A PLAN FOR USING THE UNIT OF WORK IDEA IN GENERAL SCIENCE AND BIOLOGY

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FOREWORD

The material in this study represents a partial result of study and experience in the science classroom over a period of two years. The suggested plans and procedures have actually been developed and used in real situations with some degree of success. However, since this material will be used with the student trainees in teaching science and biology it has been written from the standpoint of suggested procedures, rather than from the standpoint of definite fixed conclusions.

As Chairman of the Natural Science Committee, organized to study and adapt the science teaching in the secondary schools of Montgomery County to the Virginia Revised Course of Study, the writer has had opportunity during the past two years to become acquainted with the problems, the difficulties, and the procedures of everyday teaching wherein the unit of work plan has been gradually installed. Full acknowledgement is hereby made of any influence the work of this Committee or any of its members may have had on the development of this study.

Full acknowledgment is made of the influence and value to this study derived from six weeks spent as a visitor and student in the Curriculum Laboratory of George Peabody College, Nashville, Tennessee, in July and August, 1937.

The value and influence of participation in state conferences held at Radford State Teachers College, Radford, Virginia and at the University of Virginia, Charlottesville, Virginia, during the past two years, on problems related to this study is hereby acknowledged.

For the past two years the writer has been engaged as critic

teacher for science in Blacksburg High School. He wishes to acknowledge the value that the study and work with the student trainees has had on the development of this study. It has been developed primarily with the idea of helping them solve some of their difficulties as they attempt to learn the procedures necessary in using the unit of work.

A PLAN FOR USING THE UNIT OF WORK IDEA IN GENERAL SCIENCE AND BIOLOGY

The tentative course of study for the core curriculum of secondary schools in Virginia is organized in such a way that the unit of work idea predominates as a means of organizing worthwhile teaching procedure and purposeful pupil experiences and activities.

It is pointed out in this course of study that its material is best adapted to the experience type of unit. Three determining characteristics of this type of unit are listed as follows:

1. A dominating purpose on the part of the pupils, compatible with the aims of education.

2. A series of related activities planned by the teacher and pupils, and engaged in by the pupils to realize this dominating purpose.

3. The evaluation of these activities by the pupils with the aid of the teacher.

The form, title, and arrangement of material receive very little stress in the course of study. It is felt that the concept of the unit developed around the above named characteristics will allow the teacher great freedom and initiative in organizing the units of work to fit local conditions. (Tentative Course of Study for Virginia Secondary Schools, p. 28)

This very freedom frequently presents great difficulty to the beginning teacher and student trainee. This is particularly true with the student trainees in Science and Biology at V.P.I. where the largest part of their previous training has been highly technical in nature.

This study and arrangement of material, therefore, has been developed with the view of helping the student trainees of the Department of Biology and Science to get a broader grasp of the unit of work idea and to help them apply certain principles and procedures in developing, constructing, and using units of work in general science and biology for the eighth and ninth grade levels.

It is not the purpose of this study to defend the unit of work idea, neither is it intended that the unit be presented as the best and only plan for organising pupil experiences and teaching procedure. However, once the fundamental principles involved have been mastered by the trainee, he should be competent to adjust and adapt his teaching procedure and technique to conform to any type of unit and to the various teaching situations in which he may find himself. Furthermore, it should be stated at the outset that this study does not attempt to present a "formula" whereby the unit can be installed into a teaching situation. This installation depends on the teacher and administrator working together.

The objectives then set up for this study were:

1. To develop a satisfactory form and procedure for constructing and using units of work in general science and biology.

2. To develop and test a limited number of such units.

The procedure followed in conducting the study was:

First: To locate and to study literature dealing with the unit of work idea and various patterns of units which have been employed.

Second: From these findings, to develop objectives, standards, form, and procedure for constructing units of work in science and biology especially suitable for the Virginia course of study.

Third: To construct units of work in actual classroom situations to cover one year's work in general science for the eighth grade and one year's work in biology for the ninth grade.

Fourth: To try out the units of work in the science classes of the Blacksburg High School.

Fifth: To submit specimen units to experienced teachers in other schools for criticism.

Sixth: To revise the units in the light of actual classroom experience and teachers' criticism.

Seventh: To write up selected types of units for this study with an analysis of the unit under the following captions:

(a) Aspect emphasized in unit.

(b) Objectives sought for in terms of education and of science.

(c) Abilities needed or stressed in unit.

(d) Suggestions for evaluation of results or outcomes.

(e) Subject matter included in unit.

(f) Suggestions for adapting work in unit to meet varying conditions.

The arrangement of the material in this paper will follow the outline of procedure as closely as possible. Due to the nature of the study there will necessarily be some overlapping at places and due to the division into steps some parts will have to be longer than others. The first division dealing with literature on units is necessarily longer than the other divisions because the writer felt that a broad background of information about the unit of work idea was necessary before one specific type of unit could

be adequately developed. This information, involving a review of literature, will be presented largely in the form of a classification, description, and characteristics of units in use.

UNITS OF WORK

It might seem that the best way to present the general characteristics of a unit of work would be to analyse plans which use various units and present the analysis in a form adapted for comparison. However, a review of literature reveals that the term "unit of work" is used with an amazing as well as confusing number of meanings, ideas, and concepts. In many cases these different connotations used overlap and merge with one another to such an extent that it becomes extremely difficult if not impossible to separate them. To give an exact definition and description of a unit of work covering all the meanings of the term is almost impossible if not impractical. GoodyKoontz (1) states that, "There is probably no possibility or desirability of agreeing upon the definition of a unit or even upon the elements which constitute one. It will continue to be variously described as a section of subject matter involving many related activities and as a unit of experience involving much related subject matter."

Swindler (2) in answer to the questions, "What is the unit system of instruction?" and "What is meant by the teaching unit?" makes the statement that the question cannot be answered in a few words or sentences. He further points out that certain systems such as the Contract Plan, the Dalton Method, the Morrisonian Unit System, the Winnetka Plan, and the Unit System as developed at the University of Virginia, all of which use a unit of work in some form or other, have much in common but differ greatly in

many cases in terminology. The implication is that an analysis of these plans would not give a clear understanding of the unit of work idea.

Billet (3) points out that in actual practice the unit of work is a definite part in any of the following plans: The Problem Method, the Contract Plan, the Individualized Plan of Instruction, the Laboratory Plan of Instruction, the Dalton Plan, the Morrison Plan, and the Winnetka Technique.

Koos (4) in discussing the general situation as revealed in the National Survey of Education includes the Long Unit Assignment Plan in the above group and points out that schools reporting use of the Dalton Plan, the Winnetka Technique, and the Morrison Plan deviated very widely in their procedures from the plans as described by their originators. On the other hand, those schools using the other six plans listed above used almost the same identical procedures regardless of the name of the plan they were using. Koos then concludes, "A significant implication here is that terminology is needlessly elaborate and complex and that the educational world is better off if it discards most of this jargon." Koos, op. cit.

Billet (3) after considering the above plans and discussing their lack of uniformity in implication, procedure, and meaning, states that the best proof of this lack lies in the published literature of the field "where the evidence is written in letters so high that he who runs may read."

Obviously it would be very difficult to build up an understanding of the general idea of units of work by analyzing each plan or method which uses a unit in any form. A better plan seems to be to set up a general classification of various units and then point out the general (and specific)

characteristics of each type. Such a procedure will have three advantages for this study. First, it will help to show the rather distinct features underlying the development and use of each type of unit. Second, it will help to develop a general understanding of the implications and use of "units of work" in teaching. Third, it will serve as a reference and as a basis for comparing and developing appropriate units of work adapted to different situations.

There are several studies available which attempt to give a general classification of the types of units in use today. Leonard (6) in discussing the unit states that the term is used generally to imply some meaningful organization of material grouped around some topic, theme, experience, activity, or aim. With this definition in mind he suggests the following classification:

1. Traditional Subject Matter Unit.
2. Functional Subject Matter Unit.
3. Possible Child Experience Unit.
4. Immediate Child Interest Unit.

A chart analysis of this classification is shown on pages 22-23 and also on page 21, so that it may be compared with another chart given later.

Harap (7) states that, "In the broadest sense the unit of work appears to us to be a complete and coherent learning experience having a purpose which is meaningful to the pupil and which is closely related to a life situation, an aspect of the social or natural environment, or a center of child interest." He suggests the following captions as a tentative

classification of the BASES on which a unit of work can be built:

1. A complete life experience or situation.
   (a) A life-like enterprise.
   (b) A practical task.
   (c) A job.
   (d) A game.
   (e) Personal behavior.
2. An aspect of social environment.
   (a) A phase of business.
   (b) A geographic unit.
   (c) A social institution.
   (d) A phase of economic life.
3. An aspect of the natural environment.
   (a) A phase of the natural environment, such as weather.
4. A center of child interest.
5. A generalization, or theme, or concept.
   (a) Social organization - Man and his world (literature).
   (b) Social policy - Utilization of natural resources (social studies).
   (c) Historical - Territorial expansion.
   (d) Social environment - Living together (social studies).
   (e) Physical - The changing earth (science).
   (f) Biological - Evolution (science).
6. An important class of things.
   (a) In the plant world.

(b) In the animal world.

(c) In the business world.

(d) In music.

(e) In geographic environment.

7. A technical principle or phase of a conventional subject.

(a) A scientific principle - Gravity (science).

(b) An artistic principle - Form (art).

(c) A phase of science - Cells and tissues.

(d) A graded step or process - Decimals (mathematics).

Bruner gives the following captions as a means of classifying units:

1. Units of unplanned experience.

2. Units that start with an adjudged worthwhile, wholehearted, purposeful experience and eventuate in whatever subject matter they will.

3. The theme or generalization unit.

4. A unit in which the teacher determines in advance the information or skill which she thinks the pupils need, and consciously plans activities which will eventuate in the desired ends.

5. Subject matter units involving correlation.

6. The drill or topic unit.

An analysis of the three classifications given above along with the statement given by GoodyKoontz (p. 4) and the generalised definitions of units given will show that the various types of units tend to group themselves under two large divisions, namely, Subject Matter Units and Pupil Activity Units. By providing sufficient sub-divisions under these two large classifications, it is possible to arrive at a rather exact classification

of the various units. Caswell and Campbell (9) using the apparent, or attempted "source of unity" as the basis of classification divide the entire field of units under the two headings mentioned. They state: "In one case the primary point of orientation may be a phase of the group culture or a segment of potential subject matter - - - the second general group of units seek their primary point of orientation in the experience of the learner."

Using this idea, they give the following classification: (Op. Cit. p. 406).

Types of Units

I. Subject Matter.
   A. Topical unit.
   B. Generalization unit.
   C. Unit based on significant aspect of environment or culture.

II. Experience unit.
   A. Unit based on center of interest.
   B. Unit based on pupil purpose.
   C. Unit based on pupil need.

A study of this classification will show that the various types of units mentioned in the other classification are in reality included in one form or another here. Furthermore, since this classification has the type of units arranged in excellent outline form it will be followed in the discussion and description of units.

Much of the following discussion (concerning this classification) is adapted from Caswell and Campbell (9). For a more detailed description, the reader is referred to this source.

I. Subject Matter Unit

A. Topical Unit.

There is very little difference between this type of unit and the usual topical organization of subject matter. The topics are simply broadened to cover larger areas of work. In reading over a list of topical units the layman has frequently to refer to the word "unit" to be sure that he is not reading the table of contents or the index by mistake. Many of the older text books have been rewritten in terms of topical units with very little fundamental change in the actual contents. The material has simply undergone a renaming process. French (10) states that the topical unit simply stresses acquisition of subject matter so that more subject matter might be learned. Any other learning may be considered as purely accidental, unconsciously included by the teacher. Bruner points out that this type of unit is developed for the sole purpose of teaching pupils skills and subject matter facts. He states that, "All too often this type of unit employs the Memoriter Method only. Sheer repetition under compulsion is the only instrument employed."

Caswell and Campbell (9) state that, "Unless the curriculum maker can see something more fundamental in unit organization than the concept underlying this type of unit there appears to be no justification for departing from the customary topical organization of instruction."

An examination of unit titles and specimen units of this type reveals the fact that certain formalized subjects such as geometry and certain parts of English lend themselves readily to this type of organization; however, since this type of unit represents very little modification

(if any at all) of subject matter to meet the individual pupil's, teacher's, or school's needs, there seems to be no logical reason for the teachers to spend a great deal of time developing them for their own classes. The subject matter specialists and authors of texts certainly can do this much better in most cases.

B. Generalization Unit.

This unit attempts to develop an understanding of a generalization, a law, or a principle. Usually some generalization or theme which is either applicable or helps to explain some contemporary problem of life is selected. Then, subject matter (which is absolutely necessary in this type unit), and activities are chosen to illustrate and explain the generalization selected. This subject matter is frequently drawn from several periods of the race's development.

In the case of history, this might eliminate the chronological order usually used, and in the case of geography the regional organization would be eliminated.

This type unit is already in use in many of the science and mathematics texts where subject matter is frequently organized around basic principles or laws, and illustrative materials from various sources are brought together to explain and to demonstrate the general application of the principle or law selected.

This type of unit with its logical subject matter organization, while appealing to the subject matter specialists in the field of physics, chemistry, and to some parts of general science and biology, where sequence

of subject matter is already established does not appeal to the specialists in the field of social studies because they contend that the logical organization does not include a sufficient amount of fundamental materials or variety of experiences to engender the essential ideals, attitudes, appreciations, and understandings compatible with the objectives of social studies instruction. It should be noted that subject matter used in this unit is selected by the text book writer or the teacher when organizing the unit. The pupil simply performs the unit as a learning exercise.

Bruner (8) states that, "The first and most important task in building this type of unit consists of choosing from all the possible themes those which, if understood, would be most strategic in the life of the individual and would eventuate in the most good to society."

C. Unit Based on Significant Aspect of Environment or Culture.

The basis and value of organization of this type of unit depends on the significance of the material used in explaining contemporary life. This unit, when well selected and organized, should have real meaning to all learners. Such units are usually selected because of their general significance, not because the class, or the group at a particular time, in the judgment of the teacher, would profit from such a unit. For this reason it is possible, and usually the case, for the units to be selected and organized in advance. This leads to the possibility that the same units may be taught over and over each year, thus permitting inflexibility of instruction to develop, unless the school guards against such a practice.

Henry C. Morrison (11), who perhaps more than any one person

has done more toward developing this type of unit, gives the following as a definition of unit, "A comprehensive and significant aspect of the environment, of an organized science, of an art, or of conduct, which being learned, results in adaptation in personality."

Burton (12), in discussing this type of unit, states that the subject matter is really the material from which and through the use of which the outcome desired is derived. He further lists these outcomes as (1) the attitude of understanding, (2) the attitude of appreciation, and (3) special abilities. He analyzes Morrison's definition of the unit as a "significant comprehensive aspect of the environment" to mean that the units are really principles or values which are significant because they help interpret, explain, or give mastery over a part or aspect of the environment. They are comprehensive because they are based on an internally coherent body of material or a subject field.

Organization of instructional material under this type of unit does much to eliminate meaningless facts, useless information, and unimportant relationships if the student and his environmental conditions are kept in mind while the unit is being organized.

Traditionally such units are usually selected, organized and taught with the idea of having the child learn some certain part or parts of subject matter considered of value. In organizing the unit a grave danger lies in the lack of consideration of the interest or purposes of the child. Instead of basing the unit on the child's needs and interest, an examination of the environment and given areas of culture is made and then significant aspects of these are selected for units. In the classroom the problem becomes one of method with some teachers finding excellent ways

of motivating and stimulating interest in the work of the unit and others simply administering the unit to the children.

The very fact that subject matter is the basis of this unit offers a possibility in type of procedure which may be both desirable and undesirable. The desirable feature of this possibility is that teaching by this type of unit involves planned teaching. The teacher can devote much time outside of the classroom to planning the various approaches, activities, experiences, and teaching materials which will be used in the class. Since the learner's interests and desires are more or less secondary in the organizational stage, very little modification will be necessary to the unit as it is taught or administered to the pupils. Hence, the teacher can go into the classroom knowing fairly well the direction the teaching will take for that particular day or period of time. The efficient teacher is supposed to modify his plan somewhat in the light of classroom developments, but in general his plans will follow a certain trend or pattern. His teaching will be planned.

In the administration of this type of unit, undesirable features in procedure may result. Since this type of unit is based on potential subject matter, it becomes quite possible for all units within the same field to tend to be the same. As Caswell and Campbell (9 p. 413) state, "This makes it possible to organize this type of unit in advance in all details, to teach the same unit again and again, and to assign a specific amount of time for the development of a unit."

In other words, it is quite possible for teachers, when using this type of unit, to regiment themselves in their procedures in such manner

as to stifle all pupil initiative, creativeness, and interest.

The greatest objection or criticism, however, of this type unit seems to lie in the fact that the comprehensive and significant aspect selected by the teacher as a unit might not possess unity and significance for the immature pupil.

II. Experience Units

(Child Activity)

A. Unit Based on Center of Interest.

In this type of unit the teaching materials, activities and procedures are developed around a central theme of child interest. Keeler and Sweets (13 p. 2) give the following definition for this type of unit, "A unit of work is a series of worthwhile experiences bound together around some central theme of child interest."

The discussion of this type of unit given by Keeler and Sweets is so self-explanatory that much of that discussion is given here. They state, "Some incident serves as a starting point to arouse such an interest; activities of a compelling nature further stimulate this interest, information from almost every branch of knowledge is drawn upon to answer the questions which arise. Individual expression of this interest is encouraged through various media.

"The length of time spent upon one unit depends upon the fresh points of view that continually arise. These are pursued until the keen desire for information is satisfied and the whole is organized into some form of summary. Then the topic is allowed to lie dormant and new interests

are pursued. * * * In this type of unit the child is really the starting point for the work involved. His interests, his past experiences and his present needs determine what his school activities will be. The teacher and the pupil together plan the work as the plan proceeds.

"The teacher is a co-worker with the group. She must help the students select subjects and experiences suitable to their age and ability. She must plan trips, suggest library references, stimulate activities and have materials available and be conscious of the scope of information in related fields. She must know how to make pupils aware of their own interests. She must be resourceful in the use of any and all available supplies in the laboratory, shop, library, and environment."

Caswell and Campbell (9 p. 420) point out two weaknesses which frequently occur as this unit is developed in general practice. First, that the activities used really develop no connecting thread to give them vital relationship to one another. Much of the work is apt to flow on and on like a wandering brook, simply because the preceding activity suggested them and the pupils are interested in them. There is too much aimless and unplanned teaching.

The second weakness is that evidence of child interest can usually be produced in almost any area of culture or in some activity about almost any topic selected by the teacher. Hence it is frequently a relatively easy matter for units that appear but little more than logically organized subject matter to be produced in the name of child interest whether the interest is real or not. Certain objections to this type of unit also lie in the fact that many question the stability of child interest, and the ability of teacher to sift the worthwhile interests from the trans-

itery, ephemeral interests so common to the child. This type of unit cannot be written up in advance since it really represents the expression in action of the thing in which the child is most interested. In its purest form there is little if any teacher guidance. The teacher is supposed to be able so to manipulate the environmental factors as to surround the child with a wealth of alluring situations which invite him to create and to live.

Another big weakness of this type unit so far as general education is concerned seems to be that its success depends upon creative teaching in all phases of its development and use and many teachers simply do not possess this creative ability.

B. Unit Based on Pupil Purpose.

In the pupil-purpose unit the learner is brought to consider some end, objective, or outcome as worthwhile and desires to achieve this outcome. To do so he engages in a series of activities which he has helped to select while working cooperatively with the teacher. All activities and subject matter are selected with the end, objective, or outcome desired clearly in mind. The activities are intimately related to one another, in this case, because each has its place in contributing to the common end selected. The length of the unit may be varied to suit the rapidity of achievement of purpose on the part of the particular group.

The Tentative Course of Study for Virginia Elementary Schools (14) states that this type of unit is characterized by:

1. A dominating purpose on the part of the pupils, compatible with the aims of education.

2. A series of related activities planned by the teacher and

pupils, and engaged in by the pupils to realize this dominating purpose.

3. The evaluation of these activities by the pupils with the aid of the teacher.

Obviously units of this type can be made very flexible to meet different groups under different circumstances and backgrounds. To prevent too much flexibility and too much aimless pursuit of pupil purposes, the course of study or the curriculum is usually outlined with due regard to pupil interest on the different levels so that the units may be developed within the limitations thus set up. The Virginia state curriculum program uses this method of limiting, or directing, the work within the several grades for the elementary and secondary schools by use of centers of interest developed around certain major social functions. (See page 18, Tentative Course of Study for Core Curriculum of Virginia Secondary Schools, Grade VIII) Hence we see that the units although based on pupil experience really are guided within the scope and sequence set up by the course of study. Certain other characteristics or criteria of this type of unit have been summarized in the Unified Report of Principals Conferences (15) held at several centers in Virginia on Program for Improvement of Instruction in March and February, 1937, and are included here:

1. A unit of work should be selected from real life situations thus insuring functional value.

2. A unit of work should be comprehensive enough to provide a variety of purposeful activities that will insure a maximum of understanding and abilities for all pupils.

3. A unit of work should provide for creative expression and should stimulate pupils to seek other worthwhile experiences.

4. A unit of work should provide for the development of an integrated personality.

5. A unit of work should develop desirable attitudes toward cooperative living by encouraging pupil participation in group activities.

6. A unit of work should furnish leads into related units of work and should stimulate in the pupil the desire for continued widening of his interests and understanding.

The chief function of the teacher in this type of unit is to discover (or develop) child interests and purpose and then to organize, through cooperative effort with pupils, the subject matter and teaching materials in such a way that the purpose set up may be realized. (In Virginia these purposes are confined to certain areas for each grade set up in the course of study.)

If pupil purpose is lacking or ignored the activities and procedures in this type of unit, in a sense, become mechanical instructional procedures, and no opportunity for growth in ability to make decisions and choices is given to the child. Consequently, one of the principal aims of education is not realized.

C. Unit Based on Pupil Needs.

This type of unit is so closely related to the pupil-purpose type that a close analysis is usually necessary to distinguish the two. In this unit the student feels a compelling need for the acquisition of an end or outcome and engages in a series of activities to reach this end. The chief difference seems to lie in the substitution of the concept of the word "need" for the concept of the word "purpose" as a point about which to

organise the instructional material. Wynne (16 p. 21) states that "Either the new conception of purpose or the conception of experienced need may be employed." By new conception of purpose, he refers to the idea of dominating purpose.

As mentioned, the characteristics of this type unit and the pupil-purpose type are very closely related. The distinction between the two seems to hinge on a highly theoretical discussion (which will not be gone into in this study) as to the value of purpose and of need as a basis for unit organization.

Caswell and Campbell (9) have prepared a chart showing the characteristics of the various types of units just discussed. Parts of this chart are reproduced below, with the following information added:

1. The place of the teacher in planning and developing the unit.

2. The place of the subject matter in the unit.

3. The place of the students in planning units.

This chart will set forth the characteristics of the various types of units and also serve as a convenient method of comparing and contrasting the units.

CHART SHOWING COMPARISON OF UNIT ORGANIZATION
(Leonard)

Bases for Comparison (1)	Traditional Subject Matter Unit (2)	Functional Subject Matter Unit (3)	Possible Child Experience (4)	Immediate Child Experience (5)
How is subject matter selected?	Selected from present organized subject matter. The unit represents a grouping of this material around some topic.	Same process used as with traditional subject matter unit except care is taken to select seemingly useful material which is treated as a problem.	Selection of some social problem, may be child or adult problem or adult problem or both but within possibilities of child's comprehension or experience.	Selection of some immediate experience of the children which arises within the group.
How is learning motivated?	Motivated by marks, tests, threats, failure, requirements of essentials, punishments and extraneous rewards, appeal to pupil competition and personal pride.	Many of the same means used in the traditional plan are used here; however, some attempts are made to utilize natural curiosities and some interests and pupils are urged to learn because of some need, present or future (mostly future).	Motivated through a sense of the utility of learning, by use of children's interests and experiences and through the use of interests as leads to unit organization.	Motivated by the children's interest in their own proposed activities.
What provisions are made for individual differences?	Differentiation is made by the extension of time to some, by limiting the amount of learning to some, by ability grouping, and by some individual drill.	Several of the same methods used in the traditional plan are used here. In addition different activities are introduced and not all are required to do the same except for minimum essentials. Contract levels are used frequently.	Differentiation made by providing many different activities which may contribute to a group activity or to an individual one. Activities are adjusted to capacities and interests.	Activities are adjusted to capacities and interests and experiences. Activities may be individual or may be those which contribute to group undertaking, Children select their own activities.
What kind of activities are typical?	Usual activities are reading, writing, reciting, testing, and drilling.	Same kind of activities used in traditional plan are used here. Some discussion, individual and group work are introduced. Life problems are used for illustrations or to establish functional concepts.	Usual activities are reading, writing, discussing, interviewing, constructing, taking field trips, interpreting analyzing and speaking.	Usual activities are same as those used in the possible child experience unit plus any the children suggest.
What sources are used by pupil?	Sources used are course of study, adopted textbook and maybe a few reference books pamphlets and magazines.	Courses of study, one or several textbooks, magazines and newspapers. Some commercial material and a few community sources.	Course of study, many textbooks, community leaders and institutions, pupil's experiences and material they make and collect, many references and materials.	Use many books where needed, community environment, pupils experiences and materials they make. Pupils are urged to create their own materials.
How are abilities developed?	Are developed separately as skills to be automatically recalled whenever the need arises. Largely class drill by use of standard prepared materials based upon common essentials.	Same procedure used as in traditional subject unit but pupils are taught through illustrations of life problems to make use of abilities taught largely in class drills.	Abilities are developed in situations whenever needed in connection with the problem. Skills may be isolated for drill which is largely individual.	Abilities are developed only as necessary to carry on the activities under way. Drill is entirely individual.

-Continued-

Bases for Comparison (1)	Traditional subject Matter Unit (2)	Functional Subject Matter Unit (3)	Possible Child Experience (4)	Immediate Child Experience (5)
What are some sample title units?	1. The food getting of plants. 2. Social letter forms. 3. Measurement of area. 4. The body and its diseases. 5. Forms of government. 6. Literary forms.	1. How do plants get food? 2. What are the characteristics of a good business letter? 3. How does measurement help the scientist determine distances? 4. How is the government organized? 5. What are the characteristics of various literary forms?	1. How may farmers in this section improve their corn crop? 2. How may one increase his friendships by social correspondence? 3. How are distances between planets measured? 4. How can we improve health through the control of disease? 5. How does man control himself through government? 6. How does man use various mediums to express himself in writing?	1. How can I get my roses to bloom? 2. Writing to our friends. 3. The stars. 4. Keeping well. 5. Controlling ourselves. 6. Keeping records of our ideas.
How is subject matter organized?	Strict subject lines are maintained.	Subject matter lines are maintained but correlation is introduced where it is natural and easily introduced.	Taught separately by groups or subjects. May be grouped. Many subjects may be synthesized around a unit. There may be correlation, fusion or integration.	No subject matter lines are maintained. Complete integration of the learning materials around major activities is the plan of organization.
How is the class controlled?	Class is controlled entirely by the teacher who follows rigid time schedules.	Class is controlled by teacher but recognition by pupil of worth of learning may secure a measure of pupil control. Time schedules are maintained but some variation is allowed.	There is some teacher control apparent but major control is by the pupils through their recognition of the necessity for sustained individual and group work to succeed in achieving purposes recognized. Time schedule may or may not be routinized.	Pupils control themselves to achieve the pruposes they have set up in the study of the unit. No time shcedule is fixed. Creation disregards time.
What types of thinking are involved?	Memorization, factual recall, analysis, some interpretation and generalization by superior pupils.	Memorization, factual reacll, organization, application, outlining, problem solving involving analysis, interpretation and conclusion.	Some memorization and selective recall, discussion, original solution to problems, outlining, summarizing, establishing relationships, deductive reasoning, interpretation, generalization, problem solving and association, application and organization of facts and principles.	Same type are involved as those of possible child experience unit, but here there is more provision for individual investigation and solutions, for making decisions, and criticisms, and for creative endeavor.

Chart Classification and Comparison of Units
(From Caswell and Campbell)

	Subject Matter Units			Experience Units		
Type of Unit	A. Topical	B. Generalization	Significant Aspect C. of Culture or Environ.	A. Center of Interest	B. Pupil Purpose	C. Pupil Need
Source of Unity	The sequence of relationship between items of subject matter	Relationship of all materials to one generalization, principle or law	Relation of aspect selected to race development or problems of contemporary life	Interest of pupils in activities and objects which group around one head	The dominating purpose of pupil to achieve end.	A need which the pupil recongizes
Illustrations of source from which units may be drawn	Civil War; vertebrates; plant life; transportation	Principles in physics, chemistry, biology, general science	Water systems. Transportation. Biology of plant life.	Any object or activity in which children are interested as radio, steamships, electricity, boats.	Purposes arise from interest. Interest in fire may lead to purpose to find out how fire dept. works. Interest in radio lead to study of communication.	Need to make purchases, to select good, to read, to keep personal accounts.
Place of teacher in planning and developing unit	Teacher (or text) does all planning and developing work. Assignment consists of topics or pages	In science, most material is planned in this manner in text. Teacher must plan how to adapt text to class	Conventionally, teacher plans problems, activities, subject matter and materials in advance	Must plan continuously day by day. Must find interests of pupils and help pupil select activities based on interests. Unit is developed from day to day.	Must plan continuously as interests develop. Must be familiar with interests and abilities of children and limits of work for grades. Must be able to adjust plans to meet new conditions and local teaching situations.	Must plan work continuously as needs arise. A thorough understanding of pupils is necessary.
Place of pupil in planing and developing unit	Pupil does no planning. Studies topics and text.	Has very small part. May be required to fill in facts relating to generalized law or principle.	Pupil may select certain activities, but in general has little part in development of unit.	Pupil helps select subject matter, activities and experiences which will engage in. Pupils' work in things are most interested in.	Pupil helps plan activities to engage in to reach end set up by purpose.	Pupil helps select material to develop their need. Engage in activities are most interested in.
Place of Subject Matter (Text)	Basis of topical organization	Basis of organization. Is selected to explain, illustrate & develop the principle or law being generalized.	Subject matter which relates, explains & develops understanding of aspect is selected	Only subject matter which relates to interest is selected. Subject matter includes activities, experiences, etc.	Subject matter from all fields selected to develop and achieve and set up.	Only subject matter which helps develop and fulfill needs is selected.
Sequence of Unit	A given sequence of units and material is followed	May be arranged in advance or may vary. Sequence within unit may vary. Teacher can vary material.	Variation of units sequence possible. Sequence within unit may vary. Teacher left some choice. May be very regimented.	Cannot be planned in advance	Full sequence cannot be planned in advance. General ideas & plans within grade limits may be preplanned.	If group is well-known by teacher is possible to plan work in sequence, otherwise cannot be planned in advance.
Length	May be any length. May be predetermined.	Varies. May be approximated in advance	Varies as conception of importance of aspect varies.	Usually extend over long periods of time.	Varies according to group and unit selected.	Short compared to other units.

From the foregoing discussion and classification of types of units, it will readily be seen that an exact definition can be given only if the type of unit or unit organization being considered is known in advance. The best general definition seems to be Leonard's (6 p. 103), wherein he states, "The term is used generally to imply some meaningful organization of material grouped around some topic, theme, experience, activity, or aim." This will be the concept of the term "unit of work" used in the remainder of this study. A review of the discussion of various types of units will show how each attempts to get a meaningful organization of material (subject matter, activities, experiences, etc.) grouped around the topic, theme, experience, activity, or aim.

The absence of such names as the Dalton Method, the Contract Plan, the Winnetka Technique, the Written Assignment Plan, the Project Method, the Problem Method, the Project, and the Miller Contract Plan, may have been noticed in the classification. A close analysis of these various plans reveals that while they make some use of the several types of units (with a great deal of confused overlapping) they are really somewhat similar procedures or plans for teaching passing under different names. This statement is further borne out by Kees (4) (See p. 5).

Instead of a detailed analysis of the philosophy, principles, and techniques of these plans, a summary of their more important contribution to procedure will be presented.

The Contract Plan was popularized by the Dalton Laboratory Plan, wherein the teachers worked out assignments or units to cover a month's work and then entered into an agreement or contract with the pupil as to the

amount of work to be done. Different pupils would select varying amounts of work, according to their abilities. Instruction sheets for doing the work were given to the pupils. Frequently very little choice was left to the pupil as to the activities to be engaged in.

The written assignment might be used to designate the rest of the several plans mentioned above. The point of approach is slightly different under many of the various names but the actual procedure is very similar. Usually the unit assignments are mimeographed and distributed to the pupils. In some plans the pupil is motivated by the relation of the material in the unit to life-like situations. In a few such as the Miller Contract Plan the pupil is given opportunity to help select the material around definite guide lines. Some plans divide the work into three parts and assign grades to the pupils according to the amount of work they complete, thereby attempting to plan and provide for individual differences in pupil ability (not interests). The project method attempts to develop pupil purpose as a motive for completing the work involved in the unit. In all of the plans the content arrangement will fall under one or more of the unitary classifications previously given.

OBJECTIVES AND CRITERIA FOR A UNIT OF WORK

There are many statements of objectives and criteria for a unit of work to be found in courses of study and books about courses of study. Apparently, few attempts have been made to summarize these objectives and criteria under any set form or classification. No attempt will be made in this study to develop such a classification. Instead, objectives and

criteria will be set up for the type of unit of work advocated in the Tentative Course of Study for the Core Curriculum of Virginia Secondary Schools, namely, the experience unit, based on a dominating pupil purpose. Constant reference should be made to the chart comparison of this unit with others as given on pages 21-22-23 and to the general discussion of this type of unit as given on page 17.

The following objectives for this type unit are suggested:

1. To organize teaching procedures and materials into a series of guided purposeful activities based upon pupil experience (and activities) which extend pupil interests and modify pupil behavior in terms compatible with the aims of education.

2. To organize the units as far as possible around the aspects of the centers of interest for the respective grades as set up in the Tentative Course of Study for the Core Curriculum of Virginia Secondary Schools.

The following criteria are suggested as suitable for this type of unit:

1. The unit must be an outgrowth of a dominating pupil purpose - that is, the pupils must see the value of engaging in the activities of the unit and want to do so.

2. The type of behavior necessary to develop and complete the unit must be compatible with the aims of education.

3. The material selected for the unit should be from, or related to, real life situations recognizable by the pupils.

4. The unit should be comprehensive enough to provide a variety of purposeful activities that will insure a maximum of understandings by all the pupils, not just a few.

5. The unit should provide full opportunity for the pupils to originate, plan, and direct activities.

6. The unit should furnish leads into other units of work.

7. The material and references needed should be available to the particular class situation.

8. The unit should provide opportunity for evaluation of results by the pupils.

9. The unit should be related to or grow out of some aspect or problem selected for emphasis in Course of Study.

10. All parts of the unit should make a coherent whole.

This list represents a condensed form of many objectives. As such, it should serve the beginning teacher. Experience with units will enable the teacher to expand these objectives to meet his particular situation.

FORM IN WHICH THE UNIT MAY BE PRESENTED

As pointed out in the general discussion of units, the form in which they are developed varies and can usually be adapted to meet individual preferences and conditions. Harap (20) points out four principal forms for written units of work: "(1) The outline arranged under several headings; (2) An outline arranged in two or more parallel columns; (3) Solid paragraphs under several headings; and (4) An informal account." The Tentative Course of Study for Virginia Elementary Schools (p. 26) gives a chart or

plan sheet for units under an outline arranged in five parallel columns and suggests a sheet 11 x 26 inches in size for the chart. However, investigation of the forms mentioned and experience with the forms in classroom situations seems to establish the outline form arranged under several headings as the superior form when ease in handling, in constructing, and in filing is considered; also, when flexibility from the standpoint of completeness, accuracy, and modifications is considered. The final selection of form must necessarily be left to the individual, but the following paragraph headings are given for a suggested form which seems to meet all requirements and as one which has proved satisfactory in actual use:

I. Title of Unit.

II. Aspect (or problem under aspect) emphasized in unit.

III. Objectives sought in unit.

1. In terms of aims of education and of particular field in which unit is to be developed.

IV. Abilities needed and stressed in unit.

V. Proposed procedure in initiating unit.

1. Proposed approach (things interesting to children that may lead to development of unit and give an overview of entire unit).

2. Proposed steps in initiating unit.

3. Possible activities that may be used.

VI. Possible subject matter that may be used.

VII. Proposed method to culminate unit so that emphasis may be placed on aspect set up under II.

VIII. Evaluation of unit.

IX. References used.

X. Leads to other units of work which may be suggested.

If the beginning teacher fills in a rather complete outline of a unit for a few times he will soon find that less and less detail work is required under each step. When the teacher reaches this stage of proficiency he should make a careful study of the essentials for the units of work he is using and developing and modify the above form to meet his own situation, needs and requirements.

The paragraph headings suggested are in the main self-explanatory; however, a brief discussion of these headings as they relate to a unit developed from the materials in the Tentative Course of Study for the Core Curriculum of Virginia Secondary Schools will facilitate their use by beginning teachers.

Title of Unit. Since the unit is one based on pupil experience, the title, insofar as possible, should express an undertaking in terms of activity or doing something. For example, "Planning and installing playground equipment." "Finding out how our community protects its health." Topics are sometimes used as titles to units. This is permissible if care is taken to insure that the pupils know just what is to be done about the topic.

Aspect (or problem under aspect) emphasized in unit. This refers to the aspect (or sub-problem related to it) as set up in the Tentative Course of Study for Core Curriculum. Selection of the aspect is usually teacher made according to the needs of the classroom situation.

Objectives sought for in unit. The objectives in terms of aims of education are to be selected from the list of aims as given in the Tentative Course of Study for Core Curriculum, page 2 . A careful selection of a few of the aims is better at this stage. A long list is to be avoided. At the conclusion of the unit the outcomes may be checked against the entire list of aims if so desired. The selection of objectives in terms of the particular field in which the unit is being developed will depend on the particular area from which the unit material is being drawn. The objectives in terms of aims of education must be in accord with the objectives in terms of the subject field.

Abilities needed and stressed in unit. This refers to the list of abilities as set up in the Tentative Course of Study. If stress is to be put on science abilities, refer to this list. Too long a list of abilities should be avoided.

Procedure in initiating unit.

1. Proposed approach - this is self-explanatory.

2. Proposed steps in initiating unit: A list of the ways planned to start the unit. The Tentative Course of Study for Virginia Elementary Schools (p. 27) lists three general ways: (1) by using some immediate interest of the children; (2) by setting the stage through trips, exhibits, stories, et cetera; or (3) by utilising some unusual happening. Several proposed approaches may be listed. Only an approach which will stimulate and challenge should be used. The method is to go from the large problem to its parts and then back to the large problem.

3. Possible activities that may be used. A list of possible activities having the definite purpose of developing a fuller understanding

of the aspect selected should be listed. Preference should be given those activities involving cooperating rather than individual projects. If many types of activities are included, the individual differences of the group are better met.

Possible subject matter. It should be noted that the term "subject matter" is being used here in the restricted sense as applying to text book material. In the broadest sense subject matter will include everything done or used by the pupils to meet the purpose set up for studying the unit. Subject matter in this type of unit serves to develop a fuller understanding of the aspect (or problem) relating to the center of interest for that particular grade. It is not taught for the mere sake of acquiring the facts. The possible subject matter material which the teacher feels will be of value to the pupil in developing a full understanding of the unit should be listed in brief outline form. No hesitation should be felt in drawing on desirable subject matter from other fields. A word of caution might not be amiss here. The beginning teacher should not attempt to include subject matter which is not readily available or which will require too much effort to secure. The tentative course of study in use at the present time gives a full list of materials and subject matter for the various aspects. The teacher should consult this as a guide and suggested source but should avoid attempting to include too much of the material presented.

Proposed method to culminate unit. A brief statement of proposed plan whereby all activities will be tied in so that a complete picture of entire unit may be developed.

Evaluation of unit. A brief statement of methods to be employed to measure achievement of desired outcomes. Include objective and subjective methods. As experience is gained, this step will become more flexible but probably require less detailed planning.

References used. A complete list of proposed references with exact page where possible. Some teachers may prefer to put the references in same section with proposed subject matter. Space should be provided for new references worked up with class.

Leads to units of work. A list of suggestions or ideas for new units, which the development of the present unit has possibly suggested.

Suggestions for other forms, or for modification of the above form, can be found in the following references:

Yoakum, G. A. - The Improvement of The Assignment.

The Florida State Course of Study for Elemementary School Grades I-VI p. 12-19.

Parkhurst, Helen - Education on the Dalton Plan. pp. 66-67.

CONSTRUCTING AND INITIATING THE UNIT

The expression "developing and initiating the unit of work" is used in this study to mean those steps taken by teacher and pupils to organize the teaching unit into form for use. Techniques for these steps vary considerably. There is no one form or method which is best for all units and all situations. Usually each type of unit instruction uses a slightly different technique. No attempt will be made here to list and analyze all these. To do so would necessarily extend this study far beyond its proposed purpose. Instead, plans and procedures which are directly suitable

or related to the pupil purpose unit, which is the one suggested ~~to~~ in the Virginia Course of Study, will be used.

These plans and procedures are not final. They are given as plans which have proved to be practical. As the teacher gains experience in the development and initiation of units, the plans are frequently modified to meet the teaching situation. Caswell and Campbell (9) suggested that planning should involve three steps (a) a pre-plan; (b) a readjustment of plans as work progresses; and (c) an evaluation of the work after its completion to note points that need improvement and to note leads for new units. The teacher first sets up tentative objectives and plans for a unit based on proposed pupil interests and activities and, in most cases, related to some center of interest, problem or aspect as set up in the Course of Study. This pre-plan should include teaching materials, experiences, and activities, from the teacher standpoint, necessary in developing the unit. This proposed unit is then modified, revised and adapted to the needs and interests of the pupils and the situation through a cooperative study of the proposed unit by the pupils under the direction of the teacher. Then a tentative program of work (or unit) is organized around these revised plans, the final unit being developed by the pupils working from this initial plan.

Following the criteria of a unit as given on page 26, and the form as given on page 28, the construction and initiation of a unit in general science or biology can proceed by the following steps.

Step 1. Refer to objectives and criteria of unit as given on page 26. Keep these in mind as development of unit proceeds.

Step 2. Select some problem or phase of the aspect selected for emphasis for grade level and subject.

a. This selection will be largely guided by conference with core field teachers and by the needs of pupils and community.

Step 3. Set up proposed objectives for unit in terms of aims of education and subject field being taught.

Step 4. Select proposed subject matter for unit from available reference books and community resources related to problem.

Step 5. Make a list of the possible activities which might help in developing a fuller understanding of the problem selected in step 2.

Step 6. Present the problem to the pupils by discussion, pertinent questions, pupil reports, readings, trips, demonstrations, or any combination of these activities. The chief purpose of this presentation period is to have the pupils grasp the importance and significance of the entire problem and to have them become interested enough to determine to make a further study of the problem. This step provides opportunity for much initiative on the part of the teacher.

Step 7. Modify original plans, where necessary, to develop unit along lines suggested or developed in pursuit of procedure in step 6.

Step 8. Keep the important desired outcomes of the unit in mind and as unit proceeds note needs for further emphasis so that the outcomes may be achieved.

Step 9. Evaluate unit in terms of objectives and desired outcomes. Allow as much pupil participation as possible here.

Step 10. List any leads or suggestions which come up and which may be used for other units of work.

SPECIMEN UNITS

The following units are presented as illustrations of unitary organization developed around the foregoing plans. While they are presented as "proposed" units, they, in reality, represent units revised in the light of criticism from experienced science teachers, and in the light of teacher-pupil cooperation through a period of two years in the classroom.

In use these units can be modified to meet almost any situation if the teacher will note the interests and leads manifested by the pupils during the introductory and developmental stages.

PROPOSED UNIT FOR BIOLOGY

I. Title of Unit: How Living Things May Be Improved.

II. Aspect Emphasized in Unit: How do biological discoveries increase man's use and control of nature?

III. Objectives Sought in Unit:

Objectives in terms of aims of education and science.

A. To develop attitude of inquiry. (101)*

B. To develop attitude of self-cultivation. (103)

C. To develop the ability to appreciate the orderliness and manifestations of nature. (205)

D. To develop an understanding of man's increasing control of nature. (205)

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* The code numbers used after the objectives refer to the coded classification as used in the Tentative Course of Study for Virginia.

E. To develop an understanding of the influence of nature upon the development of plants and animals. (204)

IV. Abilities Needed or Stressed in Unit:

A. The ability to use reference books.

B. The ability to bring together and evaluate facts relating to a problem.

C. The scientific attitude as it applies to (1) the use and respect for the experimental method, (2) to the search for data, and (3) to the disposition to be free from superstitious beliefs and unexplainable mysteries.

V. Proposed Procedure in Initiating Unit:

A. Teacher show different varieties of same plants and seeds to class. For example, white, yellow, red corn. If possible have two varieties crossed on one ear. Show pictures of both plants and animals which show results of crossing different breeds. Show pictures of albinos, mutants, etc. Point out differences in characteristics possessed by pupils in class, such as color of eye, light hair, dark hair, blonde, brunette.

B. After display of the visual material lead the class in discussing questions and problems related to the above. Such questions as the following might be asked: Why do the same kinds of plants have so many different characteristics? Is it possible for a plant with one colored flowers to produce a plant with a differently colored flower? How are characteristics passed from one generation to the next? What is the meaning of the term "heredity"? Can man make use of hereditary laws to change plants and animals? As the discussion proceeds, make full use of all

pertinent questions raised by class. This discussion should be continued until pupils' interest in and grasp of problem has been fully established. This discussion should lead to a definite formulation of a purpose for studying the unit. The title as given above may be modified to suit the purpose set up by the class after the class discussion.

C. The possible activities that may be used are:

1. Reading to find out the nature of heredity.
2. Reading to find out the influence of environment upon the production of individual differences.
3. Reading about the work of Gregor Mendel.
4. Reading to find out the various methods of propagation of plants.
5. Preparing a diagram of two unit characters showing the results for three generations of cross-breeding.
6. Preparing a special report on any one of the following:
   a. Vegetables our grandparents did not have.
   . Fruits our grandparents did not have.
   b. What we owe to Burbank.
   c. How the farmer improves his crop through selection.
7. Collecting specimens of various breeds of corn, wheat, flowers, et cetera.
8. Preparing a report on how information derived from trapnesting the laying hen can be used to increase egg production.

9. Making a list of all the kinds of domesticated animals and plants in your locality that are useful to man. Indicate those you know to have been improved by such factors as selection, budding, grafting, crossing, etc.
10. Making a diagram of a chromosome and placing in it the genes or determiners for some unit characters.
11. Making a report to class on the work of DeVries.
12. Making a list of ten plants and five animal mutants.
13. Reading to find out how living things are changed by crossing.
14. Studying the selection and breeding of corn.
15. Preparing slides and pictures for the projection machines to illustrate any phase of the problem. (Note: Ideas for possible slides and illustrations may be obtained from biological supply catalogues)
16. Taking field trip to observe variations, mutants and crop selection.
17. Making graph of variations in height and weight for age groups within class.

VI. Possible Subject Matter:

Heredity

Physical basis

Chromosomes and genes

History of genes in maturing germ cells

History of genes in fertilization

Behavior of characters in heredity

Unit characters

Pure-line heredity

Heredity of contrasting characters

Genic history

Dominance and recession

Ratio of inherited characters as an average

Some characters inherited

Physical, mental, et cetera

Certain factors affecting hereditary characters

Environment

X rays (experimental work)

Hybrids

Basis of new domestic plants, animals and species

Mutation

Cause and occurence in plants and animals

Brief introduction to eugenics

VII. Proposed Method to Culminate Unit.

A. Have various members answer the questions set up as worthwhile to study by reading reports of their investigation.

B. Present the slides and pictures illustrating material which helps answer questions raised in problem.

C. Have children write brief essays answering questions raised in problem.

VIII. Evaluation of Unit.

A. Use objective tests designed to test for information relating to subject matter involved. (See sample test for this unit. p. 51)

B. Make use of final essays to judge pupil's ability to organize material.

C. Make use of observation of pupil's reaction to work, attitude toward class and teacher, and enthusiasm for school life to determine development of desirable social traits. A chart of desirable traits might be used and checked by teacher observation from time to time as the unit progresses. (See proposed evaluation chart, p. 49)

Through a knowledge of the pupil background and interests, the teacher can adapt the work of this unit to meet varying conditions. The teacher should watch pupil response to the introduction and plan work accordingly. If the interests of the class are predominantly rural more emphasis might be placed on farm crops and animals. If the group is mostly urban, greater emphasis on eugenics and racial improvement might be indicated. A wide use of varied activities should provide for differences in group and individual interests.

IX. References.

Smallwood Reveley Bailey. New Biology pp. 362-395.

Baker and Mills. Dynamic Biology pp. 624-684.

Curtis Caldwell and Sherman. Biology for Today pp. 613-650.

Hunter. Problems in Biology pp. 620-643.

Moon and Man. Biology For Beginners pp. 440-474, 667-689.

Pieper, Beauchamp, and Frank. Everyday Problems in Biology pp. 505-552.

United States Department of Agriculture, Farmers Bulletins:
157 The Propagation of Plants
229 The Production of Good Seed Corn
1116 Selection and Care of Poultry Breeding Stock
1167 Essentials of Animal Breeding
1338 Seed Potatoes and How to Produce Them
1436 Why Potatoes Run Out
1727 Selection of Hens for Egg Production

General Seed Catalogues, such as Burpee's and Stark Brothers.

X. Leads to Other Units of Work.

The chief lead developed was to a unit on conservation of plants and animals.

PROPOSED UNIT FOR GENERAL SCIENCE

I. Title of Unit: How Do We Safeguard Our Own Health and The Health of Our Community?

II. Aspect Emphasized: Aspect 1. How and why do nature and agencies resulting from invention and discoveries affect the protection and conservation of life and property? The specific problem from this aspect is "How does man protect himself against communicable disease?"

III. Objectives Sought in Unit in Terms of Aims of Education:

To help develop:

A. The attitude of inquiry. (101)

B. The attitude of respect for personality. (105)

C. The attitude of critical-mindedness. (106)

D. The attitude of generalizing. (111)

E. The scientific attitude. (113)

F. The understanding of the relation of health to human development.

Objectives in terms of science:

A. To develop useful, interesting, and enduring acquaintance with important matters of science relating to health.

B. To develop understanding of important scientific principles and generalizations relating to health.

C. To provide training in the development and use of scientific methods as applied to the problems of daily healthful living.

IV. Abilities Needed and Stressed in Unit:

A. Ability to use scientific method in problems.

B. Ability to follow directions in scientific procedure.

C. Ability to use reference books.

D. Ability to administer first aid.

E. Ability to use scientific apparatus.

V. Proposed Procedure in Initiating Unit:

A. Approach. Discuss the work of the various local agencies which help in maintaining community health. Have Boy and Girl Scouts report on stress placed on good health within their organizations. Discuss the protective measures used by local dairies and grocery stores to protect their products. Show films and pictures relating to various phases of health. Show records of number of absentees from school due to sickness.

B. Initiating Unit. In this unit the approach and initiation are closely related. As the above reports and discussions proceed the teacher can note the questions and directions of interest manifested by the class. Additional questions which may be included whenever the discussion will warrant are: How may one be sure that water is pure? How does our community secure a pure supply of water? What precautions need to be taken to secure adequate sewerage disposal? How are vitamins related to good health? How does cold storage help in maintaining good health?

The pupil-teacher discussion relating to the above questions and topics should lead to a definite formulation of a purpose for studying the unit. The proposed purpose in this unit being to find out how health is protected. The dominating purpose having been established, the following procedure may be followed in organizing work. By teacher-

pupil discussion break-up work involved in studying one large problem into smaller sub-problems. The following are suggested for this problem:

Problem I. What can we do to protect ourselves from disease germs?

Problem II. How can we secure pure water?

Problem III. Why do we need plenty of pure air, and how may we get it?

Problem IV. How can we keep our foods pure?

Problem V. What we should do to prevent and care for accidents.

Problem VI. How does our digestive system affect our health?

Select activities, experiments, projects, and reports for the various sub-problems by allowing pupils to make suggestions after reading reference material available. Teacher supplement the list where necessary.

C. The proposed activities for this unit divided up according to problems are:

Problem 1. Experiment. Do air, water, and food contain living things?

Experiment. What effect does bacteria have on foods? Demonstration, pasteurization of milk.

Experiment. To show growth of bacteria and molds in air.

Experiment. To determine the presence of bacteria in milk.

Reading to determine the nature and effect of disease germs.

Supplementing the above experiments and demonstrations with reports and other reading, visits to local dairy, meat markets, and grocery stores to observe methods of protection from germs.

Problem 2. Committee report on local water supply, and sewerage disposal. Demonstrations of filtering, and purifying water.

Reading to find out answers to class and teacher questions relating to problem.

Problem 3. Diagram of ventilating system used in home and school. Group report on airconditioning used by local concerns (theatre). Diagram showing path of air from the time it enters intil it leaves the body. Reading to answer class and teacher questions.

Problem 4. Demonstration of tests for adulterants in food. Report on visit to dairy, grocery, et cetera. Reports on use of disinfectants. Examine spoiled food under microscope. Report on pure food laws. Reading to answer class and teacher questions.

Problem 5. Demonstrations of first aid, artificial respiration, bandaging, et cetera. Reports on cause and prevention of accidents in home, school, and community.

Problem 6. Reports on effect of vitamin deficiency, Test for classes of foods. Collection of patent medicine advertisements for aids to digestion. Reading to answer class questions.

Note: The activities given in the above are suggestive. Many more will suggest themselves for the different classes and problems. The pupils will probably suggest additional ones as they read several texts.

VI. Subject Matter That May Be Used:

Bacteria, helpful and otherwise.

Water purification: Chlorination, sedimentation, filtering, chemicals, distillation. Sanitary sewerage disposal.

The air we breathe. Pure air, foul air, ventilation.

Food, its values, preparation and preservation.

Prevention of accidents, administering first aid.

Digestion and health. Digestive system of man. Care of digestive system. Proper foods for good digestion.

VII. Proposed Culmination of Unit:

Have pupil give brief introductory review of entire problem and then have pupils give a summarizing report on the question raised in each sub-problem.

VIII. Evaluation of Unit:

Use chart as given below for pupil evaluation. Use objective and essay test for subject matter.

IX. References:

Clement Collister Thurston. Our Surroundings, pp. 439-463 - 58-61-648-707 - 478-486 - 355.

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Regenstein and Teeters. Science At Work, pp. 233-307.

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Additional references for projects and reports, the students to consult index for page numbers:

Health Essentials - Andress, Aldinger, Golberger.

Civic Science in the Community - Hunter and Whitman.

Dynamic Biology - Baker and Miles.

New Biology - Smallwood, Reveley, Bailey.

Problems in Biology - Hunter.

Biology For Today - Curtis-Caldwell-Sherman.

Biology and Human Welfare - Peabody and Hunt.

For bulletins, free material, and the like, consult the Tentative Course of Study and the bibliographies at the end of the various texts used. The list of material available is too long to include here. Selection of this material can be made according to pupil interests.

Suggested Evaluation Forms

When using the above type units, much of the evaluation should be pupil-made as well as teacher-made. The following forms are suggested as being valuable for recording observational data. The charts are practically self-explanatory. The traits, characteristics, or modifications in behavior which are considered of value are listed in the proper spaces then checked from time to time by both teachers and pupils. A careful study of the charts will reveal their flexibility and ease of modification to fit any situation and to aid in recording data on any observable trait. Different units will stress the development of different traits, characteristics, and attitudes. These observable traits can be incorporated into the chart at will.

The suggested test for aid in evaluation was mimeographed and given to the individual student. This test has purposely been designed to cover a wide range of knowledge applicable to the field or area covered by the unit so that some evaluation might be indicated for the growth of all pupils. Where hetrogenous grouping exists in the class room some such test is almost a necessity. No one test, however, is completely satisfactory for all classes. The reader is cautioned against adopting this test in its entirety for each and every class. It is given as a type of test which can (and must) be modified to meet the objectives and needs for the particular class group being taught. No scoring or grading scale is presented since the writer feels that such a scale should be developed by the teacher when the test is modified to cover a particular situation or class.

Teacher Evaluation Charts for Observable Traits (Traits to be Listed as Need For Checking or Development Arises)

	Cooperation	Neatness	Care of Materials	Use of References	Punctuality	Preperation	Loyalty	Originality	Courtesy								
	−	+	✓	✓	−	✓	−	✓	−								
Anderson John																	
Abbot Mary																	
Barnett Henry																	
Curtis Robert																	
Devlin James																	
Fainter John																	
Harmon Charles																	
Harris William																	

Check Code:

(−) Pupil lacking in that particular trait.

(+) Pupil Possesses trait to high degree.

(✓) Pupil shows average ability for that trait.

Self Evaluating Chart

Subject _____ Name _____

Date:																				
Started work promptly																				
Had all materials that needed for day																				
Worked as neatly as possible																				
Worked accurately as knew how to make it																				
Have used several references																				
Have done my share on committee work																				
Have really tried to follow instructions																				
Have made suggestons which class or teacher accepted																				
Have been prompt at cla sses, and had work ready on time																				

Directions: From time to time you willbe given a chance in class to check your work on this sheet. You are to check it according to your own opinion. This sheet is to be kept until called for by your teacher. Check your work as follows: place a plus mark (+) opposite the statements you have carried out to the best of your ability. Place a check (v) opposite the statements you have carried out only fairly well. Place a minus (-) after the statements which you have not succeeded in carrying out. The space below may be used for any explanation you mey want to make about your checks and for suggestions for the next check sheet.

Biology Test - Heredity

In each blank space at the left place the word which best fills the blank of the sentence.

_____1. A peculiarity or physical trait which is transmitted from parent to offspring is called a _____.

_____2. Difference in heads of wheat illustrates_____.

_____3. The transmission of characteristics from parent to offspring is called _____.

_____4. Characteristics are transmitted by _____.

_____5. A cross between two different kinds is called a_____.

_____6. The resemblence of an individual to its parents is mainly due to _____.

_____7. A sudden unusual variation in an offspring which in turn produces offspring with the same differences is called___.

_____8. The science which aims at the improvement of the human race is_____.

_____9. The name of a great scientist who experimented with fruit flies is_____.

_____10. The hereditary traits are carried in the _____, which are found in the chromosomes.

From the following list of terms relating to natural selection, select the one which best fits the statements below and write the letter of this term in the blank provided:

a. Heredity.

b. Variation.

c. Survival of fittest.

d. Struggle for existance.

e. Overproduction.

_____1. Pine needles in the same bundle are not always the same in length.

_____2. Many frogs are caught by other animals.

_____3. The apple tree depends on the sun and the rain.

_____4. The grasshopper often lays two hundred eggs at a time.

_____5. Some kinds of wheat are more resistant to rusts than others.

_____6. Each dandelion blossom contains a great many seeds.

_____7. Very few plants can grow on windy mountain tops.

_____8. A child resembles his father.

_____9. Only ten raspberry bushes were able to stand the cold of last winter.

_____10. The African negro has kinky black hair.

Three of Mendel's laws are given below. The following experiment illustrates them. Before each write the letter of the law which best applies:

a. The law of dominant and recessive characteristics.

b. The law of unit characteristics.

c. The law of segregation.

_____1. Pure white corn x pure white corn produces pure white corn.

_____2. Pure yellow x pure green peas produce all hybrid peas.

_____3. Pure green x hybrid yellow produce one-half pure green and one-half hybrid yellow.

_____4. Hybrid yellow plus hybrid yellow produce one-fourth pure yellow, one-half hybrid yellow, and one-fourth pure green.

_____5. Pure yellow corn x pure yellow corn produces pure yellow corn.

Solve the following problems using the following information. Capital letters indicate dominant characteristics. Small letters indicate recessive characteristics. Use a capital letter and a small letter to indicate hybrids.

1. W X w produce _____
2. Y X w produce _____
3. B X p produce _____
4. Yg X Yg produce _____
5. S X S produce _____
6. Wx X Wx produce _____
7. H X S produce _____
8. R X R produce _____
9. r X r produce _____
10. Ab X Ab produce _____

Tell briefly the story that a hereditary study of the following families has shown:

1. The Edwards.
2. The Jukes.
3. The Kallikaks

Write a brief report showing how it is possible to improve living things by selection.

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