Analytic Teaching: A Focus on the Learner

Dr. Carolyn Christopher, Director of Planning, Sid Richardson Grant for the Fort Worth Public Schools, asked how I liked analytic teaching and *Harry Stottlemeier's Discovery*. Spontaneously, I replied, "Never has anything appeared so easy but actually been so hard."

While taking the graduate's course "Analytic Teaching," I observed the ease with which my instructor pulled ideas and hypothetical situations from the text. Enviously, I referred to these as the "hidden agenda."

The instructional manual, although essential to the study of philosophical inquiry, is only a springboard. From it, a teacher must practice a high dive into the art of purposeful discussion — a discussion which can be divergent, leading to many ideas from the students, or convergent, with many ideas focusing into one.

My first attempts kept me in deep water. An early observation of the instructor concerning my lesson on personal identity was that it was too abstract.

The instructor modeled the importance of being as concrete as possible. He asked the students, "Would you still be you if you changed your clothes?" The students assured him they would. "If you get your hair cut will you still be you?" They affirmed they would. "Let's hope this doesn't happen, but if you lost an arm or leg, would you still be you?" Children were now totally engrossed to see where this discussion would focus.

"What parts of you could be exchanged and you would still be you?" Discussion of heart, liver, and kidney transplants diverged for a brief moment.

"What could you not exchange and still be you?" The students replied "Your brain." Asking "why" brought the students into focus as they had the joy of discussing why the brain might be considered "unique."

The children received insight which left them in high esteem of their thoughts; I learned a lesson. Not only do you need to map your ideas of where to go during a discussion, but you must also consider with whom you are taking the trip.

How should teachers teach analytic thinking? Before this can be answered, we must ask: How do children learn? The art of effective teaching must be based on the learner.

Few people have greater insight on learning than Swiss psychologist, Jean Piaget. Although Piaget's theory of mental development is suggestive rather than conclusive, dozens of studies have substantiated his ideas.

Piaget asserts that the basis of all learning is the child's own activity as he interacts with his physical and social environment. Mental activity requires adaptation to the environment. Adaptation consists of two opposed but inseparable processes, assimilation and accommodation.

The child assimilates when he fits a new experience into his pre-existing mental structure. He interprets his new experience in the light of his old experience.

The child accommodates as he tries to adjust the mental structure in light of the experience.

Like a pendulum, assimilation and accommodation create an inertia which modify the concept and eventually the child's mental activity is altered.

As a child progresses from infancy to maturity, his characteristic ways of acting and thinking are changed several times.

Piaget identified these four distinct stages of mental growth as: sensori-motor, pre-operational, concrete operations, and formal operations.

Although a child in the fourth grade is well into the stage of concrete operations, he is unlikely to complete anything involving formal operations.

This does not imply that if the teacher gives a demonstration with concrete models, or if the child uses the models himself that he will adapt the concept into his mental schema.

Seymour Papert, author of *Mindstorms — Children, Computers, and Power Ideas*, worked with Piaget for five years (1959-64) at Piaget's Center for Genetic Epistemology in Geneva.

In *Mindstorms*, Papert describes a cross-cultural investigation which discerns concrete operation from formal operation.[4]

> In society after society, children seem to develop cognitive capacities in the same order. In particular, his stage (a child's) of concrete operations, to which the conservations typically belong, begins four or more years earlier than the next and final stage, the stage of formal operations. The construct of a stage of concrete operations is supported by the observation that, typically, children in our society at six or seven make a breakthrough in many realms, and seemingly all at once. They are able to use units of numbers, space, and time; to reason by transitivity; to build up classificatory systems. But there are things they cannot do. In particular, they flounder in situations that call for thinking not about how things are but about all the ways they could be. Let us consider the following example, which I anticipated in the introduction.
>
> A child is given a collection of beads of different colors, say green, red, blue, and black, and is asked to construct all the possible pairs of colors: green-blue, green-red, green-black, and then the triplets and so on. Just as children do not acquire conservation until their seventh year, children around the world are unable to carry out such combinatorial tasks before their eleventh or twelfth year. Indeed, many adults who are "intelligent" enough to live normal lives never acquire this ability.

Although a child's progress through the four major stages of mental growth is fixed, the rate of progress is not. Transition from one stage to the next can be hastened by enriching experiences and good teaching. However, if our expectation of a ten-year-old is to have him or her analyze, hypothesize, and draw conclusions, then we may fall short of our goal.

The degree of success or failure of Analytic Teaching will be determined by the teacher's awareness of the learner. A teacher must realize when the activities of the instructional manual do not match the child's mental process to assimilate or accommodate the experience.

A teacher may choose to omit such an exercise if it is not essential to the program. Many points in question, however, are vital to philosophical inquiry.

In chapter four of *Harry Stottlemeier's Discovery*, the instruction manual suggests that all quantifiers can be reduced to only three: "all," "no" or "some." A chart is provided with examples of how ordinary sentences can be changed to sentences in standard form. After "discussing" the importance of simplifying the number of quantifiers to "all," "no," and "some," the students were assigned the task of standardizing sentences. Within a few minutes the children were wanting help. It was obvious that only a few had adapted the idea of standardization.

Now the burden was on me, the teacher, to give an experience with quantifiers which would help them adapt.

In an envelope, hidden from their view, I placed six squares. On the board I wrote:

1. All squares are orange-colored shapes.
2. No squares are orange-colored shapes.
3. Some squares are orange-colored shapes.
4. Some squares are not orange-colored shapes.

I asked Eddie to draw from the envelope without looking inside it. He drew an orange-colored square. I asked which of the statements on the board were true. The class selected "some . . . are." However, Andrew was convinced that the squares in the envelope were all orange. I asked him why. "Because you used only 'orange-colored' in your sentences on the board," he reasoned.

"Is drawing only one square enough proof that all the squares are orange?" I questioned.

"Yes," Andrew said emphatically. I asked the others if they too were convinced that all were orange-colored objects. Only a few hands appeared.

Students urgently wanted to draw again. Before doing so, I placed a check by the "some . . . are" sentence. I then wanted to know if there was a quantifier which was wrong and could be proven with only this one orange-colored square.

The class agreed that the "no . . .are" sentence was inappropriate for the situation. We placed an "X" by it.

Eddie drew again; another orange square appeared. Andrew was bubbling with enthusiasm. He was convinced he was correct. I asked if anyone wanted to change his decision on the some and no sentences. No one did; however, when asked if we could check the "all" sentence as correct, a few more students were swayed to agree because of Andrew's insistence.

An air of suspense filled the room as Eddie drew again. This time a yellow-colored square was drawn. A huge sigh was heard as the tension was released. Hands shot up. Students quickly identified "some . . . are not" as true and "all" as false. The remaining squares were drawn even though they were superfluous to the results.

This activity did not teach the children how to standardize sentences. It did, however, give the students a common experience with which most could adapt standardization to some degree.

In light of the evidence, the students reviewed why "some . . . are" and "some . . . are not" were the appropriate responses. They understood it took only one orange-colored square to make "no" incorrect and one yellow-colored square to make "all" incorrect.

For the next exercise, the sentences about the orange-colored squares remained the same. Six orange squares were returned to the envelope along with two blue triangles.

Although the process was the same, the results were different. The students checked "some . . . are" and placed an "X" by "no" after the first orange square was drawn. Eventually, a blue triangle was drawn.

Sounds of surprise and quandry filled the room. Something unexpected had happened. The students discussed the triangle. By comparison and definition the triangle was not the same as a square.

A great dilemma arose. Would it be appropriate to "X" the "some squares are not orange-colored objects"?

The students decided they must wait and draw again. A blue triangle did not count as a "some . . . are not."

"What if the blue triangle were the last object in the envelope? Would 'some . . . are not' be correct?"

Many students were hesitant. They still remembered Andrew and the yellow square.

The remaining orange squares and another blue triangle were drawn. In light of the evidence, the students checked "All squares are orange-colored objects" and placed an "X" by all others.

The students reviewed their conclusions and generalized that "some" can be used in standardizing when you have one exception to "all" and "no." The students returned to the exercise on standardization. I asked them to look at the sentences like the objects pulled from the envelope. In light of the evidence, the sentence, what would you say is true?

Example: Very few pirates are pilots — Evidence

X 1. All pirates are pilots.
X 2. No pirates are pilots.
+3. Some pirates are pilots.
+4. Some pirates are not pilots.

Of course, many children needed extended help with writing standardized sentences because this is clearly in the realm of formal operations.

When I asked them which quantifier they wanted to use, they usually knew.

The Centipede was happy quite
Until the toad in fun
Said, Pray which leg comes after which?
This wrought her mind to such a pitch
She lay distracted in a ditch
Considering how to run.

— Anonymous

Remember your first bike ride? I hope it was better than mine. My dad held me as I struggled for control. He soon stopped, however, as I was headed downhill and had accelerated faster than he could run. I heard him say in the distance, "Keep pedaling and stay upright." Fear of falling on rocks and gravel kept my equilibrium checked until I reached the bottom of the hill.

One hopes that few things are learned under such improbable conditions of fright and non-verbalization.

Children learn much of what they know without formal instruction. Does thinking about thinking embroil the child to the same state as that of the centipede?

Verbalization and Analytic Thinking are important in physical skills. Any golfer or tennis player will seek the thinking of another professional when he is in a slump. Athletes don't totally rely upon their own thinking; there is a coach. A person who is considered a professional athlete needs the keen observation and critical analysis of a trainer. Wouldn't a novice benefit from such instruction too?

A good tennis coach would not instruct me at the same level as John McEnroe (If you saw my game you would be certain of that). Perhaps my game would improve more or at a faster rate with good instruction. However, even with the best tennis coach in the world, I have limitations.

Piaget suggests that children have definable limitations to the rate at which they will pass through the stages of mental development. What are these limitations?

Piaget describes several in his book, *The Growth of Logical Thinking from Childhood to Adolescence*:

> . . . the maturation of the nervous system can do no more than determine the totality of possibilities and impossibilities at a given stage. A particular social environment remains indispensable for the realization of these possibilities. It follows that their realization can be accelerated or retarded as a function of cultural and education conditions.

The maturation of the nervous system is a physiological limitation over which we have little control. Piaget implies, however, with other limitations, cultural and educational, we can take "lemons and make lemonade." With meaningful experiences, enhanced cultural and education conditions, the time of transition from stage to stage can accelerate.

The following chart shows the developmental stages and the chronological age correlation:

(1) Sensorimotor stage (0 to 2 years)
(2) Preoperational stage (2 to 7 years)
  (a) preconceptual thought (2 to 4 years)
  (b) intuitive thought (4 to 7 years)
(3) Operational stage (7 to 16 years)
  (a) concrete operational thought (7 to 11 years)
  (b) formal operational thought (11 to 16 years)

We should note that elementary school students fall generally between 2b and 3a.

Earlier in the text, Seymour Papert describes a cross-cultural investigation which discerns concrete operational from formal operational thought. I am wondering if I too often asked my fourth graders "to combine the colored beads."

Originally, *Harry Stottlemeier's Discovery* was written for sixth grade students. I recommend the instructional manual, *Philosophical Inquiry* be reviewed in light of Piaget's theory of mental development. Supplementary exercises need to be written to give students in the stage of concrete operational thought opportunities to experience and adapt this noble idea of thinking about thinking.

How should a teacher teach analytic thinking?

(1) Consider your learner. Use the exercises in the instructional manual whenever possible, but don't continue if you discover the material is inappropriate.
(2) Provide an experience or model which will encompass the idea yet allow adaptation for the child.
(3) Use materials which you know work well. If you have math or science equipment which you know is appropriate for the age child you are teaching, incorporate it into your lesson plans.
(4) Read stories, poems, and other literature which create a dilemma, role-model, give another point of view or another culture. *Call It Courage* and *A Hundred Dresses* contain all of these elements.
(5) Encourage students to perform in the creative arts to intensify the experience. *E.g.* Role-playing the stereotypes or writing about fears.
(6) Play logic games. *E.g.* Hide a number from view (0-100). Students must ask questions which can be answered "yes" or "no." Keep a tally of the number of questions until the number is guessed. The goal is to beat your previous score with a lesser number of guesses by using logic.
(7) Provide experiences which explore real objects to develop concepts of space, probability, inductive or deductive reasoning, reversibility, *etc.*
(8) Remember there is a lag between perception and the formation of a mental image. Reinforce this mental image by reviewing the more concrete operation in light of analytical skills or formal operation. *E.g.* The standardization of sentences can be thought of as objects from an envelope . . .

Teaching Analytic Thinking is hardest when we focus only upon the material or ourselves. It is best when we focus on the learner.

Tommie Lee

Bibliography

1. Adler, Irving, *Mathematics and Mental Growth*. The John Day Co. New York. 1968, pp.42-65.
2. Flavell, John H., *The Developmental Psychology of Jean Piaget*. New York, D. Van Nostrand Co. Inc.
3. Piaget, Jean, *The Growth of Logical Thinking from Childhood to Adolescence*. New York, Basic Books.
4. Papert, Seymour, *Mindstorms — Children, Computers and Powerful Ideas*. New York, Basic Books Inc. P.174