A Stem Craft Program in the Elementary School Curriculum

George Raymond Balling

Loyola University Chicago

1953

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A STEM CRAFT PROGRAM IN THE ELEMENTARY SCHOOL CURRICULUM

by

George Raymond Balling

A Dissertation Submitted to the Faculty of the Graduate School of Loyola University in Partial Fulfillment of the Requirements for the Degree of
Doctor of Education

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1953
LIFE

George Raymond Balling was born in Chicago, Illinois, July 15, 1905.

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CHAPTER I

INTRODUCTION

Setting of the Study.

Traditionally, elementary education in the United States has been on a subject-centered, graded basis, with two major school organisational plans forming the administrative framework. These two types of school organisation are the individual classroom unit and the departmental plan.

One teacher, instructing pupils in all subjects in a single grade, is the basic element in the individual classroom unit form of organisation in the elementary school. This plan is also referred to as the self-contained classroom type of organisation.

In a one-room school the teacher would teach pupils in all the grades as well as in all the subjects. In such a situation the teacher would be cognizant of all phases of each subject at each grade level and, if so inclined, could coordinate

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all the school work into a unified experience. This could mean closely integrated educational experiences with few, if any, subjects taught in isolation.

While there is some doubt as to how well integrated the work in a one-room school actually proved to be, at least there was a possibility of integrating it. However, the one-room school is rapidly disappearing and schools with many teachers are taking its place. In these the teachers usually have pupils in only one grade or in some cases in half a grade. The teacher teaches all the subjects to a class, and if she wishes can integrate these subjects very closely.

When pupils are promoted to the next grade, however, there is an almost complete break in their educational life, since a new teacher takes charge and brings a new personality, a new outlook on life, and a new concept of subject matter, to bear upon the child. The result is likely to be a series of fairly well integrated learning experiences, interrupted each half year or year by a complete break in continuity. This tends to produce a highly stratified educational pattern. The individual classroom unit provides excellent opportunity for integration between subjects, but for little or none between

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grades. A diagram of this type of organization is included in Figure 1.

![Diagram of grades]

**FIGURE 1**

**INDIVIDUAL CLASSROOM UNIT ORGANIZATION**

The second major type of elementary school organization is that known as departmental. According to Otto the departmental organization originated in this country toward the end of the eighteenth century, but did not become an important factor until

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4 This typical diagram of an elementary school organized on the individual classroom unit plan indicates annual promotions, since each rectangle represents a full year of school work. A diagram of a school using a semi-annual promotion system would have sixteen rectangles. The faint vertical lines in the rectangles represent subject divisions.
after it was adopted in New York City in 1900. The apparent advantages of this plan led other school systems to adopt it on an ever increasing scale until about 1935, when the trend was reversed and the percentage of schools employing departmentalisation began to drop steadily. Whether or not departmentalisation will ever be abandoned is a moot question, according to Phillips, who points out that because of its neatness, and the convenience it affords administrators as well as teachers, it is likely to continue in many schools.

The fundamental principle of a departmental organization is specialization. Each teacher specializes in one subject field and has little or no connection with any of the other subjects. This involves teaching a single subject, or group of related subjects, to pupils at different grade levels in the elementary school.

Some of the advantages claimed for the departmental organization by those who favor the plan are that it tends to


improve teaching, to make use of better equipment, to enrich the curriculum, to provide for promotion by subjects, to foster vertical integration, to offer improved physical conditions for pupils, and to furnish a transition to high school attitudes and methods. Disadvantages listed by opponents of the plan are that it tends to make teachers narrow, to overburden the pupils, to impair discipline, to overemphasize the function of knowledge in education, and to destroy the unity of school life for the pupil. 8

The last two disadvantages, overemphasis on knowledge as such, and destruction of the unity of school life, are probably the chief factors responsible for the decreasing popularity of departmentalisation. The nature of the plan, employing specialists in a field to teach it as a subject, is apt to lead to stressing factual knowledge in that one field. In practice that is just about what has happened. Teachers of arithmetic are so engrossed in their mathematical concepts that they have little time for other subject fields, teachers of science take pride in their scientific field and disclaim responsibility for any other, and so on down through all the areas of learning. Little connection is made between the various subject

fields, and the expression used by Otto, "subjects taught in isolation," 9 might be an accurate description of conditions.

In a departmental program there is little integration between subjects, but because several grades of each subject are taught by one teacher, the integration between grades is likely to be very close. 10 Thus, the departmental organization is strong where the individual classroom unit is weak, in the degree of integration between grades. However, the individual classroom unit excels in the possibility of close integration among subjects, a factor which is noticeably lacking in departmentalized schools.

A typical diagram of a departmental organization in

9 Otto, Principles of Elementary Education, 225.

10 Rouse, 19.
which the upper three grades follow the specialized program is shown in Figure 2.

![Figure 2: Departmental Organization]

**FIGURE 2**

**DEPARTMENTAL ORGANIZATION**

In addition to the lack of integration between subject areas and between grades inherent in common elementary school organizational patterns, there is generally poor motivation of the school learning experiences.\(^{11}\) This is due largely to the fact that there is usually too much emphasis on subject matter, without much relationship to the pupil's real needs, interests, or abilities.\(^{12}\) Risk stated that "no learning takes place


without attention, and pointed out that attention is given freely to things which are interesting. When interest is lacking a motive which will compel attention must be developed.

Smith, Stanley, and Shores indicated that, in order to compensate for the failure of the ordinary subject organization to arouse or to utilize the learner's interest, it was necessary to use elaborate systems of motivation. Schneideman pointed out that motivation of pupils was the primary duty of teachers, with the chief difficulty arising in locating the most effective method. Risk stated that "one of the most difficult problems of the teacher is the motivation of pupils."

Need for the Study.

In view of the disadvantages of many school organizations and curricula, there appears to be a need for a program which will improve the motivation and integration of


14 Ibid., 501.


16 Rose Schneideman, *Democratic Education in Practice*, New York, 1945, 144.

17 Risk, 472.
learning experiences. The Stem Craft program, which is to be studied here was specifically designed to attempt to do this, since there have been a number of other educational plans devised to improve motivation, pupil interest, and integrated educational experiences, the literature that seems pertinent is reviewed.

Review of the Literature.

The "project method" is one of the major devices introduced to inject interest into the educational process. The origin of the project as an educational device has been traced by several writers back to the early part of the twentieth century, when it was introduced into agricultural schools to supplement school work. The "projects" were known as "home projects" and involved such farm work as selecting seed corn, caring for poultry and cattle as well as growing crops under actual conditions.

The original plan stressed concrete accomplishments, but it was soon modified to mean all sorts of things. Bode lists seven different definitions of a project, which range from, "a project is a unit of educative work in which the most prominent feature is some form of positive or concrete achievement" to,


19 Bode, 146.
"a project is a wholeheartedly purposeful activity carried on in a social context."\textsuperscript{20} The latter definition is that of Kilpatrick,\textsuperscript{21} an educator prominent in the project field, who considered learning the irregular verbs in French to be a project.\textsuperscript{22}

In referring to the original project method in which concrete achievement was featured, Bode wrote:

This method avoids the verbalism or bookishness with which education is so extensively afflicted, it is easily adapted to the native interests of the pupils, and it gives effective training in thinking. It seems reasonable to expect that the method can be extended so as to induce a different attitude toward school work in general by linking up school experiences with other experiences and thus making school work more concrete and meaningful to the pupils.\textsuperscript{23}

Unfortunately, the project method did not fulfill Bode's expectations as expressed above, since, as he pointed out later, the project usually became the goal rather than a means to the end. Unquestionably the project method produced greater student interest, but unfortunately much essential material in the skill subjects was not picked up incidentally by the pupils working on projects, and it became necessary to teach it to them.

\textsuperscript{20} Ibid., 147.
\textsuperscript{22} Ibid., 16.
\textsuperscript{23} Bode, 146.
by the usual methods. Thus the project method succeeded in injecting interest into the school program but at the expense of educational results. The plan of utilizing inherently interesting pupil activity as a stimulus for school work which lacks interest, the idea behind the project method, was excellent, but the undesirable factors mentioned have placed serious limitations on its actual use.

The "activity program" was a second educational device, closely related to the project method, introduced to increase interest and motivation of school work. The activity program was described as:

a reaction away from the practice once fairly dominant in American education of setting out in advance, chiefly in specific textbook lessons, what the pupils are expected to learn. There were those who felt that in such practice the active potentialities of the pupils themselves were not sufficiently called out or exercised. The activity program represents one line of effort for remedying what was thus felt as a defect.

Wingo, writing on the activity program, emphasized the fact that the activities must not be planned in advance by the

24 Ibid., 150 and 161.
25 Ibid., 161.
teacher, and that just any overt activity is not automatically educative.

In the descriptions of the activity program given above it can be seen that the emphasis was on pupil participation in the planning as much as it was on actual activity. True pupil activity appears to have a logical place in the educational process, but the desirability of pupils planning the school program is open to question. Bagley expressed this viewpoint when he wrote:

The theory underlying the activity program is fundamentally fallacious in the conception of freedom it implies. The freedom of the immature child to choose what he or she will or will not learn is utterly insignificant in comparison with freedom from want, fear, fraud, and superstition—a type of freedom which is won only by a systematic and effortful mastery of the lessons that man has learned as he has traversed his rough road upward from the savage and the brute.

Freeman pointed out that the original activity program, which referred mainly to a process emphasizing overt physical activity in contrast to academic work, was perfectly understandable, but that this common-sense meaning of the term had been

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28 Ibid., 96.
29 Whipple, ed., 77-78.
The state of confusion which existed in 1934 when the activity program was receiving major attention in the educational field was described by Horn in this way:

The terms "activity" and "activity program" have so little definite quality that it is difficult to discuss them. They are decidedly slippery terms. A critical and extensive study of the actual examples of "activities" that are given in printed courses of study and in other professional literature discloses under this label almost every type of teaching procedure to be found in any school. "Activities" include everything from pageants to vocabulary drills of the oldest vintage. The resulting confusion is increased by the fact that an educational experience that is labelled "activity" in one school is in others called a "problem," a project," a "unit," a "center of interest" or perhaps merely one division of a subject.31

Smith, Stanley, and Shores pointed out the need for subjects in the activity program when they wrote: "Subjects are needed in such areas as mathematics and reading because sufficient skill in these fields cannot be developed in the activities and projects carried on in the non-specialized activity program."32

There have been several curriculum plans devised which tend to improve the condition described as subjects taught in isolation and foster integrated educational experiences. Four of

30 Ibid., 89.
31 Ibid., 194.
32 Smith, Stanley, and Shores, 462.
the more common of these, the correlated, the broad fields, the 
core, and the unified, will be considered.

The "correlated curriculum" was described in a brief 
paragraph by Hopkins, et al., as follows:

The starting point is subject-matter set-out-to-be-
learned. By relating the subject-matter of one subject to 
that of another whenever possible, teachers have learned 
that an improvement in learning effect is experienced in 
each subject. Under the correlated curriculum little or no 
attempt is made to change the aim of teaching, the 
selection of subject matter, the method of presentation, or 
the evaluation of results. 33

As indicated above, the correlated curriculum differs 
but slightly from the regular subject-centered plan of teaching. 
Actually the only change involved is a different attitude on the 
part of the teacher, who is required to relate the various 
subjects whenever possible, but it is a definite attempt to get 
away from compartmentalized education. 34 This is an important 
difference, although it is only what would be expected from a 
superior teacher who has the real interests of her pupils always 
before her. Hildreth indicated a very similar viewpoint when she

33 Thomas L. Hopkins, et al., Integration, Its 
Meaning and Application, New York, 1937, 201.

34 Edward M. Roden, "Criteria of an Adequate Program," 
Phi Delta Kappan, XXII, January, 1940, 239.
Any good teacher who is genuinely interested in the children tends to set as a major objective self-discovery of the features that promote more realistic and rewarding learning at school. These teachers have not had to wait for pronouncements from educational psychologists and child-development specialists in planning rich learning experiences for children.35

In the "broad fields curriculum" the usual long list of separate subjects are merged into not more than four to six broad fields. For example, the content of reading, writing, spelling, and language is merged into one instructional field called language arts, while the work in history, geography, and civics is combined into an integrated social studies area. In addition to the ones mentioned, the common broad fields include arithmetic, science, and the creative and recreative arts.36

Hopkins et al. pointed out quite clearly how the broad fields curriculum differs from the subject curriculum.

(1) It is composed of a few fields rather than a large number of small subjects. (2) Each field has a greater area than that of the combined present subject matter of the subjects which might be grouped in the field. (3) The content of each area is usually selected on different bases from the subject-matter of a subject. (4) The teaching and learning situations permit greater pupil and teacher control and direction. (5) The bases of measurement and evaluation


are greatly extended.37

In pointing out the need for broad fields, Brueckner stated that the curriculum should be organized so as to bring out the relationships between organized bodies of human knowledge and to facilitate integrated learning.38 Thus, the primary objective of the broad fields curriculum is the integration of pupil learning experiences, although actually the integrating effect is only between the related subjects which comprise each broad field.39,40

Another approach to the improvement of instruction through integration is the "core curriculum." In this plan one of the subject fields is selected as the "core" around which the work of the other subjects is planned. Once the core subject has been decided upon, arrangements are made to correlate the other subjects very closely with it at all grade levels. Usually it is intended that the remaining subjects shall supplement and enrich the core area. The cores selected in most schools have


40 The Chicago Public Schools employ a curriculum of the broad fields type but the broad fields are called "areas of learning."
been social studies, science, or a combination of science and social studies. 41

The last of the integrative plans to be considered is known under a wide variety of names. The one selected to represent the general classification is "unified curriculum." 42 Otto calls it a "common-activities-of-living curriculum," 43 Hopkins et al. refer to it as an "experience curriculum" 44 while Oberholtzer gives it the title of "Integrated Curriculum." 45 There are other names which have been applied to this plan but those given should be sufficiently indicative. Instead of instruction being built around organized subjects, it revolves around real activities of living, such as family living, communicating, traveling, exchanging goods and services and other common activities in which people engage. The school program consists of experiences centered around home and family life, producing, distributing, and preserving goods and services,

41 Otto, Principles of Elementary Education, 226; and Smith, Stanley, and Shores, 471.

42 Hildreth, 92.

43 Otto, Principles of Elementary Education, 228.

44 Hopkins, et. al., 253.

traveling, enjoying wholesome recreation and other common activities instead of being made up of the various subjects or subject fields.  

Hopkins et al. outlined the plan as follows:

The selection, development, and direction of the experience is a cooperative undertaking in which pupils and teachers work together under teacher guidance. This means that the experience is not selected in advance by the teacher, organized into topics, activities, outcomes, with minimum essentials in subject matter. Neither is it selected in advance by the pupils. It is selected on the spot by the pupils and the teacher who compose the particular learning group.

All of the organizations and plans seem to have certain weaknesses. A short summary of how each one apparently failed to provide an efficient, integrated, and well motivated educational situation in the elementary grades follows:

1. The weakness of the individual classroom unit appeared to be the lack of integration between grades and the frequent failure of the teacher to integrate properly the various subjects.

2. The departmental organization was considered unsatisfactory because of the almost complete absence of integration between subjects.

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3. The project method showed much promise, although the absence of an organized means of assuring that essential skill subjects would be given ample coverage has hampered it to a great extent.

4. The activity program met with the same objection as the project method, in addition to which the advisability of pupil planning has been questioned.\(^48\)

5. The chief weakness of the correlated curriculum appeared to be trusting the important correlation to the ingenuity of the teacher.

6. Combining a large number of subject areas to form a smaller number of broad fields was one step in the direction of integrating learning experiences. There was nothing in the broad fields curriculum, however, to assure integration between the various broad fields.

7. The core curriculum, if the core is considered as one broad field around which the other broad fields revolve, was a definite step toward integration of student learning experiences. The chief weakness has been the choice of social studies or science as the core. It was felt that neither of these areas of learning contain sufficient natural interest for the students to provide the desirable degree of motivation for the entire program.

\(^{48}\) Whipple, ed., 77-78.
A second disadvantage of the core curriculum was the fact that the core was not usually taught by one teacher to the same group over a period of years to afford vertical integration between grades as well as horizontal integration between areas of learning.

8. Since the unified or experience curriculum was built around the interests of the pupils there should be little question about whether or not the program was interesting. However, there was considerable doubt as to the integration between the different activities, as well as the provisions for adequate coverage of the tool subjects considered so essential.

Immediate Background of the Study.

In the first six grades of the elementary school it appears desirable to retain subjects or broad fields as separate areas of learning. This is based on the premise that in these grades the pupil should acquire the "tools" of learning in the most efficient and thorough manner. Schneiderman apparently felt the same way when she wrote: "If he the child is to become a well balanced individual he needs to learn all the tool subjects, whether he likes them or not."49 Baker, et al., 50 and

49 Schneiderman, 146.

Wrightstone\textsuperscript{51} expressed a similar viewpoint. Reavis, et al. were quite definite in describing the function of the elementary school thus:

The first function of the elementary school is the direction of the child in the acquisition of the fundamental abilities and skills basic to formal learning. For example, it should seek to direct the acquisition of the ability to read so that the child can comprehend the thought of the printed page without having to decipher the mechanical elements of the word symbols; to use the common number concepts with facility; and to express his ideas through the use of oral and written speech without dividing his attention between the thought and the mechanical media of expression. The child does not emerge from the elementary period of learning until the powers described have been attained.\textsuperscript{52}

While it is fairly generally agreed that the main purpose of the elementary school is to supply the "tools" to facilitate further education and to prepare for life, there is some difference of opinion as to just how these essential tool materials should be taught. However, the different opinions can be resolved into two major categories, those which favor a subject type curriculum and those which specify a "unified" or "experience" curriculum.

The majority opinion seems to favor the group which prefers the subjects, since it is felt that each of the skill


subjects is most efficiently taught by a procedure peculiar to that skill alone. Much effort has been expended to perfect the methods of teaching reading, writing, spelling, and arithmetic with a view to making the process as efficient as possible. Combining these methods would require a compromise which would certainly result in a great loss in efficiency.

Eliminating subjects as such introduces a secondary problem. If the school work is not organized according to subject areas it must be grouped in some other fashion. One of the methods used was to organize the classwork into "activities," and Yoakam and Simpson described the results in this way:

That there are obvious weaknesses in the activity program will be evident to the unprejudiced observer. In some activity schools of a decade or two ago children often failed to learn to read, write, perform fundamental processes in arithmetic, and make satisfactory progress in achieving skill in written composition. Their knowledge of history, geography, and elementary science was often incomplete and fragmentary. . . . The authors suspect that in those activity schools in which marked success is gained in skills and knowledge, there is more systematic teaching than some theorists would like to acknowledge.

This criticism is considered applicable to other forms of organization in which subjects have been eliminated. Thus it


can be seen that a subject-type organization is considered necessary for efficiency, and assurance that the basic facts, skills, and knowledge essential for further schooling will be learned. Schneideman expressed the same idea in a slightly different way when she wrote:

Until the child has acquired all the skills which will enable him to learn independently, until he has become sufficiently mature to know what he needs as well as what he wants, neither pupil selection of material nor learning entirely through experience is sufficient to provide a solid educational foundation.55

The typical weaknesses of a subject-centered curriculum are poor motivation and lack of integration between areas of learning. Correction of both of these weaknesses is essential if the schools are to properly meet the needs of the students. Schneideman indicated a similar viewpoint as follows:

What the child needs is motivation, not the motivation of good marks, promotion, or a bicycle, but a consuming desire to know because of an inner compelling urge.

Instilling this desire is the teacher's primary duty. Her difficulty lies in choosing the method which will make the children want to cooperate.56

Struck also pointed out the essential nature of interest in the learning process when he wrote:

It is generally believed that whole-hearted, effective

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55 Schneideman, 145.

56 Ibid., 144.
activity is impossible without the drive that is associated with genuine interest in the thing to be done. Learning is no exception to this. It has long been recognized that we learn most easily, most quickly, and most thoroughly, other things being equal, when we strongly desire to learn—when we have a compelling interest in doing something. 57

In addition to a pressing need for increased motivation of subjects there is the problem of integration between them. The expression subjects taught in isolation, unfortunately often applies to the kind of educational procedures which take place in self-contained classroom units where the teacher instructs in all subject areas as well as in departmental organizations. The teachers just do not relate the content of one subject to that being studied in the others.

Probably some of the blame also belongs on the shoulders of the curriculum makers who do not plan the courses of study in such a way that integration is provided for naturally. Otto pointed this out as follows:

The content of each subject is planned without regard to the content of other subjects appearing in the offering for the same grades. It is therefore possible—even usual—to find little or no relationship between the content of the various subjects taught in the same grade. 58

57 Theodore F. Struck, Creative Teaching, New York, 1938, 126.

58 Otto, Principles of Elementary Education, 225.
statement of the Problem.

The purpose of this study is to establish a curriculum pattern which furnishes a framework for better motivation of learning experiences and for improved integration between subjects and between grades at the elementary level.

Definition of Terms.

Integrate: to unite (parts or elements) so as to form a whole. 59

Integration: the act or process of making whole or entire. 60

Motivate: to stimulate active interest in (some study) through appeal to associated interests or by special devices. 61

Stem Craft Program: a core-type curriculum in which hand work is used as the core in all grades of an elementary school.

Experimental work on the Stem Craft program was started at this point, with the feeling that a broad fields curriculum taught in an individual classroom unit, would be the best learning situation for the elementary grades if proper motivation ----------------


60 Ibid.

61 Ibid., 1599.
and integration between the broad fields and between grades could be provided.

Integration between areas of learning was to be furnished by relating all subjects to one particular subject as is done in some of the "core" plans.

Integration between grades was to be provided by having one person teach the core to every pupil in the school. There would thus be no reason for a break in the continuity of this area of learning at the end of each semester, and because of the close relationship to the other subject areas the gap between grades would be reduced.

Improved motivation for the various subjects was to be supplied by selecting for the central integrating factor a subject or activity which would be inherently interesting to children. The "expansion of interest" theory proposed by William James provided the basis for this plan. This theory in James's own words was:

Any object, not interesting in itself may become interesting through becoming associated with an object in which an interest already exists. The two associated objects grow, as it were, together: the interesting portion sheds its quality over the whole; and thus things not interesting in their own right borrow an interest which becomes as real and as strong as any natively interesting thing.62

62 William James, Talks to Teachers on Psychology, New York, 1939, 94.
Thus the primary problem in establishing a well integrated and well motivated elementary school instructional plan, later called the Stem Craft program, was to locate a subject or activity which was inherently interesting to children. Procedures.

A survey of the literature produced several suggestions for an integrative core, but only one of the areas of learning mentioned as the central element of the curriculum appeared to have the necessary natural interest. This was a subject known variously as "hand crafts," "industrial arts," "practical arts," "integrated handwork," "manual arts," "organized handwork activities," and "home mechanics." While there is some difference in the meaning implied by the several terms, the general area of learning covered is the one in which creative handwork is the important feature.

Friese made some pertinent suggestions on the value of industrial arts as a motivating and integrating factor as follows:

From the standpoint of progressive educational thinking industrial arts possesses much significant subject-matter

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and a variety of methods adaptable to the accomplishment of a present major movement in education, namely, "integration." It contains both manual and mental content, is associated with the dominant type of American occupational life, and holds great life interest. Industrial arts through its wide scope of content, is a very natural medium for bringing together and unifying or integrating various "subjects." It furnishes an avenue of approach to, it motivates, and it gives meaning to much that is of value in other subjects. Manual and mental aspects of life are brought together into significant wholes.  

On the subject of motivation, Friese 65 pointed out that industrial arts has inherent pupil interest which will furnish the driving power to impel boys to manual and mental effort, the pupil activity so necessary to real learning.

Other authors who advocated using industrial arts as the integrative core are Struck, 66 Fryklund, 67 Thompson, 68


65 Ibid., 146.

66 Struck, Creative Teaching, 590.


Alteman,69 and Fales.70 Tilley proposed a similar plan but insisted that the term "synthesis" is more descriptive than integration.71 The fact that industrial arts utilizes the kinesthetic sense so seldom employed in school work, as well as all of the other senses is also pointed out by Fales.72 He argues that only in this way can the whole child be educated.

The experiment was undertaken with the premise that a modified hand craft "core," taught in all grades throughout the school by a single teacher, might furnish improved motivation and integration of the elementary school curriculum.

Since the projected plan differed somewhat from any of the many educational uses of the term "core," it was decided to apply the expression "stem" to the curriculum being evolved. It was felt that this was a more descriptive term because the craft work was to be more of a thing out of which the other subjects grew rather than a core around which they clustered. This was

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72 Fales, 39.
not an entirely original use of the word "stem" since it was mentioned in connection with core curriculums by both Otto,73 and Aiken.74

Preliminary work at the Byrne School by the writer seemed to indicate that the basic idea was sound and that expansion of the experiment to include the entire school was warranted. It was considered necessary therefore, to secure a teacher to take over the work.

A list of desirable instructor qualities was drawn up, followed by a search of the immediate faculty to determine if any of the members would qualify.75 After considerable deliberation a fifth-grade teacher, who was well liked by the other faculty members, who maintained excellent discipline, and who was interested in creative art work, was chosen.

The new craft teacher took over the craft classes gradually while continuing to instruct her fifth-grade class. The quiet portions of the craft classes were carried on in front of the regular classroom while those which involved operations creating noise were continued in the school basement.

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73 Otto, Principles of Elementary Education, 226.


75 This list is described in detail in Chapter IV.
Results of the first semester's work under very trying conditions were encouraging, and it was relatively easy to convince the Director of the Industrial Arts Program in the Chicago Public Schools that a teaching division should be authorized to carry the program on properly.

Authorization for the new division was almost immediately forthcoming, but the only space available was a room equipped with primary tables and chairs in a temporary building adjoining the school. It was there that the Stem Craft program was given its first full-scale trial, with pupils from the first grade to the eighth grade receiving instruction in craft work specifically designed to furnish integration and greater motivation for the other school subjects.

The Stem Craft program was originated and developed in the Michael M. Byrne Elementary School, which is located on the extreme south-west side of the City of Chicago. The school is situated in a relatively new and growing community composed almost entirely of individual homes owned by people in the low-average income group. The original building housing the school is fourteen years old, but has an addition which was completed less than three years ago. The craft room is located in the new portion of the building.

When the Stem Craft program was started four years ago the enrollment of the school was approximately 350 pupils, exclusive of those in kindergarten, but this number has increased
until it is now 650 pupils. All experimental work was carried out with regular class groups or convenient subdivisions thereof. The only selective procedure used was the division of classes on the basis of reading level when small sized groups were considered necessary because of space limitations.

A description of the Stem Craft program as it has been developed forms the major portion of this study. Photographs and case studies are provided for illustration, and questionnaires completed by teachers and by parents are used to furnish a basis for evaluation of the results achieved.

**Photographs.** All photographs included in this study were taken under approximately normal classroom conditions, and none of them have been retouched in any way. In two cases it was felt that a more complete story could be told in a single picture if certain items were rearranged to provide better camera angles. This change in position constitutes the only "staging" done in connection with the photographs.

**Case Studies.** Case studies of twelve pupils and two teachers are included in Chapter V. The teachers on whom the studies were made were new to the school and were considered to be in a position to judge the effect of the Stem Craft program by comparison with conditions in the schools from which they came.

76 Figures 6 and 7, pages 76 and 78 respectively.
The pupils on whom case studies were made were
selected because it was felt they illustrated particularly well
certain aspects of the Stem Craft program. In attempting to
locate students for whom the experimental program might have
cau ded difficulty, an unusual condition was noted. Teachers
reported that there was not a single pupil in their classes who
showed a dislike for craft work although two pupils were found
who appeared to be displeased with the craft program as it was
being operated.77

Questionnaires. A questionnaire designed to determine
the opinion of teachers and parents on the major aspects of the
Stem Craft program was prepared and presented to five educators,
including the chairman and other members of the writer's
advisory committee. The suggestions made on this preliminary
questionnaire were incorporated in a revised form, which was
mimeographed after approval was received from the advisors.

The questionnaires, accompanied by a duplicated letter,
were distributed to 429 pupils to be taken home to their parents.
Questionnaire forms were given only to those pupils who had
completed one or more semesters of craft work. Of the 429 forms
distributed, 410 were filled in and returned. However, a
number of those returned were from parents who had more than one


77 A case study of one of these pupils is included as
case "K" in Chapter V.
child in school and the duplicate responses were discarded. This reduced the usable returns to 304.78

A slightly modified questionnaire, on which three of the questions were different, was distributed to fourteen regular teachers. All of these were returned.

78 Responses received on the questionnaires are included in Chapter V, and copies of the forms and the letter which accompanied them are reproduced in Appendices I, II, and III.
CHAPTER II

THE STEM CRAFT PROGRAM

Stem Craft Organization.

The Stem Craft program was designed to operate in connection with a self-contained, single classroom unit type of organization, although it could possibly be adapted for use in departmentalized schools.¹

In grades one, two, and three, the craft work preceded the classroom work on the same topic, and thus served as a realistic basis for it. There was a change in emphasis in grade four however, and some of the projects at that level, and in the two grades succeeding it, were designed to utilize in a practical way segments of the knowledge gained from the academic subjects. A part of the projects continued to precede the subject matter in these grades and supply the background material for them as in the primary grades.

The seventh and eighth grade projects were selected almost exclusively with the intention of utilizing information which had already been gained in the classroom. The purpose was

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¹ A diagram of the Stem Craft organization is included in Figure 3, page 36.

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to provide review, practical application, and "stamping in" of many of the more important scientific, mathematical, and artistic concepts.

In grades one, two, and three, the "stem" is shown below the rectangles which represent the academic work of those years, to symbolize the fact that the craft work precedes and furnishes a basis for the other areas of learning. Grades four, five, and six have the "stem" indicated below and above, to show its dual purpose of basis and application in those years. The "stem" is almost entirely above the seventh and eighth grade rectangles to indicate that practical application was the major purpose at those levels. A program of this general type, in which there would be a similar shift in purpose from the primary grades to secondary school, was proposed by Hardin.2

The globe-shaped section of the "stem" above the eighth grade level is intended to indicate the way in which the craft program extends beyond the school boundaries into extracurricular and adult-life activities. Cooking, sewing, home maintenance, and hobbies form the bulk of these out-of-school activities, which were in reality an extension of the Stem Craft program beyond the physical limits of the school. Responses on

FIGURE 3

STEM CRAFT ORGANIZATION

"STEM" SHOWN IN RED
the questionnaire item pertaining to this phase of the Stem Craft program indicated that extension of the craft work outside the school was not limited to pupils, but in a number of cases included the parents.

Comparison with Other "Plans."

There are a number of ways in which the Stem Craft program resembles certain other "plans" and methods used in elementary schools during the past thirty years. Some of these similarities will be pointed out, and for the sake of comparison the differences will also be shown.

Project Method. Stem Craft projects were almost identical to some of those which served as the basis for the original "project method." The purpose of them was to arouse pupil interest, stress concrete accomplishment, and in the primary grades furnish the basis for other learning processes, just as in the "project method." There the similarity ends, since the Stem Craft program differs from the "project method" on practically every other point, with retention in the Stem Craft plan of organized subject-matter, and the supervision of project construction being the most noticeable differences.

The "project method" of thirty years ago did not include a definite course of study in reading, writing, arithmetic, science, and social studies, but depended upon incidental learning in connection with the projects to provide
the education of the pupils. Learning by this method was too discontinuous, too random and haphazard, and too immediate in its function. The Stem Craft program retains a definite course of study in the various areas of learning and utilizes the projects to provide motivation and background material for the subjects in the lower grades, and practical application in the upper grades.

The second major difference between the Stem Craft program and the "project method" lies in the supervision of the actual work on the projects. Since the "project method" consisted largely of working on projects as the basis of incidental learning in other fields, all the work was done by the classroom teacher. She supervised all construction work and guided the development of the incidental learnings. When the projects involved actual construction, as they often did, this required teachers trained in shop work as well as academic fields, and rooms equipped with benches and tools in addition to the usual instructional materials. In the Stem Craft program all projects are constructed under the guidance of one shop-trained instructor in a single well-equipped craft room rather than under the guidance of the classroom teacher in a regular room. This is an economical arrangement which is possible of attainment even

3 Bode, 149.
4 Ibid., 150
5 Ibid.,
with present-day teacher shortages and limited budgets.

Activity Movement. The "activity movement" was quite similar to the "project method," with "activities" replacing the "projects," and so the comparisons between it and the Stem Craft program would be virtually the same as in the preceding paragraphs and will not be repeated.

Correlated Curriculum. The correlated curriculum is based on a subject-centered curriculum in which the teachers attempt to effect correlation by relating the subject matter of one subject to that of another, whenever possible. This is one of the aims of the Stem Craft program; hence, there is a strong resemblance between the two plans. However, in the Stem Craft program the correlation between areas of learning, effected whenever possible, is augmented by the planned correlation between craft work and all the subject areas. There are no other important points of difference between the two plans, although it is felt that the Stem Craft program produces more extensive and more certain correlation of subjects than the correlated curriculum.

Broad Fields Curriculum. The broad fields curriculum is fundamentally a movement in the direction of integration which combines a large number of subject areas into a smaller number

6 Whipple, ed., 194.
7 Hopkins, et al., 201
of "broad fields." The barriers between areas of learning are reduced, and hence there are fewer of them to stand in the way of integration. The Stem Craft program has been operated in connection with a broad fields curriculum, and therefore is entirely compatible with it. In fact the experimental program described in this study is essentially a broad fields curriculum to which has been added the integrating craftwork "stem."

Core Curriculum. The definition of "core curriculum" selected for use in this study from the many different descriptions to be found in the literature is this: "The core curriculum refers to one broad field which is set out as superior to any other broad field, and which operates as a center around which the other broad fields revolve." The superficial resemblance between the Stem Craft program and a core curriculum of this type is very close, indeed, although there are several essential differences.

The first point on which the two programs differ is the matter of designating the relationship of the central element to the other subjects. In the core curriculum the "core" is defined as superior to the other fields, while the "stem" is considered

8 Otto, Principles of Elementary Education, 226.
9 Hopkins, et al., 240.
basic or fundamental, but never superior. This is an important difference since it is felt that no area of learning should be considered superior to reading, writing, and arithmetic in the elementary grades.

A second point of difference is found in "revolving about." While the subjects in a core curriculum may "revolve about" the "core," in the Stem Craft program the areas of learning "grow out of" the "stem," since the craft projects are used as a basis for the work in the academic subjects.

The fact that the "stem" in the writer's program is continuous throughout all of the elementary grades is another point on which it differs from the core curriculum.

Unified, Integrated, or Experience Curriculum. There is little resemblance between the Stem Craft program and the "unified," "integrated," or "experience" curriculum since areas of learning as such are not found in these plans. Probably the chief similarity between these plans and the Stem Craft program is the objective of providing practical, well-motivated learning experiences for the pupils.

Motivation.

One of the two primary aims of the Stem Craft program is to provide for better motivation of the other areas of
learning. "Motivation is a vital condition of all learning,"\(^{10}\) according to Thompson, and school subjects as usually taught lack motivation.\(^{11}\) Often this is due to the fact that the learning materials do not have meaning for the pupils. The close alliance between meaning and motivation was pointed out by Ryans,\(^{12}\) who also wrote that "one of the most important tasks of the teacher in motivating learning is the concerned with the development of meanings."\(^{13}\)

The Stem Craft program was designed to give meaning to the other areas of learning by providing a broad background of related experience, by furnishing the "stem" to which much of the subject matter can be correlated in such a way that the logical relationships between the various areas is brought out, and by providing practical application of what has been learned. All of these points are included in Ryans' list of ways in which meanings may be developed.\(^{14}\)

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11 Schneideman, 144.


13 Ibid.

14 Ibid.
Realization of the value of the material to be learned is also a strong motivating factor. Bales indicated that "the only effectual way to make something appear to be worth learning is to have it become necessary in carrying forward some purpose that has been adopted by the class. This is effective motivation in democratically conducted classrooms." Many of the Stem Craft projects are designed with this in mind, and pupils are guided to "select" those which require information acquired in other subjects for successful completion.

Thompson indicated that "in education, motivation is the art of stimulating interest in the pupil where there has been no such interest, or where it is as yet unfelt by the pupil, and also of cultivating the interest already present..." On the same subject Ryans wrote:

Pupil interests are important sources of motivation. It is advantageous for learning to employ existing interests and attitudes in promoting learning. If none exist that can be used, attention should be given to their development. Participation in meaningful activities furnishes a background for the development of interests.

16 Thompson, 307.
17 Ryans, 325.
The Stem Craft program provides the participation in meaningful activities mentioned by Ryans, and also employs the almost universal interest in handwork to build up a motivating force which is transferred to the other subject areas through the "expansion of interest" described in Chapter I. On this point Wingo went so far as to write:

In so far as instruction is concerned, there is probably no substitute for the provision of a program of activities which enlist and expand the interests of children. When programs of this kind are provided in elementary schools, the need for obviously extrinsic devices will be slight or nonexistent.18

Interests appear to depend to a considerable degree upon the individual's ability to participate successfully in an activity.19 This is probably one of the reasons why the Stem Craft work has such an appeal to children; they can all achieve in the craft room. The fact that the completed work has substance and can be exhibited to admiring parents and relatives is also considered an important factor from the standpoint of motivation.

The Stem Craft program furnishes motivation by providing meaning for the subject areas, demonstrating the necessity of many phases of them, and by capitalizing on the natural

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18 Wingo, Learning and Instruction, 296.
19 Ryans, 305.
interest of children in handwork.

Integration.

The second major objective of the Stem Craft program was increased integration between subject areas and between grades.

Integration Between Areas of Learning. Integration between areas of learning was accomplished by relating the Stem Craft program to all of them in the closest possible manner. This was based on the theory that things related to the same thing are related to each other.

Relating Stem Craft projects to other areas of learning was a continuous task of the craft teacher. She planned the projects to produce the maximum amount of relationship, and constantly evaluated the results to ascertain how well the objectives were being attained.

The classroom teachers also strived to develop the greatest amount of correlation between the subject areas and the Stem Craft program. This two-way effort to produce the maximum degree of integration between craft projects and the other areas of learning might well be called the "Stem Craft attitude." It was a frame of mind in which all of the teaching personnel constantly sought ways to bring out relationships between Stem Craft projects and the other subject fields. This indirectly resulted in focusing attention on relationships
between the areas of learning themselves.

The "Stem Craft attitude" is the part of the program most difficult to describe, owing to the intangible nature of attitudes. However, an actual happening witnessed by the writer may help to illustrate what is meant.

A fifth grade boy was working in the craft room with a group of his classmates on the construction of a diorama showing a southern plantation. He had been elected to make the cotton gin, and was uncertain as to its appearance. When he asked the teacher what a cotton gin looked like she countered with a question as to where he would look up things he did not know. His answer, "the dictionary," brought from the teacher the suggestion that a dictionary was not likely to contain pictures of a cotton gin. After some thought the boy said "the encyclopedia," and started off, only to be checked with the teacher's question, "which volume?" After more deep thought and several incorrect attempts the boy suggested that the index would lead him to the correct volume. A nod from the teacher sent him to the room library to find out how his cotton gin should look. The boy returned in a few minutes with a volume of the encyclopedia which contained a good picture of a cotton gin, and he was extremely proud of his accomplishment of locating it.

It is felt that this incident gives some idea of what is meant by the "Stem Craft attitude." The craft teacher used
the desire for information on the cotton gin to teach an excellent lesson on the proper use of the encyclopedia, to demonstrate the practical value of reference books, and to help strengthen the relationship between the craft work and the language arts area of learning.20

Integration Between Grades. The gap in the educational process which usually exists between grades in the various forms of school organization, was reduced somewhat by the Stem Craft program.

The break in educational continuity referred to is caused by the normal mechanics of a graded school organization, which decrees promotions at the end of each year or half year. In a large percentage of schools this means that pupils move to a different room and come under the guidance of a different teacher as a result of these annual or semi-annual promotions. The educational experiences of one term are brought to an abrupt end at the time of promotion, and an entirely new set of learning activities, generally quite unrelated to those of the previous term, are instituted by a different teacher, with a different personality, different classroom routine, and different instructional materials. Disrupting the continuity of the educational process in this way probably has a profound effect on the

20 "Introduction to Use of the Encyclopedia" is a unit in the fifth grade language arts area of learning in the Chicago Public Schools.
The Stem Craft program attempted to reduce the impact of the promotion-time break in educational continuity by carrying over projects from one grade to the next, and by having the same person teach craft work to all students. Stem Craft "between grades" projects are described in Chapter IV. They were begun during the last few weeks of one semester, completed in the first week or two of the new term, and served as a tangible link between the two grades.

The fact that the same teacher carried on the craft program without a break in class routine also tended to lend continuity to the educational experiences of the pupils. The same teacher, continuing to conduct the same work in a familiar craft room, provided a connection with the past for students who were trying to get acquainted with a new classroom teacher, new subjects, and new ways of doing things in a new grade. The number of pupils who sought guidance from the craft teacher at the beginning of each new semester indicated that she was an important factor in bridging the gap between grades.
CHAPTER III

FACTORS UNDERLYING THE ESTABLISHMENT OF A STEM CRAFT PROGRAM

There were a number of matters which required careful consideration before a program such as the Stem Craft organization could be placed in successful operation. These underlying factors will be discussed in some detail in this chapter.

Class Size.

When the original Stem Craft program was set up there was some doubt as to the most effective class size. While the number of pupils in classes varies over a certain range due to local conditions, there was at least one important decision required. Should the craft classes include the entire classroom group of from thirty to forty-five pupils or should it encompass only half that number?

Both complete classes and half classes were scheduled for the Stem Craft program and given a trial for a full year. The decision at the end of that time was in favor of the half class, numbering from fifteen to twenty-four pupils. The amount of work accomplished, the manual skills acquired, the pupil interest developed, and the overall efficiency of the craft program strongly favored the half class. This finding was
substantiated by Newell, who concluded that when teaching was on an individual basis, as it was to a great extent in the STEM Craft program, a critical level existed somewhere in the neighborhood of twenty-five pupils.  

Newkirk and Johnson recommended that craft classes not exceed twenty-four pupils at any time.

Division of Classes.

A second consideration pertinent at this point, and based on the one just discussed, was how the classes should be divided if only half of the pupils were to attend the STEM Craft class at any one time.

Since the number of boys and girls is usually about equal in each class group, and it is considered advisable to segregate them for physical education, the simple solution appeared to be scheduling one sex for craft work while the other attended gymnasium classes. Some leaders in the industrial arts field, however, recommend that elementary school classes in that

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1 Clarence A. Newell, Class Size and Adaptability, Teachers College, Columbia University, New York, 1943, 37.


subject include boys and girls in the same group, so the possibility of pairing the Stem Craft program with physical education was discarded as unsuitable.

If the craft classes were not to be separated into groups of boys and girls, how should they be divided? Splitting time with library science was considered, but the wide variation in time allotments for the two fields made this relatively impractical. The plan which seemed most promising divided the class according to the reading level of the pupils, and scheduled one group for craft work at the time the other group was engaged in language arts activities.

The most apparent advantage of the reading level division was the benefit it afforded the pupils and teachers by providing reading groups which were fairly homogeneous. When this plan was in operation the homeroom teacher was scheduled to teach language arts to the group which did not report to the Stem Craft laboratory. Thus she worked with only half of the pupils in reading, and they were children with either the lowest reading achievement or those with the highest reading levels. Such a division reduced the total range of reading ability in

the group by approximately fifty per cent and permitted the
class to work at a level which was attainable by practically
every student. It was found to be not only practical but very
efficient to use in the two groups different books, with a
considerable difference in difficulty. Interest was more easily
maintained and the teacher was not required to keep the other
half of the class occupied while she taught the reading lesson.

Another advantage of the plan of dividing the class on
the basis of reading level was the possibility of regulating the
length of the reading period to meet the needs of the pupils in
this basic skill subject. The different reading requirements of
the two groups could be met to a certain extent by arranging the
schedule so the slower reading group received a shorter craft
period than the better group. This resulted in a longer reading
period for those who needed more assistance, and a shorter one
for the better readers. Bathurst et al. suggested that it is part
of a teacher's duty to do just this when they wrote: "The
teacher provides opportunity for practice to improve skill in
reading for those who need it, while those who do not need it
work in what is important for them."5

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5 Effie G. Bathurst, Paul E. Blackwood, Helen K.
Mackintosh, and Elsa Schneider, The Place of Subjects in the
Length of Class Periods.

The length of class period most suitable for craft work was determined after a number of trials. It was found that sixty minutes was the minimum period which could be utilized effectively and one hundred twenty minutes the maximum. The one-hour periods proved most satisfactory for the younger children, one and a half hour for the middle grades, and two hours for the upper grades.

Teacher Qualifications.

If the Stem Craft program was to succeed in accomplishing the objectives set forth in Chapter II, it appeared desirable that the instructor possess certain qualifications. While skill in cooking, sewing, and mechanical processes was highly desirable, it was not considered to be the primary requirement. The most important qualification appeared to be acceptance by the entire faculty and staff, as well as the ability to gain their cooperation. It was felt that the preliminary screening of possible Stem Craft teachers should be made on this basis.

Second in order of importance seemed to be the ability to maintain class control under all circumstances. A natural type of control in which the teacher received respect and obedience as a matter of course was the only type considered, since an instructor who must consciously strive to maintain order would be too occupied with that part of the job to accomplish the
Stem Craft objectives of motivation and integration.

Ingenuity and resourcefulness were other qualities which were considered essential in the prospective Stem Craft teacher, since without them an instructor would find it difficult to conduct a truly integrative craft program or capitalize on natural pupil interest as a source of motivation.

Artistic ability of the creative type was deemed essential if the craft program was to meet the needs of individual pupils in a satisfying manner. The ability and inclination to try new methods, new materials, and new ideas were also considered important attributes.

As noted in an earlier paragraph, a high degree of skill in cooking, sewing, and mechanical processes would be helpful but not essential. This is not intended to minimize the benefits of actual skill in these fields, but rather to indicate that the other factors were considered more important in determining the most suitable teacher.

Newkirk and Johnson described the qualifications for an effective craft teacher in the following way:

She must understand the various techniques, must be able to do the construction work with a fair degree of proficiency, and must know how to teach these techniques to children. A knowledge of materials and their manipulation should be as much a part of her professional training as methods of teaching reading or the social studies. In addition, she should have an understanding of the fundamental principles of fine arts, so that she may help her pupils to achieve
artistic as well as informational satisfaction from their construction work. 6

It was felt that if at all possible the Stem Craft instructor should be a teacher who had been on the faculty for several years and was thoroughly familiar with school conditions, as well as the individual faculty members. A teacher imported from outside the school would find it extremely difficult to operate an integrative program for several years because the close cooperation required is not likely to be given to a new teacher.

Craft Room.

The craft room used in the experiment measured twenty-three feet by thirty feet, and was considered somewhat small for much of the work. If possible, a larger room should be provided. A first floor location would probably prove most desirable, since the noise of the working children tends to disturb any class which might be immediately below the craft room. Water, gas, electricity, and sewer connections are necessary, as well as ample storage space for tools, utensils, materials, and partially completed projects.

Equipment.

Workbenches with stations for twenty-four pupils were considered a basic requirement. It was felt that these benches

6 Newkirk and Johnson, 11.
should be equipped with eight woodworking vises and eight machinists vises to provide effective working conditions for craft classes. A minimum of two sewing machines, a sink, and cooking stoves with a total of at least twelve burners were also considered desirable. An electric jig saw, drill press, and bench grinder would be valuable although not absolutely necessary. A pottery kiln, copper enameling stove, and several small tabletop looms would also prove useful if they could be provided.

Cooking utensils in sufficient quantity to permit at least twelve pupils to cook simultaneously were considered an essential from the standpoint of efficiency. A shelf with a wide variety of culinary, mechanical, technical and graphic art reference books proved to be a valuable aid and should be provided.

Scheduling.

Since the Stem Craft program was essentially a different form of school organization, some rearrangement of the normal program was involved. The most important step was the preparation of the schedule of craft classes. This schedule became the basic one for the entire school, with physical

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7 A list of utensils and hand tools considered desirable is included in Appendix V.

8 A list of selected reference books is included in Appendix VI.
education, library science, and other special schedules being
built around it.

Gaining Acceptance.

The Stem Craft program with its many unique features
may not be considered desirable by school authorities, the
faculty, or the community until its value has been proven to
them. This may be the most difficult phase of establishing such
a program and so a few procedures which proved helpful to the
writer will be included.

The logical place to start gaining acceptance for a
Stem Craft program is with the faculty, because if they cannot
be convinced of its worth the entire matter should probably be
dropped. It would be useless to try to force acceptance through
administrative pressure. If the proposed program is presented
properly, a zealous faculty will almost certainly be interested
in a plan which promises to increase pupil interest in school
work, improve educational results, provide half-size reading
groups divided according to ability, and furnish concrete
material around which academic subjects can be taught. The
possibility of acceptance will be increased if it is pointed out
that all of the advantages mentioned can be obtained without
additional work on the part of the classroom teacher.

After the faculty has accepted the proposed plan the
next task is to convince the community of its worth. Here again
a type of salesmanship is required to obtain parental approval.
In the present experiment, several craft classes were formed as additional school activities, and suitable publicity was provided. Parents were pleased to hear and read in the local newspaper that their children were being given an opportunity to acquire useful skills, and before the first semester had been completed a number of requests for expansion of the program were received.

The following semester the teacher who had been selected to teach the craft program was scheduled for two craft classes in addition to her regular classroom program. These craft classes were conducted at tables placed in front of her regular room and in the basement when the work involved hammering. Pictures were taken of these craft classes being carried on under adverse conditions in case they would be required to convince school authorities of the necessity of a craft room. Approval by the community of the additional craft work was immediate, and requests for further expansion were received.

The final step in establishing the Stem Craft program was convincing the school authorities of its value. In the present case this was not difficult, since those who determine the policies of the Chicago Public School System have for some time favored craft work generally, and home mechanics specifically, in the upper elementary grades. It was necessary only to explain the probable advantages of extending the craft work down through the grades to gain approval for an
experimental program of this kind. It was not necessary to use the pictures of craft work under difficulties nor letters from parents requesting extension of the program downward, although in other localities conditions might have been different.

One factor which was probably instrumental in gaining approval was the fact that the craft teacher was to come from the existing school faculty. This made it unnecessary for school authorities to obtain a teacher for the Stem Craft class. Since the supply of home mechanics teachers rarely equals the demands of the Chicago School System, finding an additional one with the particular qualifications considered desirable for this experiment would probably be somewhat difficult. In this case an additional craft teacher was provided in a field where a scarcity exists and her place was filled by a regular teacher, the supply of which was fairly adequate. This is another reason for selecting the Stem Craft teacher from the present faculty.
CHAPTER IV

THE STEM CRAFT PROGRAM IN OPERATION

Selection of Projects.

Projects for the Stem Craft program were selected by mutual agreement between classroom teachers and the craft instructor. The craft instructor and the regular teachers conferred to determine subject areas to be included and discuss possible projects which would achieve the objectives of the Stem Craft program in these fields. Often this involved constructing pilot projects to determine their suitability for the children concerned.

Frequently, as a result of the conference with the craft instructor, the classroom teacher would start working toward the project in the classroom so that its introduction in the craft class would seem a natural circumstance. In this way, many of the Stem Craft projects started in the classroom, moved to the craft laboratory, and often were finished in the classroom. This helped to make the craft work an integral part of the class work rather than a separate school activity. Since the integration of learning experiences was one of the primary aims of the Stem Craft program this approach was an important factor.
Types of Projects.

Three types of projects were used in the Stem Craft program: "general," "between grades," and "regular."

General Projects. "General" projects are those carried on throughout the entire school. The purpose of such projects was to provide a single integrative "stem" for the learning experiences of all the pupils in the school.

One of the most successful "general" projects was the making of puppets by every child in the school. The type of puppet constructed varied from grade to grade, but the fact that the entire student body made them served to bring the group closer together. The first and second grade students made simple stick puppets which were pupil drawings mounted on a stick so they could be manipulated to dramatize simple stories. Hand puppets involving various degrees of complexity were made in the middle grades, while the upper grade children made more complicated string-controlled marionettes.

Greatest emphasis was placed on acting out the stories found in the readers by means of the puppets. The purpose was to give meaning and motivation to the essential skill subject of reading. In the upper grades the social studies also served as a source of material to be dramatized by the children.

A portable puppet stage was constructed, decorated, and wired by the seventh and eighth grade pupils to make possible
the presentation of puppet shows under the best conditions. The stage was designed so that all types of puppets and marionettes could be used, and it was moved from room to room on a regular schedule.

Some of the puppet shows were of such quality that they were presented to other classes, and in a few cases to the entire student body. Two of the dramatizations received sufficient publicity to elicit requests for performances from neighboring schools. Although the school-wide puppet project was carried on almost two years ago many of the figures are still being used in various ways throughout the school by the pupils who made them.1

Other "general" projects used throughout the school were Christmas tree ornaments, Halloween and Easter decorations, and exercises in pottery making, weaving, sewing, and cooking.

**Between Grades Projects.** The "between grades" projects are probably some of the most original aspects of the Stem Craft program. In ordinary school organizations all classwork is brought to completion as the school term draws to a close and an entirely new group of learning experiences are begun by another teacher when the new semester opens. Little or nothing is

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1 Figure 4, page 64 shows a group of second grade pupils presenting a puppet show to their classmates.
FIGURE 4

A STEM CRAFT "GENERAL" PROJECT
carried over from one term to the next. This leaves a definite gap in the mental growth of the child and certainly does not help to make it a continuous process. Bobbitt expressed this quite well when he wrote: "A school program of subjects, topics, or units, in which each is taken up once and for all during some semester or year, finished, and generally neglected thereafter, is quite alien to the process of continuous growth."²

The Stem Craft "between grades" projects were specifically designed to bridge this gap. They were started near the close of one term and completed after the next one was in progress. These projects were based on the classwork which was drawing to a close and were later used as a basis for the work being started in the new term.

Dioramas have proven to be one of the most successful projects for spanning the gap between grades. These three-dimensional representations of a portion of the work of the term were evidence of what the pupils had learned about a particular subject. They were a type of concrete summary of his knowledge and experience. When the dioramas were completed in the first few days of the new term, they were used by the classroom teacher as a starting point for the semester's work.

² Franklin Bobbitt, Curriculum of Modern Education, New York, 1941, 95.
Questioning the builders of the dioramas served as a review for the class, and a source of information for the teacher on what the pupils had learned. There was something definite to help the teacher carry on the work of the previous semester, and she was not required to make a fresh start. This tended to make the class work a continuation of what had been done previously, and eliminated to a certain extent the gap which usually exists between grades.

The Stem Craft instructor unobtrusively arranged to have all the subject fields covered in the construction of the dioramas, although, in general, pupils were encouraged to construct their dioramas in the field which interested them most. In the upper grades each child constructed a diorama, while in the intermediate grades it is done on a committee basis, with several children working on a single scene. All subject fields except writing were worked into the dioramas by children in the fourth, fifth, sixth, and seventh grades.

In addition to the projects specifically designed to provide integration between the grades, many "regular" and "general" projects were carried over from one semester to the next. The fact that the same teacher continued the craft work without a break at the end of each semester also helped to provide an uninterrupted school experience.
Regular Projects. "Regular" Stem Craft projects constituted the major portion of the craft work and were intended to produce the greatest degree of motivation and integration of subjects in a single grade. These "regular" projects were designed to accomplish a specific purpose with a certain group of children, and usually were carried on with the pupils of one class only. They were developed to meet the needs which the classroom teacher felt were the most important in that particular grade. Careful work on the course of study by the classroom teacher and the craft instructor preceded the selection of the project most suitable to accomplish the objectives of the Stem Craft program at that grade level.

In the primary grades consideration was given to the relatively short interest span of the pupils, and the projects, or subdivisions thereof, were selected so that they could be completed in a single lesson.

Since the pupils in the lower grades were usually lacking in background material on which theoretical or symbolic subject matter could be based, the Stem Craft program endeavored to furnish as much of this background material as possible. Therefore, in grades one, two, and three, the craft projects preceded the subject matter and served as a basis for it.

3 Hildreth, 233.
In grades four, five, and six, a double purpose was served by the craft work. Some of the projects served as a basis for the other subjects while a part of them put into practice things learned in the classroom.

While the seventh and eighth grades are not universally considered a part of the elementary school, they are so designated in Chicago and are therefore included in this study. The craft projects in the seventh and eighth grades almost without exception were planned to utilize in a practical way material which had been learned in the various subjects.

An example of this is the method of laying out multi-sided trays. A prepared pattern would have made this a simple task, but in the eighth grade Stem Craft classes pupils were required to accomplish it by using a protractor. This involved dividing the total number of degrees in a circle by the number of sides required, and then utilizing a protractor to transfer the calculated angles to the piece of metal from which the tray was to be made. Thus some very theoretical concepts the pupils had acquired about angles, degrees, radii, diameters, and perpendicul ars were actually used by the students in a practical way.

In contrast to the protractor method just described, was the one used in the fifth grade classes where a small tray

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4 Otto, Organizational and Administrative Practices, 2.
was also one of the projects. The major mathematical concept which confronted students in grade five was fractional parts. Hence pupils working with fractions in their arithmetic class were given the opportunity to divide real circles of metal into fractional parts as a step in the construction of this project. The layout method involved folding circles of paper into the desired number of segments and then transferring the fractional parts to the metal disc. In a number of cases pupils who were having difficulty with fractions suddenly discovered the meaning of fractional parts while working out the tray problem.

In the eighth grade emphasis was upon utilizing what had already been learned in the classroom, while in fifth grade the objective was to furnish a practical illustration of a difficult concept at the time it was being studied.

Projects Used in the Experiment.

"Regular" Stem Craft projects which have proven successful in each grade are described in some detail at this point.

Kindergarten. The craft program was carried on for two terms at the kindergarten level, and one of the outstanding projects was the construction of a zoo. The actual starting point for the work was a trip to the Brookfield Zoo. Considerable advance preparation was done by the kindergarten teacher to get the children ready for the annual trip to this
wonderland of animals. Stories, pictures, songs, and dances were employed to work up interest and background for the trip.

The tour through the zoo was a memorable occasion for most of the children, so when the craft teacher talked to them the following day it required little effort to get them to "decide" to build a zoo of their own. Shapes, sizes, and colors of the animals were discussed, and the children began modeling animals from clay.

After producing a sizeable menagerie in clay, and learning much about the shapes of animals, the children were led by the teacher to realize that clay was not the best medium for the purpose. Other possibilities were discussed, and the suggestion to use cardboard boxes arose from the children.

The cardboard box animals were much larger and more permanent than the original ones of clay and the group felt that cages were necessary. The crude cages were constructed of packing box wood, and everything was thoroughly painted with kalsomine colors; animals, cages, tables, floor, and pupils. A relatively permanent exhibit of the completed zoo was then set up in the corner of the room and served as a basis for many more stories, songs, dances, and pictures.5

First Grade. In first grade the primary objectives ------------------

5 Figure 5, page 71, shows the zoo project under construction.
FIGURE 5
A KINDERGARTEN ZOO PROJECT
of the Stem Craft program were to provide motivation and back-
ground material for the all-important language arts. Activities
were planned which would enrich the vocabularies of the children
and furnish concrete objects to serve as a basis for stories,
spelling lessons, science questions, and number work. One of
the most successful projects for the accomplishment of these
objectives was the construction of a model farm.

Certainly no claim to originality is made for the farm
project, since it has been used over and over in the "project
method," the "activity program," and elsewhere. Nevertheless,
it is felt that the way in which the farm was used in the Stem
Craft program was sufficiently different to warrant some
exposition here.

It would be difficult to give an exact explanation of
how the farm was utilized in the "project" and "activity"
programs since there was such a divergence of opinion as to the
definition of each method. Bode gave seven definitions of the
"project method" and Kilpatrick's committee collected forty-
two definitions of the "activity program." Based on the
descriptions given in Chapter I, the "project" and "activity"
use of the farm would be essentially the same. The farm would be

6 Bode, 146-147.
7 Whipple, ed., 46.
the "concrete achievement," or "purposeful activity," through which the pupils would learn to read, write, spell, and learn numbers. While there undoubtedly would be some learning of this type it could be rather haphazard and not consistent, as pointed out in "The Activity Movement."10

In the Stem Craft program the farm was used as a means of arousing interest and furnishing the background material for the specialized teaching of reading, writing, spelling, and number work. Each of the skill subjects was taught as such, using a method developed for efficiency in that particular field, with the farm project as the center of interest. Learning the essential skill subjects was not left to chance as was usually done in the other two methods.

The farm consisted of a wide assortment of buildings, silos, fences, crops, trees, and animals. The classroom teacher prepared the children for the project by reading stories and showing them pictures of farms which included all of these objects. The craft teacher then assisted the children to formulate plans and carry out the construction of the farm.

All construction work was done in the craft room.

8 Bode, 146.
9 Ibid.
10 Whipple, ed., 58.
where tools, materials, and working space were available. The classroom teacher was freed of the task of obtaining these essentials, and was not required to possess the mechanical skills and background necessary to carry out effectively such a project. She could concentrate on utilizing the farm as the basis for her reading, writing, spelling, science, and arithmetic lessons. This was probably the most important way in which the Stem Craft farm project differed from a farm in a conventional classroom--complete freedom for the teacher to concentrate on teaching the skill subjects without being harassed by procurement and construction problems.

In the farm project, as well as in all the other craft work in the primary grades, considerable emphasis was placed on teaching the children to follow directions. The purpose was not to obtain blind, thoughtless following of directions, but rather the understanding of why as well as how. This is an extremely important ability for young children to acquire, and craft work is probably one of the best mediums to provide for it, since failure to follow directions shows up so plainly and painfully.

The photograph of a completed farm project shows the farm and the various other classroom activities which grew out of it; reading, writing, spelling, science, number work, sentence construction, and seat work.\textsuperscript{11}

\textsuperscript{11} Figure 6, page 76
Other successful first grade projects were a circus, and different sets of stick puppets. The puppets were actually pupil drawings of characters in the readers, mounted on sticks to permit the acting out of simple stories.

Second Grade. At the second grade level, it was found that short-term projects were of greater benefit than any which could be considered major undertakings. The seven year old children seem to be most interested in what might be called animated drawings, and this was used as the central theme in most of the small projects.

The animated drawings referred to were just a slight improvement on the stick puppets mentioned as first grade projects. In fact, the figures used during the first few weeks of second grade were almost identical to them, except that two drawings were used to provide the puppets with a back as well as a front. Later the drawings were made on cardboard so the legs, arms, heads, and bodies could be pivoted for flexibility. This gave much more life-like action when stories were being portrayed.

As manual skill increased, the jointed figures became more complex and were made of wood. The jointed parts were arranged so they could be moved by pulling strings, much as the old-time "jumping jacks" were operated.

Since one of the readers used in second grade was based on a zoo trip, a zoo populated with jointed wooden animals was one of the projects. In this case the joints were made somewhat
FIGURE 6

FIRST GRADE FARM PROJECT
stiff so the animals could be made to stand or sit in various positions. These figures were actually toys, and when the school use for them had been exhausted they were taken home and used as such. Wilson offered some excellent suggestions on the practical construction of these thin wood figures.12

When the children were making the jointed figures they were frequently observed turning to their readers to determine what color eyes, hair, dress, or coat a particular individual should have. This was in reality a form of research, and seems significant at this early age.

A park to enclose the zoo was a project from which much was learned about natural science, since leaves, twigs, grass, and small flowers were used in the construction.

The photograph13 is one of the first steps in the process, as it shows the back of the two-sided, unjointed pupil drawings mounted on sticks. A front view of this same setting was included earlier as Figure 4, page 64.

Third Grade. Third grade courses of study generally place considerable emphasis on a study of the community. While this is normally a part of the social studies program it has been

12 Della Ford Wilson, Primary Industrial Arts, Peoria, Illinois, 1926, 174-89.
13 Figure 7, page 78.
FIGURE 7

A PUPPET SHOW IN SECOND GRADE
found to serve well as a "stem" for all the other work in the grade.

The community project was started by the classroom teacher with an extensive discussion and study of the houses in which the children lived. Paragraphs were written during the language arts period describing the houses, pictures of them were drawn during the creative art period, and under the guidance of a skilled teacher, a suggestion to construct models of the homes in the craft room was almost certain to be made.

Actual construction of the model houses was supervised by the craft teacher, and for third grade pupils it was a project of considerable magnitude, especially when the entire yard surrounding the homes was included. Discussions on types of roofs, building materials, sizes and number of windows, roofing, painting, landscaping, fences, and many other phases of house construction and decoration were held when the questions arose. Each child acquired considerable practical knowledge about his own house in this manner since he was required to obtain from outside sources all the information concerning his home.

Constructing the model houses required several weeks, since they were carefully made with frequent use of rulers, pencils, knives, punches, and scissors. "Building materials" consisted of cardboard, paper, metal, plastic, wire, and wood. As soon as the first houses were completed they were grouped together to form a small community, and immediately certain
problems arose. One of these was the incongruous condition of two fences between each house, where there should have been only one. Discussion in class and questioning at home resulted in bringing out many facts about community property, easements, surveys, etc.

Another thing which was noted by the children was the absence of stores and a school building. After discussions on the support of public institutions, and factors such as zoning laws, shopping areas, and business streets, which govern the construction of commercial buildings, the better workers who had finished their own houses were formed into committees to make models of these additional buildings.

The placement of business and public buildings in the growing community always brought up objections from the children because they were too near or too distant from certain homes. The suggestion to set the model houses out on the playground or the gymnasium floor in correct relation to one another generally followed. The gymnasium floor proved most satisfactory, and streets drawn with chalk or paved with strips of paper assisted in locating the models. Airplane photographs of the school district were quite helpful at this point.

After the community had been arranged to the satisfac-

14 Figure 8, page 81, shows this phase of the project.
FIGURE 8

STEM CRAFT COMMUNITY PROJECT, INTERMEDIATE STAGE
tion of all the children, one of them was selected to draw a "picture" of it on the blackboard. The map which resulted was compared with an actual map of the city, and a small district map which was available.\textsuperscript{15} The transition from the community on the floor to the "picture," and thence to the map was not difficult, and almost every child could locate his home on the map after one or two attempts. Acquiring the ability to understand maps in the third grade in such a natural manner was a valuable outcome of the project, even though it was not one of the original objectives.

The integrating effect of the community project on the other areas of learning was excellent, since this project was used as a basis for reading, composition, arithmetic, spelling, science, and social studies. Every subject area was closely correlated to the miniature community which grew from day to day under the guidance of the Stem Craft teacher.

An additional benefit of the project which had not been anticipated was the development of a strong community spirit. Pupils of their own accord adopted the expressions "our" and "we" when speaking of the work being done, and were quite concerned when some of the houses were not constructed as well

\textsuperscript{15} Figure 9, page 83, shows the model houses on the gymnasium floor.
FIGURE 9

STEM CRAFT COMMUNITY PROJECT, FINAL STAGE
as they might have been. Steps were taken by the children them-
selves to correct the carelessness of erring classmates, so that
"our community will be the best in the city."

In several cases pupils who were normally careless, indolent, and non-achievers, became highly enthusiastic and displayed an unusual amount of zeal and interest. Two boys in this category actually became what might be called "community leaders" as a result of a community project conducted a year ago. This improvement appears to be relatively permanent, since the boys are continuing to show a high degree of interest and effort. Case studies of the two boys are included in Chapter V under the designations D, and E.

Fourth Grade. The "American Indian," was a unit normally included in the fourth grade course of study in the Chicago Public Schools. An extensive Stem Craft Indian Project was developed to take advantage of the handwork possibilities and the natural youthful interest in the crafts of the early inhabitants of this country.

Indian crafts are comparatively simple and can be carried on by the average fourth grade pupil without undue difficulty. The Stem Craft project based on the Indian unit in the social studies curriculum therefore included practically all types of art and craft work practiced by the various tribes. Weaving, basketry, pottery making, mask construction, metal craft, bead work, and leather tooling were some of the Indian
activities utilized.

The children obtained their ideas for individual Indian projects from stories in the readers, descriptive material and pictures in the social studies textbooks, and the wide variety of reference books on Indians in the room library. Many of the decorative patterns were based on authentic Indian symbols and designs. These were developed in the creative art period under the direction of the regular classroom teacher. The meanings of the more common symbols used in picture writing were studied and an Indian picture dictionary prepared by each child. Simple picture stories were drawn by the pupils, and some of them were worked into the designs stamped on metal pins, bracelets, and key tags, or tooled into leather coin purses, book marks, and pencil holders.

All of the subject fields were linked to the Indian project as closely as possible. Stories about Indians were read in the language arts period, the areas inhabited by the various tribes constituted the basis for the geography portion of social studies, while a history of the Indians and the part they played in the story of our country made up the balance of the program. Indian melodies and dances were studied during the music hour and the art work was almost entirely Indian. In the arithmetic class, problems were revised so that Indians planted acres of corn, etc., instead of the usual farmer, and the science lessons were concerned with Indian fibres, dyes, food
preservation, wild fruits, roots, and vegetables. The gymnastic program included Indian games and dances, so there was not a single subject which was not closely correlated with the Stem Craft Indian project.

Since the Indian project was quite extensive it will be broken down into several sections.

One of the simplest parts of the project was the making of "wampum bags," used for carrying marbles, school supplies, money, and countless other things. It was a simple bag made of muslin, with hand-stitched seams and a draw string. The bag was decorated with an Indian design, which was worked out on the muslin with ordinary wax crayon. When the design had been completed it was "fixed" by covering it with a piece of paper and melting out the wax with a hot flat iron. This left a permanent, dyed pattern which would not wash out. The same process was used effectively to make place mats instead of wampum bags.

Making Indian jewelry was a fascinating phase of the project. Key tags, decorative pins, and bracelets were shaped from copper or aluminum and stamped with Indian symbols. The dies for stamping the symbols were made by filing the design on the end of a piece of drill rod, after which the rod was hardened and tempered. Making the dies was beyond the ability of most of the fourth grade pupils and was done chiefly by the instructor, although several students made some of their own which worked quite well.
Leather tooling was a simple craft in which Indian designs could be used effectively. Patterns were burned into the leather with an electric pencil or stamped in with the same dies used on the jewelry. The articles decorated were small change purses, book marks, and pencil holders, made from scraps of leather obtained from an upholstering firm. Plastic imitation leather upholstering material also worked out very well.

Baskets and mats were woven with an Indian motif of reed, fibre cord, or tightly twisted crepe paper. The crepe paper strips, which were made into a tough fibre by being pulled through a simple "twister," have been found the most satisfactory because of the wide variety of brilliant colors available. The finished basket or mat was made water-proof and rigid by saturating it with white shellac.

Belts and small mats for hot dishes were woven from cotton yarn, or worked out in beads. Feather head dresses were made by some of the pupils, although this was largely done as "extra credit" work outside of school hours. Simple dishes and bowls were made of oven-hardening clay, baked hard in an oven, and decorated with Indian designs.

 Masks were made by covering a clay model with strips of newspaper soaked in water and paste. When a sufficient number of layers had been built up to form a mask, it was permitted to harden. The dry mask was later removed from the model and decorated by painting.
Although Indians are not particularly known for the art of engraving, it was discovered in the craft class that Indian designs lent themselves admirably to reproduction on soft metal through the use of an engraving tool. Small copper, brass, or aluminum trays, made by a simple bending process, were engraved with Indian designs and held great interest for the children.

The Stem Craft Indian project attracted sufficient attention in school circles to warrant two television presentations.16

**Fifth Grade.** A fifth grade Stem Craft project which proved quite successful was taken from the science course of study. "Aviation" was the unit, and the project was the construction of a model airplane by each child.

The actual project was preceded by considerable classroom study in the field, and was started only after the class had advanced to a point where they knew something about various types of planes. The idea of constructing models ostensibly came from the pupils, although in reality it was drawn from them by the teacher at the time the project was planned to begin.

16 Figure 10, page 89, is a photograph taken in the studio during a performance which shows some of the Indian craft work being demonstrated.
FIGURE 10

FOURTH GRADE STEM CRAFT INDIAN PROJECT ON TELEVISION
After the class "decided" to build model planes, there was much discussion of the model kits available in the stores, of the advantages of the different materials used, of the mechanical and technical difficulties apt to be encountered in building the models at school, and of the possibility of holding an exhibit of the finished products. No restrictions were placed on how difficult or complicated the model might be, although the pupils themselves ruled out certain plastic model kits because they were "too easy." Boys who had built models served as advisors to the others and in general felt impelled to show their experience by electing to build very complicated planes.

Much of the actual work was carried on in the classroom during the science period as can be seen in the photograph, although the drilling, cutting, burning, painting and large-scale cementing took place in the craft room. The craft teacher served as the technical consultant while the classroom teacher guided the group in matters of a scientific nature.

All of the subject fields were closely integrated with the project. Aviation readers furnished the basis of the reading program, oral and written compositions were on airplanes, the spelling words included a high percentage of aircraft terms

17 Figure 11, page 91.
FIGURE 11

FIFTH GRADE AVIATION PROJECT
and the social studies covered the importance of the air age in history and geography. Even the arithmetic problems were modified to include airplanes, balloons, and rockets, where usually trains, automobiles, and horses were the factors involved. It would be difficult to conceive a more integrated program than the one built around the model airplane project, and one in which pupil interest could be maintained at such a high level in all subjects for an extended period of time.

In addition to the effective motivation and integration of school subjects provided for by this Stem Craft project, much extra-curricular activity also resulted, and the benefits extended far beyond the limits of the classroom. A large amount of voluntary outside reading, as well as the construction at home of additional model planes by practically every pupil were some of the more apparent results. A number of children have continued the work as a hobby, and several pupils who have never been to the public library are now regular patrons as a result of their reading on aviation. The level of scientific knowledge in the field of aviation reached by the ten and eleven year old pupils was unquestionably quite high. Girls as well as boys were heard intelligently discussing matters such as dihedral angle, lift-frac ratio, skin friction, and other aviation factors about which the average adult would have but little knowledge.

An exhibit of the finished models was held and each pupil gave a talk on the construction, unique features, and
specifications of the particular plane he or she had built. The highly motivated, carefully prepared talks provided excellent experience in public speaking for pupils who usually are quite self-conscious. The project supplied the interest, information, and the desire to explain, and the children were able to concentrate on oral exposition of the topic without being troubled by unfamiliar material or an uninteresting subject.

Other projects which proved valuable in the fifth grade were Mexican pottery, Mexican bead work, hollow papier-mâché animals, and small metal trays.

The original "between grades" diorama projects were developed to span the gap between fifth and sixth grade. These were small-committee projects, which not only helped to link the two grades, but also served as the basis for dioramas constructed by individual pupils in the sixth grade.

Sixth Grade. Handwork in the sixth grade classes included what is known in the Chicago Public Schools as "home mechanics" as well as the Stem Craft program.

The home mechanics course of study in the sixth grade was intended to serve as a means of orienting the pupils in that field and consisted of two major divisions, "Elementary
Textiles" and "Elementary Home Maintenance." The work of the year covered all home mechanics areas in a way designed to provide an overview of what was to come in the later two years. Since the home mechanics curriculum did not originate with the writer, and constitutes only a part of the craft work program, it will not be included here.

The Stem Craft program in the sixth grade was interwoven with the home mechanics work in such a way that one contributed to the other. Stem Craft projects were so intimately related to the home mechanics units that the pupils and classroom teacher could scarcely tell where one began and the other one ended.

The more successful Stem Craft projects at the sixth grade level included hooking rugs, constructing individual dioramas, and hammering metal trays.

Hooked rugs had a natural relationship to the sixth grade social science units on "Early Civilization in America" and "how changes came about in ways of living," as well as the science unit on "simplification of work by machines." They also connected effectively with the elementary textile unit in home mechanics and the fine arts program.

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18 A brief outline of the home mechanics course of study is provided in Appendix IV.
For convenience and economy the rugs were made in small sections about eight inches square. Students first prepared a full size design on paper in color during the art lesson, and then transferred it to a piece of burlap. Each child constructed a simple wooden frame to which the burlap was attached with thumb tacks.

Long narrow strips of cloth cut from discarded clothing, drapes, or blankets were used for the pile. This was "hooked" through the burlap with a large crochet needle or a simple notched towel rod. Use of old material provided a wide range of texture and colors for the rugs at practically no cost. It also furnished an opportunity to determine in a practical way the qualities and "feel" of all textiles normally found around the home.

Some pupils finished just the original eight inch rug unit and used it for decorative purposes or for protecting furniture from hot dishes or flower pots. Others became so interested in the work that they hooked additional squares which were stitched together to make larger rugs. A number of children continued to hook rugs during their leisure time at home, and as a result several parents took up the work as a hobby.  

19 Figure 12, page 97, shows a group of children working on rug squares. Note how closely the completed square matches the original pattern lying in front of the boy in the right center of the photograph.
Dioramas, or "museum boxes" as they are often called, proved to be very effective in providing motivation and integration at the sixth grade level. From an educational standpoint these three-dimensional picture boxes served as a device through which abstract units might acquire a degree of concreteness. They also served as an indication of what the pupils had learned about a topic.

Constructing a diorama illustrating a situation in science, social studies, language arts, health, or safety, required broad knowledge of all phases of the topic concerned. Frequently it became necessary for students to consult textbooks and reference volumes to establish points which were not entirely clear. The pupil in this way gained familiarity with reference materials and research procedures, which was an excellent practical use of techniques learned in the library.

Hammered metal trays provided a Stem Craft project which correlated very closely with the social studies units on early civilizations in Asia and Europe. The actual process used by people in the Middle Ages to make vessels and utensils from metal were employed to make useful and ornamental trays.

The trays were hammered into shape with the rounded end of a ball-peen hammer. They were made of sheet copper or brass, and were decorated by applying initials or designs made from metal of a contrasting color. Designs, initials, or monograms were prepared in the classroom during the creative art period.
FIGURE 12

MAKING HOOKED RUGS
Decorations were attached to the trays by a process called "sweating," which was one of the more difficult, but extremely useful types of soldering.

Seventh and Eighth Grades. In many educational systems the elementary school is considered to encompass only the first six grades. In Chicago Public Schools, however, the elementary school includes grades one to eight in addition to a kindergarten. Although Otto found this arrangement used in only seven per cent of the school systems which replied to his questionnaire, the seventh and eighth grades are included here because they were actually present in the experimental school.

The seventh and eighth grade classes in Chicago follow the home mechanics course of study as the basic handwork program, although this was augmented by the Stem Craft projects in the experimental school. The home mechanics curriculum for the upper two grades was based on a four unit, two year program. These units were titled: (1) Home and Clothing, (2) Electricity, Utensils, and Crafts, (3) Foods and Nutrition, and (4) House, Garden and Crafts.

Since the home mechanics course of study covered a wide

20 Otto, Organizational and Administrative Practices. 2.

21 Ibid.

22 Areas of Learning, 2. A brief outline of the home mechanics units from this source is included in Appendix IV.
range of craft work and was quite flexible, the Stem Craft program in these grades was essentially an application of Stem Craft objectives to modified home mechanics projects. In other words, regular home mechanics projects were adapted to the Stem Craft purpose of providing better motivation, improved integration, and practical application for the other areas of learning.

An example of this was the construction of an electric table lamp. In the usual home mechanics class each child would make a lamp from a set of standard drawings, and the finished products would all be quite similar in design and construction. The students received a series of excellent mechanical and electrical experiences in making the lamp, but there was no connection between the project and any of the other areas of learning.

In the Stem Craft program the table lamp project began with a design drawn by the student of an original lamp, the idea for which he obtained from one of his other subjects. This required a search of text-books and reference material to locate a suitable idea, and in itself had considerable educational value.

After the "theme" of the lamp had been determined, the student decided what materials would be used. In some cases the lamp bases were constructed entirely from raw material such as wood, metal or plastic, while in others objects such as bottles,
jugs, vases, bowls, dolls, models, cruets, glass bricks, etc., were used as a part of the base.

Each original lamp base posed individual problems concerning provisions for stability, rigidity, safety, beauty, and an acceptable means of holding the all-important electrical lamp socket. Construction in many cases involved drilling holes in glass, china, or tile; riveting, reaming, and other unusual processes with educational possibilities. Computational problems involving lengths, inside and outside diameters, circumference, perimeter, angles, and areas were encountered and utilized in practice what had been learned in the arithmetic lessons.23

The aesthetic considerations involved in selecting a shade of suitable size, shape, and color for the original lamp bases furnished an extremely practical and well motivated unit for the fine arts class.

Another home mechanics project which was greatly modified to meet the Stem Craft objectives was an aluminum serving tray. Ordinarily this project utilized a prepared metal pattern to make the division of the metal disc into the proper number of parts a simple matter. This would be followed by a simple bending process and sometimes by decoration with a vibra-tool or

23 Figure 13, page 101, shows a group working on a lamp project. Some of the craft room reference books can be seen in the background.
FIGURE 13

STEM CRAFT LAMP PROJECT
nail head pattern. A serviceable tray was produced in this manner but with a very limited amount of correlation with other subject fields.

In the Stem Craft program the metal disc was divided into the desired number of parts by determining mathematically the angle required to subtend a chord of the proper length to produce the correct division. These angles were laid out on the disc with a protractor after the center had been found through the use of a pair of dividers. Several very abstract mathematical concepts learned in the arithmetic class were thus put to practical use and given meaning in laying out the tray.

In order to produce definite correlation between the mathematical problems involved and the tray itself, each pupil was required to work out his particular tray problem on paper as an exercise in arithmetic, and submit it for inspection before starting work on the metal. The trays were made in different sizes, different number of sides, and with various combinations of wide and narrow sides, so that each child had an original set of calculations to make.

The trays were decorated by engraving them with a tool known as a graver. The engraving process is employed by jewelers to monogram silverware, and use of it by children of elementary

24 Figure 14, page 103 shows both of these processes.
FIGURE 14

STEM CRAFT TRAY PROJECT
school age is quite unusual. However, it was actually a method of drawing or lettering on metal, and was closely related to handwriting. Noticeable improvement in penmanship was observed in a number of cases after students started engraving.25

Each pupil was encouraged to make his own engraver from drill rod available in the craft room so that he might take it home to use in his leisure time. Most of the students availed themselves of this opportunity and a number of engraving hobbies for children and parents were the result.

Wrought aluminum handles were attached to the trays by riveting, after the engraving and bending had been completed. Forming, twisting, drilling, and riveting the handles provided mechanical experiences seldom encountered elsewhere at the elementary school level.

The designs used to decorate the trays were developed during the fine arts period in the classroom, and engraving them on metal was merely executing them in a permanent and useful medium. This served to emphasize the practical side of art and further correlate it with the Stem Craft program.

25 The four girls visible in Figure 14, page 103, were engraving designs on the metal discs prior to the bending process.
CHAPTER V

EVALUATION

Evaluation of an emerging program such as the Stem Craft plan is not a simple task. The prime objectives of the program were improved integration and better motivation of learning experiences, both of which are difficult to measure objectively. While improved motivation should eventually result in greater scholastic achievement, the measurement of the gain requires control groups which could be equated with experimental group on a number of factors. Such a procedure was not considered practical at the time, and it was felt that some other means of evaluation should be used.

A discussion with faculty and advisory committee members produced the plan of using parent and teacher questionnaires, as well as case studies of selected pupils and teachers as a basis for evaluation. This appeared to be the most logical method of evaluation at this time since most of the parents and teachers were cognizant of conditions before the Stem Craft program was started, and thus would be able to judge what changes had taken place as a result of the introduction of the craft work.
The Questionnaire.

A questionnaire was prepared and submitted to a number of educators in the field, including the chairman and members of the advisory board. Suggestions for improvement were incorporated in two revisions of the original questionnaire before the final form was prepared for duplication and distribution. The objective was to develop a questionnaire which would determine the opinion of parents and teachers on the various aspects of the Stem Craft program in relation to how well the aims of the plan had been carried out.

Questionnaires for parents were mimeographed and distributed with a covering letter to all pupils who had completed one or more semesters of craft work. The letter was headed "Byrne Booster Community Bulletin," under which title a bulletin is issued to parents on a bi-weekly basis. Other questionnaires have been distributed in this same manner and responses have been excellent. The questionnaire on "Spiritual Values" mentioned in the covering letter was the most recent of these.

The total number of questionnaire forms distributed was 429, of which 410 (95.6 per cent) were returned. However, a number of those returned were from parents who had more than one child in school, and the duplicate responses were discarded, leaving 304 usable returns.

The questionnaires for teachers, which were slightly different than those prepared for the parents, were duplicated
and distributed to 14 teachers. All of these forms were returned.\(^1\)

The questionnaires included 18 items, 17 of which were of the forced choice type and one with space in which suggestions could be written. The forced choice items contained three choices, one of which was considered favorable (A), one neutral (B), and one unfavorable (C).

**Questionnaire Results.**

On the 304 usable returns from parents, 4,963 items were marked with one of the three possible choices. A total of 3,705, (74.4 per cent) were favorable responses, 1,207, (24.2 per cent) were neutral, and 71, (1.4 per cent) were unfavorable. A tabulation of the responses to each of the 17 forced choice items is included in Table I, page 122.

The number in the stub column of the table corresponds to the item number in the questionnaire, and the one or two word description of the factor involved is in effect a summary of the question.

The total number of responses to the different items varies slightly due to the fact that some of the parents failed to mark an item or two. In many cases the reason for not marking

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\(^1\) Copies of the covering letter and the two questionnaires, are included in Appendixes I, II, and III, respectively.
an item was given, and in every instance was considered a logical one.

The question concerning interest was worded: "How do you feel the craft program has affected your child's interest in school?" The replies of the parents on this aspect of motivation showed that 89.6 per cent felt there had been an improvement, 9.7 per cent were neutral, and 0.7 per cent considered the results unfavorable.

On the item concerning the effect of craft work on the other studies the returns were 66.0 per cent favorable, 34.0 per cent neutral, and none unfavorable. The fact that not one parent out of the 304 who replied had noticed any bad effect on the other studies would seem to be an indication that the time spent in the craft room had not reduced the effectiveness of the work in the other fields. In fact the next question, concerning the time spent in craft work, received responses which showed that 92.9 per cent of the parents felt that the time was well spent.

Responses to the question on the value of craft work in teaching the importance of planning were 80.5 per cent favorable, 15.9 per cent neutral, and 3.8 per cent unfavorable.

The question concerning choosing an adult occupation received replies which indicated 60.9 per cent of the parents felt that the craft work had been helpful in this respect, and 39.1 per cent were neutral. There were no unfavorable responses. A number of parents of children in the lower grades did not
<table>
<thead>
<tr>
<th>Factor</th>
<th>Favorable</th>
<th>Neutral</th>
<th>Unfavorable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Per cent</td>
<td>No.</td>
</tr>
<tr>
<td>1. Interest</td>
<td>267</td>
<td>89.6</td>
<td>29</td>
</tr>
<tr>
<td>2. Other studies</td>
<td>196</td>
<td>66.0</td>
<td>101</td>
</tr>
<tr>
<td>3. Time spent</td>
<td>298</td>
<td>92.9</td>
<td>11</td>
</tr>
<tr>
<td>4. Planning</td>
<td>233</td>
<td>80.3</td>
<td>46</td>
</tr>
<tr>
<td>5. Occupations</td>
<td>178</td>
<td>60.9</td>
<td>114</td>
</tr>
<tr>
<td>6. Unification</td>
<td>231</td>
<td>79.1</td>
<td>56</td>
</tr>
<tr>
<td>7. Between grades</td>
<td>206</td>
<td>70.8</td>
<td>85</td>
</tr>
<tr>
<td>8. Outside reading</td>
<td>168</td>
<td>63.7</td>
<td>106</td>
</tr>
<tr>
<td>9. Consumer values</td>
<td>217</td>
<td>75.4</td>
<td>64</td>
</tr>
<tr>
<td>10. Strong, weak points</td>
<td>239</td>
<td>83.0</td>
<td>44</td>
</tr>
<tr>
<td>11. Home, directly</td>
<td>198</td>
<td>67.6</td>
<td>91</td>
</tr>
<tr>
<td>12. Home, indirectly</td>
<td>212</td>
<td>72.9</td>
<td>76</td>
</tr>
<tr>
<td>13. Leisure time</td>
<td>224</td>
<td>76.5</td>
<td>60</td>
</tr>
<tr>
<td>14. Part of education</td>
<td>196</td>
<td>66.9</td>
<td>93</td>
</tr>
<tr>
<td>15. Change of time</td>
<td>124</td>
<td>42.7</td>
<td>160</td>
</tr>
<tr>
<td>16. General opinion</td>
<td>255</td>
<td>85.7</td>
<td>40</td>
</tr>
<tr>
<td>17. Overall effect</td>
<td>265</td>
<td>88.9</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>3705</td>
<td>74.4</td>
<td>1207</td>
</tr>
</tbody>
</table>
answer this question, but indicated that they considered their child was too young for the effect to be noticeable.

The effect of the craft program in bringing the various school subjects together to form a unified program was the subject of another item. Replies were 79.1 per cent favorable, 19.2 per cent neutral, and 1.7 per cent unfavorable. A companion question on the integration of grades received replies which were 70.8 per cent favorable, 29.2 per cent neutral, and none unfavorable. Responses to these two questions concerning the integrating effect of the Stem Craft program would seem to indicate that a large majority of the parents were convinced of its value for this purpose.

The items on outside reading and consumer values are not considered of major importance, although they received favorable replies of 63.7 per cent and 75.4 per cent respectively.

"What do you feel the craft program has done in giving your child an insight into his or her limitations and strong points?" Eighty-three per cent of the parents replied that the craft program had been helpful in this respect, 15.3 per cent were neutral, and 1.7 per cent gave an unfavorable reply.

Item number 11 requested information on how the craft program had affected the parent, and 67.6 per cent indicated that they had been able to put to use some of the ideas brought home by the child. The following question concerned the effect of the craft work on the child outside of school and 72.9 per cent of
the parents replied that it had been helpful.

Seventy-six and one-half per cent of the parents indicated that they considered the craft work had been beneficial to their children in providing for leisure-time activities.

The item concerning a possible change in the amount of time devoted to craft work received replies which indicated that 42.7 per cent of the parents considered the period of time should be increased, 55.2 per cent recommended that it remain as it was, and 2.1 per cent suggested that the amount of time be decreased.

A total of 253 parents, 85.7 per cent, indicated that the Stem Craft program had raised their opinion of the Byrne School, 13.6 per cent gave a neutral response, and 0.7 per cent marked the unfavorable category. This would appear to prove the contention, at least for the population concerned, that the Stem Craft program tends to improve public relations.

On the question of the overall effect of the craft program, 88.9 per cent of the parents expressed the opinion that it had been beneficial, 10.4 per cent indicated they felt it had no effect, and 0.7 per cent replied that the effect had been bad. The ratio of favorable to neutral replies was 8 : 1 and favorable to unfavorable 123 : 1, for what seems to be a definite expression of approval on the part of the parents.
Questionnaire returns from parents of children at different grade levels were kept separate and tabulated on that basis. The results are shown in Table II below.

**TABLE II**

RESPONSES OF PARENTS ACCORDING TO GRADE LEVEL OF THEIR CHILDREN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Favorable</th>
<th>Neutral</th>
<th>Unfavorable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Cent</td>
<td>No.</td>
<td>Cent</td>
</tr>
<tr>
<td>1</td>
<td>154</td>
<td>75.9</td>
<td>49</td>
<td>24.1</td>
</tr>
<tr>
<td>2</td>
<td>344</td>
<td>80.9</td>
<td>80</td>
<td>18.9</td>
</tr>
<tr>
<td>3</td>
<td>511</td>
<td>79.0</td>
<td>136</td>
<td>21.0</td>
</tr>
<tr>
<td>4</td>
<td>464</td>
<td>74.7</td>
<td>156</td>
<td>25.1</td>
</tr>
<tr>
<td>5</td>
<td>834</td>
<td>75.8</td>
<td>251</td>
<td>22.8</td>
</tr>
<tr>
<td>6</td>
<td>560</td>
<td>70.0</td>
<td>214</td>
<td>26.8</td>
</tr>
<tr>
<td>7</td>
<td>488</td>
<td>68.8</td>
<td>205</td>
<td>28.8</td>
</tr>
<tr>
<td>8</td>
<td>350</td>
<td>73.5</td>
<td>116</td>
<td>24.4</td>
</tr>
<tr>
<td>Total</td>
<td>3705</td>
<td>74.4</td>
<td>1207</td>
<td>24.2</td>
</tr>
</tbody>
</table>
No attempt was made to identify the individuals who completed the questionnaires, although a few parents did sign their replies. The fact that the classroom teachers received the completed returns from the children and delivered them in a single packet made classification according to grades possible without identification of individual questionnaires.

An analysis of the returns according to grade did not indicate any significant differences, although replies from parents of pupils in the second grade showed the highest percentage of favorable responses, and from those in seventh grade the lowest.

The questionnaire distributed to teachers was essentially the same as the one prepared for parents, except that the words "your child" were changed to "your pupils" in 14 of the questions, and three substitute questions, numbers 11, 12, and 13, were used where the original ones concerned activities away from school.²

The teacher questionnaires were collected by a disinterested party in such a manner that there would be no way of identifying the persons who filled them out. This was considered desirable to insure replies which would represent the teachers' own opinion.

² Cf. Copy of questionnaire, Appendix III.
The replies on the questionnaires filled out by the 14 teachers were tabulated and the results are shown in Table III, page 115.

Responses of the teachers showed a much wider variation than those of the parents. While the smaller population of teachers may have been partially responsible for this, there probably were other factors involved.

Favorable responses ranged from 21.4 per cent on the question of helping in the choice of adult occupations, to 100 per cent on the item concerned with providing an insight into limitations and strong points. When these two questions are examined carefully a logical reason for the wide variation becomes apparent. The explanation for the small number of teachers who replied that the craft program appeared to be helpful in clarifying the thinking of the children on the choice of an adult occupation would seem to be that teachers are not in a good position to determine this result. The fact that the majority of teachers, 78.6 per cent, gave a neutral reply to this question would tend to substantiate this explanation. The question of consumer values also had few favorable replies, 28.6 per cent, and a large number of neutral responses, 71.4 per cent. This is another area in which teachers are not readily able to observe the factor in question.

In the matter of assisting the children to gain an insight into their limitations and strong points, the teachers
## TABLE III
RESPONSES BY TEACHERS ON INDIVIDUAL ITEMS OF THE QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Favorable</th>
<th>Neutral</th>
<th>Unfavorable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Percent</td>
<td>No.</td>
</tr>
<tr>
<td>1. Interest</td>
<td>13</td>
<td>92.9</td>
<td>1</td>
</tr>
<tr>
<td>2. Other studies</td>
<td>10</td>
<td>71.4</td>
<td>3</td>
</tr>
<tr>
<td>3. Time spent</td>
<td>11</td>
<td>78.6</td>
<td>2</td>
</tr>
<tr>
<td>4. Planning</td>
<td>8</td>
<td>57.1</td>
<td>5</td>
</tr>
<tr>
<td>5. Occupations</td>
<td>3</td>
<td>21.4</td>
<td>11</td>
</tr>
<tr>
<td>6. Unification</td>
<td>9</td>
<td>64.3</td>
<td>5</td>
</tr>
<tr>
<td>7. Between grades</td>
<td>7</td>
<td>50.0</td>
<td>7</td>
</tr>
<tr>
<td>8. Outside reading</td>
<td>6</td>
<td>42.9</td>
<td>3</td>
</tr>
<tr>
<td>9. Consumer values</td>
<td>4</td>
<td>28.6</td>
<td>10</td>
</tr>
<tr>
<td>10. Strong, weak points</td>
<td>14</td>
<td>100.0</td>
<td>0</td>
</tr>
<tr>
<td>11. Discipline</td>
<td>4</td>
<td>28.6</td>
<td>9</td>
</tr>
<tr>
<td>12. Motivation</td>
<td>11</td>
<td>78.6</td>
<td>3</td>
</tr>
<tr>
<td>13. Follow directions</td>
<td>11</td>
<td>78.6</td>
<td>3</td>
</tr>
<tr>
<td>14. Part of education</td>
<td>11</td>
<td>78.6</td>
<td>3</td>
</tr>
<tr>
<td>15. Change of time</td>
<td>6</td>
<td>42.9</td>
<td>7</td>
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<tr>
<td>16. General opinion</td>
<td>12</td>
<td>85.6</td>
<td>2</td>
</tr>
<tr>
<td>17. Overall effect</td>
<td>13</td>
<td>92.9</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>64.3</td>
<td>80</td>
</tr>
</tbody>
</table>
are in a relatively good position to judge the results of the craft work. Since every teacher gave a favorable reply to this question there appeared to be little or no indecision on their part.

Thus, the wide variation in the replies, which seems to have a logical reason behind it, would appear to indicate that the questionnaire received careful thought from the teachers, and that the results, therefore, represent a reasonably good expression of their actual opinion. If this assumption is correct, then the responses of the teachers concerning the overall effect of the Stem Craft program on the children would seem to be especially significant. On this question 92.9 per cent indicated that they considered the craft program to be beneficial, 7.1 per cent were doubtful, and there were no unfavorable replies. This would appear to indicate that the teachers who were working with the program were convinced of its value.

In addition to the 17 forced choice items on the questionnaire, there was one on which parents and teachers were requested to write in suggestions concerning the craft program. This provided an opportunity for those completing the questionnaire to express themselves on any points not covered in the 17 forced choice questions. Of the 304 usable replies, 121 or approximately 40 per cent had one or more suggestions written in the blank spaces.

Most of the suggestions offered by the parents fell
rather readily into four categories. A total of 40 of them could be considered complimentary in that the suggestions were to continue the program. Typical responses were, "continue the good work," and "keep up the craft work."

There were 30 who suggested that the craft program should place more emphasis on cooking and sewing for girls and on manual training for the boys. Two typical replies in this category were, "the craft program should include teaching the girls to cook, bake, and sew and teach the boys manual training besides the things they are now taught," and "girls should have a little more training in sewing and cooking. Work done so far has been very good."

Another group of parents, 15 in number, suggested that more time be given to craft work. A few of the replies are quoted as examples. "In my opinion the Byrne School Craft program has been very beneficial to the pupils of the school. My suggestion would be to increase the time spent by the children in the work room." "I believe at least one hour a day should be donated to the child in the craft room."

A total of ten parents suggested that pupils be required to finish their projects in school. A typical reply of this type was: "The only suggestion I should like to make is that they be made to finish a project and bring it home for the parents to see."

There were 26 suggestions which did not fall into
logical categories and so were listed as general in nature. One of these is included here as an example: "Many of the children in this neighborhood have no place to spend their time in the evening. Children should have some time in the evening to have stem craft."

Of the 14 teachers completing questionnaires, ten of them (71.5 per cent) made suggestions concerning the program. A total of six suggested that more time be allotted to craft work, two suggested changes in the way discipline problems arising in the craft room be handled, and two expressed the opinion that the craft work should be restricted to the allotted time so it would not interfere with other school activities.

**Summary of Questionnaire results**

Since evaluation of the stem craft program for this study based primarily on the replies received from parents and teachers on questionnaires, a summary of certain aspects of these replies will be included for clarity.

An adequate sampling of the population concerned was assured by the high percentage of returns received. Replies from the parents of 95.6 per cent of the pupils in the stem craft program were completed and returned. In the case of the teacher questionnaire 100 per cent of the forms were completed and returned.

In view of the tendency for parents to be critical of new features in the curricula offered their children, the fact
that 74.4 per cent of all the replies were favorable to the Stem Craft program is considered significant. When the number of favorable replies (3705) is compared to the number of unfavorable ones (71), the ratio is found to be 52:1, which appears to indicate parental approval.

Since the primary objectives of the Stem Craft program were better motivation and improved integration, the opinion of the parents on these two points is considered especially important in making an evaluation of the results achieved. On the question designed to determine how parents felt the Stem Craft program affected their child's interest in school 89.6 per cent of them gave a favorable reply. The question on what effect the Stem Craft program had on bringing the various school subjects together to form a unified program received replies indicating that 79.1 per cent of the parents felt that it had helped to accomplish this objective of improved integration. The question concerning integration between grades received responses showing that 70.8 per cent of the parents felt that the Stem Craft program had been helpful in doing this. The final forced choice question was: "What is your opinion of the overall effect of the craft program on your child?" A total of 88.9 per cent of the parents replied that they thought it had been beneficial.

Replies by teachers on the same questions indicated favorable opinions as follows: motivation 92.9 per cent, integration between subjects 64.3 per cent, integration between grades
50.0 per cent, and overall effect 92.9 per cent. The fact that there were no unfavorable responses to any of these four questions is also considered significant.

One of the questions concerning an important phase of the guidance value of the Stem Craft program, how the craft work had helped the children to gain an insight into their limitations and strong points, received replies which are considered worth including in this summary even though guidance was not one of the primary objectives of the program. Responses from parents indicated that 85.0 per cent felt that the Stem Craft program had been helpful in doing this, and 100 per cent of the teachers indicated the same opinion. The significance of unanimous approval of any particular instructional phase of a school program by a group of teachers will be apparent to anyone with experience in the field of education.

The high ratio of favorable replies to unfavorable replies, 52:1 for parents and 30:1 for teachers, seems to indicate that the Stem Craft program has attained the objectives of better motivation and improved integration of learning experiences at least insofar as the opinion of the parents and teachers are concerned.

Additional Benefits of the Stem Craft Program.

When the Stem Craft program was instituted it was felt that better motivation of learning experiences, and improved integration between grades and between areas of learning, would
provide ample reason for continuation of the experiment. There were additional benefits from the new program however, which had not been anticipated, but which have proven almost as valuable as the original objectives.

**Public Relations.** Probably the most obvious of the extra benefits was the unusual possibility for building good public relations in the community through the medium of the Stem Craft program.

The experimental program was scarcely a week old when the first expressions of parental interest and approval were received. These indications of favorable community opinion continued and took the form of letters from parents, personal visits, and highly complimentary notices in the local newspapers. By the end of the first semester of experimental Stem Craft work the entire community had heard of it through word of mouth or the local press, and written requests were received by the school for an increase in the scope of the program.

Local interest in the Stem Craft program did not remain entirely on that one phase of the educational program, but soon spread to other aspects of the school work. While the craft work provided a starting point for a wave of public interest in the school, all parts of the school program benefited.

Interesting news releases and excellent publicity pictures were the natural result of a program such as the Stem Craft plan, and they were used to headline stories about other
school activities which in themselves would probably not warrant 
mention in the press. Craft work was thus used as the backbone 
of the school publicity program, and did much to build up good 
public relations with the community.

Thus Warner's claims for the value of a craft program 
in promoting good public relations seem to be substantiated at 
the Byrne School:

The more favorably a school is known to the community, the 
better will be the over-all relationships between them. 
Since some of the results of industrial arts work are more 
objective and are of greater primary interest to citizens 
in general, the opportunity is provided to advertise the 
school through this department. People who see exhibits of 
projects or pictures of work done in industrial arts classes 
are likely to assume that it is representative of other good 
work in the school. If students go home enthusiastic about 
the work in their shop classes, a general approval of the 
whole school program by the parents is apt to follow. All 
good will, which is developed in this manner reflects to the 
benefit of the school as an institution....

Guidance. A second unforeseen benefit of the Stem 
Craft program was the basis it provided for guidance.

One of the more valuable aids in a guidance program is 
individual evaluation. This evaluation should be a continuous 
process according to Crow and Crow, and is usually based on 
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3 William E. Warner, Industrial Arts in General 

4 Lester D. Crow and Alice Crow, An Introduction to 
Guidance, New York, 1951, 104.

5 Ibid., 105.
The Stem Craft program, in which one teacher was in a position to observe individual pupils over a period of years in a wide variety of situations, provided a sound and relatively accurate basis for individual evaluation. The craft teacher could observe how each child reacted to emergencies, problem situations, failure, success, and set-backs. She could also discover each pupil's manual dexterity, artistic ability, interests, attitudes, drives, ingenuity, originality, self-control, willingness to co-operate, ability to work with others, etc.

When it was noted soon after the craft program was started that there were inherent guidance possibilities present, provisions were made to record the observations of the instructor for future use by the guidance counselor. A cumulative record of each pupil was made by the craft teacher on a card which was normally kept on file in the craft room. The back of the card was used for anecdotal records of incidents which occurred in the craft room.

In addition to providing a record of individual evaluation for use by the regular guidance counselor, the Stem Craft instructor furnished continuous guidance for her pupils.

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6 Ibid., 106.

7 The home mechanics cumulative record card is reproduced in Appendix VII.
Her post was well fitted for this purpose, since she was in contact with each pupil at least once a week for a number of years, and was in a position to assist whenever a need for guidance arose.

By a fortunate coincidence the teacher chosen to direct the Stem Craft program was an experienced guidance counselor, with all of the background and training in that field required for such a position in the Chicago Public Schools. As a result, she had a "guidance point of view," which Crow and Crow\(^8\) consider an important aspect of a good guidance program.

A number of pupils, who were obviously in need of guidance when they transferred into the Byrne School, seemed to find the solution of their problems, with the assistance of the instructor, in the Stem Craft program. Certain "problem" pupils who were in the school when the experimental plan was instituted were also aided materially by the guidance function of the program.\(^9\)

Since guidance is a facet of education receiving increasing emphasis at present,\(^10\) the way in which the Stem Craft program served to provide assistance in three specific areas of

\(^8\) Crow and Crow, 41.

\(^9\) Case histories of some of these pupils are included in Chapter V.

\(^10\) Crow and Crow, 4.
guidance is included here. Bawden et al. designate the three areas as (1) vocational, (2) educational, and (3) recreational,\textsuperscript{11} although the latter one was referred to as "personal" by Crow and Crow.\textsuperscript{12}

In the elementary school the Stem Craft program furnished a broad base for vocational guidance. This was generally absent in grammar schools, and the important vocational decisions which must be made prior to entering high school were of necessity founded on the results of tests and scales. Orientation in the industrial field furnished by actual "tryout" experiences in the Stem Craft program assisted the pupils to decide on the area in which they were fitted and interested.\textsuperscript{13}

Further assistance in the field of vocational guidance was furnished by the cumulative record compiled by the craft teacher on how each pupil performed over a period of years in the handwork program. This record included the child's strengths and weaknesses, as well as anecdotal notations covering any unusual incidents in which he was concerned.

On parent interview day when representatives of high schools conferred with parents of prospective elementary school graduates on the school their children would attend and on the

\textsuperscript{11} Bawden et al., 50
\textsuperscript{12} Crow and Crow, 12.
course of study they should follow, the craft teacher and her
record card were important factors in many of the vocational
choices.

Until recently, educational guidance was practiced
almost entirely at the high school level, but is now finding its
way into the elementary school. At this lower level, educational-
guidance is essentially concerned with stimulating interest
and making pupils want to learn what is being taught in the
various subjects. This was one of the primary objectives of
the Stem Craft program, and in view of the favorable
questionnaire responses seemed to be achieved to a considerable
extent.

The third specific area of guidance, which was given
different names by various authorities in the field, was
described as "aiding the individual to make wise choices and
adjustments in the important matter of his recreational
activities." Bawden et al., called it "recreational gui-
dance," while Jones referred to it as "leisure time,
avocational, or cultural guidance," and described it as

14 Crow, and Crow, 11.
15 Ibid., 233-234.
16 Bawden, et al., 51.
17 Ibid.
18 Arthur J. Jones, Principles of Guidance, New York,
1930, 61.
guidance designed to assist in the "choice of leisure time activities now and the preparation for useful forms of leisure time activities in later life."\textsuperscript{19}

Davis indicated how important he felt this area of guidance to be when he wrote:

Wise use of leisure time is too important to be left to chance....it is in part because the school has paid so little attention to the intelligent use of leisure time that such unsatisfactory use is being made of this time now.\textsuperscript{20}

In this area of guidance the Stem Craft program appeared to have unusual possibilities. A wide variety of crafts suitable for leisure time were presented to the pupils, and try-outs in the various fields were a part of the regular Stem Craft program. As a result, a large percentage of the pupils adopted various phases of the craft work as hobbies, and many of the parents took up crafts as leisure time occupations as a consequence of the Stem Craft activities of their children. "Leisure time guidance" is a definite possibility in the Stem Craft program, since it is difficult to imagine a more intimate or extensive contact with hobby-type activities than is to be found therein. When these craft experiences are under the supervision of a guidance-minded instructor, the result is likely to be the adoption of adult leisure time activities which fit the

\begin{flushright}
\textsuperscript{19} Ibid. \\
\textsuperscript{20} Davis, 335.
\end{flushright}
interests, needs, and abilities of the individuals concerned.  

Individual Differences. Individual differences have posed serious problems for teachers ever since mass education has been practiced. Organized research to discover principles of teaching has presented new possibilities for individualizing instruction through diversified assignments for small groups and through individual guidance of learning. Thus, every child is considered as a unique person with individual interests and talents to be developed.

Teachers who are worthy of the title are well aware of the variability among school children, and strive to provide for it. Much can and is done in the classroom and remedial classes to compensate for differences in ability in the various areas of learning. Unfortunately however, the range of adaptation possible in a classroom is somewhat limited, particularly when the pupils' interest and greatest ability lies in the area of manual or creative arts, as so many do.

There is a biological reason for the large percentage of children whose primary interest is in doing things involving the large muscles, according to Warner, who pointed out that it was as abnormal for a child to be quiet as to go without eating.

21 Ibid.
22 Hildreth, 386.
23 Ibid.
"The enthusiasm with which a pupil leaves his studies for the playground or the shop is a direct result of his natural need for activity.\textsuperscript{24}

In some cases where mental ability is low, a pupil may never feel the joy of success in any academic subject. If the non-achieving child is not physically handicapped, he can frequently do at least average quality work with his hands. In a craft class he is often able to complete successful projects, which will provide him with an opportunity to feel the pride of accomplishment and the consequent rise in self esteem which is denied him in other school activities.\textsuperscript{25} For such students the Stem Craft program furnished the necessary environment for success, and an understanding instructor made the maximum educational use of the results.

The slow learner was not the only one who profited from the Stem Craft program, however, as there were many average or superior children who needed the same creative activity to give meaning to the various areas of learning. Lorey pointed this out as follows:

Children of good intelligence but non-verbal orienta-

\textsuperscript{24} Warner, 42.

\textsuperscript{25} Ibid., 146.

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tion sometimes progress astonishingly in academic work when they gain insights into numbers and words through carpentry experiences. Troubled children find healing in the bang of the hammer, the rhythmic motion of the file, the smell of shavings, the feel of wood. Girls as well as boys react favorably to the opportunities for muscular activity, creative release, and recognition for their productions.26

The Educational Policies Commission in their description of the ideal elementary school indicated that it should include "shops, laboratories, and studios which provide space, equipment, and instructors in the whole range of manual, artistic, dramatic, and home-art expression...." to develop each child's own special talents to the limit.27

Many individual differences which keep children from obtaining the maximum benefit in the ordinary course of study, were accommodated in the Stem Craft program under the supervision of a teacher whose aim it was to have the craft work meet the needs and interests of the pupil to the greatest possible degree.

Socialization. Direct development of desirable social traits such as co-operation, leadership, and followership, is somewhat difficult in the ordinary academic school program. Generally, if an effort is made to give direct training in these areas of socialization, artificial situations are set up to


furnish the necessary environment. At best conditions are not natural and the training is likely to be somewhat superficial.

In contrast to "staged" conditions, the Stem Craft program provided situations in which these social relationships might develop naturally. Group undertakings, in which a number of pupils co-operate in the planning and construction of some project, furnished natural opportunities for the practice of desirable social traits.

Co-operation was expected as the normal result of a group project, but if it did not develop naturally the conditions present in the Stem Craft program were suitable for instruction in this important democratic trait. Leadership and followership also tended to come about in a natural manner when a group was interested in the best possible results from the efforts of its members.

In many school situations the importance of training in followership is lost sight of completely and most emphasis is directed to the development of leadership. In a group frequently there can be only one leader and the others must be followers. This point could be demonstrated in the Stem Craft program, along with the importance of being a good follower.

Case Studies

A number of case studies of pupils and teachers are included to permit the reader to make his own evaluation of the Stem Craft program. The studies were made of pupils and teachers
in the Byrne School whose experiences in the Stem Craft program seemed to illustrate some particular phase of the plan. Data for the case histories was obtained from the student's cumulative record, the Stem Craft record card, anecdotal records, pupil interviews, and conferences with classroom teachers, the craft teacher, the guidance counselor, and parents of the children.

While every effort was made to keep the studies objective, it is realized that certain subjective judgements were involved and that these may have been influenced by enthusiasm for the Stem Craft program.

Case Study A. A, twelve and a half years of age, transferred into Byrne in an upper grade from a school out of state. She was brilliant, with an IQ around 140 or higher. The exact figure is in doubt since her scores on four of the six parts of the Chicago Primary Mental Abilities test far exceeded the maximum age scores given on the profile chart. Her achievement test scores were, reading 10.8, spelling 9.2, and arithmetic 9.0.

When A's mother entered her in school she informed the writer that her daughter was far ahead of the Byrne pupils and requested that she be advanced a half year. The mother stated that A was going to medical school and that an extra semester start on the long pre-med program would be an advantage, particularly since the child would probably be quite bored with the simple classwork she would encounter at Byrne.
Unfortunately A also knew that she was bright and did not hesitate to let others know it. She took pleasure in showing up all the other members of the class and as a result was a very unpopular person in only a few weeks.

However, the teacher in the Stem Craft program noticed that A was far behind most of the class where handwork was concerned. This deficiency was purposely emphasized rather than minimized by the teacher, because it was felt that it was the only way to bring A to realize that she was not some superior being. A few casual conferences were held between A and the Stem Craft teacher in which it was pointed out that a person usually excels in one of two things and is average or below in many others. She was also brought to realize that it was the total of all abilities that really counted and that when calculated on that basis she was just a high average pupil.

A report card grade of "C" in craft work, as contrasted with "E's" in all other subjects, brought the indignant mother to school to enter a complaint which required approximately two hours for delivery.

After a short period of obvious disillusionment, A's attitude changed noticeably and she dropped many of her superior ways toward others. However, by that time she was thoroughly disliked by all the pupils and it appeared that she would spend an unhappy year at Byrne.

Fortunately for A the class decided to write and
present a playlet to demonstrate the proper steps to take in the event of an atom bomb attack. Committees were formed to write the play, build the scenery, and develop the sound and lighting effects as a part of the craft program. A was not placed on a committee, but after subtle suggestions by the craft teacher, who had noticed that she had artistic ability, was reluctantly added to the scenery group. As it happened A was the only one on this committee with any degree of artistic ability and before work had progressed very far A was doing the designing and most of the scenery painting.

The scenery proved to be of almost professional quality, and A received the acclamation of all who viewed it. By the end of the year A was one of the most popular pupils in the class.

This was an unusual case which might have had an unhappy ending if the guidance function of the Stem Craft program had not been available to force A to change her attitude and then give her an opportunity to prove her true worth.

A also illustrated the effect of the Stem Craft program on one of the skill subjects. She was somewhat careless with her handwriting when she came to Byrne and the classroom teacher was constantly working for improvement. Some gain was noted during the penmanship period but not on other papers.

The careless writing continued for about six months, when the classroom teacher noted a sudden improvement. A was taking her time with all of her writing tasks instead of rushing
through them as she had done previously. The change in writing habits coincided exactly with A's introduction to engraving in the Stem Craft class. She was fascinated by the gravers and how they enabled her to write on metal. She also apparently realized how carelessly she had been forming her letters and took steps to correct the deficiency. A's freehand engraving on metal was outstanding, and many of the students as well as the instructor requested her to engrave names and other information on metal projects.

The classroom and craft teachers felt certain that engraving was the factor which produced the improvement in A's handwriting.

Case Study B. B was an extremely large, intermediate grade pupil with an IQ of 99 and a school record of several failures. A number of child-study examinations had been made by psychologists in an effort to determine the cause of his very poor record of achievement, but nothing definite could be located. His reading level was 2.5, spelling 2.2, and arithmetic 3.4, and B was fast becoming a thoroughly discouraged pupil on the verge of truancy when the Stem Craft program was started.

B was very much interested in the craft work although he did not show any definite ability along those lines. He sought out the tasks that involved considerable manual labor and always appeared happy when doing heavy lifting, pounding, prying, sawing, or anything which utilized the large muscles. He seemed
to enjoy wrapping his large hand around a hammer handle and just gripping it as hard as he could. He would frequently go around the craft room with a hammer in his hand even though he was not doing anything that involved pounding.

After what might be called a "workout" in the craft room B would be content in the classroom and try very hard to keep up with his group in the regular subjects, something he had not done prior to the first handwork classes. His efforts were actual rather than apparent because on two successive tests B registered a gain of almost two years in reading level over a period of only a single year. When he graduated from Byrne his reading level was only one-tenth of a year below the class median, and his arithmetic achievement was approximately a year above the median.

From a poor student with low achievement B metamorphised into an above average pupil who became sufficiently interested in school work to attend summer school to make up one of the failures he had experienced. He is now attending high school and his grades are slightly above average.

It is felt that the Stem Craft program was of benefit to B chiefly by providing him an opportunity to exercise constructively his extremely large muscles. The fact that he could demonstrate in school his ability to lift more, saw faster, and hammer harder than anyone else in the class inflated his ego sufficiently to kindle his desire to compete in the other subjects
also. It seemed to make his large size appear purposeful and remove the stigma of being an overgrown dummy.

Case Study C. C, age fourteen, IQ 74, reading level 2.6, spelling 1.7, arithmetic 4.9, grade placement 6B, was small for his age and did not appear out of place in the group except for the fact that he was unable to do most of the classwork.

When the Chicago Primary Mental Abilities test was administered in the fourth grade, C's score on four of the six parts was below the minimum score listed for the test, barely above the minimum in the reasoning part but extremely high on the space factor. Several psychological examinations were given to C in an attempt to diagnose his difficulties but the findings merely showed "very slow rate of mental growth."

When the Stem Craft program started C was an immediate success. The metalworking unit for sixth grade began with a small copper tray, which C completed before most of the other members of the class were half finished. The eighth grade group was working on large serving trays and C astounded the craft teacher by bringing to school one of that type which he made at home out of scrap metal. It was well made, showed considerable originality, and had an excellent finish. From then on C was allowed to work with the eighth grade group and his projects were equal to the best in the class.

The older group decorated their trays by engraving designs on them, and C did very well with the graver. He again
surprised the craft teacher by bringing to school a graver which he made at home from a common nail. It engraved practically as well as the commercial tool and gave the instructor and the writer the idea of encouraging other pupils to make gravers so they would have one of their own to use outside of school. This proved to be quite successful as indicated in Chapter IV.

Two of C's serving trays were exhibited at the state fair in Springfield, and one of them was chosen as the outstanding tray displayed by the entire Chicago Public School System. The exhibit included work chiefly from high schools and junior colleges and the fact that a tray made by a sixth grade boy stood out from the rest was a tribute to his workmanship. This award was of vital importance to C, since it gave him a feeling of success seldom experienced by normal or brilliant children. The effect of the statewide recognition on a boy who could never really compete with his classmates in academic subjects was quite significant, and it has continued to give him the courage to keep trying in the fact of almost insurmountable difficulties.

C was so engrossed in craft work that he spent most of his time outside of school making things out of metal, and selling them to friends and neighbors. According to the parents, there had never been any indication of the boys' ability in hand work and they were quite pleased and proud when it was discovered by the Stem Craft program.
C wanted to spend the entire day in the craft room and returned very reluctantly to his other studies. While he tried to do his classwork, he was unable to show any great improvement, and it was felt that he should attend a school where a much larger proportion of the time was spent on hand work, and academic studies were of a more practical nature. Arrangements were therefore made for C to transfer to a pre-vocational school where he made a very good record.

C is now in high school and is getting along reasonably well in spite of the fact that he is still classed as a non-reader. A conference with his high-school instructors brought out their opinion that it was only C's remarkable success with craft work that has enabled him to continue in school in the face of so many serious handicaps. His teachers feel that while his achievement level is discouragingly low he is gaining much worthwhile knowledge and experience. They predicted that C will be a fine citizen and a credit to the community.

The Stem Craft program was instrumental in discovering C's unusual ability to do creative hand work and gave him his first taste of success before he became completely discouraged with school.

Case Study D. D, age ten, IQ 103, reading level 3.0, grade placement 4B, was a social nonconformist and a discipline problem from the time he entered kindergarten. He spent an entire year in kindergarten apart from the group, never once
joining in the games or group activities. He exhibited many anti-social tendencies, including a desire to hurt the other children by hitting or kicking them whenever the opportunity arose.

A slight improvement was noted in first and second grade, although D continued to remain apart from the class as much as possible. His work was very poor, and despite two extra terms in the primary grades his reading level was a year below grade.

While D was in third grade the Stem Craft community project was undertaken in his room and it appeared to hold great attraction for him. For the first time he took an active part in a group activity. In fact he became so active that he was soon one of the leaders of the project. His own part of the project, a model of his house and the surrounding yard, was well and quickly made, and to the surprise of the teacher he began advising and helping his classmates with their construction work. He was quite insistant that the other children do neat, careful work to avoid spoiling "our community." In at least one case he was observed persuading a pupil with a poorly constructed house to "make it over" so it would be a credit to the project.

D and another boy (E, whose case study follows) made a number of excellent suggestions in connection with the community project, and when the final phase of arranging the houses on the gymnasium floor was undertaken they became
supervisors who directed the other children in the work. After the houses had been placed, D carefully adjusted each one of them to produce perfect alignment, and in general showed great concern for the appearance of the completed project.

After the community project was completed, D did not lapse into his previous aloof manner, but continued to take an active part in class activities. This changed attitude has continued to the present time, almost a year since it was first noticed, and D's school work has shown a definite improvement, with a corresponding decrease in disciplinary difficulties.

Case Study E. E, age eleven years, IQ 91, reading level 3.2, arithmetic achievement 3.5, grade placement 4B was also a serious discipline problem from the first day he entered kindergarten. He seemed to take great delight in making classmates suffer, and on various occasions was in difficulty for throwing and shooting things at other pupils, or hitting, kicking, tripping, and pushing them.

There were two possible reasons for this bad behavior. One was that E was following in the footsteps of his father and brother, both of whom were virtual social outcasts. The other possibility was that E was unconsciously trying to settle a debt he felt society owed to him for the loss of the sight of an eye, which was injured by a shot fired at him by his older brother.

With the double handicap of a sightless eye and an unwholesome attitude toward everyone in general, E's school work
was far less than satisfactory. His work in the craft room left much to be desired also, since he was constantly getting into difficulty for throwing or shooting things in the shop. However, when his class undertook the Stem Craft community project, E experienced a decided change of attitude. Something in the project seemed to fascinate him and he became an enthusiastic participant. What was even more unusual, E seemed to grasp the true meaning of the community project and worked with, instead of against, the other members of the class.

E completed his own model house at home after school hours, which was probably the first time he had ever done any school work outside of regular school hours. He volunteered to make some of the public buildings for the project and did much of the work on them at home. E took great pride in his own models and in the project as a whole. He offered his assistance to a number of the pupils who were having difficulty, and was quite pleased when his services were accepted.

In the final phase of the project, when the houses were arranged on the gymnasium floor as an actual community, E begged to be allowed to draw the streets and place the commercial and public buildings. His interest and concern for accuracy were unusual, and the teachers agreed that they had never seen E as happy as he was when laying out the community.

The community project was the first school work in which E had ever shown interest, and the first in which he had
ever experienced any degree of success. The fact that the class accepted his leadership on that occasion, plus the interest he developed and the success he achieved, have had what appears to be a relatively permanent effect on E. It has been almost a year since the project was undertaken and E has been in only one difficulty in that period; he has developed an interest in school work, and has an entirely different attitude toward people in general.

It is felt that the Stem Craft project which attracted the interest of this socially maladjusted boy, plus the judicious handling of the situation by the craft and classroom teachers, did much to solve a potentially serious juvenile problem.

Case Study F. F, age ten, IQ 93, reading level 4.0, had an arithmetic achievement of 4.8 and was in grade 4A.

The home in which F was reared represented far from ideal conditions. During World War II, F's mother shot her father because of another woman. The father recovered, but the mother was incarcerated and later divorced. After the divorce, the father married the other woman involved and was given custody of the three children.

F and the other children were very poorly clothed, and appeared undernourished. In the primary grades F was rejected by the other pupils in her group and she frequently misbehaved to gain attention. On several occasions she was caught stealing from the desks of other children, apparently because it was the
only way she could obtain the articles that looked so important in
the eyes of little children, or in the case of edibles, because
she was actually hungry.

In academic work F was only a fair student, but when
the Stem Craft program was started at her grade level she
became an outstanding pupil in that field. F was exceedingly
industrious in the craft class and usually completed two projects
to everyone made by the other students.

Cooking and sewing held especial interest for F, and
the reason was not difficult to discern. When she was in the
third grade F was already making articles of wearing apparel to
supplement her scanty wardrobe, and her appearance improved
steadily. Her attraction for cooking was utilized by the craft
teacher to modify F's attitude toward soap and water. This was
done by insisting that she must be perfectly clean before she
would be allowed to have any contact with food. As a result F
is now a clean, neatly dressed child who bears scant resemblance
to the dirty waif of a few years ago.

F's excellence in craft work has made her a leader in
the group, and her advice and opinions are sought by boys and
girls alike. Her sense of accomplishment and position in her
group have made F a cheerful, happy girl, even though her home
environment has continued to be most unsatisfactory. It is felt
that the Stem Craft program has provided F with the skill to
make many of the things she actually needs, in addition to giving
her a taste of leadership and success.

**Case Study G.** Born in Scotland in 1941, G came to the United States in 1948. He was eleven years of age, had an IQ of 117, reading level of 10.2, and grade placement of 7A, at the time of this study.

G was a timid, nervous child when he entered Byrne School. The description given by the mother of wartime conditions under which he was raised made his actions seem quite normal. The fact that a dearly loved grandfather was unable to make the trip because of illness was a secondary factor in G's emotional condition.

However, G soon changed from a timid boy to a virtual bully, and was frequently involved in fights and other disturbances both in and out of school. His classwork also suffered since G would not apply himself, and flatly refused to do any homework. After a number of techniques failed to produce improvement in G's behavior and application to his studies, the classroom teacher resorted to depriving him of the opportunity to attend the Stem Craft class with the other pupils. She was not convinced that this would have much effect since G was not particularly adept in hand work, but was quite pleased with the actual outcome.

G was very unhappy when he was not permitted to go to the craft room with the other members of the class, and before the time for the next craft class arrived he made a solemn
promise to the teacher that he would do his homework, apply himself in class, and keep out of trouble if she would allow him in the Stem Craft classes again. These promises have been faithfully kept for the past five months, and as a result G appears to be destined to receive the school honor award when he graduates a year hence.

It seems that the powerful influence with the teacher was able to exert on G for his own good by depriving him of craft work, gives some indication of the value the Stem Craft program has from an administrative standpoint. It was the best means that could be found to channel G's superior ability into productive educational purposes.

**Case Study H.** H, age nine, IQ 100, reading level 3.6, arithmetic achievement 4.3, grade placement 4B, transferred into the Byrne school about two years ago. He was an average student and although somewhat mischievous was not considered a behavior problem in school.

At home however, the situation was different, as H was constantly misbehaving and causing his mother a great amount of trouble. She informed H's teacher that the boy was being punished practically every evening for some breach of discipline, but with little visible effect. He was an only child and his bad behavior made his mother extremely unhappy.

When H started on the Stem Craft program his first efforts were only average, but as he became more skilled his
interest increased greatly and the quality of his work improved noticeably. The craft teacher discovered that one reason H's work showed so much improvement was that he was duplicating at home the projects he was making at school.

The boy's mother reported that H was spending practically all his leisure time on craft work, and keeping out of mischief as a result. She indicated that life in her home was pleasant and peaceful for the first time in years, and that the father was quite happy over the changed situation.

H continued his interest in craft work, and since good behavior seemed to be a natural result of that interest his mother decided to help the parents of other boys who might encounter the same difficulty. She volunteered to become a Cub Scout den mother, took the training course, and has been conducting a den in the basement of her home for some time. She was very happy working with the boys and was quite proud of H's good behavior and skill in craft work. She attributed all of the improvement in her home conditions to the Stem Craft program which had such an effect on the behavior of her son.

Case Study J. J, age twelve, IQ 93, reading level 4.4, arithmetic achievement 4.0, and grade placement 7B, was not a bright child. When she completed kindergarten at the age of six, her mental age measured only 4-11, and she entered the pre-reading class rather than the regular first grade group. J met with little success in this class, but because she was such
a well behaved child who tried so hard to do the work, she was promoted with her group.

Promotion from grade to grade continued for J in spite of her low achievement. She was a timid, attractive, well-cared-for girl, who did everything she could to keep up with the class. However, she realized her limitations and never volunteered to answer questions or accept any special duties.

J was in fourth grade when the Stem Craft program was inaugurated, and for the first time she encountered a school activity in which she could not only compete, but in which she could excel. The craft work seemed to be quite simple for J and for the first time in her school career she received a grade of "excellent" in something other than deportment. Her craft work was of such quality that most of her projects were placed on exhibition for all to see.

Success had a definite effect on J and she acquired an air of confidence with completely displaced her former timid ways. J began to volunteer for all types of duties, and where the Stem Craft program was involved she became one of the most willing and capable assistants a teacher could desire.

Although J was almost three years below grade in reading and arithmetic, her confident, willing attitude made detection of her weaknesses extremely difficult. In fact the results of a recent battery of tests were questioned by the classroom teacher, who insisted that J was doing much better work than
her scores indicated.

Case Study K. K, age eleven years, IQ 125, who had a reading level of 9.2, arithmetic achievement of 8.0, and a grade placement of 6A was a bright child to whom school work had always been a simple task. She led her class in practically every area of learning from the first day she entered school, and her cumulative record card was almost filled with perfect grades.

There were two notable exceptions to K's high grades however, and one of them was handwriting. In second grade she began to get careless in her writing habits, and despite every effort on the part of the teacher, made no improvement. A low grade on her report card, the first she had ever received, created a virtual panic in K's family. K and her parents were amazed, and could scarcely believe that such a thing could happen. In a matter of weeks, as a result of tremendous parental pressure, K's writing was again the best in the group.

K continued to lead her class in every subject until the Stem Craft program was started a few years later. Her best efforts in the craft class made a very poor showing in comparison with the work of the other students, and her report card grade was only "fair." K was a very unhappy child and her parents were also. The father, although a well educated man, stormed into school and denounced the Stem Craft program in very strong language because his daughter was unable to excell in it. (On the questionnaire used to evaluate the Stem Craft program the
father's reply was easily identified by the vitriolic comments. Practically every item received an unfavorable response.)

For sometime K exhibited a dislike for the craft classes, although she worked quite industriously in the craft room. When pupils were being selected for case studies, K was suggested as one of the two students in the school who might not like craft work. Since it was desired to include some negative cases, K's record was obtained and she was interviewed by the writer.

It was discovered that K had been receiving good grades in craft work recently, and she stated that she liked the hand work program. K appeared to have discarded her previous attitude of disliking anything in which she could not excel, and as a result of her craft experiences seemed to have gained an insight into the difficulties other pupils encountered with subjects she found so simple. It appeared that through the craft program K had acquired a normal attitude toward competition despite her father's unreasonable views in this regard.

Case Study L. L, age nine, IQ 98, reading level 3.4, and arithmetic achievement 3.9, was placed in grade 4B when he transferred into Byrne school. He was belligerent, insubordinate, and seemed to distrust everyone. His mother attributed this to the small apartment they occupied before moving into the Byrne district. However, L's behavior did not improve with his new environment, even though it included a new house, his own room,
and a large yard in which to play.

After a semester of almost constant difficulty, the Stem Craft program was extended to include L's class, and a decided change came over him. He was fascinated with the craft work and would do almost anything to avoid missing even a minute of it. L developed a strong liking for the craft teacher, and his attitude toward his classroom teacher changed as a result from antagonism to confidence and trust. Traits such as courtesy, self-control, honesty, and unselfishness, which had been noticeably lacking in L, began to make their appearance.

L's devoted mother was so pleased with the effect of the craft work on her son that she has taken several craft classes and affiliated herself with the local Cub Scout movement. L is now a happy, well-adjusted lad who seems to have overcome many of his former behavior problems as a result of his contact with the Stem Craft program.

**Case Study X, (Teacher).** Miss X transferred to the Byrne school after five years experience in other schools. Her assignment was to an intermediate grade room and she was somewhat doubtful about the Stem Craft program and the possible benefits of an educational nature to be derived from it.

The major project carried on with Miss X's group was one concerning the community, and is described in Chapter IV. As the project unfolded and every subject taught in the grade was involved to a considerable degree, Miss X's doubt changed to
enthusiasm. She developed a number of new ideas in connection with the project and the result was the most successful community project ever to be completed in the Stem Craft program.

Miss X was particularly impressed with the effect of the project on two boys with extremely low achievement, case studies of whom are included in this Chapter as "D" and "E". She pointed out that these boys experienced real success for the first time in their school history by excelling in the construction work, and indicated that there was a definite change for the better in the boy's attitude toward school work as a result.

Group pressure on certain careless children to improve their workmanship and avoid lowering the quality of the community undertaking was also noted by Miss X, who thought that it was far more effective than her efforts to accomplish the same end.

**Case Study Y.** (Teacher). Miss Y, a teacher with four years experience, transferred to the Byrne School and was placed in charge of a primary group. She had worked with beginning students and was quite familiar with the difficulties of teaching children to read.

When the Stem Craft schedule was circulated, shortly after Miss Y took up her duties, she noticed that her group was programmed for craft work one hour per week and was quite concerned about it. She stated to other teachers that she did
not see how that much time could be spared from the teaching of reading.

However, Miss Y sent her group to the craft room at the appointed time, and the results were such that two weeks later she inquired if it would be possible for her class to have craft work more than just one period a week. She said the children returned from the craft class with greater ability to follow directions and so much additional interest in their pre-reading tasks, that it was possible to accomplish more and better work in less time. She pointed out that this was not just an impression on her part since only half of the children went to craft class at a time and the remaining part constituted a crude form of control by which she could compare the difference in the results obtained.

Miss Y said she was convinced that an hour a day in the craft room would actually shorten the time required to teach reading because of the greater motivation, training, and background material acquired in the Stem Craft program.

Miss Y also stated that the craft classes had virtually eliminated her discipline problems, since the threat of depriving a pupil of craft work was all that was needed to settle even difficult cases. Still another way in which she felt the craft program helped her classwork was that it tended to spur the children to finish their tasks to avoid being delayed in going to the craft room.
CHAPTER VI

SUMMARY AND RECOMMENDATIONS

Summary.

The Stem Craft program was designed to overcome what was considered to be weaknesses in the usual elementary school curricula, namely, poor integration between subject areas and between grades, and insufficient motivation of learning experiences.

One of the primary objectives of the Stem Craft program was to furnish improved integration between areas of learning by providing a craft work "stem" which was closely correlated with all the subject fields. Better integration between grades was to be supplied by having the craft work "stem" carried on throughout the school by a single teacher on a continuous basis, unbroken by semester divisions. Improved motivation was to be provided by utilizing the interest inherent in the craft work "stem" to infuse interest into the other learning experiences.

The degree of success which was attained by the Stem Craft program in meeting the objectives stated can in part be judged by the questionnaire responses of the parents of 95.6 percent of the children now in school who have worked in the program. Practically all of the parents were familiar with condi-
tions regarding motivation and integration of subjects at the Byrne School before and after the craft program was instituted, and so were in an advantageous position to judge the results. On the question of better integration between subject areas, the ratio of favorable to unfavorable replies was 48:1. The proportion of favorable to unfavorable replies on the question of improved integration between grades could not be calculated, since there were no unfavorable ones. The question of increased motivation received replies which indicated that favorable opinion outweighed the unfavorable in the proportion of 133:1.

It was felt that the opinions of parents expressed on the questionnaire were a definite indication that the Stem Craft program had to some degree attained its primary objectives of better integration and improved motivation. The questionnaire results tended to show that two secondary objectives, improved public relations and better guidance service had also been achieved.

The teachers expressed opinions which would tend to substantiate the contention that the Stem Craft objectives had been reached, since the ratio of favorable to unfavorable replies on their questionnaire was 30:1.

Recommendations.

The fact that the majority of parents in the community and teachers in the school appear to have been convinced of the value of the Stem Craft program, seems to warrant the
recommendation that this plan be given a trial in other elementary schools. The material in this dissertation and that contained in the appendices should prove helpful in starting such a program elsewhere.

It is realized that there were certain intangible factors which would be difficult to isolate but which may have been responsible for some of the apparent success of the Stem Craft program. A few of these were the ability and attitude of the craft teacher, the co-operation of the faculty, students, and parents, as well as the understanding of the officials of the Chicago Public School System. If a Stem Craft program were to be instituted in a school in which these favorable factors were lacking, the results would undoubtedly be affected adversely.

On the basis of experience gained in working with the Stem Craft program for several years, it is recommended that one craft teacher be provided for each 400 pupils if optimum results are to be obtained. In larger schools two or more craft teachers could be utilized. It is suggested that if more than one teacher is employed the program be arranged to permit each craft teacher to advance through the grade with the children, to avoid interference with the integration and guidance functions.

The Stem Craft program appeared to have value for most children regardless of their intellectual ability. No attempt was made to determine the relationship between IQ and success in craft work, and there was no evidence to indicate that there
would be anything but a positive correlation between these two factors. However, research work on this relationship would probably prove profitable. It is also suggested that a study of the relationship between IQ and the degree of motivation provided by the Stem Craft program might be of value since there appears to be an indication that negative correlation may exist.

It is recommended that an evaluation study such as that of Meyer[1] be made of the outcomes of the Stem Craft program after the experimental period has been completed, the procedures stabilized, and a larger number of pupils have had an opportunity to work for several years in the program.

The guidance possibilities of the Stem Craft program should be explored further since there appears to be great potential value in such study.

Expansion of the Stem Craft program to include parents in evening classes seems worthy of consideration. Integration of home and school learning experiences could conceivably result from such a program, and extension upward into adult life of the leisure time guidance function of the Stem Craft work should prove valuable.

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UNPUBLISHED MATERIAL


APPENDIX I

LETTER WHICH ACCOMPANIED QUESTIONNAIRE FOR PARENTS

December 1, 1952

BYRNE BOOSTER COMMUNITY BULLETIN

In recent years we have been experimenting with a Stem Craft (Home Mechanics) program at Byrne and think it important to have it evaluated by the parents.

The attached questionnaire is provided for you to use in expressing your opinion of the effect of the program on you and your child. Please indicate your ideas on this form and have your child return it to his or her teacher as soon as possible.

Do not put your name on the questionnaire. If you have more than one child in the grades receiving this form and the answers to the questions should be the same for each one, you are requested to fill out only one form. On those forms not filled out please write across the top of the first page "Have filled out a form for another one of my children," and have the child who received it return it to school. The teacher will check to see that a questionnaire is returned by each pupil, since we are anxious to get complete coverage if possible.

Kindly indicate the answer to each question which comes closest to expressing your opinion by placing an X in the proper blank. Any suggestions you have to offer on the lines provided in Item 18 will be given serious consideration.

Your response to our questionnaire on spiritual values last spring was excellent, and the information you furnished is proving very helpful. Please assist us again in our effort to make Byrne a better school for your child, by filling out the attached form.

Thank you!
APPENDIX II

STEM CRAFT QUESTIONNAIRE FOR PARENTS

1. How do you feel the craft program has affected your child's interest in school? A. Has improved it___ , B. Has had no effect___ , C. Has had a bad effect____ .

2. What effect do you think the craft program has had on your child's work in the other studies? A. Has improved it___ , B. Has had no effect___ , C. Has had a bad effect____ .

3. What is your opinion of the time spent by your child in the craft work? A. It is well spent____ , B. Doubtful____ , C. Would be better spent on regular school subjects____ .

4. Do you think the craft program has helped your child to realize the importance of careful planning in advance? A. Yes— , B. Doubtful____ , C. No____ .

5. What do you feel has been the effect of the craft program on your child's thinking concerning his or her choice of an adult occupation? A. Has Helped___ , B. Has had no effect____ , C. Has had a bad effect____ .

6. What effect do you think the craft program has had on bringing the various school subjects together to form a unified program? A. Has helped____ , B. Has had no effect____ , C. Has had an adverse effect____ .

7. How do you feel the craft program has affected the adjustment of your child when moving from one grade to another? A. Has made the adjustment easier___ , B. Has had no effect____ , C. Has made the adjustment more difficult____ .

8. What do you feel has been the effect of the craft program on the amount of voluntary reading done by your child? A. Has increased it____ , B. Has had no effect____ , C. Has decreased it____ .
9. How do you think the craft program has affected your child's knowledge of values as a consumer? A. Has helped____ B. Doubtful____ C. Has had a negative effect____

10. What do you feel the craft program has done in giving your child an insight into his or her limitations and strong points? A. Has helped____ B. Doubtful____ C. Has had a negative effect____

11. How has the craft program affected your home directly? A. It has been beneficial as I have been able to put to use some of the ideas brought home by my child____ B. Has had no effect____ C. The effect has been bad since the craft ideas brought home by my child have only caused trouble____

12. What has been the indirect effect of the craft program on your home? A. Helpful, as my child has been able to put to good use around the home things learned in the craft program____ B. Has had no effect____ C. Has had an undesirable effect, since everything my child tries to do as a result of it causes difficulty____

13. How has the school craft program affected your child's use of leisure time? A. Beneficially, since quite a little leisure time is spent carrying on craft work at home____ B. Not at all, since no craft work is done____ C. Detrimentally, since much time is wasted on useless craft work____

14. How would you rate the craft program as a part of your child's education? A. High____ B. Medium____ C. Low____

15. If you were consulted concerning a possible change in the length of time your child spends in the craft program at school what would be your recommendation? A. Increase the amount of time____ B. Keep the length of time the same____ C. Decrease the amount of time____

16. How has the craft program affected your opinion of the Byrne School in general? A. Has raised it____ B. Has left it unchanged____ C. Has lowered it____

17. What is your opinion of the overall effect of the craft program on your child? A. Has been beneficial____ B. Has had no effect____ C. Has had a bad effect____
18. Do you have any suggestions to offer concerning the craft program?

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1 Twelve double spaced lines were provided on the form.
APPENDIX III

STEM CRAFT QUESTIONNAIRE FOR TEACHERS

1. How do you feel the craft program has affected your pupils' interest in school? A. Has improved it__, B. Has had no effect__, C. Has had a bad effect__. 

2. What effect do you think the craft program has had on your pupils' work in the other studies? A. Has improved it__, B. Has had no effect__, C. Has had a bad effect__. 

3. What is your opinion of the time spent by your pupils in the craft work? A. It is well spent__, B. Doubtful__, C. Would be better spent on regular school subjects__. 

4. Do you think the craft program has helped your pupils to realize the importance of careful planning in advance? A. Yes__, B. Doubtful__, C. No__. 

5. What do you feel has been the effect of the craft program on your pupils' thinking concerning his or her choice of an adult occupation? A. Has helped__, B. Has had no effect__, C. Has had a bad effect__. 

6. What effect do you think the craft program has had on bringing the various school subjects together to form a unified program? A. Has helped__, B. Has had no effect__, C. Has had an adverse effect__. 

7. How do you feel the craft program has affected the adjustment of your pupils when moving from one grade to another? A. Has made the adjustment easier__, B. Has had no effect__, C. Has made the adjustment more difficult__. 

8. What do you feel has been the effect of the craft program on the amount of voluntary reading done by your pupils? A. Has increased it__, B. Has had no effect__, C. Has decreased it__. 

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9. How do you think the craft program has affected your pupils' knowledge of values as a consumer? A. Has helped____ B. Doubtful____ C. Has had a negative effect____

10. What do you feel the craft program has done in giving your pupils an insight into his or her limitations and strong points? A. Has helped____ B. Doubtful____ C. Has had a negative effect____

11. What effect has the craft program had on your maintenance of discipline in the room? A. Made it easier____ B. No effect____ C. Made it more difficult____

12. What effect do you think the craft program has had on the motivation of the other subjects? A. Increased it____ B. No effect____ C. Reduced it____

13. How do you think the craft program has affected the pupils' willingness and/or ability to follow directions? A. Increased it____ B. No effect____ C. Reduced it____

14. How would you rate the craft program as a part of your pupils' education? A. High____ B. Medium____ C. Low____

15. If you were consulted concerning a possible change in the length of time your pupils spend in the craft program at school what would be your recommendation? A. Increase the amount of time____ B. Keep the length of time the same____ C. Decrease the amount of time____

16. How has the craft program affected your opinion of the Byrne School in general? A. Has raised it____ B. Has left it unchanged____ C. Has lowered it____

17. What is your opinion of the overall effect of the craft program on your pupils? A. Has been beneficial____ B. Has had no effect____ C. Has had a bad effect____

18. Do you have any suggestions to offer concerning the craft program?

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1 Twenty double spaced lines were provided on the form.
APPENDIX IV

OUTLINE OF HOME MECHANICS CURRICULUM

A brief outline of the Home Mechanics curriculum used in the sixth, seventh and eighth grades of the Chicago Public Schools which have Home Mechanics laboratories.¹

SIXTH GRADE

I. Elementary Home Maintenance

a. Woodcraft
   Study: woods, finishes, fastenings, and tools.
   Projects: make game board, match holder, letter holder.

b. Sanitation
   Study: water supply to home, Plumbing system in the home, types of plumbing fixtures, simple repairs.
   Projects: assemble pipe fittings, replace faucet washer and Fuller ball, make tooth brush holder, utensil holder.

c. Electricity
   Study: conductors, insulators, fuses, circuits.
   Projects: connect simple circuits, make telegraph set.

d. Gardening
   Study: Plants, gardening theory, gardening tools.

1 Areas of Learning, 2.
Projects: plant seeds, bulbs, cuttings, make plant markers, vine rack, simple bird house.

e Metals
Study: characteristics of metals, cleaning, polishing, soldering.

Projects: soldering exercises, make pin tray, ash tray, house numbers.

f Drawing
Study: patterns, home lay-outs.


II Elementary Textiles

a Selection and care of clothing
Study: fibers, weaves, weight, wearing quality, colors.

Projects: sew on buttons, snaps, zippers, do mending and darning. Make work apron, kitchen apron, laundry bag, weave table mat.

b Textiles
Study: block printing, dying, and tinting.

Projects: practice on sewing machine, use hand sewing tools, make kitchen towel, gingham luncheon cloth, fringed napkins.

SEVENTH AND EIGHTH GRADES

The course is not divided into seventh and eighth grade sections but the four major units follow in a regular order, and take two years to complete the cycle.

I Electricity, Utensils and Crafts
Study: fuses, splices, magnetism, meter reading, appliance testing and repair.

Projects: make splices, connect bell and house wiring circuits, read meters. Construct a table or wall lamp, make an electromagnet.

II Foods and Nutrition
Study: planning, cooking and serving meals, buying food, nutrition, vitamins, manners, and social
III Home and Clothing
Study: consumer values, choosing personal wardrobe, ironing, removing spots, repairing clothing.

Projects: iron, remove spots, repair clothing. Make ascot scarf, belts, butcher or work apron, ditty bag, place mats, oven mitt, shoe polishing mit.

IV House, Garden and Crafts
Study: water and gas meters, pipe fitting, locks, glass cutting, pipe threading, care of lawns, transplanting, garden peats, air conditioning.

Projects: assemble pipe fittings, repair ball cock, repair faucet, cut glass and fit to frame, repair locks, thread pipe, read gas meter. Make ash tray, cookie cutter, jewelry, book ends, ornamental shelf.
APPENDIX V

LIST OF HAND TOOLS AND COOKING UTENSILS

A list of hand tools and cooking utensils which have been found to be useful in the Stem Craft laboratory is included to aid in setting up such a program elsewhere. Three quantity columns are included: minimum, for the small shop or limited budget, average, for the more generous budget, and ideal, for use where space and funds are not limiting factors.

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<th>Article</th>
<th>Min.</th>
<th>Av.</th>
<th>Ideal</th>
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APPENDIX VI

SELECTED REFERENCE MATERIAL FOR A STEM CRAFT ROOM LIBRARY

Books


Baxter, Laura, Margaret Justin, and Lucille Rust, Our Clothing, J. B. Lippincott Company, Chicago, 1952.

Baxter, Laura, Margaret Justin, and Lucille Rust, Our Food, J. B. Lippincott Company, Chicago, 1951.

Baxter, Laura, Margaret Justin, and Lucille Rust, Our Home and Family, J. B. Lippincott Company, Chicago, 1956.

Baxter, Laura, Margaret Justin, and Lucille Rust, Our Share in the Home, J. B. Lippincott Company, Chicago, 1945.

Baxter, Laura, Margaret Justin, and Lucille Rust, Sharing Family Living, J. B. Lippincott Company, Chicago, 1951.


Pamphlets

Art Metal Designs, Metal Goods Corp., St. Louis, Missouri.


Cherry, Raymond, General Plastics, McKnight and McKnight, Bloomington, Illinois, 1948.


The Handicrafters Sketchbook, The Handicrafters, Waupun, Wisconsin.


Knots and Braids in Handicraft, Handicrafters, Waupun, Wisconsin, 1941.
Lion, Helen H., How to do Ceramics, Walter T. Foster, Laguna Beach, California.

Mark, Mary E. Techniques of Sewing, Board of Education, Chicago, 1945.


Modern Felt Handicraft, Handicrafters, Waupun, Wisconsin, 1946.


Periodicals

Childrens Activities, Child Training Association, Inc., Chicago.


Family Circle, Family Circle, Inc., Newark, New Jersey.

The Grade Teacher, Educational Publishing Corp., Darien, Conn.

Homecraft, General Publishing Co., Chicago.


Junior Arts and Activities, Jones Publishing Co., Chicago.

McCall's Needlework and Crafts Annual, McCall Corp., New York.


APPENDIX VII

STEM CRAFT RECORD CARD

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<th>Room</th>
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Date Card started ____________  Pupil left ____________

a Actual size of card slightly larger than shown.

b Reverse side of card used for anecdotal records.
The dissertation submitted by George Raymond Balling has been read and approved by five members of the Department of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the dissertation is now given final approval with reference to content, form, and mechanical accuracy.

The dissertation is therefore accepted in partial fulfillment of the requirements for the Degree of Doctor of Education.

[Signature]
Date June 1, 1953