds. A fundamental psychological law teaches that nothing remains isolated in the mind. A new fact is seized upon by old ideas and associations; innumerable relationships are at once established between itself and the stock of old knowledge. Until this association takes place a new fact remains meaningless.
>
> . . . . . .
>
> . . . correlation may be a guiding principle of teaching. . . Correlation by interelating the vast knowledge stock would produce a unified, compact, and well-organized course of study. Since correlation is also a means of association, of giving new view points to old ideas, it would result in increased thoroughness of comprehension. Concepts would, therefore, be fewer, richer, more lasting if organization through correlation were made a basic endeavor in teaching.

Ericson (11, p.129-130) suggests correlation as a means of enriching teaching: "The teacher who wishes to popularize and vitalize his teaching, then, might well reach out for opportunities to correlate his work and make it fit into a larger sphere of educational activity".

The above quotations stand as evidence of the probability of the improvement of teaching through correlation of industrial arts with other subject areas. Dewey (7, p.10) suggests industrial arts as a center of

correlation for the school program. Be that as it may, it is not the intention of this study to point to the industrial arts classes as the core of a correlated program. A core suggests the reorganization of existing programs, and as here thought of, correlation is not intended as a substitute but rather as an additional treatment of that which already exists. The problem which faces education is not <u>what</u> to do, but, rather, <u>how</u> to do it, how to bring about changes and yet not cause undue confusion and upheaval in the existing program. That correlation is, in some measure, an answer to this seems evident.

CHAPTER IV

METHODS OF CORRELATION

The opportunities for correlation with industrial arts subjects and departments, and between industrial arts and other subjects, are probably greater than can be found elsewhere in the modern school.

Friese (13, p.161) states that:

> Correlation can be made a very important phase of industrial arts teaching. It could dominate the aims, content, and procedures of industrial arts were it permitted to do so. Yet many industrial arts teachers and school leaders fail to see the educational challenge that lies in this direction. But among progressive industrial arts teachers and supervisors, a unified program of school experiences for a particular individual is in the making.

Thus, can be seen the major role industrial arts plays in the correlation of subject areas. It is with this thought in mind that the following suggestions are offered as guides to the formulation of such a program.

Correlation Within An Industrial Arts Subject. The related information, which is so vitally a part of the industrial arts classes, is often referred to as "knowing units", in contrast to the "doing units" or manipulative skills. The correlation of these two is of prime

importance to the realization of industrial arts objectives and may well be of equal importance in teaching. In considering how best to correlate related information with manipulative skills a further classification of the "knowing units" would lend assistance. They can be classified into three general types: The first type may be considered as the related information necessary to aid in the performance of the manipulative skills. For example, the types and kinds of cutting oils used, the cutting speeds and feeds necessary for the different kinds of metals worked. This type of information is taught while manual instruction is taking place. The second type may be thought of as that aspect of a project or problem which leads to discussion topics of general information. For example, while a student is engaged in the forging of a cold chisel, an opportunity is offered to initiate a discussion recalling the location of iron deposits, which in turn could lead to mining methods and transportation and thence, to blast furnaces and methods of steel production. The third type, where manual and informative aspects of several representative trades are essential in the unfolding of a

true educational project, for example, feeling a need, making plans, executing, and judging results. This type of correlation is needed in unit shops and in the several kinds of general shops. (13, p.161-162)

Correlation Between Two or More Industrial Arts Subjects. Some projects demand work experience in design and construction in the various shop classes other than the one in which they are initiated. This is particularly evidenced in unit shop courses, and in those general industrial arts classes which are conducted through student rotation in several unit shops. The traditional barriers between courses and rooms must be removed, and cooperative teaching attitudes and procedures must be developed in and among the several industrial arts teachers. For example, perhaps a student is planning to build a cedar chest which entails, in its construction, some metal work, some woodwork, and the working drawings needed for completion. The correlation anticipated under these circumstances would encourage the student to draw and blueprint the working drawings in the drafting class, perform the necessary construction and assembly in the woodshop class and use the facilities of the metal shop class toward realizing the completed project.

Correlation Between Industrial Arts Subjects and Subjects in Other Departments. Of the many areas in the school program those which seem to lend themselves particularly well to correlation with industrial arts are: art and design, vocational and educational guidance, the physical sciences, English, industrial history, geography, social problems of industry, and economic problems of industry.

Friese (13, p.162-163) cites the following actual cases of correlation and cooperation between industrial arts courses and other areas in the school:

> Interchange of automotive and chemistry classes for emphasis upon theory and applications.
>
> Similar interchange of physics and machine shop classes.
>
> Industrial arts department provides English classes with theme topics of vital interest to particular groups.
>
> Similarly the industrial department provides English classes with lists of names of semi-technical and semipopular books concerned with industries and occupations for outside readings.
>
> English department gives individual aid to students who hand in poorly prepared papers or tests in industrial arts courses.
>
> Art department provides individual aid to industrial arts students with their problems in design.
>
> Art department provides organized and scheduled class instruction in design for specific industrial arts classes.
>
> Industrial arts department provides scheduled lessons in occupations and educational

guidance in trades and industries for the vocational guidance department, as an integral part of its services.

Additional Opportunities For Correlation and Cooperation. Friese (13, p.163) very aptly points out the value gained by a survey of the entire school curriculum.

> An analysis of subject matter, methods, and class organization of industrial classes and other classes frequently reveals a surprisingly large number of opportunities for correlation and cooperation. To accomplish the desirable educational results that are possible, however, requires that someone catch a vision of the possibilities and also be in a position to bring the two or more teachers or department heads together. With the backing of the school administration, the teachers may well be charged with the responsibility of discovering subject matter which may yield superior educational values when correlated. This frequently requires the dissipation of inertia and petty jealousies, and demands that someone in a responsible position assume or be given a position of leadership in the work. Otherwise, accomplishments will likely be limited. Once set up, such correlating and cooperating arrangements should become a part of the course of study of each subject involved. This will assure a degree of permanence.

Friese (13, p.165) outlines the success factors of correlation, saying:

> The following factors influence the amount of correlation in industrial education and reflect the degree of its effectiveness.
>
> Aggressive, progressive, and far-seeing school administrators.

Teachers who are willing to follow a leadership which asks for different aims, course materials, and procedure that reflect the increased social emphasis upon American education.

Industrial teachers and other teachers who have a broad viewpoint of education as a whole, and the particular contributions of various groups of subjects; and who visualize significant relationships between groups of subjects.

Teachers who themselves dare to urge and inaugurate these correlating and coordinating relationships in the interests of better learning.

Carefully worked out courses of study (complete sets of plans and specifications for doing the entire job of teaching a course) with the various correlating conditions named, described, and tied into the manual core of the industrial course at significant points.

Suggested Topics Which Lend Themselves to Correlation. Following is a list of topics which, it is felt, will lend themselves readily to correlation with other areas. It is suggested that these be used as the basis of group problems or projects.

Group Problems or Projects.

1. Industrial revolution
2. Production of steel
3. Production of iron
4. Production of glass
5. Tanning of leather
6. Production of paper

7. Production of textiles
8. Development of measurement
9. Development of numbers
10. Development of electricity
11. Development of radio
12. Development of television
13. Development of advertising
14. Development of power
15. Development of lumber industry
16. Development of weapons
17. Development of printing
18. Development of oil
19. Development of transportation
20. Development of communication
21. Development of photography
22. Development of prehistoric man
23. Development of sanitation
24. Development of medicine
25. Development of literature
26. Development of synthetics
27. Natural resources

A Suggested Approach to a Group Project. A topic was selected from the above list of group projects to

exemplify the approach to a correlated program. Because circumstances will dictate possible changes it is not offered as a complete outline.

Project: Process of Paper Manufacture.

General Objectives.

1. To gain experience in working with a wide variety of materials.

2. To offer an opportunity for self-expression.

3. To gain knowledge of the importance of paper and its relation to the progress of man.

4. To offer an opportunity for the application and obtaining of, information from the various subject areas in the school.

5. To gain knowledge of the occupations in paper making and its allied fields.

Specific Objectives in Industrial Arts.

1. To construct a paper making machine.

2. To make paper in the classroom.

3. To use paper in the construction of simple projects.

4. To use the facilities in the different shops to aid in completing the project.

Specific Objectives of Other Subjects.

1. To make available those facilities in this class which contribute toward the realization of the industrial arts class project.

2. Endeavor to use those contributions from the industrial arts class project which readily fortifies or relates to the content of this subject.

Examples of Correlation With Other Areas.

English.

1. Classroom discussion. Many opportunities are presented in the English class to discuss various aspects of paper. The early methods of writing, the languages used, the significance of the "scribes", and the different qualities of paper are examples for classroom discussion.

2.. Letter writing. Writing letters is a phase of English. If these letters are written to be sent to someone, the anticipation of receiving answers will tend to increase motivation. Information may be sought from manufacturers concerning the latest advances in paper manufacture, the more recent uses of paper, and the largest consumers of paper. In addition, samples of the different types or grades of paper may be sought.

3. Reports. The discussions in the English class, the historical development discussed in the history class, the process of paper making witnessed in the industrial arts class, any of the phases of the paper making process are excellent sources for oral and written reports.

4. Spelling. Throughout these discussions, reports, letters and etc., there is an opportunity for introducing new words and the spelling of them.

Mathematics

1. Measurement. Any number of opportunities are offered to the mathematics classes for practice in measurement such as, distance of transportation and transportation costs, cost of material, cost of labor, cost of production, calculating speeds, distances, and percentages. Practice in addition, subtraction, dividing, etc., will be included in the above activities.

2. Graphs and charts. Incidences will occur in a project such as this in which the construction of charts and graphs will play a major role and give opportunity to read and construct them. Cost figures, production figures, and consumption figures will lend adequate material for this practice.

History

1. Development of paper. The early invention of paper and its development through the ages lends itself well to the history class. The invention of paper making machines and the effect upon society is also an important aspect of history.

2. Historical events. Correlating the events of history with the progress in the manufacture of paper points out relationships which would perhaps be more significant to the pupil.

Geography

1. Materials. The geographical location of the materials of manufacture and their relationship to transportation, distribution, and consumption would point to an easy correlate with economics.

2. Natural resources. The geographical location of the centers of paper manufacture and their relation to the location of natural resources would be educationally significant at the same time create interest within the students.

Economics

1. Consumption. See History No. 1

2. Supply and demand. Perhaps through the letters written by the English class, figures of amount produced and amount consumed would be obtained, these could well be used to illustrate the factors of supply and demand.

Chemistry

1. Solutions. There are numerous processes of making paper which use different chemical solutions, such as, sulfite, sulfate, soda, and water. It would be interesting for the students in industrial arts who are taking chemistry to learn of the chemical reaction of the different processes and why they are used.

2. Qualities of paper. The activities mentioned above would apply to the chemical processes required to produce the different qualities of paper. These are: Rosin--wet strength, alum--sizing, starch--glaze, clay--surface texture, copperas--water proofing, and borax--fire proofing.

There are further correlations possible: in botany, to study the trees and plants which are adapted to the making of paper, and in art, help might be given in the designing of projects made from paper.

Example of Correlation in an Individual Project.

Individual projects offer numerous opportunities for correlations between subject areas, and may be considered important vehicles for this method of instruction.

Industrial arts is characterized by the extensive use of individual projects, any one of which could serve as a correlating medium. An example of the problems presenting themselves for solution by the student and the correlations entailed in these solutions, is offered by Vaughn and Mays (24, p.150-152)

> Suppose a boy desires to build a model airplane. A large number of inquiries immediately come to mind. Each demands investigation from authoritative sources, before the worker may proceed intelligently. Assuming the boy to have a reasonably clear conception of the basic principles upon which an airplane is built, the following are typical questions which present themselves to him for solution.
>
> 1. What type of machine shall I undertake? (This will necessitate an understanding or an investigation of the various types of machines and a decision as to the type best suited to his purposes and his ability.)
> 2. What shall be the size and proportions of the fuselage and the size and relative proportions of the planes or wings in order to support the machine and maintain balance? (This will require considerable mathematical work in making the reductions, even if the government plans for the army planes are available.)
> 3. What shall be the size of the propeller?

(Any number of mathematical and physical principles are involved here.)

4. Of what materials should the fuselage and propeller be made? (This will cause the eager investigation as to the different woods used in regular airplane construction and as to their comparative value, strength, weight, character of growth, etc.)

5. What is the proper position of a propeller and why? (Here attention may be called to the common position of a motor boat propeller and the whole principle of propeller action may be studied.)

6. How are the wings formed and how is the wood treated to assure its proper bending?

7. What power is available for model plane and how shall it be applied? (This may be made the means of investigation and study of the whole question of motor power and its application to airplanes. Interesting information is available concerning the importance and difficulty of the motor problem in the airplane service of the army.)

8. How is an airplane controlled and guided in its flight?

9. What devices have been adopted for landing purposes? On what principles do they operate?

10. Upon what principles must a heavier-than-air craft depend for its successful operation? (This will lead directly into the story of the experiments made on the theory that an airplane must be lighter than air. Such investigations will bring up the whole question of the weight of air, its increasing rarity as the flier ascends, and various meteorological conditions to be met.)

Such a project involves a considerable accumulation of mechanical data, some necessary drawings, a number of mathematical computations, the understanding and application of several principles of physics, and a valuable lesson on the nature, growth, habitat, weight, strength, and the susceptibility to durable finish of the various woods that are used in airplane construction.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

There has been considerable unrest in education throughout history. Each period has brought new attempts to improve teaching. That the present system is superior to those of the past can hardly be denied. Yet to complacently rest upon these laurels is to invite degradation and decay. Only by constantly searching and continually striving for better teaching and for better education can the objectives of education be attained.

The problem of the study was to determine if, by correlating subject areas, an improvement in teaching would follow. Judging from the comments of educators there seems to be definite harmony in the belief that through the correlation of subjects an improvement in teaching will result. Not only will industrial arts receive its share, but correlation, carried throughout the school, will be beneficial to all instruction. Correlation cannot, however, be considered a panacea of all teaching difficulties, rather it should be thought of as an aid to a better learning situation, a step forward in educational practice and procedure.

Recommendations. In view of the evidence that points to correlation as an improvement in teaching, it is recommended that:

1. The curriculum be more flexible, thus encouraging attempts to cross subject matter lines.

2. Teachers list the contributions that they might offer toward such a program.

3. Teachers strive for a broad viewpoint of education, to see education as a whole.

4. Complete programs be worked out cooperatively among the teachers, noting points of correlation, and agreement be sought as to the procedures by which these may be realized.

5. Teachers strive to visualize relationships between subjects and groups of subjects, to aid in stimulating pupil motivation.

To recommend the correlation of subjects, is to recommend better organization, cooperation, understanding, and a fuller realization of the objectives of education.

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