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REVIEW OF RECENT RESEARCH ON METHODS OF TEACHING.

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SIXTY SOURCES ON TEACHING METHODS, MOST PUBLISHED BETWEEN 1958 AND 1964, ARE REVIEWED AS A BASIS FOR POSSIBLE REVISION OF COLLEGE COURSES ON METHODS. EIGHT DEAL WITH DEFINITIONS OF INSTRUCTION AND TEACHING, FIVE WITH THE TEACHER, NINE WITH GROUPING, 15 WITH HEURISTIC METHODS, FOUR WITH PROBLEM SOLVING, AND 19 WITH CREATIVITY. A SUMMARY LISTS THE FINDINGS IN EACH CATEGORY AND THEIR IMPLICATIONS. REPRESENTATIVE ENTRIES ARE--(1) SKILLED TEACHERS UTILIZE SELF-DIRECTING SMALL GROUPS, (2) TEACHERS NEED TRAINING NOT ONLY IN SUBJECT MATTER BUT ALSO IN MANY OTHER ABILITIES AND BEHAVIORS WHICH WILL DEVELOP SOCIAL AND LEARNING SKILLS, (3) STUDENTS BENEFIT FROM INDIVIDUAL ASSISTANCE AND WORKING IN SMALL GROUPS, (4) THE EFFECTIVENESS OF HEURISTIC METHODS APPEARS TO DEPEND UPON THE SKILL OF THE TEACHER IN HELPING THE STUDENTS TO FIND OUT THINGS FOR THEMSELVES, (5) IN EVERY AREA OF THE HOME ECONOMICS CURRICULUM, STUDENTS CAN BE GUIDED TO SEEK ANSWERS TO PROBLEMS, AND THE TEACHER SHOULD AVOID PROVIDING THE SOLUTIONS, AND (6) THERE IS A POSITIVE CORRELATION BETWEEN CREATIVITY AND THE TEACHER'S SHOWING PERSONAL INTEREST IN THE STUDENT. THIS ARTICLE WAS PUBLISHED IN "ILLINOIS TEACHER OF HOME ECONOMICS," VOLUME 9, NUMBER 1, 1965. (MS)

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REVIEW OF RECENT RESEARCH ON METHODS OF TEACHING

By

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The teacher education curriculum in many colleges and universities traditionally includes courses in methods. This investigqtion was undertaken to find out what research has pointed up in recent years concerning methods. These findings could be used as a basis for the revision of such college courses.

Just what is meant by method: Instruction? Teaching? Dewey (1) said that method means an arrangement of subject matter which makes it most effective in use. Also, method is concerned with facilitating the movement through what is to be learned as expeditiously as possible. Smith and Ennis(2) define teaching as a system of actions intended to induce learning. B. Othanel Smith (3) states: to instruct is to tell or to show students how to do something, what the case is, or what is desirable or good to do, and so on, and to engage them in conversation. For Smith teaching is a broader term than instruction; teaching includes not only instruction but all of the other things a teacher does in the classroom.

Some current conceptions of instruction are:

1. Instruction consists in providing stimuli to evoke specific responses and reinforcing responses by proper reaction to them; the program of instruction is then made up of a sequence of stimuli punctuated by responses and reinforcements.

2. Instruction is a process of interaction: the teacher does something to the students, the students do something in return. As a result of these reciprocal actions, the student learns.

3. Instruction is both interactive and stimulus-response, plus common-sense observations, and includes such categories as: teacher response to students, pupil behavior and teacher activities.

Smith (3) describes instruction as a form of influence behavior. The teacher not only influences behavior but is also influenced by student behavior. Instructional behavior may then be said to consist of observing, diagnosing, acting. Instructional behavior deals with subject matter as

well as with students.

In further analyzing influence behavior, Smith (3) lists its components. The teacher asks questions, listens and appraises answers; listens to students questions; reprimands, approves, or reacts neutrally to students. He tells them how to do something or shows how it is done. He listens to students tell how to do something or observes their efforts to do it. The operations of the teacher are the means by which he arranges or maneuvers the subject matter of instruction. They are geared to such outcomes as definitions, explanations, evaluations, and classifications. The teacher's strategies are directed to the control, not of the subject matter of instruction, but of the total situation in such a way that the behavior of the student is directed to a particular end which is more or less clearly visualized by the teacher.

Wright and Proctor (4) classified the content of what mathematics teachers say to their pupils as promotiong (a) ability to think, (b) appreciation of mathematics, and (c) curiosity and initiative. This calls attention to the fact that what the teacher says to the pupil goes beyond the exposition of subject matter. Interaction of the teacher and pupils includes methods, content-related matters, and development of understandings.

Fattu (5) states that the teaching process, being exceedingly intricate, is hedged in with all sorts of pressures: local and regional, social and political, financial and professional, to name but a few. Lindley J. Stiles (6) lists factors influencing instruction: (a) societal structure in which the instruction exists, (b) the particular goals of education being served, (c) theories of learning held by those who teach, and (d) the maturity level of the students.

Not only is the teaching process complex because of the many pressures influencing it but because no one theory has yet been found that satisfactorily explains the learning process. Stiles (6) states that the particular theory or theories held by the teacher may influence the choice of method and the effectiveness of given instructional procedures under specific circumstances.

Wallen and Travers (7) explain the origins of teaching patterns. The most widely used methods are based either on philosophical tradition or on the teacher's personal needs. Philosophies which have influenced teaching are the Rogerian theory which suggests that teachers foster mental health and provide some degree of therapy, and the Rousseau concept that development will proceed harmoniously of its own accord if the child is provided with a suitable environment. The teacher may use the lecture method because he needs to be self-assertive, authoritarian methods because this is the way to control students, etc. Other teaching patterns are derived from teaching tradition, from social learnings in the teacher's

background, from conditions existing in the school and community, and from scientific research in learning.

Little effort has been made to design methods in terms of established principles of learning. Methods have arisen outside of a scientific context. Research on methods of teaching lack sophistication. Studies comparing the effectiveness of two methods are generally studies comparing two largely unknown conditions.

Wallen and Travers (7) state that the era of research involving the comparison of one teaching method to another seems to be coming to a close. Few studies have been undertaken during the last decade. They suggest that workers must surely go back, take stock of their position, and realize that the starting place must be the systematic design of teaching methods. They advise that an attempt should be made to design a teaching method which makes use of a wide range of learning principles. Only then may there be some hope of finding a teaching method that is superior to others not systematically designed.

Even with such a systematically designed teaching method and the best intentions on the part of school personnel, ordinary school and class conditions are not highly suitable for experimentation. Task and method variables ought to be tested under controlled conditions.

Getzels (8) tells us that new methods and materials are like those that they are supposed to supersede in that they are based more on exhortation and testimonial than on empirical demonstration.

Certain teachers regularly and predictably produce in children learning phenomena along indicated lines--what exactly is it that these teachers do that makes the difference? Can this be communicated to others? Can creative thinking and problem solving be taught systematically in the classroom?

The professional teacher will help students plan their work and their lives more effectively, see that they engage in thoughtful, creative interaction as contrasted with the rote learning of imitative reaction. The teacher will become a diagnostician and prescriber for the remedying of weaknesses, and the fortifying of strengths. He will help students correlate, refine, integrate, and interrelate experiences relevant to important learning goals.

The Teacher

Many studies having to do with analysis of the teacher's job, operations, interactions, and relationships in the classroom are found in recent literature but few concerned with the use of specific methods and their effect. Teacher effectiveness and teacher behavior seem to be

related and some of the findings have a bearing on teacher education.

Investigations of Ryans (9) have pointed to some characteristics of teachers which are likely to be positively correlated or associated with teacher effectiveness. A list of these characteristics includes: measured cognitive or intellectual abilities, achievement in college courses, knowledge of the subject matter to be taught, general cultural knowledge, attitudes favorable to students, generosity and tolerance in appraisals of other persons, strong interest in reading and other literary matters, participation in social and community affairs, and early experience in caring for children and teaching (such as reading to children). Ryan (9) warns that these findings should be more useful when results are considered in actuarial context rather than in attempting highly accurate prediction for given individuals.

Flanders (10) found increased pupil learning to be greatest in the classes of teachers who displayed flexible behavior. Flexible behavior was described as behavior that reflected predominantly direct or dominative teacher influence in certain situations, as when the pupil's perception of the goal was clear and acceptable, and predominantly indirect teacher influence in other situations.

Investigation by Heil and Washburne (11) involving increments in pupil learning pointed to a possible inference about the nature of teacher behavior. They reported that pupil gains on the Stanford Achievement Test, pupils' positive feelings, and children's social acceptance of one another suggested self-controlling, orderly, and work-oriented behavior of the teacher.

Bowers and Soar (12) concluded from their studies of teacher effectiveness that teachers with high social skills rely less on individual seat work, assignments in workbooks, individual reading, written work of all sorts, and use more activities which involve interaction between pupils, in other words: more pupil interaction and less of either teacher-pupil interaction or solitary work on the part of the pupils. Skilled teachers utilize self-directing small groups of pupils more than do less skilled teachers. Self-direction and pupil participation were found to be more typical of classrooms of more skilled teachers. Social skills which pupils learned (skill in cooperative work and planning) were greater in the classrooms of skilled teachers.

Turner and others (13) in a series of studies reported that effective teachers are persons who are good solvers of problems in a wide variety of teaching situations. Results indicated that pupils taught by high scoring teachers--good problem solvers--in grades four and five attained significantly greater achievement than pupils taught by low-scoring teachers in the same grades.

Grouping

There are few studies relative to grouping found in current literature in comparison to the wide use made of various kinds of grouping in the schools. Scientific investigation is difficult and conclusions must be tentative. Several studies have reported the effectiveness of teaching large and small groups.

Nachman and Opochinsky (14) compared the achievement, as measured by examination performance, of college students in a small class with a matched group of students in a large class. Results showed that the students in the small class made higher scores on quizzes that covered material presented in the classroom, but that the two groups did equally well on final examinations for which they studied.

Siegel, Macomber, and Adams (15) compared the learning outcomes of large-group and small-group instruction on the college level. Achievement was measured by the final examination. Students in the large groups did as well as those in the small groups. Students with high ability performed equally well on tests regardless of instructional procedures, whereas students with low ability occasionally suffered by assignment to a large class. Tests in critical thinking and attitude change did not consistently favor the experimental large-group instruction.

In another investigation of group size and effectiveness of teaching, Siegel, Adams, and Macomber (16) found no significant difference in the effectiveness of large-group and small-group instruction.

In studying a group of 128 fourth-grade pupils, half working in small groups and half as individuals, Hudgins (17) found no differences in individual problem solving.

Blue (18) reported significant results in a study of college students in a sociology course. Students who studied in groups made higher achievement scores than students who studied independently. Also, all but the exceptional student improved when studying in an organized group.

Beach (19) used lecture, discussion and small-group and independent study in organizing a course in educational psychology. He concluded that the less sociable students achieved more by lecture and that the more sociable students achieved more by the small-group procedure.

Klausmeier, Wiersma, and Harris (20) found that individuals who worked alone did less well on initial learning tasks than did subjects who practiced in pairs or in groups of four. On measures of transfer, individual learners attained a higher level of performance than did paired or grouped learners.

In an effort to initiate and evaluate learning in skill subjects when pupils worked in teams, McHugh (21) worked with fourth-grade, fifth-grade, and sixth-grade pupils. The achievement gain apparently due to this procedure was significant for grades five and six; no gain was reported

for grade four. Reading and language improved in grade six, arithmetic in grades five and six, and spelling in all grades.

Gurnee (22) found no evidence of social facilitation when a group worked on a common task, although this has been one of the major arguments for grouping. Imitation of more successful group members appeared to account for the superiority of a group arrangement over individual learning situations.

Heuristic Methods

During the past several years much has been written about programmed teaching, computer technology, and so forth. Some new terms have appeared in isolated items which indicate that there has been a shift from an operational base to a theoretical base in the definition of learning processes in which inferred processed become the descriptive categories of human learning. New methods of instruction have a heuristic basis: students are trained to find out things for themselves.

Henderson (23) tells of two methods used in teaching secondary school mathematics. The issue has been that of determining the consequences of "tell-and-do" and "heuristic" methods. The former consists of the following steps: (1) stating the item of knowledge, (2) clarifying the meaning, (3) justifying the item, (4) clinching the understanding (often done by having students work problems based on the knowledge being taught), and (5) making a transition to the next item to be taught. The second method, heuristic or discovery, calls for the teacher to direct the student's attention to some data. The student infers from these data. If his inference, as evidenced by his verbal or nonverbal behavior, is correct, the method terminates. If his inference is incorrect, the teacher utilizes the same method with new data or selects another heuristic method which will allow the student to converge on the correct knowledge. But the teacher does not state the item of knowledge; the student discovers it.

Cited by Henderson (23) is the unpublished study of Nichols in the teaching of geometry. Two groups were taught for the same length of time, but one was taught by a dependence approach (tell-and-do) and the other by a structured search approach (heuristic). On the basis of tests measuring various kinds of ability and skills, the researcher concluded that the two approaches were equally effective for high school freshmen whether of average or superior IQ. Other investigators have measured a difference in groups taught experimentally. The evidence has not been conclusive so the reader must draw his own conclusions.

In presenting sets of verbal materials to be learned the problem is to organize the first set in order to facilitate the learning of the second set. The initial material is known as an advance organizer. Ausubel and his associates (24, 25, 26) attacked this problem in a series of studies. In one they hypothesized that advance organizers used

to increase the discriminability of the two sets would facilitate learning and retention. Comparative, expository, and historical organizers were used with different groups. One group was to compare and contrast Christianity and Buddhism, for another group principal ideas of Buddhism were described, for the third, historical and human interest materials on Buddhism were presented. On a test given after three days, the group exposed to the comparative organizer performed significantly better than did the other two groups. It was concluded that unfamiliar material was learned and retained to the degree that the existing concept structure was clear and stable. After ten days both the comparative and expository groups achieved a higher measure of retention than did the historical group. It would appear that the effects of the advance organizer are limited. The effects seem to be attenuated by prior knowledge, which itself may be acting in some way as an organizing variable.

Wittrock (27) reasoned that the organizers employed by Ausubel and associates served to induce a set that actively engaged the subjects in utilizing their prior knowledge. He repeated the studied with slight variations in the organizers. Groups were given instructions to compare, to compare and contrast, to understand and remember. The two groups asked respectively to compare and to compare and contrast did significantly better on measures of learning and retention than did the groups directed to understand and remember.

A term used in recent literature is discovery learning, which McDonald (28) describes as an omnibus category. A basic characteristic is that of confronting the learner with a problematic situation in which he must devise a solution, discover a principle, or explain some phenomenon. Taba (29) says "Learning by discovery as pursued today pertains largely to cognitive aspects of learning: the development and organization of concepts, ideas, and insights, and the use of inference and other logical processes to control a situation."

Discovery learning involves two aspects: the assimilation of content of some sort and operations of cognitive processes required to organize and use this content. The learner must construct his own conceptual scheme with which to process and to organize the information. Taba (29) continues: "Teaching is directed to enabling the learner to establish a relationship between his existing schemata and the new phenomena and to remake or extend the schemata to accommodate new facts and events. In doing this the learner has to decenter his current view of the situation or of the problem and reorganize his perception of it. He must also build a strategy of inquiry." In discovery learning content is seen not only as an array of facts to be absorbed but as something that has structure, namely, a way of organizing detailed facts in the light of some concepts and principles.

"The act of discovery" says Taba(29), "occurs at the point in the learner's efforts at which he grasps the organizing principles imbedded in a concrete instance or series of instances and can therefore transfer this information. The learner can see the relationship of the facts before him, he can understand the causes of the phenomenon, and he can relate what he sees to his prior knowledge. This point in the learner's efforts is also referred to as the moment of insight."

Learning by discovery has its proper place among accepted techniques available to teachers, states Ausubel (30). For certain designated purposes and for certain carefully specified learning situations, its rationale is clear and defensible. Ausubel (30) says that learning by discovery can be used effectively when the learner is in the concrete stage of logical operation and is dependent both on empirical props and on a preliminary phase of intuitive, subverbal insight for the learning of complex abstractions. It can also be used in the early stages of teaching older individuals a new discipline.

Learning by discovery has obvious uses and advantages in teaching the problem-solving technique and methods of scientific inquiry within a given discipline and in testing for meaningful comprehension of material learned through didactic exposition. To ascertain whether learners genuinely understand or have merely memorized a given abstract proposition, there are few better methods than to require them to solve problems involving application of that proposition.

Discovery methods are not unique in their ability to generate self-confidence, intellectual excitement, and sustained motivation for learning. Good expository teaching can accomplish these same objectives. Learning by discovery is not the only way of arriving at meaning--much learning can be accomplished by other methods, such as deduction, logical inference, or some form of exposition by the teacher or even by reading a book. The task of the teacher is to provide an appropriate balance between discovery learning, which requires depth study, and other types of learning in order to assure scope, continues Taba (29). This depth study needs to be reserved for points at which new families of concepts or ideas are introduced. And, these experiences need to be alternated with types which extend information, generalizations, or their application in order to insure adequate scope.

The discovery method is time consuming and therefore the scope of coverage is limited. However, Bruner (31) tells us that with the discovery method one gets greater mileage from learning. Discovery methods are often rationalized in terms of the currently fashionable slogan that the school's responsibility is to make every child a critical and creative thinker. Ausubel (30) says that the school can help only in actualizing its expression in those rare individuals who already possess the necessary potentialities.

To test the effects of the discovery method, a contrasting method must be used, usually one in which some form of direction is given. Kersh (32) set up three groups: the first employed guided discovery; the second, a directed-learning approach; and the third, a rote-learning procedure. The task was to discover a set of mathematical rules. On measures of retention and transfer, the level of performance of the guided discovery group was intermediate between the level of the rote-learning sample that was highest in achievement and the level of the directed-learning sample that was lowest. However, more individuals in the guided-discovery group than in the other groups reported using the rules.

In an experiment with a code-deciphering task, Wittrock (33) asigned subjects to treatments in a factorial design as follows: (a) rule given, answer given, (b) rule given, answer not given, (c) rule not given, answer given, (d) rule not given, answer not given. When measured for immediate learning, those given the most direction (those given the rules) did show a significantly higher performance level than did the groups not receiving the rules. However, the discovery group, which was given neither rule nor answer was the only one that had retention scores higher than learning scores.

Proponents of the discovery method argue that a premature verbalization of the generalization or the rule deprives the individual of the essential learning. The learner must be able to reorganize his own cognitive structure. If verbalization prevents this, the learner is put in the position of absorbing the generalization without necessarily understanding what it stands for or how to work it.

Ausubel (34) states that discovery methods are primarily useful for evaluating meaningful outcomes and for teaching problem-solving techniques, appreciation of scientific method, and awareness of the sources of knowledge, but not for transmitting subject matter content.

Another "new" method with a heuristic basis is inquiry training. Of this method, Brown (35) asks: "Which came first, knowledge or inquiry? This is the same silly argument as to which came first, the chicken or the egg. The teaching-learning process can begin with either inquiry or acquisition." There needs to be a balance but both cannot be emphasized at the same time. Also the factor of maturity enters in, what is a problem worthy of inquiry for a child would be just common knowledge for an adult. Consider the child who is learning how to tie his shoe laces. This is a problem of experimental inquiry for the four-year-old but ought to have long been reduced to a satisfactory skill for the ten-year-old.

Suchman (36) has developed a program for training in inquiry skills with reference to science instruction. He conceives that some dissonance is necessary for the development of such skills: a puzzling problem, a lack of structure. However, induction of relational constructs or discovery depends on existing conceptual systems in the child. He believes that, under the right conditions, children can acquire the attitudes, skills, and strategies that are fundamental to inquiry regardless of the area.

In Suchman's investigations twelve classes in a variety of elementary schools were exposed to inquiry training. Groups of children were shown short films of simple physics demonstrations that pose problems of causality. Control groups were taught scientific principles in the usual didactic manner but experimental groups were asked to construct an explanation and to show why it had such results. To do this the children must obtain infromation not given in the film; the teacher became the source of data. They asked questions which could be answered by "yes" and "no". By requiring a child to talk, the teacher can get a clearer picture of how he is thinking. The groups did not differ significantly on a measure of conceptual growth in physics. Inquiry subjects asked more questions, both general and analytic. The general conclusion appeared to be that the inquiry subjects learned to ask more questions of the type for which they were trained, although results were frequently confounded by a fluency factor.

In this method of instruction, says Suchman (37), children are helped in three ways to build inquiry skills: to build a general operational schema for inquiry, to practice gathering data and constructing explanatory systems, and to evaluate critically their past inquiries. The child sees something happen which has an outcome he could not have predicted. Suchman wants him to take the initiative, to piece together explanations under his own power. Children who discover that they are able to formulate a rule or a law from a series of concrete observations or experiments come to realize that they are able to find ways of predicting and controlling their environment.

Suchman (36) divides inquiry into four main types of action: searching, data processing, discovery, and verification. No attempt is made to teach children how to invent or adapt conceptual systems. However, one of the ultimate goals of education is to create an awareness and use by the individual of his conceptual system. The teacher should be able to assist students in the formation of these systems.

Problem Solving

In research on problem solving and its effectiveness, it has been found that students who were taught to follow a particular method or procedure were actually taught not to think; they used the same procedure when given a different type of problem. Problem solving is designed to help individuals meet their needs more adequately in the basic aspects of living and to stimulate them to participate more effectively in the affairs of the democratic society to which they belong.

Giving students instructions to generalize a method of solution has a tendency to increase their "set" or inflexibility toward attacking and solving problems. Some studies have shown that students who worked

on a variety of problems where no single attack was successful learned to be flexible. However, those who had continued success with one method used it rigidly even where it was incorrect.

Even though many writers state that it is not usually possible to teach a definite procedure for dealing with a problem, others have advocated the hard-and-fast sequence of Dewey's (38) phases of reflective thinking (a. defining and analyzing the problem, b. establishing criteria by which to judge proposals, c. finding possible solutions, d. evaluating proposals in order to reach a solution, and e. planning how to put the selected proposal or solution into effect).

Brilhart and Jochem (39) investigated the outcomes of different problem-solving discussion patterns in which ideation, criteria, and evaluation, were separated or combined and in which the sequence of ideation and criteria were changed. They found that emphasis placed on value and quality during problem-solving discussion evidently dampens the expression of ideas. There seemed to be a greater preference for the idea-criteria-evaluation pattern over the criteria-idea-evaluation pattern. This possibly indicates that talking about criteria apart from definite ideas to be judged may be artificial and frustrating. A number of current textbooks and manuals advise establishing criteria before attempting to find solutions. This appears dubious at best and harmful at worst.

In brainstorming the processes of ideation and evaluation are separated. There is little information concerning the effect of this. With the type of problems and experimental groups used, brainstorming tends to produce more tentative solutions and more good tentative solutions. Parnes (40) compared the production of ideas across time periods. Subjects were instructed to think of as many uses as possible. Their responses were scored for uniquenes. More good ideas were found in the second half of the test period than in the first. Maier and Hoffman (41) found that ideas produced later in the problem-solving process tend to be superior to those produced first. Methods for delaying decision-making appear to have merit for both individuals and groups.

The mechanized application of problem solving can become a thought-inhibiting rather than a thought-provoking device. Problem solving should develop originality and diversity in thinking. A wide variety of teaching methods should be used to help students develop their own abilities in decision making. The teacher's role is to help students seek relevant knowledge, understand important values, analyze possible alternatives, and project possible consequences in dealing with different problems.

Creativity

A topic which has attracted recent attention is creativity training. A large amount of evidence has been obtained indicating that

teachers and school procedures are combining to frustrate and discourage any creative tendencies shown by students. The student who is different, imaginative, curious is apt to be regarded as an "odd-ball". If creativity is to be considered an important element to be fostered in our schools, substantial changes will need to be made. What is creativity? What are the characteristics of creative individuals? What conditions in the classroom will allow for the development of these potentialities?

Creativity is the process of sensing problems, forming ideas or hypotheses, testing hypotheses, and communicating the results. As contrasted to conformity, it is a successful step into the unknown. Creativity involves divergent thinking, that is, speculative in that it takes off from information already possessed, in contrast to convergent thinking which uses information to converge on an already-existing answer.

The creative person is a fluent, flexible and elaborate thinker, states Guilford (42), and he is inclined to be on the impulsive side. More than most, he lets his feelings and emotions dictate action, but he is also a reflective thinker. He likes to ponder over the nature of things, about why people behave as they do. The creative person is also self-assertive, self-sufficient, tolerant of ambiguity. He may welcome disorder and complexity.

Taylor (43) summarizes the characteristics of creativity as follows: Ability to sense problems is an intellectual characteristic included in creativity. Ability to sense ambiguities plus effective questioning ability may be important in creative activity. Also, motivational characteristics suggested are curiosity or inquiringness of mind, liking to think, liking to manipulate and toy with ideas, intellectual persistence, need of recognition of achievement, need for variety, effective work habits, high energy, and willingness to take long-range risks.

Other personality characteristics listed by Taylor are: devotion to autonomy, more self-sufficient than most people, more independent in making judgments, more complex as a person, more self-accepting, more resourceful and adventurous, more radical, more controlling of his own behavior, possibly more emotionally sensitive, and more introverted but bold.

Torrance (44) describes creative individuals: they can tolerate a great deal of ambiguity, do not have a pressing need for immediate answers, can tolerate hypotheses of a highly speculative sort.

Barkan (45) drew some conclusions concerning the developing process of creativity through the observations of a small number of elementary art classes: Children show greater spurts of growth at some points than at others. The degree of growth from first to second grade seems to be more dramatic than from kindergarten to first grade. The insatiable curiosity of second graders about the "why" and "how" of

things changes into a more alert quest for explanations in the third and fourth grades. Most fourth graders tend to be perfectionistic and easily discouraged by adult pressure.

Little attention has been given to developmental phenomena during high school years but most existing evidence is fairly consistent. Investigators report a decline in imagination functioning between sixth and seventh grade and on into the eighth. There follows a period of fairly steady growth until about the end of the high school period at which time there is a leveling off or a slight decline.

Twelve to fourteen year olds need help in developing specific short-range goals and in making a tentative vocational choice around which to organize present activities. Young people at this age should not be asked to be too different from their peers.

For fourteen to sixteen year olds much of the imaginative activity seems to be focused on a future career. Adventure is the keyword for all phases of life for both sexes. The youth worries about peer acceptance and his fears cause him to avoid situations which involve exploration, testing abilities and such. This is the time for learning the skills of creative problem solving and for practicing the skill of finding "third alternatives" which are creative solutions, advises Barkan (45). Students can be stimulated to list all the things they can and cannot do in "hopeless" situations.

Sixteen to eighteen year olds need to give the imagination full rein as they sort what is and is not important. Their interests are usually stable enough to be assessed along with special aptitudes. This is a good age for vocational testing and guidance. Adults need to make themselves available and to provide provocative "food for thought" in classes. Aesthetic interests and skills should be encouraged. Youths need help in finding creative ways to stand by their beliefs and to practice their social ideals.

MacKinnon (46) compared a number of architects, research scientists, and student engineers with individuals judged not to be highly creative in these fields of endeavor. Measures of art preferences, personality scales, and intelligence tests were used. The subjects, who were rated to be highly creative, exhibited a greater tendency to show independence of judgment, to be more esthetically sensitive (except in the instance of the engineers), to give more expression to the feminine side of their nature, and to be open-minded.

One way in which an individual searches for his uniqueness is through his vocational choice. Getzels (47) found that his highly creative subjects gave a greater number of different occupations and more "unusual" or rare occupations than his highly intelligent subjects.

Barron (48), in studying one hundred Air Force captains, found that originality was associated with traits of independence of judgment,

need for personal mastery, rebelliousness, disorderliness, exhibitionism, and self-centeredness.

Getzel and Jackson (49), and Torrance (50) in studies of creative students and creativity in the classroom suggest that teachers tend to prefer in their classes students with high IQ's, that is, with highly developed convergent thought processes, over the average student, but not to prefer students with highly developed divergent thought processes.

Sears (51) has shown that there are positive correlations between creativity and teachers' rewarding by personal interest in the child's ideas, accompanied by high frequency of listening to the child. Such teaching techniques probably provide an atmosphere in which the child can permit himself more leeway in expression of unconventional ideas without the threat of devastating criticism. A condition of creative thinking in the classroom, as elsewhere, is an optimum balance of stimulation. The nature of this balance for given students, teachers, and subject matter is unknown.

Spaulding (52) attempted to relate attributes of teachers and classroom climate dimensions to a number of variables, including flexibility and originality. He recorded teacher-pupil transactions at the fourth- to sixth-grade level in a number of schools. According to his measures, two teacher styles were negatively correlated to flexibility and originality. In one style, the teacher responded primarily to the social and emotional qualities of the pupils rather than to their cognitive performance. In the second style, the teacher created a formal group-instruction situation, in which teacher control was maintained by shame, ridicule, or admonition.

Newell, Shaw, and Simon (53) summarized a large body of research on computer programming and problem solving. They maintained that creativity is nothing but problem solving in a novel and difficult situation. They suggested that not only problem selection but also the process of evaluating alternate strategies may be key aspects to creative thinking.

Anderson and Anderson (54) trained sixth-grade children to produce novel responses in the form of unusual uses of familiar objects. The test included novel uses of familiar objects that had not been used in training as well as some insight problems that could be solved through use of objects in novel ways. The trained subjects performed significantly better than the control group on novel uses of objects that had not been employed in training, the two groups did not differ on the insight problems.

Torrance (55) experimented with teaching creative thinking to children in the first three grades. He found that in the second and third grades, the trained children were consistently superior to the untrained children in all his measures of creative thinking. Using Osborn's (56) principles for stimulating new ideas (i.e., instructions to produce a large number of ideas without regard to quality) resulted

in fewer responses than instructions to produce interesting, unusual, and clever ideas.

A study by Taylor, Berry, and Block (57) suggests that it is the instruction to "let go" and express all ideas that is crucial and that doing so in a group may actually have a harmful effect on the process. They found that, as compared with twelve nominal groups (i.e., groups composed artificially of four individuals each who actually worked alone), the performance of twelve real groups (i.e., groups composed of four individuals each who actually worked together) was markedly inferior in the quantity, originality, and quality of ideas.

What are conditions in the classroom that promote creativity? Anderson (58) discussed open and closed systems of education and the effect of each on creativity. The open system accepts uniqueness in perception and thinking. Methods used are the seminar, class discussion, term papers, experiments, and student projects. The open system permits originality, experimentation, initiative, and invention. The closed system is concerned little with originality or invention by the student; the concern is mainly with acquiring a body of knowledge and memorizing facts. The student has only to learn what has already been discovered or agreed upon. He learns to follow directions and to do what he is told. It is in this system that the heritage of the race is preserved.

The closed system, as defined by Anderson, contributes to the development of inflexible and noncreative persons. The open system, on the other hand, facilitates the development of creative imaginative persons increasingly able to change in light of new knowledge and new requirements.

Torrance (44) suggests that it might be helpful to encourage children to deal with alternative answers, to put off formulating answers until a range of possibilities has been explored. He gives other hints about fostering creativity: (1) Creative individuals seem to need psychological safety such as is provided in the rules for brainstorming where no criticism is allowed during the sessions. (2) Individuals need to have experience and skill in the subject area if they are to function in a highly creative way: they need to be able to control the syntax and techniques of the area in which they are working. (3) Creative behavior, like most other types of behavior, should be appreciated when it occurs (behavior that is rewarded tends to persist).

Scofield (59) gives rules for teachers who wish to help pupils learn freedom of inquiry and become creative.

1. Encourage pupils to progress at their own pace.

2. Permit varying approaches by pupils to the subject matter.

3. Permit pupils to struggle with a problem, try different resources and tentative solutions, and experience the final exhileration of solving it themselves.

4. De-emphasize any need for immediately giving the "right" answer but encourage many trial answers.

5. Refrain from giving punishment in any form for attempted incorrect responses.

6. Do not consider rote memorization or imitation of textbook thinking as good learning.

7. Provide procedures by which evaluation of progress is commensurate with ability to progress.

Scofield continues by emphasizing that creative adults and creative citizens can be developed by plenty of practice in a classroom where the climate is supportive and where each child is given freedom to learn by himself with supportive guidance from the teachers.

If teachers believe that a major concern of education is to help every child become his best self, they certainly must use the methods which will allow each one to develop his creative potential.

Briggs (60) gives some generalizations regarding the method of teaching used:

1. Attitudes and value judgments are relatively unaffected by the manner in which the students are taught.

2. Some students respond better to one method than to another depending on their own personality and psychological needs.

3. Students taught permissively usually do about as well as others on objective tests of knowledge at the end of the course.

4. Students tend to be most dissatisfied with a permissively-taught course, and experience (especially at the beginning) a sense of frustration and lack of achievement.

5. As a result of the problem-solving method of teaching students tend to show personality growth and an improvement in emotional and social adjustment and self-insight.

6. Individual differences among students are more important than differences of instructional technique in determining the educational impact.

7. The most effective class is one in which the content is organized to facilitate team activities, a good rapport exists between student and teacher, a considerable amount of authority is delegated to students, and the grading system is designed to encourage incentives to group activity, participation, and responsibility.

SUMMARY

Findings based on previous discussion	Implications for teaching home economics
The Teacher	
Characteristics associated with teacher effectiveness are:	
measured cognitive or intellectual abilities (9)	In preparing for teaching, knowledge of subject matter is important but a number of other factors appear to help to make effective teachers. Persons who will be in a vocation where they deal with people, and especially those in teaching, would do well to get many kinds of experience in participation and leadership. These include participation in school, church and community affairs, working with others in committee work, holding office in small and large organizations and fulfilling responsible positions as a follower as well as a leader.
achievement in college courses (9)	
knowledge of subject matter to be taught (9)	
general cultural knowledge (9)	
attitudes favorable to students (9)	
generosity and tolerance in appraisals of other persons (9)	
strong interest in reading and other literary matters (9)	
participation in social and community affairs (9)	
early experience in caring for children and teaching (9)	
self-controlling, orderly, and work-oriented behavior (11)	The teacher should be aware of her own goals as well as those of her students. She should not force her goals on students and should move cautiously in giving guidance when student goals are unclear.
flexible behavior (10)	Teacher example is more apt to be followed than teacher exhortation so it would behoove the teacher to see that she acts as students should learn to act.

high social skills (12) good problem-solving ability (13)	Students follow the example of the teacher and will gain not only in social skills but will be better able to work cooperatively and be self-directing.
Skilled teachers utilize self-directing small groups (12)	In preparing for teaching, emphasis should be given to practice with small groups and possibly with having groups work in different ways. Having every student do the same thing at the same time is not being flexible. Following the needs of individual students and allowing each to work at his own rate and in his own way will help him learn step by step to be self-directing.

Grouping

Size of class:

Students in a small class made higher scores on quizzes that covered material presented in the classroom (14)	Teachers of home economics might consider this an indication that pupils profit from individual assistance or perhaps from some personal contact with the instructor. If classes need to be large, some of the work might be accomplished through groups.
Students with low ability sometimes suffered by assignment to a large class (15)	

Pairing or grouping:

In sociology class, students who studied in groups made higher achievement scores than those who studied independently (18)	The teacher might assign groups for study periods. (Earlier research showed that students worked better with groups of their own choosing.)
Less sociable students achieved more by lecture and more sociable achieved more by small group study (19)	Realizing that some students profit from lecture, the teacher could use this method occasionally where subject matter lends itself to this method.

Students who practiced initial learning tasks in pairs or groups of four did better than those who worked alone. Individual learners gained more on measures of transfer (20)	In working out answers to problems small groups might gain more in the various areas of home economics: clothing construction, adequate food for the family, play school, interior decoration, and others. Once some answers have been found by members of a group, a student would do better to work individually to transfer the learning as in a "practical" exam or in doing a home experience.
Imitation of more successful group members appeared to account for the superiority of a group arrangement over individual learning situations (22)	It would be advisable to change the personnel of the groups so students would have the opportunity to experience and imitate successful group members.

Heuristic Methods

The effectiveness of heuristic methods appears to depend on the skill of the teacher in drawing out the students to find out things for themselves (23)	The teacher should allow time for the students to get their own answers. She must remember that it would be faster to give them the answers but the information may mean more if they "discover" it.
Advance organizers seem to help in learning if the organizer is a part of prior knowledge of the student. Comparative and expository organizers enhance retention (24, 25, 26)	Background information in such areas as: nutrition (findings about food elements, stories of discovery of vitamins, stories about various foods) nutrition in time of cave man and today, child care then and now, home furnishings, compare and contrast in 19th and 20 centuries can be used. Have students search for background material needed for these and others.
Retention seems to be greater when students must search for answers (27, 33)	
Premature verbalization of the generalization or rule deprives the student of the essential learning (30, 31)	Students should be led to state the rule or generalization involved when they reach the moment of "insight" for it is only in this process that the information becomes meaningful to them.

Discovery learning involves two aspects: assimilation of content and operations required to organize and use this content (29)

In asking questions the student is becoming more fluent and questions asked indicate to the teacher the extent of learning that is taking place. The student is also learning a process which will be useful to him when the teacher is not there to guide him.

Problem Solving

Students who learned to solve a variety of problems where no single attack was successful learned to be flexible.

Emphasis placed on value and quality during problem-solving discussion seems to dampen the expression of ideas (39)

Talking about criteria apart from definite ideas appears to be artificial and frustrating (39)

In every area included in the home economics curriculum students can be guided to seek answers to problems. The teacher should avoid providing solutions but should give the pupils freedom to search for them. Freedom of discussion of solutions can be allowed with the teacher pointing out reasons for choices.

A variety of problems should be used so that no single method of attack will be successful.

In brainstorming, more good ideas seem to be produced during the latter part of the session (40, 41)

Plenty of time should be allowed for ideas to develop. The teacher should not expect all ideas to be good ones, but these may lead to better ones.

Creativity

Characteristics of creative persons:

fluent, flexible, elaborate thinker (42)

self-assertive, self-sufficient, tolerant of ambiguity (42)

curiosity or inquiringness of mind (43)

The teacher should encourage students to deal with possible solutions, allow time for speculating with these, and wait for an answer until many possibilities have been examined. She should guide students in evaluating alternate answers.

She should allow for flexibility in dealing with subject matter.

liking to manipulate or toy with ideas (43)	Recognition should be given for ideas and possible solutions.
intellectual persistence (43)	
need of recognition of achievement (43)	
resourceful and adventurous (43)	
emotionally sensitive (43)	
toleration of highly speculative hypotheses (44)	
There are positive correlations between creativity and teachers' rewarding by personal interest in the student (51)	The classroom atmosphere should allow each student to be accepted and to be aware that he will not be shamed or ridiculed if his responses are unusual.
Not only problem selection but also the process of evaluating alternate strategies may be key aspects to creative thinking (53)	
The open system of education permits originality, experimentation, initiative, and invention (58)	Methods used in the open system would be seminar, class discussion, term papers, experiments, and student projects (58)

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