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A Study of How Children Can Be Taught to Think Better

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A STUDY OF HOW CHILDREN CAN BE TAUGHT TO THINK BETTER

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By

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CHAPTER I

INTRODUCTION

The Problem and the Need for It

This study was concerned with ways to improve the thinking of upper elementary school children. An attempt was made to analyze classroom situations which do and do not help children learn to think, and to make suggestions for developing skills in thinking. Criteria were developed by the writer and were presented to upper elementary classroom teachers to help them evaluate themselves in teaching children to think. This problem was the study of how classroom teachers can teach children to think better.

If the democratic way of life in the United States is to survive and the world tomorrow is to be a good place in which to live; then the schools must assume the responsibility of educating boys and girls so that they will have the ability to solve the ever-changing problems of the present and future.[1]

Although teaching children to think has long been one of the major objectives of education,[2] it is "...comparatively

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[1]William Heard Kilpatrick, Philosophy of Education (New York: The Macmillan Company, 1951), p. 418.

[2]John Henry Melzer, "What is Functional Logic?" Peabody Journal of Education, XXX (September, 1952), 80.

new for schools to seek ways whereby they may effectively and directly teach pupils to think."[1] The writer feels that teaching children to think better at all maturity levels is the best assurance teachers can give children for solving present and future problems. Before teachers can teach children to think, they must know what skills in thinking can be taught and how they can be taught. Therefore, it was the purpose of this study to bring together available facts and opinions from widely scattered sources to help classroom teachers evaluate their teaching procedures in relation to what has been done to teach children to think and to make suggestions to stimulate action in improving instruction in thinking.

Definition of Terms

The Dictionary of Education[2] defines "thinking" as a, "Mental activity as distinguished from sensation; may be cognitive or problem solving." Russell[3] says the term "thinking" as frequently used is "...an omnibus term--a mental process with many aspects." In the writer's opinion these different aspects, or types, or kinds of thinking can be divided into two groups:

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[1]Open-Mindedness Can Be Taught (Curriculum Office Philadelphia Public Schools, January, 1949), p. 21.

[2]Carter V. Good, Editor, Dictionary of Education (New York: McGraw-Hill Book Co. Inc., 1945), p. 424.

[3]David H. Russell, "The Development of Thinking Processes," Review of Educational Research, XXIII (April, 1953), 137.

1. Thinking Without a Purpose: In this classification would be the autistic or day-dreaming type of thinking. Dewey[1] says, "To this uncontrolled coursing of ideas through our heads the name 'thinking' is sometimes given." In this same group the writer placed the type of thinking that is the same as believing. Such thoughts are often acquired through tradition and imitation. They are pre-judgments. They are not based upon facts or evidence, hence they are often prejudices.[2] In thinking of this first group, there is no purpose for thinking other than for entertainment.

2. Thinking With a Purpose: All types of thinking included in this group were done for a purpose, to achieve a goal, or to solve a problem. Reflective, productive, critical, creative, and scientific thinking belong to this grouping. It is with these types that the classroom teacher is concerned. For this reason the writer has defined the purposeful kinds of thinking which she used most often by the authorities in their writings since 1945.[3]

Reflective Thinking. This is defined variously as, "The process by which a problem situation is oriented in the context of related facts and implications are drawn out of the perspective of previously

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[1]John Dewey, How We Think (Boston: D. C. Heath and Company, 1933), p. 4.

[2]Ibid., p. 5.

[3]See Bibliography and Selected List of Readings in Appendix.

established truths;"[1] or "The kind of thinking that consists of turning a subject over in the mind and giving it serious and consecutive consideration."[2] It "... involves not simply a sequence of ideas, but con-sequence-a consecutive ordering in such a way that each determines the next as its proper outcome, while each outcome in turn leans back on, or refers to, its predecessors."[3]

Critical Thinking. "Thinking that proceeds on the basis of careful evaluation of premises and evidence and comes to conclusions cautiously through the consideration of all pertinent factors."[4]

Creative Thinking. "Thinking that is inventive, that explores novel situations or reaches new solutions to old problems, or that results in thoughts original to the thinker."[5] Boraas[6] says, "All effective thinking is creative in the sense that it is not a mere repetition of something learned. It is a variation, an adaptation, an invention."

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[1]Good, op. cit., p. 424.

[2]Dewey, op. cit., p. 3.

[3]Ibid., p. 4.

[4]Good, op. cit., p. 424.

[5]Ibid., p. 424.

[6]Julius Boraas, Teaching to Think (New York: The Macmillan Co., 1922), p. 14.

Constructive Thinking. Synonym for creative thinking.[1]

Scientific Thinking. "Reasoning from systematic observation to generalizations, which are verified wherever possible by experiment or further observation."[2]

Productive Thinking. The meaning of productive thinking should be broad enough in scope to include mental activity which produces a new result from what is already known. By new is meant novel to the individual involved. It refers to an act of the individual's mind apart from the fact that the result of that mental action may not have been achieved by someone else at an earlier time.... Wherever there is progress by the use of the mind, there is productive thinking.[3]

The writer summarized the following likenesses in the above kinds of thinking:

1. All were purposeful mental activities.

2. All depended on past experiences, facts, and evidence to reach this purpose.

3. These facts and experiences were put together in a new relationship with each other in order to reach a new result.

4. All aimed at solving some question, perplexity, or problem.

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[1]Good, op. cit., p. 424.

[2]Ibid., p. 425.

[3]G. W. Stewart, "Can Productive Thinking Be Taught?" Journal of Higher Education, XXI (November, 1950), 411.

5. Thought need only be new to the thinker to be original.

6. Hobson[1] says, "The method of critical thinking is identical in spirit with the scientific method."

These differences in types of purposeful thinking were significant:

1. Reflective thinking often involves use of manipulative materials in solving problems.[2]

2. Critical and scientific thinking test each conclusion through experimentation. Although the scientist may reach the conclusion by insight or inspiration, he cannot accept this conclusion unless it can be proven by the scientific method of experimentation.

3. Many results in creative thinking are reached through insight and inspiration.

The writer used this definition of "thinking" for this study. It is a compilation of the similarities of types of thinking for a purpose. Thinking is a mental process which draws upon past experiences and facts, and rearranges them until a new result is produced which satisfies the purpose of the thinker.

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[1] Cloy S. Hobson, "Teaching Critical Thinking in Our Schools," (Cram's Classroom Classics, III, No. 1, Indianapolis, Indiana), p. 5.

[2] Good, op. cit., p. 424.

Problem Solving Defined. All of the types of thinking for a purpose as defined involved solving a problem of some kind. Skinner[1] says, "We think when we are confronted by a situation for which we do not have a prepared response and which we are unwilling to meet in an impulsive way." When the individual faces "some doubt or perplexity, some dilemma, some problem, some felt need for making a response other than usually made,"[2] the individual is thinking. For this reason the problem solving method was presented in this study as the best way at the present time for classroom teachers to teach children to think.

The Dictionary of Education defines the problem solving method as, "A method of instruction by which learning is stimulated by the creation of challenging situations that demand solution."[3] In this study the writer used this interpretation of problem solving. It is the method of instruction applicable to all types of situations in which children can be taught to think. The importance of problem solving behavior is evident in the following section of this study.

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[1]Charles E. Skinner, Editor, Elementary Educational Psychology (New York: Prentice-Hall, Inc., 1950), p. 320.

[2]Ibid., p. 324.

[3]Good, op. cit., p. 310.

Research on the Improvement of Thinking Abilities

Few research studies have been made on how to teach children to think. "Unfortunately, most of the articles about children's thinking are exhortations or descriptions rather than records of careful research."[1] Russell gives three reasons for this lack of studies of children's thinking:

1. Thinking is an omnibus term. "Because the term is diffuse, it has been difficult to study in an organized way."[2]

2. Thinking can only be studied indirectly by "observing behavior, recording language, or keeping laboratory records.... All we know about thinking must be a product of inductive inference."[3]

3. "No well-rounded theory of children's thinking has been presented as a guide to experimental work."[4]

A study by Grener and Raths[5] showed that the "... thinking ability of third grade children can be measurably improved." The problem solving method was used. Improvement in thinking was measured by tests prepared by the authors.

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[1]Russell, op. cit., p. 141.

[2]Ibid., p. 137.

[3]Ibid., p. 137.

[4]Ibid., p. 137.

[5]Norma Grener and Louis Raths, "Thinking in Grade III," Educational Research Bulletin, XXIV (February 14, 1945), 38.

A study by Flanders[1] showed the relationship between verbalization and problem solving in the seventh grade. What the children said was recorded and evaluated. This investigation showed that children talk about what they are thinking: that verbalization helps to organize what was learned. One purpose of the study was to demonstrate that the language of communication is related to the language of thinking.

Furst[2] discussed studies made by Glaser, Johnson, Wesman, Weisman, and himself to show the relationship between performance on intelligence tests and thinking tests. Both types of tests were given at the beginning of the research. A period of instruction in thinking skills followed. The intelligence and thinking tests were repeated. Furst[3] summarized these investigations, "Although these studies cover a diversity of situations and emphasize different aspects of 'critical thinking', none of them points toward a high relationship. Critical thinking thus appears to be somewhat independent of what is commonly measured as 'general intelligence'."

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[1]Ned Allen Flanders, "Verbalization and Learning in the Classroom," The Elementary School Journal, XLVIII (March, 1948), 385-392.

[2]Edward J. Furst, "Relationship Between Tests of Intelligence and Tests of Critical Thinking and of Knowledge," Journal of Educational Research, XLIII (April, 1950), 614-625.

[3]Ibid., p. 615.

Although the intelligence scores remained about the same of the children tested, the thinking results were higher after a period of instruction.

Summary of Results from These Research Studies. From these investigations the writer drew the following conclusions:

1. Too few research studies have been made on teaching children to think to make any definite conclusion.

2. In all of the investigations, children made a higher score in thinking after a period of instruction; hence, it can be assumed that the thinking of children can be improved.

3. Practice in solving problems was the method used to improve thinking of the learners.

Method of Research

This study was an exhaustive survey of available material in Porter Library of Pittsburg, Kansas. The Joplin Public Library was thoroughly searched. The superintendent of the Joplin Schools, Roi Wood, and the principal of Lafayette School, Joe Loeb, made available their professional libraries to the writer. The personal library of Miss Velda Williams of the Horace Mann Training School of Pittsburg, Kansas was very helpful.

The writer ordered bulletins from Columbia University, New York; Association of Childhood Education, Washington, D. C.; and Science Research Associates, Chicago.

The National Education Association Research Department supplied bulletins and a helpful bibliography.

The writer was fairly confident that she had found all material available in the immediate area on how to teach children to think.

Scope and Limitations

This study was limited to how to teach upper elementary children (grades five and six) to think. It was a compilation of facts and opinions of authorities rather than an application--except in an informal way--of these ideas on how to teach thinking. The writer found a scarcity of sources concerning thinking of this age group.

Since this study was a treatment of applied thinking skills rather than an analysis of theoretical research on the nature of thinking, the psychologists' opinions of how thinking takes place were not included. However, the writer was handicapped by the psychologists' lack of knowledge about how the mind thinks. Having made this study before these data were available, limited the writer to a study of thinking skills as have been developed from the behavior of children resulting from the mental process known as thinking. When scientists are sure how the mind thinks, there may be other more simple and direct ways of teaching children to think which are not evident at this time. However, the writer feels that teaching children to think cannot wait until all is known about the mind. These facts may be known

in a few years or not for a great many years. Since it is possible to teach children some skills in thinking, this writer feels that a study of how to aid classroom teachers in teaching thinking skills is worthwhile.

CHAPTER II

PROVIDING AN ADEQUATE SCHOOL SITUATION FOR THINKING

Introduction

A school situation in which the learner can be taught to think involves a good teacher, a rich curriculum, and a stimulating physical environment. In order to show that these factors in the school situation are important in teaching children to think, the writer has compiled a list of reasons why children have not learned to think effectively at school.

1. Emphasis has been placed upon subject matter rather than problems real to the child.[1]

2. Thinking has been considered a process of content hence, it has been taught as a subject or course rather than a skill to be used in every phase of the curriculum.[2]

3. Some educators have assumed that since the learner's I.Q. remained fairly constant, that his ability in thinking could not be changed.[3]

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[1] Infra, p. 17.

[2] Melzer, op. cit., p. 80.

[3] Supra, p. 4.

4. Scientists have not yet provided teachers with facts about how the mind thinks. When this is known, more rapid progress can be made in ways of teaching children to think.[1]

5. Many teachers are not good thinkers. They have not received training in how to think or how to teach children to think.[2] This responsibility has not been accepted by all colleges and universities which train teachers.

These reasons for failure in teaching children to think should be a challenge to psychologists to provide teachers more information about thinking; to the colleges and universities to provide a curriculum for teachers in which thinking is necessary; to the classroom teacher to surround the learner with a rich environment needed for thinking and to provide a curriculum in which children can put thinking into action by solving their own problems and group problems.

Physical School Environment Necessary for Good Thinking

The right school environment is very important in teaching children to think. Since teachers cannot force pupils to learn, they can only create the kind of situation and set

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[1] Supra, p. 2.

[2] J. P. Guilford, "Creativity," American Psychologist, V (September, 1950), 448.

the scene in which thinking is possible.[1] Fertile school environment for thinking should be rich and stimulating. It should be challenging to the learner and to the teacher. It should encourage purposeful and varied pupil activity, arouse and guide curiosity, and provide for problem solving at the child's level of maturity.[2]

Size of Class. Wofford[3] says that ten to fifteen learners are about right for a class. Jacobson[4] thinks about thirty-five should be the maximum for a good learning situation. No definite number can be set as ideal because the size of an efficient functioning classroom depends upon factors which vary such as: the ability of the teacher, size of the room, organization of the curriculum, and the social and mental differences of the pupils. The number of pupils in the classroom should be small enough so that each child may contribute and feel a part of the group. A small class makes it possible for the teacher to give individual help to each child as well as to work with small groups. Smaller classes lessen the diversity of interest

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[1]Kimball Wiles, Teaching for Better Schools (New York: Prentice-Hall, Inc., 1952), p. 21.

[2]Freeman Macomber, Guiding Child Development in the Elementary School (New York: American Book Company, 1941), p. 222.

[3]Kate V. Wofford, Teaching in Small Schools (New York: The Macmillan Company, 1946), p. 207.

[4]Paul B. Jacobson, William C. Reavis, James D. Logsdon, Duties of School Principals (New York: Prentice-Hall, Inc., 1941), p. 456.

within a group. This makes choosing a problem for group solving easier as a particular problem may be important to a larger percentage of the group. Better teacher-pupil planning is made possible if the class of children is small.[1]

Physical Characteristics of the Classroom. The physical characteristics of the school itself is important. Thinking can take place in any type of school room; but the right kind of room aids in teaching the child to think. Ideally, the classroom should be large enough so that children can move around with ease and carry on any type of activity they wish. Furniture should be comfortable, adjustable, and movable. Good lighting, adequate ventilation, and heat are essential to good working conditions. This writer should like to add that air-conditioning is just as essential. There should be many books on various reading levels, as well as reference materials such as: encyclopedias, atlases, dictionaries, magazines, maps, etc. Tools and varied supplies should be handy. There should be plenty of storage cabinets. Walls and floor space should be pleasing in color and of materials which can easily be cleaned.[2]

Few teachers are fortunate to have such a classroom. However, if teachers are aware of what a desirable classroom

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[1]C. W. Hunnicutt, Answering Children's Questions (New York: Bureau of Publications, Teachers College, Columbia University, 1949), p.45.

[2]Edith M. Leonard, Lillian E. Miles, and Catherine S. Van der Ker, The Child at Home and School (New York: American Book Co., 1942), pp. 440-453.

is like, they can work toward the ideal. Many adaptations can be made in existing classrooms. Money spent in the future can be used to purchase material, needed to provide a classroom which facilitates learning and thinking.

The Curriculum

Curriculum experiences in the elementary school are usually organized by subjects or by problems.[1] The writer has summarized the two types by the following comparison.

By Subjects	By Problems
1. Schools should build basic skills and understandings to prepare children for adult life.	1. Schools should help children solve their immediate problems.
2. Subject matter is organized into subjects. The daily plan is divided into short periods for each subject.	2. Subject matter is important as a resource for solving a problem. The daily plan is organized around the problems.
3. Planning is done by teacher--usually by following the textbook.	3. Planning is guided by the teacher but children have a part in the deciding what is important to do next.
4. Every child is using the same textbook. Perhaps there are several groups within the room but each group is using "the basal textbook."	4. There are many books of many types. There are also various tools and materials available. The child or group uses what he needs to solve the problem.

It is the contention of this writer that curriculum organized around solving problems is more helpful in teaching children to think. A detailed discussion of problem solving will follow in Chapter III.

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[1]Florence B. Stratemeyer, Hamden L. Forkner, and Margaret G. McKim, Developing a Curriculum for Modern Living (New York: Bureau of Publications, Teachers College, Columbia University, 1947), p. 9.

The Role of the Teacher

"The success or failure of critical thinking depends in the last analysis upon the ability and desire of the individual teacher. Only through the teacher can we expect to inspire pupils to be human, capable of thinking straight and fearlessly."[1]

The Teacher Must Know Children and Society. If a teacher wishes to teach children to think, she must know children and the problems of society. She must understand the broad aims of education and have a philosophy of education which is consistent with these aims. She must be able to guide children in experiences which will develop children in skills of thinking to solve problems of a changing, complex, democratic society.[2]

The Teacher Must Be a Leader. A teacher in a classroom where thinking is to take place must be a sympathetic, creative, and resourceful leader. She must be a counselor and guide.[3] She must be able "to provide enough direction to give the pupils a sense of security, but not enough to discourage initiative."[4] Although the teacher makes maximum use of cooperative planning with the learners, as a leader

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[1]Hobson, op. cit., p. 7.

[2]Macomber, op. cit., p. 15.

[3]Ibid., p. 35.

[4]Wiles, op. cit., p. 38.

she studies the questions and problems of the children so that she can make suggestions to show and lead to deeper and broader implications.[1] A teacher who is a wise leader, seeks to become a working member of the group rather than becoming an authoritarian. In this way she can share the decisions of leadership with the learners.[2] This type of leadership will help children learn to think better.

The Teacher Should Be a Participator. Teachers are learners. They can't know all the answers. They should be a participator in the activities going on in the classroom. The degree of participation will depend upon the ability and maturity levels of the learners. The teacher is a resource person. She guides, stimulates, and encourages the learner.[3]

The teacher plans with the pupils. As a participator and member of the group, the teacher should live up to group decisions. If she does not, then the teacher is demonstrating that she never has been a member of the group.[4]

Permissive Atmosphere. There should be a "permissive atmosphere" in the classroom where thinking is to take place. The children should feel secure. They should feel free to

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[1]Stratemeyer, op. cit., pp. 304-305.

[2]Wiles, op. cit., pp. 36-37.

[3]Newer Instructional Practices of Promise, Twelfth Yearbook (Washington, D. C.: National Education Association, The Department of Supervisors and Directors of Instruction, 1930), p. 17.

[4]Wiles, op. cit., p. 39.

express themselves; to question; to experiment; to create; to discuss; to share; to work alone or in groups. Such an atmosphere provides good living, good learning, and good thinking.[1]

The Teacher Should Help To Develop Good Human Relations. If the teacher wishes to create a learning situation in which boys and girls feel free to experiment, explore, express themselves, and work together, then she needs to improve the human relations in the class. The teacher does this first by being emotionally mature herself. Then she helps each pupil to feel that he belongs to the group. She helps each child feel successful. She encourages children to work together and help each other. The teacher promotes good human relations by being a person in which children put their trust and will come for help without fear.[2]

Classrooms Which Do Not Provide a Good Setting for Thinking. The writer feels that a description of the type of classroom in which thinking--if it takes place--occurs in spite of the school environment, should help teachers identify and improve their own classroom situation. Mastery of subject matter is the major aim of such a classroom. Memorization of facts is stressed. Every child in a group

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[1]Toward Better Teaching, 1949 Yearbook (Washington, D.C.: Association for Supervision and Curriculum Development of the National Education Association, 1949), pp. 151-152.

[2]Wiles, op. cit., p. 35.

uses the same textbook. There is much emphasis on marks or grades. Competition and rivalry are strong. Pupils do not talk out loud or move freely about the room. Desks and chairs are in a set position.[1] The child's chief concern is to satisfy the teacher.[2] Dewey[3] says, "In schools where the chief aim is to establish mechanical habit and instill uniformity of conduct, the conditions that stimulate wonder and keep it energetic and vital are necessarily ruled out."

Each factor in the school situation makes an important contribution to good learning and thinking--the teacher, the learner, the curriculum, and the school environment.

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[1]Macomber, op. cit., pp. 1-14.

[2]Dewey, op. cit., p. 51.

[3]Ibid., p. 53.

CHAPTER III

TEACHABLE PRINCIPLES AND TECHNIQUES IN PROBLEM SOLVING

"A child's thinking is limited at least by his background of experience and by his mental maturity. Within these limits there seem to be certain technics or abilities in thinking which can be improved."[1] This chapter was an analysis of these principles, techniques, and skills which can be taught about problem solving.

"Altho there are certain specific thinking abilities which may be learned, most writers on the curriculum agree that these are acquired most efficiently, not as isolated activities, but as a part of other learnings."[2] The following discussion of problem solving was not aimed at any school subject, but is applicable and adaptable to all phases of the curriculum.

Since "thinking always involves a problem,"[3] the writer contends that teachers should be thoroughly familiar with problem-solving principles and techniques. Thorndike[4] says,

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[1]Russell, op. cit., p. 141.

[2]Ibid., p. 141.

[3]Skinner, op. cit., p. 326.

[4]Robert L. Thorndike, "How Children Learn the Principles and Techniques of Problem-Solving," Learning and Instruction, Forty-Ninth Yearbook, Part I (Chicago: The University of Chicago Press, 1950), p. 192.

"If we (teachers) can identify typical and recurring attitudes, skills, and procedures in problem-solution, we can then inquire into ways of teaching these attitudes, skills, and procedures to children." The purpose of this chapter was to discuss the principles and techniques of problem solving.

In order to do this, problem solving was broken down into parts or phases. This was done solely for an analysis of problem solving and was not intended to be a description of any individual solving a problem. If thinking were as logical and orderly as these steps, teaching of it would be simplified.

> Actual behavior in response to a problem situation is often confused, illogical, and disorderly. Furthermore, each problem-solver and each problem to be solved has its own characteristics. Diversity rather than uniformity is the rule in the attack upon problem situations. We do not find the problem-solver going neatly and logically through the sequence of steps (of problem solving). Rather, he jumps around, often starting in the middle, returning then to the initial steps, moving back and forth between hypotheses, problem clarification, appraisal of implications, and hypotheses again.[1]

The writer used these aspects or steps of problem solving in this study:

1. Select and clarify the problem.
2. Locate and collect evidence.
3. Organize the data.
4. Arrive at a solution.
5. Test and evaluate the solution.

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[1] Ibid., pp. 196-197.

There follows a discussion of each of these steps. Suggestions as to how classroom teachers can use this method of teaching children to think follow in Chapter IV.

Selection and Clarification of Problem

Thinking Starts With a Problem. "...if the pupil is to do any thinking, he must be confronted by a situation for which he does not have a prepared response and to which he is eager to make satisfactory adjustment."[1] Individuals like to think about their own difficulties, problems, and needs.

> Problems arise in pursuit of individual aims and purposes. The range of problems which the individual encounters, therefore, is a function of the range of experiences which he had, the range of activities which he engages, and the range of interests which he develops.... A rich life, rich in experiences and interests is also rich in problems and in opportunities to learn by meeting them.[2]

Therefore, the teacher should be alert to judge whether a problem meets the needs and interests of the learner. Thorndike[3] says, "The school is as much concerned with creating problems as it is with solving them." The teacher should provide "school experiences which will introduce the pupil to a wide range of problems, the solution of which contributes to satisfactory individual and group living."[4]

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[1]Skinner, op. cit., p. 326.

[2]Thorndike, op. cit., pp. 197-198.

[3]Ibid., p. 194.

[4]Ibid., p. 194.

Two Types of Problems. Thorndike[1] classifies problems into two types. In the first group are those problems motivated by the need to act, or practical problems. In the second group are those problems motivated by the need to understand. These are termed intellectual problems. The school should provide for solving both types of problems.

Selecting a Problem to Solve. Of necessity to the classroom teacher who wishes to help children learn to think by solving problems, is the knowledge of how to go about selecting a problem. Ideally this should be a cooperative enterprise of the teacher and the pupils. How much responsibility the teacher will have to assume depends upon the amount of experience the group has had in solving problems, the richness of the school environment,[2] the organization of the curriculum upon problems rather than subjects,[3] the atmosphere of the classroom--whether it is friendly to questions,[4] and the mental maturity of the learner.

The Open-Mindedness Study[5] made by the Philadelphia teachers offers these suggestions for choosing a problem:

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[1] Ibid., p. 195.

[2] Supra, p. 14.

[3] Supra, p. 17.

[4] Supra, p. 14.

[5] Joseph Goldstein, Constance Masi, Warren Vann, and Sadie Zion, "Thinking Can Be Learned," Educational Leadership VI (January, 1949), 235-239.

1. Is it worth our time?
2. Can we get facts about it?
3. Can we do anything about it?
4. Can everybody help find an answer?
5. Are we interested in the problem?

The degree of success of any class in solving a problem is related to what extent the learners have identified themselves with it, and to what extent they have participated in selecting and determining the importance of the problem.[1]

Clarification of the Problem. The problem should be written so every child can see it and discuss it. Unless each child has the same understanding of the main points and words used, confusion will result in organizing the problem. The scope of the problem should be settled.[2] What factors should be included in the solution and what factors should be excluded? Known facts pertaining to the problem should be listed. All of these procedures--defining the problem in writing, discussing the meaning and scope of it, and listing known relevant facts--help to make the problem clear and definite in the child's mind.

Location and Collection of Evidence

Sometimes the learner can draw upon past experiences and reach an immediate conclusion to the problem. More

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[1] Ibid., p. 236.

[2] Thorndike, op. cit., p. 199.

often information must be located, collected, and organized before a decision about the problem can be reached.

Locating Evidence. "Evidence means any kind of information--either facts or opinions--that are reliable, and that bear upon the case at hand."[1] Since all sources of information are not equally reliable, children should be taught to evaluate the sources from which evidence is obtained.

It should be pointed out to children that information is not always true just because it comes from a printed page or was told to them by an adult. Some simple ways to evaluate references might include: (1) finding out about the author, the position he holds, his experiences, what he has written, other writings, etc.; (2) checking the publishing house to see what other books it has published to establish its reliability; (3) by reading many references and comparing them, inconsistencies often show up; (4) by noting how the information was obtained, by first-hand experiences, etc.; (5) by observing if there are many debatable and misleading statements; (6) by observing the date of the reference.

Evidence may be found by reading (books, magazines, encyclopedia, maps, newspapers, etc.), from talking with resource persons, from observation, carrying on experiments, and by first-hand investigation. As many sources of information should be used as are available. The nature of the

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[1]"Don't Jump to Conclusion," Senior Scholastic, LIV (March 23, 1949), 5.

problem will determine the kind of evidence needed for its solution. Teachers must not assume that children can locate information just because they can read. These skills must be taught.[1]

Importance of Facts. Facts are just as necessary to a curriculum based on problems as one based on mastery of subject matter. The difference is one of purpose. In a school organized around subject matter, learning of facts is the main purpose of instruction. In a school where problems are the basis of learning, facts become a means of attaining this aim. Without facts, thinking does not take place.[2]

First-Hand Evidence. Gaining information through first-hand evidence is an important aspect of gathering data for problem solving. Multi-sensory experiences are helpful in making the problem real to the child. Even the slowest learner can manipulate objects and perhaps see relationships not possible in any other way. Experimenting and recording of results is a valuable experience using first-hand evidence.[3] Wingo[4] says

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[1]Fay Adams, Educating America's Children (New York: The Ronald Press Company, 1946), p. 311.

[2]Cecil V. Millierd, Child Growth and Development (Boston: D. C. Heath and Company, 1951), pp. 268-269.

[3]James V. Farrell and James R. Wailes, "Multi-Sensory Approach to Science in the Elementary School," Elementary School Journal, LII (January, 1952), 271-276.

[4]G. Max Wingo, "Implications for Improving Instruction in the Upper Elementary Grades," Learning and Instruction, Forty-Ninth Yearbook, Part I (Chicago: The University of Chicago Press, 1950), p. 289.

> It is not maintained that all learning suitable for the upper elementary child can or need be gained in this way (first-hand experience). It is maintained that it is a highly valuable pattern of experience and should be given an important place in the elementary school.

Organization of Data

Discussion, a Way of Organizing Data. Discussion is an "...oral activity engaged in by a small group of people for the purpose of clarifying issues."[1] As evidence and information is being collected, discussion is one of the best ways of clarifying and organizing these data. Talking over the problem makes it a common possession. Discussion provides an opportunity for each member of the group to present his contributions and opinions. Thus, he defines his own views and becomes responsible for them to the group.[2] Discussion is a learning process because talking over the problem not only helps to solve it but raises other questions and problems.[3] Flesch[4] says discussion "...is the greatest idea generator known to man." So not only can data be organized by discussion, but ideas for a solution are produced.

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[1]Wofford, op. cit., p. 205.

[2]John S. Brubacher, Dan H. Cooper, Harold Spears, Editors, Eclectic Philosophy of Education (New York: Prentice-Hall, Inc., 1951), p. 359.

[3]Wofford, op. cit., p. 205.

[4]Rudolph F. Flesch, The Art of Clear Thinking (New York: Harper and Brothers, 1951), p. 144.

Individuals Need to Organize Data. Before the group meets for a discussion period each member or small group should organize the information he has in order to know what ideas to present to the group and to be able to explain and defend them. Children of upper elementary level should be able to take notes, make an outline, pick out main topics, see relationship of facts, and make summaries. Even though the individual child organizes his own findings, he should enter into the discussion with the expectation of modifying or changing his opinions as other ideas are presented.[1]

Teacher Responsibility in a Discussion. The teacher has an important responsibility in guiding a discussion. She is a member of the group and should not dominate it. Talk should not be directed at her but to all the group. Raths[2] says the teacher should enter into the discussion when resources of the children are exhausted, if the pupils get off the subject, if time is running short, if the topic is exhausted or if the children need expert information.

Discussions need to be summarized. Writing important points on the board gets them before the group. Many discussions may follow before the group is ready to reach a solution.

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[1] Louis Raths, "Improving Classroom Discussion," Educational Research Bulletin, XXIV (January 17, 1945), 10.

[2] Loc. cit.

Arriving at a Solution

When and how an individual or group arrives at a solution to a problem depends upon many factors. The complexity of the problem, the experience background of the pupils, the social and mental maturity level of the learners, the amount of experience they have had in solving problems, and the ability of the teacher to guide and help are all contributing factors in arriving at a solution.

How an idea is produced has not been definitely established. Flesch[1] says it is what happens in your brain when a remembered pattern matches the pattern of the situation before you. Peterson[2] experimented with children to show that the learner gets an idea for solving a problem more quickly if the new problem contains familiar situations. The writer found several methods for solving a problem which classroom teachers could use:

1. Insight. Flesch[3] says after the preparation stage of gathering facts, relax, put the problem away, do something else and the unconscious mind works. Ideas may come at odd times in odd places; sometimes while sleeping; usually when the thinker is relaxed. The

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[1]Flesch, op. cit., p. 91.

[2]G. M. Peterson, "An Empirical Study of the Ability to Generalize," Journal of Genetic Psychology, VI (1932), 90-114, as quoted in Cecil V. Milliard, Child Growth and Development (Boston: D. C. Heath and Company, 1951), p. 266.

[3]Flesch, op. cit., p. 146.

writer thinks that it is important for children to know that ideas sometimes happen in such circumstances.

2. Check-List. Suppose the answer doesn't come through insight, try using a check-list. Flesch[1] says this is the same as the twenty questions technique. He gives three basic rules for this method of solving a problem:

A. Don't waste time in wild stabs.

B. Ask questions that have an even chance of being answered yes or no.

C. Vary your approach. Try looking at the problem from different angles. Take the opposite view, turn it around, or upside down.

"Most problems are solved by looking sharply at some thing that has been staring you in the face all the time."[2]

3. Trial and Error. "The solution to a problem will never be found through 'blind' trial and error. It will be reached only if the individual knows what he is looking for and is mature and experienced enough to recognize it when it results."[3] Children can learn by their mistakes. They may need more information before they attempt another solution.

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[1] Ibid., p. 144.

[2] Ibid., p. 110.

[3] Milliard, op. cit., p. 265.

4. Application of Principle. This is sometimes called generalization. Brownell and Hendrickson[1] point out that, "Not all problem-solving leads to generalizations, but generalizations are attainable in no other way." Discussion helps in bringing out the relationships which lead to generalizations.

As stated before in this study[2] when scientists provide teachers with knowledge of how the mind "gets an idea" more direct and better ways of reaching a solution to a problem will undoubtedly be evident.

Testing and Evaluation of the Solution

A solution should be tested by use if possible. A problem involving manipulation of objects can be tested in this way--such as a science experiment. Problems which deal with abstract ideas cannot always be tested. For this reason, problems concerning the child's behavior are good. Such situations are vital to the child and they can test their decisions by trying out the behavior suggested by their solution. In the writer's school there were too many children using a small playground. The children decided that if each grade group played on a certain part of the playground, all would have a better chance to play. This solution was tried out. It worked very well except that some

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[1]William A. Brownell and Gordon Hendrickson, "How Children Learn Information, Concepts, and Generalization," Learning and Instruction, Forty-Ninth Yearbook, Part I (Chicago: The University of Chicago Press, 1950), p. 119.

[2]Supra, p. 11

changes were needed in the "boundary lines." The solution to this problem was tested through action. When the solution was evaluated, changes were made in the boundary lines.[1]

Errors in Problem Solving. Children (as well as adults) will make many errors in solving a problem. These mistakes can be a learning situation if the child can detect what is wrong. The writer thinks some of the pitfalls of reaching a satisfying conclusion should be pointed out. If teachers are aware of them, they can help children; see the harmful effects of making a hasty decision before they have enough evidence; avoid the influence of prejudice; realize the harm of blind faith in the printed page and the opinion of others; and develop awareness of the relationships of data.[2]

Effect of Prejudice and Emotions on Problem Solving. A child's emotions, prejudices, likes and dislikes do influence decisions in solving a problem.

> The teacher's responsibility in working with children is to help them see how these factors influence thinking, and help them learn to examine their thinking to see that their conclusions are not the result of prejudice and emotional reactions only but also of reasoned facts and valid information.[3]

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[1]Lafayette Elementary School, Joplin, Missouri.

[2]Skinner, op. cit., p. 327.

[3]Paul E. Blackwood, "How Children Learn to Think" (U. S. Office of Education, Federal Security Agency, Place of Subjects Series, No. 10, 1951), Washington, D. C.: Superintendent of Documents, Government Printing Office), p. 14.

Gould[1] says, "We unconsciously accept only those arguments that are favorable to our position, and reject those that are against it. Psychologists have concluded that the greatest single obstacle to clear thinking is the tendency of people to believe only those things that they want to believe."

Summary

The following principles and techniques of problem solving are summarized from the preceding discussion:

1. Thinking starts when the learner is confronted with a situation for which he has no prepared response.

2. No techniques of thinking are applicable to all problems.

3. Therefore, the curriculum should provide experiences for meeting many and varied problems.

4. Problems are easier to solve if they contain likenesses to other problems.

5. Problems are not "problems" to children unless they have meaning enough to them to arouse interest.

6. Every child should understand the problem, its scope and facts already known about it.

7. Valid information is essential to solving a problem.

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[1]Kenneth M. Gould, "Don't Let Your Feeling Dictate Your Thinking," Senior Scholastic, LIV (March 23, 1949), 5.

8. How to find this information, organize, and evaluate it is vital to solving a problem.

9. The influence of emotions and prejudices must be accepted and coped with.

10. Seeing relationships is necessary for reaching a satisfactory conclusion.

11. Discussion is a good way of bringing out relationships and reaching conclusions.

12. A solution should be tested by action if possible.

13. This action should be evaluated, then modified or changed if necessary.

14. In teaching children to think, it is essential that the teacher be a person who understands the process of problem solving and who is skilled in carrying out the principles and techniques.

15. The public and boards of education can help in teaching children to think by providing a suitable physical environment, small groups of children, and materials and books with which to work.

CHAPTER IV

SUGGESTIONS FOR APPLICATION AND EVALUATION OF PRINCIPLES AND TECHNIQUES OF PROBLEM SOLVING

Problem solving has been regarded with favor by many educational authorities but "...has never been used widely in schools.... While the theoretical aspects of problem solving have been worked out but implications for teaching practices have not."[1] The purpose of this chapter is to make suggestions to show how classroom teachers can apply the principles and techniques of problem solving to their teaching and to suggest criteria for them to use to evaluate their progress in teaching children to think.

Application of Problem Solving Principles and Techniques

Many of the suggestions for teaching skills in thinking and problem solving are related. In teaching them, no attempt should be made to isolate them or to teach them in any order. They should be taught as needed in solving a problem. In this discussion, these skills have been arranged in the sequential order of solving a problem solely for emphasis. No attempt has been made to classify these skills around

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[1] Wingo, op. cit., p. 287.

subject matter such as reading, English, etc. If the curriculum is organized to solve problems, no subject matter classification is necessary.

Principles and Techniques of Problem Solving	Suggestions for Application in the Classroom
Thinking starts with a problem which is of genuine concern to the learner.	1. The atmosphere of the classroom must put the child at ease so that he will ask questions. 2. Children's questions should be met frankly and with an open mind. The teacher need not pose as knowing all the answers. An attitude of "How can we find out?" is more stimulating to thinking.
The responsibility of recognizing which of the children's questions and interests will develop into a problem for group solving is largely one for the teacher.	1. A small group (not more than twenty-five) is desirable. 2. The teacher should know the interests and abilities of each child. A notebook or file on each pupil will be helpful. 3. The teacher should be able to recognize whether a question or interest of a particular child would develop into a problem for the group. A knowledge of child behavior and of curriculum experiences which satisfy the need of a particular age group will be helpful.
The choice, scope, and complexity of a problem are dependent upon the range of experience, activities, and interest of the children.	1. The schoolroom must be an interesting place to spend the day with books, magazines, science equipment and collections, maps, shop materials, paints and plenty of paper, etc. 2. The teacher and children should plan to do things together according to the interests of the group--take trips, walks, view films and film strips, organize a club, etc. Problems real to the child grow out of such environment and experiences.

Defining and clarifying the problem are necessary to successful solution.

The teacher and the group of learners should do this together. Either the teacher or a child will have to act as leader. A statement of the problem can be written on the board. A discussion about the meaning of words, what solving of the problem includes, what conditions the problem does not include, and what facts are already known should follow. Then the statement of the problem should be revised to meet the results of the discussion.

Valid information is necessary to successful problem solving.

Children should learn these skills as they need them:

1. How to use the library.
2. How to use reference books.
3. How to skim printed material.
4. How to take notes.
5. How to use maps, charts, graphs, etc.

Opportunities for the following kinds of situations should be taken advantage of:

1. Listening--Much information can be gained by learning to listen attentively and thinking, "How can we use this information in solving our problem?"
2. Interviewing--Persons about the school, home, and community can give much information for problem solving. Learning how to interview by planning questions to ask, by learning to be gracious and polite are skills which can be taught.
3. Observing--Children can learn to look for and see things about them that they overlook every day. They can learn to do a controlled observation as in a science experiment.
4. Reading--Children should be taught that reading is a valuable tool in gathering information. They can learn to pick out main points, skim, take notes, and share their findings with the group.

5. Viewing Films and Filmstrips--How to find information and use it from this source is a valuable skill which can be taught.

6. Evaluating Information--Children should learn to distinguish between facts and opinions, to cross-check information, to check on authorities, to observe recency of materials, to challenge the validity of what is printed or said.

Organization of information is necessary to see the relationship of data.

Individual skills which can be taught:

1. Outlining of material.
2. Preparing a report or summary of information found by the individual.
3. Preparing a summary of the findings of a small group.
4. Learning to pick out main points.

Group Skills:

1. Learning to discuss and exchange ideas about the problem.
2. Making a group outline as the discussion goes on.
3. Making a summary of what has been accomplished.
4. Making group plans for further work.
5. Learning to play twenty questions.

Activities which help children organize their information:

1. Preparing a bulletin board.
2. Keeping a scrapbook with headings.
3. Recording progress of solving the problem in a log or diary.
4. Planning a program concerning the problem.
5. Writing a play, poem, story, etc., about it.
6. Dramatizing a problem situation.
7. Collecting and classifying science specimens.

Many solutions may be found before a satisfactory one can be reached which will stand up under testing and evaluation.

1. Practice should be given in making choices and evaluating decisions.
2. Skill in "If I do this, then so and so will probably result," is a valuable practice to learn.
3. Learning to make summaries and to generalize can be practiced by upper elementary children.
4. Evaluation of individual work, group progress, and accomplishments for the school day all help in learning to evaluate.

The above listed skills, classroom activities and situations which will help in teaching children to think was intended to be suggestions. A creative teacher will be continually changing her ideas and devising better ways to teach children to think better.

Criteria for Teachers to Evaluate Thinking in Their Classrooms

On the basis of this study, the writer has prepared a list of checking points or criteria against which teachers may evaluate their efforts in teaching children problem solving behavior. The list is not exhaustive, nor is it claimed by the writer to be permanent.

Directions: Underline the answer which most nearly describes your classroom situation.

Philosophies and Values

	Underline One		
1. Do I believe that learning is developing desirable behavior rather than accumulation of facts?	Yes	No	Partly true
2. Do I believe that thinking is a goal of education?	Yes	No	Partly true

3. Do I accept the opinion that thinking starts with a problem?	Yes	No	Partly true
4. If so, do I believe that by helping children solve problems on their maturity level will enable them to solve future problems?	Yes	No	Partly true
5. Do I believe that children learn how to live in a democracy by living democratically in the school room?	Yes	No	Partly true
6. Do I believe that facts are important, but not as a goal of education, but as a means to thinking and problem solving?	Yes	No	Partly true
7. Am I flexible to change and willing to accept what authorities say, but experiment and have an open mind for better teaching techniques?	Yes	No	Sometimes
8. Do I solve my own problems effectively?	Yes	No	Sometimes
9. Do I get along with people and have a satisfying life?	Yes	No	Part of the time
10. Am I challenged by new environment, books, people, and travel?	Yes	No	Sometimes
11. Have I read a book on philosophy within the last year?	Yes	No	
12. On problems of the world?	Yes	No	
13. On teaching techniques?	Yes	No	
14. Have I learned to do one new thing within the last year?	Yes	No	
15. Is there always something I want to do waiting when there is time for it?	Yes	No	Sometimes
16. Have I taken part in a planning group of teachers within the last year?	Yes	No	
17. Have I worked with at least one group of parents or laymen on some school or community problem?	Yes	No	
18. Am I willing to accept the best solution to a problem for my building and try to make it a success?	Yes	No	Sometimes
19. Am I capable of having a really good time with my friends?	Yes	No	Sometimes
20. Do I have a ready smile and a sense of humor?	Yes	No	Sometimes

The best answer was yes to each question

How can I improve myself?

What have I done for self-improvement?

The Classroom

1. Is it large enough so that each child can move about freely?	Yes	No	
2. Are there less than twenty-five pupils?	Yes	No	
3. Can the furniture be moved about as desired?	Yes	No	
4. Is it a comfortable room with good lighting, ventilation, and heat?	Yes	No	
5. Is it attractively decorated with pleasing colors?	Yes	No	
6. Are there many books, magazines, reference books, dictionaries, atlases, in low bookshelves?	Yes	No	Some
7. Are there manipulative materials out ready to be used, such as: paints, paper, scissors, paste, saws, hammers, plywood, etc.?	Yes	No	Some
8. Are there science materials for experiments?	Yes	No	Some
9. Is there a place for collections of science specimens?	Yes	No	
10. Are there many large, low bulletin boards?	Yes	No	Some
11. Are audio-visual materials available for the children to use?	Yes	No	Some

The best answer was yes to each question

What else does our room need for good learning and thinking?

What can I do about these needs?

What have I done to improve the room?

Teacher-Pupil Relationship

1. Do I listen when children want to talk to me?	Yes	No	Sometimes
2. Do I treat children as equals and discuss their problems with them?	Yes	No	Sometimes
3. Do I help them find the answers to their questions rather than telling them the answers?	Yes	No	Sometimes
4. If necessary, do I say frankly, "I don't know," to a child's question and follow with, "How can we find out?"	Yes	No	Sometimes
5. Do children accept me in their group as one of them, yet as guide if they need me?	Yes	No	Sometimes
6. Am I friendly and kind, but firm in personal relationships?	Yes	No	Sometimes
7. Do I treat the pupils as courteously as I expect them to treat me?	Yes	No	Sometimes
8. Do I consider each child as an individual and keep some kind of records of his reactions in the classroom?	Yes	No	Sometimes
9. Do children feel free to investigate, experiment, plan and carry out activities in our classroom?	Yes	No	Sometimes

The best answer was yes to each question

What are my best points?

What relationships should I try to improve?

What progress have I made in improvement?

Curriculum

1. Do I have to follow a prepared course of study?	Yes	No	Optional
2. If so, do the teachers help plan it?	Yes	No	
3. Am I free to develop the curriculum around the problems which arise in my room?	Yes	No	
4. Am I free to plan the daily schedule as I choose?	Yes	No	
5. Is my daily plan divided into a few large periods rather than many short ones?	Yes	No	
6. Is my daily plan flexible to take advantage of source material, problem or opportunity for learning which arises during the day?	Yes	No	
7. Do the learners and I plan and evaluate together?	Yes	No	Sometimes
8. Do I feel the responsibility of learning to know which of the children's interests would develop into a good group problem?	Yes	No	
9. Do I provide time for skills?	Yes	No	
10. For talking together?	Yes	No	
11. For creative expression?	Yes	No	
12. For manipulative experiences?	Yes	No	
13. For individual help?	Yes	No	
14. Do I make an effort to use resource people of the community?	Yes	No	
15. Do I make use of other community resources?	Yes	No	
16. Am I willing to serve on committees and planning groups to improve the curriculum?	Yes	No	

The best answer was yes to these questions.

What are the good points about our curriculum?

What needs to be changed?

What can I do to help improve the curriculum?

What has been accomplished within the past year?

Problem Solving Principles and Techniques

1. Do I believe that thinking starts with a problem which is of genuine concern to the learner?	Yes	No	
2. Do I provide an atmosphere in which problems can arise?			
A. Are the children free to ask questions?	Yes	No	
B. Are they encouraged to find the answers to their questions for themselves?	Yes	No	
C. Do I provide as many kinds of experiences as possible realizing that problems grow out of these activities?	Yes	No	
D. Do I surround the children with many materials to experiment with and to use as source materials?	Yes	No	Some
3. Were the problems selected of vital interest to most of the learners?	Yes	No	
4. Did all the children understand the problem?	Yes	No	Most
5. Did we limit it in scope?	Yes	No	
6. Did we list information we already knew about the problem?	Yes	No	
7. Was there wide participation of the children?	Yes	No	
8. Were their contributions organized and relevant to the problem?	Yes	No	
9. Did every child feel he had contributed something to the solution of the problem?	Yes	No	Most
10. Did we spend enough time in gathering information to exhaust our resources?	Yes	No	
11. Did we try to see relationships of our data?	Yes	No	
12. Did we discuss the effect of our emotions and prejudices on our decisions?	Yes	No	
13. Did we test our solution to the problem?	Yes	No	
14. Did we evaluate our work in solving the problem?	Yes	No	

Skills which I consciously tried to improve this year:

1. Using the library. How?

2. Using reference books. How?

3. Learning to skim. How?

4. Taking notes. How?

5. Using maps. How?

6. Using charts. How?

7. Using graphs. How?

8. Learning to listen to others. How?

9. Learning to discuss a problem. How?

10. Learning to interview. How?

11. Learning to make observation. How?

12. Learning to summarize. How?

13. Learning to outline. How?

Did I help the learners organize their data with any of these activities?

1. Preparing a bulletin board. What kind?

2. Preparing a scrapbook?

3. Keeping a log or diary of progress in solving the problem.

4. Planning a program concerning the problem.

5. Writing a play.

6. Writing poems or stories.

7. Dramatizing a problem situation.

8. Collecting and classifying science specimens.

9. What other activities did we participate in which would help us to gather or organize data?

Summary and Conclusions

Although many teachers may agree with authorities that solving problems is the best way known at the present time of teaching children to think, they have not practiced this theory in their classrooms. The purpose of this study was to help bridge the gap between believing in the theory of problem solving and the lack of application of it in the classroom.

The writer thoroughly searched the area of Pittsburg, Kansas, and Joplin, Missouri, for facts and opinions written since 1945 on how to teach children to think. Problem solving was chosen as the method by which all types of thinking for a purpose could be taught. The study was divided into three parts:

1. The school situation necessary for good thinking.

2. The principles and techniques of problem solving which can be taught.

3. Suggestions for application of these principles and techniques. Criteria for teachers to use to evaluate themselves in teaching children to think were worked out by the writer.

Ways to teach children to think will change and improve as information about mental processes becomes known. Problem solving is the best method known at the present time for teaching children to think. The responsibility of providing

a learning situation for solving problems depends largely upon the classroom teacher. Teachers can do a better job of teaching children to think if:

1. they understand the process of solving problems;

2. they are given instruction and practice in applying the principles and techniques of problem solving;

3. they know how to evaluate their classroom procedures to see what they have done to teach children to think and to plan definite action for improving problem solving in their classroom.

Some ways in which the teacher can formulate plans for action in improving thinking include:

1. Talking with other teachers.

2. Reading magazine articles and books on problem solving.

3. Discussing it with supervisors.

4. Visiting other teachers who are solving problems in the classroom.

5. Participating in an in-service training program on how to teach thinking.

6. Experimenting with own ideas about how improvement in thinking can be taught.

7. Being flexible and open-minded about ideas of others on problem solving.

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