how children learn to

THINK

by Paul E. Blackwood

Bulletin 1951, No. 10

FEDERAL SECURITY AGENCY • Oscar R. Ewing, *Administrator*
Office of Education • Earl James McGrath, *Commissioner*

CONTENTS

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 15 cents

FOREWORD

THIS BULLETIN is one of a series on the place of subjects in the elementary school curriculum. The first of the series showed how subject matter is introduced into the program in a modern school. It was titled *The Place of Subjects in the Curriculum*, Office of Education Bulletin, 1949, No. 12. The other bulletins in the series discuss how various skills, such as reading, creating in art, and writing are developed in the modern school program. This particular bulletin deals with how children learn to think.

From several illustrations of children at work in the classroom, some principles about thinking and problem solving are identified. Children are most inclined to think when they are given an opportunity to think about real and important problems. The examples given show how important it is to have a classroom environment in which good thinking is expected and encouraged.

Skillful teaching stimulates children to think carefully. And skillful teaching takes into account the obstacles to good thinking, such as lack of information and highly charged emotions. These and other obstacles are pointed out.

It is intended that persons who read this bulletin discover anew that opportunities to help children think abound in all phases of the school program. It is hoped that readers will find numerous suggestions here for using the opportunities that exist to develop good thinking habits in children.

GALEN JONES, *Director*
Instruction, Organization, and Services Branch,
Division of State and Local School Systems

The question is "How shall we house and feed the rabbit?"

How Children Learn To Think

"YOU AREN'T THINKING!" is a common admonition of parents and teachers to their children. The implication is, of course, that they believe children should be thinking. Indeed, many times the children are thinking but perhaps not in the way nor on the question which is in the mind of someone else. It is a recognized fact that children can solve problems—have been doing so even before they began to walk. Some are more successful than others. Parents and other associates of children have in many instances permitted the development of poor thinking habits before the children reach school. Children, for example, may have become completely dependent on parents for answers. They may have had their curiosity curbed to such an extent that they have no questions to ask or they may even be afraid to ask questions.

The school must recognize that children are different in this respect. Some children have learned how to think. Others must get a fresh start with adults who understand them. Thus, one of the most frequently stated purposes of the school is: To help children learn to think better.

Serious consideration of this purpose in the school eventually leads to an examination of classroom procedures with respect to helping children learn to think better. In the following pages, a number of situations will be described which show how teachers and groups of children directly and indirectly improved their ability to think clearly.

THE QUESTION—A FIRST STEP IN THINKING

In the third grade, at lunchtime, Ray asked Miss Harrison, "What makes the flies so bad around our school?"

When Miss Harrison relaxed in her chair, turned to Ray, and asked seriously, "What do *you* think?," she had made a beginning in helping one third-grader think. It was an important question to Ray because the flies kept buzzing around his face and ears and they annoyed him.

Moreover, every once in a while, one would land on his sandwich and then on the edge of his milk glass.

"We'll talk about it after lunch," Miss Harrison said to Ray. So Miss Harrison took the next important step just after lunch and asked all the third-graders whether or not the flies had bothered them. Almost every third-grader had noticed the flies.

"Ray asked, 'What makes the flies so bad around our school?' " she said. "He has been thinking about it. Has anyone else wondered about the flies?"

A number of hands went up, and Miss Harrison asked one child after another what his question was.

"What do flies eat?"

"Where do they come from?"

"Why do they come here?"

"Will they die in winter?"

"Are they bad?"

"How can we get rid of them?"

"Boy, that's a lot to know!" Ray exclaimed as he saw that his question was responsible for all this discussion.

"But wouldn't you like to know?" Miss Harrison asked.

In this instance it almost goes without saying that the children decided to study about flies and that Miss Harrison helped them plan ways to find the answers to their questions. Ray worked hard to get information on the questions because he could see that the answers to the questions of the other children would help him with a better answer to his original question.

Thus, a problem of interest and concern to most of the children was opened for further study by Miss Harrison who didn't answer Ray's question for him. When teachers quickly and arbitrarily answer questions like Ray's, they destroy at the outset the very best opportunities to help children think.

FIRST-HAND EXPERIENCE—A WAY OF INVESTIGATING

One day while the first-grade children were studying animals, one child observed from a picture that one calf had a red tongue and that another *seemed* to have a black tongue. A discussion followed on the color of a calf's tongue. There was much interest and conversation. All of the children seemed to believe that all calves had red tongues. The group decided to find out. They discussed ways of finding out. They would ask their parents. They would ask older children, the principal, the woman from the Dairy Council. They would find books about cows.

They searched through the available books, but they were disappointed in the books—the books did not answer the question.

So the following week, the first grade went to a dairy farm. They asked the farmer about calves' tongues. The farmer showed the children his calves and said this particular breed had black tongues. He opened the mouths of some of the calves that had red tongues. After seeing the mouths of many calves, the children were satisfied—some calves have red tongues, other kinds have black tongues.[1]

This question does not seem of much importance to an adult, but it is typical of the questions which children raise at home and in school. When such questions arise in school, the teacher, with the group, must on some basis, decide whether or not to spend time on them. The teacher needs to have some sound criteria by which she judges the importance of certain problems compared to others. For example, is the question or problem relevant to the unit or topic which the children are studying? Is it a question which needs answering to prepare the group for understanding some subsequent question? Does the question permit investigation, reading, and a variety of other ways of finding information? These tests of the importance of the question relate to how much the question contributes to an understanding of a study under way.

Another type of criterion might also be applied: Is the question of such immediate concern and interest to the group that, even though it is unrelated to what they are studying formally, it must be answered to some extent to satisfy the children and to free them psychologically to think about more important matters?

The foregoing example is probably not an important problem to most first-graders. In fact, it was of secondary importance to this group of children. Yet, it was related to their study of animals, and it did serve as a means of planning an activity—a trip—which provided them with much information in addition to the color of calves' tongues. Whether or not this particular question is of great importance in itself, the way the children studied it does illustrate some important aspects of problem-solving and critical thinking.

In this problem the children were clear as to what they wanted to find out. They doubted the pictures. They had an hypothesis to be checked. They collected information from various sources including direct observation on a trip to the farm. They used their newly acquired information to draw a conclusion. Thus, in a straightforward way these children had applied a number of commonly recommended steps for thinking through a question or problem. In this example, the importance of providing first-hand experiences as a basis for thinking is illustrated.

[1] Description of an activity of a first grade in the George Rogers Clark School, Louisville, Ky.

RESULTS OF CONTINUING OBSERVATIONS ARE RECORDED

"The narcissus is growing!" Carol announced to the rest of the second grade.[2]

As the group gathered around the narcissus plant, Miss West realized that many of the children were impressed with the sudden appearance overnight, of some green shoots on the narcissus bulb. The gist of several of the remarks was captured in one of Frank's questions.

"I wonder how fast it will grow?" he asked.

"We could measure it every day," Jane said.

"That's a very good idea," Miss West said.

She went to her chair in the planning circle suggesting as she went that they all join her so they could decide what to do about measuring the narcissus plant.

From their discussion they decided to measure the plant each day just as Jane had suggested. They would measure the same leaf. They would make a record of their measurements every other day. This they would keep on a chart which Miss West was to write on the blackboard.

"Why do we need a written record?" Miss West asked.

"Because we will not remember the numbers every day without writing them down," Jim volunteered. They decided on a chart like this:

OUR NARCISSUS PLANT

Day	How Tall	How Much It Grew
Monday		
Wednesday		
Friday		
Monday		

Each day several children measured the same leaf the first thing in the morning. They used a 12-inch ruler. They computed their results and agreed upon the measurement Miss West would record. After the second measurement had been recorded, they figured out how much the narcissus grew in the 2-day period. With yellow chalk, Miss West marked the points on the ruler so the children could see the amount of the increased length, which was the distance between the chalk marks. On the days when they recorded the measurements, she asked a child to draw a chalk mark the length of the increased growth in the right-hand column of their chart. This helped the children get a further visual

[2] This illustration is adapted from an activity in a second grade, East Leonard School in Grand Rapids, Mich.

impression of the amount of growth. It also helped them develop a further idea of how to use a ruler.

The narcissus grew rapidly and suddenly one day the children encountered a difficulty.

"Miss West," John called excitedly, "the ruler won't reach anymore!"

This was indeed true. The narcissus had grown taller than 12 inches. The previous record showed that the narcissus was 11 inches tall. How tall was it now? How could they find out? Here was a new problem. Miss West decided that this new situation called for some further discussion. She asked John if he would carefully move the narcissus to a low table in the center of their discussion circle. As John did this, Miss West and the children went to their chairs.

"After this experience, we all had some new ideas to share about boats."

"How shall we measure the narcissus today?" Miss West asked.

"We could use a yardstick," John said. "There is one by your desk." He got up and brought the yardstick to the circle and volunteered to measure the narcissus plant.

"It comes to here," he said holding his fingers near the 13-inch mark.

"How tall is it, today?" Miss West asked.

"Thirteen inches" said Jane who was sitting near the plant and could see the numbers. Most of the children seemed to understand the use of the yardstick. But Bob didn't.

945244°—51——2

"How can you change from a short ruler to a long one?" he asked.

To help Bob (and possibly others) see the relationship of the 12-inch ruler to the yardstick, Miss West stood the ruler up against the yardstick so that the corresponding numbers coincided.

"Now, Bob, where does the top end of the ruler come on the yardstick?"

Bob examined the ruler and yardstick and saw that the top of the ruler was by the "12" on the yardstick. He also saw that the yardstick had inch marks on it just the same as the ruler, only more of them. He seemed to understand the use of the yardstick to get the total length. But he still wondered how to find out the amount of growth since the plant was 11 inches tall.

A number of children wanted to tell Bob, but Miss West discouraged them from telling him. She gave them a few minutes to whisper their ideas among themselves while she urged Bob to think about it. She fastened the ruler to the yardstick with rubber bands so the numbers still coincided. She had Bob put a yellow chalk mark on the ruler at "11" inches and a yellow chalk mark on the yardstick at "13" inches. By this time, all the children, having shared their ideas with their neighbors, were watching Bob again. He was holding one thumb at the "11"-inch mark and the other at the "13"-inch mark.

"Oh! I see. It grew this much," Bob said as he viewed the distance between his thumbs. He tilted the ruler-yardstick combination so everyone could see.

"Would you make a mark in the chart to show how much the narcissus grew?" Miss West asked.

Jim helped Bob hold the yardstick up against the blackboard and Bob drew a line as long as from "11" to "13".

"How many inches is that?" Miss West asked.

"Two inches," chorused the second-graders.

At this point, Bob surprised everyone by saying, "You wouldn't need to use the yardstick at all."

"How else could you measure the narcissus?" Miss West asked.

"You could use the ruler as far as it would reach and then start over," Bob explained, as he proceeded to separate the ruler from the yardstick. He held the ruler up against the narcissus plant, marked the 12-inch point with his finger, and then moved the ruler up again.

"It says '1' inch on the ruler now and it was '12' to here," Bob said, indicating the bottom portion. "That makes 13!"

This seems simple enough. But Bob had had an *insight* into a new way of using the ruler and yardstick. It made him feel good, made the teacher feel good, and made his classmates feel good. But more important, he had grasped an important new idea of measurement.

This example illustrates a number of important principles about how

children learn to think. First, the group was having a continuous experience with measurement. All of the children had an opportunity to measure the plant. It was part of the expectancy of the group that each person learn to measure correctly.

Second, the children *kept a record* of numbers which represented height of the plant. There was no necessity to remember the numbers; they were in the record. But it was necessary to have the numbers to figure out how fast the plant grew. Records are most useful when they are seen as ways of keeping track of information needed for future reference. Sometimes, this is a good way to decide whether a record should be made: Will we need this information later in solving our problem?

Third, this example shows how number concepts are developed in connection with an *interesting activity* of the group using real materials.

Fourth, it illustrates how *insight* into a problem results after children have had sufficient *related and meaningful experience*. Thus, Bob, who had trouble at first, had an insight about another way to measure the narcissus.

The example also illustrates the important part played by the teacher in directing the situation so that real thinking and problem solving was both expected and made possible.

SHAPING UP THE PROBLEM

The sixth grade were meeting to make plans for a party which they were going to hold 2 weeks later. It had already been agreed that each person would be assessed his share to pay for the party. John was presiding.

"Well, how much do you think each one should pay?" he asked.

A barrage of comments flooded the air.

"Twenty cents."

"Fifty cents."

"Divide it up equal."

"Not as much as last time."

"Enough to have ice cream."

John saw that the remarks were lost to most ears, so he urged them to address him and be recognized. But it was Alice who sensed the basic difficulty.

"What is it we are trying to decide?" Alice asked when she was recognized by John.

Joe stood up and said: "We should decide what we want to have to eat that will cost money before we can decide how much to pay."

"That's a good idea," John replied. "Does someone want to suggest what we might have?"

"Well, we will need decorations and something to eat. Maybe ice cream and cookies and hot chocolate."

"Or apples," someone added.

"Even if we decide what we want to eat, and how to decorate, we still wouldn't know today how much it would cost us."

The discussion was still rambling a little.

"John, I think we should have a foods committee—and maybe a decoration committee, as well as the program committee you appointed last week," Alice said.

"And what would they do?" John asked.

"Well," Alice continued, "the food committee would decide on something good to eat, go find out how much it would cost, and then tell us our share at our meeting the day after tomorrow. If it seemed too much we could say so."

A rich classroom environment stimulates thinking.

"And ditto for the decorations. I don't think we should go over twenty-five cents each, at the most," Henry said. "That would give the committees some idea of how much we want to spend."

John summarized thus: "It seems we need more information, and we might use a committee to get the information for us. Henry has suggested we tell the committee not to plan anything that would cost more than twenty-five cents. What do you think? Will someone make a motion?" John waited while the group buzzed a little.

Then Nancy came up with a motion: "I move that John appoint two committees of three—one for food and one for decorations—which would meet together to figure out the cost of the party."

They passed the motion and John appointed the committees.

In the foregoing episode, Alice got the group on the right track by urging them to get their problem clearly stated. In classroom situations, this is an important function of the teachers, not to state the problem for the group, but to help the group clarify it. As children are given more experience in this, the teacher will be required less and less to word the problem—some member of the class will do it. This takes time because it is a difficult skill to acquire. But since it is an important step in thinking, teachers must work consistently with children on it, and at the same time, be patient with them as they learn to clarify problems.

Aimless discussion and, hence, aimless thinking was prevented in this group by an early recognition that more information was needed. A committee was appointed to get the information. The committee was supposed to do some preliminary thinking for the group in addition so that a satisfactory decision could be made. Making wise decisions requires careful thinking and children should be given opportunities to help arrive at decisions which involve them and are important to them.

It was helpful in this situation for the committee to be given a clear and specific job to do. Their time and thought could be given to preparing a proposal about the cost of the party rather than meeting and wondering what they were supposed to do.

And did you notice how John, after asking someone to state a motion, allowed ample time for thinking to go on? Teachers are often not as patient as John. Too frequently, they ask a question and then before there is a possibility of anyone's thinking through an answer, they deprive the children of the opportunity to think by answering the question—or by asking another. This latter procedure is helpful only if the second question clarifies the first.

This example should also help remind us that children belong to various groups and organizations, such as student councils, Boy Scouts, Girl Scouts, and safety patrols. We can scarcely expect them to blossom out and do superlative thinking in their organizations without having opportunities to do so in their classroom work.

WIDE PARTICIPATION AND STICKING TO THE POINT

There are times when it is necessary in group discussions to urge children to "stick to the point," to "stay on the track," "to keep to the subject." Without help in this regard children easily wander from topic to topic whether related to the original question or not. Clear thinking

ultimately depends upon seeing the relationships of relevant facts to the solution of the problem. Random and unguided discussion in itself does not point up the important and related facts. The teacher must, therefore, check on the relevance or irrelevance of children's comments so they will gain increasing skill in drawing upon their knowledge and experience in addressing themselves to a question or problem.

It is not possible, however, for a child or a group of children, to think clearly about the solution of a problem before the problem is agreed upon. Therefore, much of the discussion of children in classrooms must be geared to clarifying the problem. In this, as in other phases of discussion, the teacher must see the value of permitting children to contribute in whatever way they are able to contribute. The teacher must make children feel free to contribute to the discussion. The situation must be such that each child senses that his contribution will be accorded serious consideration as the group explores the problem.

As was said earlier, when children enter freely into a discussion, a number of kinds of contributions occur. It is in this setting that the teacher is faced with the dilemma of encouraging wide participation and at the same time giving guidance in "sticking to the point."

The way one teacher handled such a group discussion is illustrated in the following account of a third grade at work.

Someone had been watering the plants and had left a partly filled pitcher of cold water on the window ledge. As Janet walked by the pitcher she ran her finger across it and made a mark on the pitcher. Then she paused and wrote "J" on it. Very soon the "J" began to disappear. Janet noticed that Mrs. Vance saw her by the pitcher.

"See, it has water on it," Janet said.

By that time all of the children were turning to watch Janet and the pitcher, and Johnny said: "What makes it wet on the outside?"

This tied in with their study of weather and Mrs. Vance saw the opportunity to help the children understand how moisture gets out of the air. She asked Janet to carry the pitcher to the center of the room and the others formed a large circle with their chairs.

"Now let's think about this," Mrs. Vance said, "Johnny wants to know what makes it wet on the outside."

"It must leak."

"Maybe someone spilled the water on it."

"But it's too smooth and even to be spilled on," someone protested.

"If it leaked, some more would probably be running down."

"Is the water inside warm or cold?" Mrs. Vance asked.

Several children tested it with their fingers and agreed it was cool. The child who had originally suggested that the pitcher leaked said: "Maybe it only leaks cold water, not warm water."

"Sometimes my father's glasses cloud over when he comes in out of the cold," Ned volunteered.

With this lead, Mrs. Vance asked, "On what other things do you sometimes see moisture?"

"On windows when it's cold outside."

"On the water pipes in the basement."

"Inside the refrigerator—you have to defrost it."

"We check our facts before drawing a conclusion."

"And on the ground when it rains."

"Yes, now, what is the question we began talking about?" Mrs. Vance asked.

"What makes the pitcher wet on the outside?" someone said.

"Well, let's write that down," Mrs. Vance said. She wrote the question carefully on the blackboard where all could see it.

Jerry had edged his way to the bookshelves. He had been leafing through a book. He said, "Here is a picture showing drops of water on the outside of a glass. It probably tells what caused it."

"I think the pitcher was cold and it made moisture settle on it," Floyd said, "because it's when they are cold that glasses get all steamed over."

"You may be right, Floyd," Mrs. Vance said. "Before tomorrow, Jerry, will you find out what the book says? And let's also plan another way to help find out if the cold has anything to do with it. How many of you could bring a small, shiny tin can tomorrow?" Almost everyone put up a hand. "Tomorrow, then, bring small cans and we will try to find out what causes water to collect on the outside of the cans. Before tomorrow, all of you think of two things that we might try out."

Mrs. Vance for her part planned to bring ice cubes so that every child could have a can of ice water.

Once more Mrs. Vance asked, "What is it we want to find out?"

Several hands went up and she acknowledged Dolly who read the question from the board: "What makes the pitcher wet on the outside?"

In the preceding discussion, Mrs. Vance gave many children a chance to talk. Various kinds of contributions were made. Some children speculated about the possible answer. They were encouraged to be creative in stating their ideas. Some thought of "other places" where water collects. Floyd came right out with a correct answer. "The cold pitcher causes water to collect on its outside," he said in effect.

Mrs. Vance turned this statement into another hypothesis to be checked. By doing so she gave recognition to the contribution and at the same time left the question open so that other children would need to engage in further investigation and thinking to answer the question for themselves.

Jerry cited a reading reference. Mrs. Vance recognized the importance of reading by asking Jerry to do further reading on the question. In the long run, of course, reading continues to be a major source of information. Reference reading is important in helping children learn to think because it is one source of facts, and it is a means, too, of checking on conclusions arrived at from direct observation.

In this example the group began plans to get some additional evidence by experimenting. Mrs. Vance encouraged someone to reformulate the question being discussed. This is an important step in clarifying thinking. In any group there are usually several who have forgotten or never

understood the question or problem being studied. Having the question restated helps those who have forgotten, and tends to keep everyone on the track. This is an aid to thinking.

The main point of the illustration just given is that the teacher permitted the children to attack the question in a number of different ways. She gave them freedom to explore it from various angles. During this process, they were learning—were building up ideas and common experiences to be used in thinking more formally about the specific question. Mrs. Vance was careful not to "squelch" discussion by insisting that each remark be directed to the specific question—and nothing else. She knew that children think better when they are free to express the ideas which seem to them to be related to the question. Some errors occur—some statements are not relevant. As children mature in their ability to think, they will examine their thoughts more closely before expressing them, and withhold those that do not really bear on the question.

Mrs. Vance helped clarify the reason for doing an experiment and for reading. She was not asking them to "recall" memorized material or to "recite" something she had told them or which they had read in a book. Best thinking goes on when the teacher keeps "recall" and "reciting" lessons at a minimum and keeps thought-provoking questions at a maximum.

EMOTIONS AND THINKING

The Chinook salmon which Kenneth had been reading about were still fighting their way up and over the falls. He was still seeing in his mind's eye the tremendous power of the water at the dam and was wondering how many salmon would make it up safely, and where did they come from, and did other fish behave this way—and was the Columbia River the only river in which salmon swam. Kenneth was in the seventh grade. All these things were going through his mind when Miss Jones, the teacher, said: "Boys and girls, it's time for us to work on our arithmetic problems." After waiting several moments, she said, "Kenneth, you're *not* paying attention! You're not thinking!"

Well, maybe he wasn't. But something very important was going on in Kenneth's head. And some days when this sort of thing happened, he was scolded by his teacher. And almost always, at times like this, he had trouble doing his arithmetic afterwards.

Different names are given to what was going on in Kenneth's head. Maybe it was daydreaming, maybe it was imagination, maybe it was thinking. We all know that such things go on in our heads. Almost everyone would agree that all people need to have opportunities for this sort of mental wool-gathering. Perhaps pupils have too little of it in their school days.

Teachers too often try to move children so quickly from one mood to another, from one process to another, that the child cannot follow at all. Scolding may change the outward activity of a child, but will upset him emotionally so that he is temporarily blocked from thinking constructively.

RECOGNIZING CAUSES FOR ERRORS IN THINKING

In addition to keeping in mind the points mentioned thus far, the teacher has a further responsibility for making the total learning situation as good as possible for thinking to go on. Sometimes this means eliminating or at least recognizing the common causes for errors in thinking. Here are a few of them:

(1) A child may be temporarily upset emotionally. This was illustrated in the reaction of Kenneth to his teacher's scolding when he had been "day-dreaming" or "reflecting" about the fish in the Columbia River. Other more serious types of psychological mental blocks may be present in some children. Such blocks may serve as a means of escape which prevent him from giving undivided attention. Likewise, a child may have a poor physical health condition, either temporary or chronic, which makes it difficult for him to give undivided attention to thinking about some self-assigned, group-assigned, or teacher-assigned question. When John has a "toothache" or Carol has "indigestion," thinking about a question such as "How do automobiles affect our lives?" may seem unimportant to them.

(2) A child or group of children may find the materials or questions being studied inappropriate to their intellectual or educational level, or their experience background. Second-graders, in general, may have little inclination or ability to think, for example, about the weather conditions in Egypt. But talking about the rain which fell on all of them that morning has real meaning.

(3) Faulty language comprehension may lead to an incorrect conception or to a misunderstanding of the problem being studied. Almost every teacher has had the experience of hearing a pupil say, "Oh, I see now what you are talking about," even after several days of discussion on a topic. Such a comment may indicate that the language was not clear. Or it may mean that during this period, the pupil had engaged in activities which helped him understand the problem. It happens, sometimes, that children cannot clearly state a problem or question until

they possess nearly enough information to answer the question. This suggests that teachers must continually help children build accurate and useful vocabulary and language, and at the same time provide experiences which help give meaning to the words and concepts being developed.

(4) Everyone has wishes and prejudices. They sometimes influence one's thinking. For example, if a child is extremely anxious to go on a picnic, if he "wishes" to go very much, and if the weather seems too cold and rain threatens, his ability to consider these factors objectively in deciding whether it is wise to go is limited. His wish becomes a more powerful factor in making the decision than the weather elements. Likewise, a person's choices and decisions are sometimes influenced by his prejudices.

Thus, in helping children think carefully, it is important for teachers to recognize that wishes, likes and dislikes do influence decisions. It may not be possible, nor necessarily desirable, to eliminate these kinds of factors. People will always have wishes and prejudices. Part of the task of education is to eliminate certain undesirable prejudices and modify others. But the fact remains that in any group there will be persons with strong wishes and prejudices. The teacher's responsibility in working with children is to help them see how these things influence thinking, and to help them learn to examine their thinking to see that their conclusions are not the result of prejudices and emotional reactions only but also of reasoned facts and valid information.

Simple experiments help us think through difficult ideas.

EVALUATING GROUP THINKING

A great deal of group discussion and group activity goes on in the modern elementary school. Most of the illustrations which have been used here concern children working on common problems in groups. It is not to be concluded from this, however, that children cannot or should not be encouraged to do individual problem-solving, and to "think for themselves" when problems confront them individually.

Since the typical elementary teacher does work with children in groups, most of the time, how is she to know whether or not children are improving in their ability to do group thinking? Here are a few characteristics of good group thinking.

(1) The problem is clarified so that most of the children understand what is being discussed.

(2) There is wide participation of children and their contributions are relevant to the understanding and solution of the problem. They stick to the point. The group does not depend upon just one or a few persons for all ideas.

(3) New ideas and new problems are sifted out and put aside for discussion at another time if they don't relate to the question being considered.

(4) Children insist on getting sufficient and accurate facts to use in thinking through a problem. They realize that many sound facts gained through first-hand experiences help in reaching sound conclusions.

(5) The group draws on a variety of sources of information as a basis for thinking. This is important because some children may gain information and experience more readily from one kind of activity than from another type.

(6) The members of the group are increasingly more conscious of checking on "cause and effect" relationships. They question "loose" explanations. It is an evidence of good thinking when children correctly foresee the connections between things—when they can predict accurately.

(7) There is willingness to explore a problem thoroughly before coming to a conclusion. The group does not rush to a conclusion nor does it permit its members to do so. The group is willing to suspend judgment.

(8) Prejudices, superstitions, and personal biases do not unduly influence decisions. Children recognize the presence of such factors and take them into account as part of the "data" to be considered in reaching conclusions.

(9) The decisions, conclusions, and suggestions arrived at by an individual or a group prove to be all right when carried out, applied, or tested in real life situations.

(10) The children begin to generalize the principles of good thinking. There is evidence that basic patterns of good thinking are present in a variety of situations, not just in classroom group discussion under the direction of a teacher.

(11) Children evaluate their thinking processes. They check on whether they are applying the principles of good thinking to their individual and group problems. They are objective and honestly critical of how they have worked on a problem. They improve their thinking by taking into account the weaknesses they have observed.

We all believe that it is important in the school to help children learn to think better. It will not happen automatically. But it can be planned for in many situations in the school. It is not a skill that is developed in connection with any one subject—science, arithmetic, social studies, spelling—and disregarded in others. It should be developed in all of them. It is important for the classroom to be a stimulating environment. When children are continually challenged with questions and perplexities that require new information and the necessity of arriving at new conclusions to be tested through experience, they are in a situation that stimulates thought.

Time and consideration must be given to the problem of improving thinking if we take it seriously as a purpose of the school.

* * * * * * *

Grateful acknowledgement is made to the individuals and school systems that supplied the basic materials and photographs used in this bulletin.

BIBLIOGRAPHY

The items listed here represent only a few of the many available books and magazine articles on the subject of thinking and problem solving. These are some that have special application to classroom teaching.

ALMY, MILLIE. Are They Too Young for Problem Solving? *Progressive Education*. 27: 148–151, March 1950.

By numerous examples this article shows that young children can and do solve problems on their level of maturity.

BATHURST, EFFIE G. *et al*. The Place of Subjects in the Curriculum. Washington, U. S. Government Printing Office, 1949. Federal Security Agency, Office of Education. Bulletin 1949, No. 12. 33 p.

Describes a typical day in a modern classroom, with comments about how different subject matter is used in studying the problems confronted by the children.

BOHAAS, JULIUS. Teaching to Think. New York, The Macmillan Co., 1922. 289 p.

Discusses the principal types of thinking which are required in everyday life, and indicates practical ways and means for their development in the school.

BURTT, EDWIN ARTHUR. Right Thinking. A Study of Its Principles and Methods. New York, Harper and Bros., 1946. 764 p.

The first chapters of this book discuss the steps in thinking, analyse a typical case of reasoning, and point out how wrong thinking occurs.

Childhood Education. 27: 295–326. March 1951. "We Solve Problems."

This entire issue is devoted to how children solve the problems they meet in today's puzzling world. Examples are drawn from children in the nursery school, kindergarten, primary, and intermediate levels.

CLARKE, E. L. The Art of Straight Thinking. New York, D. Appleton-Century Co., 1931. 470 p.

Points out how to apply the scientific method to social problems.

CURRAN, CLYDE E. Teaching People to Think. *Progressive Education*. 28: 132–135, February 1951.

Emphasizes the need for the teacher to understand each child in order to help him think; a stimulating learning situation is a prerequisite to thinking.

DEWEY, JOHN. How We Think. New York, D. C. Heath and Co., 1933. 301 p.

The subtitle of this classic book describes it as "a restatement of the relation of reflective thinking to the educative process." The book analyses the steps in a complete thought process.

FIREMAN, PETER. Sound Thinking. New York, Island Press, 1947. 240 p.

Part One (Chapters I–IX) considers the various modes of thinking, such as intuitive, inductive, and deductive. It discusses how one's senses, opinions, and sentiments enter into thinking. Part Two presents illustrations of the art of thinking from the history of theory of knowledge.

GLASER, EDWARD M. An Experiment in the Development of Critical Thinking. New York, Bureau of Publications, Teachers College, Columbia University, 1941. 212 p.

Describes an experiment which was carried on to discover the conditions under which ability to think critically is improved. The volume has in it an extensive bibliography on critical thinking.

GOODSON, MAX R. Problem Solving in the Elementary School. *Progressive Education*, 27: 143–147, March 1950.

Includes several examples of children working in groups to solve problems. An analysis of the method of problem solving is included.

THOULESS, R. H. How To Think Straight. New York. Simon and Schuster, 1939. 246 p.

Cites many examples of both good and faulty thinking and gives rules and precautions to follow to assure "straight thinking."