Iowa Science Teachers Journal

Volume 24 | Number 1 Article 2

1987

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Alice Krueger
Mississippi Bend Area Education Agency

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Alice Krueger
Science Consultant
Mississippi Bend Area Education Agency
729 Twenty-first Street
Bettendorf, Iowa 52722

Thinking skill instruction for school-age children is a significant topic for today's educators to consider. A coalition of 27 educational groups, including the National Education Association and the Association for Supervision and Curriculum Development, has been formed to promote thinking skill instruction in the nation's classrooms (Lytle, 1986). A poll of ASCD members shows that about 90 percent want better thinking skill instruction to be a major priority in the coming year (Beyer, 1984). Educators taking the Graduate Student Examinations now have to think through a section on reasoning.

Defining "thinking" is difficult, but any set of definitions usually has common points. First, thinking is a mental process. Second, thinking operates on knowledge or content matter. Third, thinking is directed towards solving a problem of some sort.

There are implications to these common definitional points. Because thinking is mental, its operations are covert, and must be inferred from behavior. This makes observation and evaluation of thinking and instruction in thinking skills (description of the desired process and correction of the student's attempts) very difficult for a teacher. Thinking is knowledge-dependent; it is impossible to do "higher order" thinking without having the "lower order" knowledge and comprehension of content matter. Also, thinking always has a point, a purpose for exercising the thinking skills.

In defining "thinking skills," researchers provide examples of what biological taxonomists have come to know as "lumping" and "splitting." Bloom's (1956) taxonomy of educational objectives in the cognitive domain represents a middle ground, identifying six levels of thinking. Barry Beyer's (1984) three divisions (microskills, critical thinking skills, thinking processes) represent the minimal approach to classification, while the proponents of factorial intelligence theory, such as Guilford (1961), list hundreds of separately identified thought processes. Obviously there is no consensus among experts concerning the nature of thinking skills.

In addition to classifying thinking skills, researchers have identified a number of pertinent research results. First, thinking skills must be taught in content areas, not as an isolated task (Joyce, 1985). Furthermore, all children should be taught to improve their thinking skills because all of them can do so, not only those in the Talented and Gifted program where thinking skills instruction is often confined (Bloom, 1978). Thinking skills should be taught overtly; students should know the purpose of studying these topics (Barell, 1985). Thinking skill instruction should be part of the K-12 curriculum in all content areas (Beyer, 1986). Effective thinking skill teaching relies heavily on the interaction between teacher and student (Feldman, 1986). Also, such instruction should emphasize the process of thinking, not the products.

Teachers can place five emphases on thinking skills in their classrooms. All are equally important; this is not a hierarchy. First, teachers must allow thinking. At first glance, perhaps this statement seems ludicrous. However, the decline in student thinking ability by mid-elementary age is well documented. One young child of the author's acquaintence, who before attending kindergarten was able to tell long stories about pictures in books and magazines, refused to do so after a few months of school. She had learned that if you didn't know the right answer, you didn't volunteer anything.

Second, as with any skill, a good teacher models thinking skills. Of course, teachers are thinking all the time, but modeling means overtly performing specified skills with the procedures and products clearly identified to the observers (Feldman, 1986).

Third, students should be encouraged to apply thinking skills. It has been shown that student-generated higher order thought questions are better evidence of the teaching of higher order thinking skills than are the teacher's use of higher order questions (Beyer, 1985).

Fourth, students and teachers should discuss thinking, a process sometimes referred to as meta-cognition or thinking about thinking. Often the best way to hone a skill is to analyze it and describe it clearly to another.

All of the preceding processes are important to establish a classroom climate which facilitates student thinking. The focus of the rest of this paper will be on actual thinking skill instruction, which is the fifth component of thinking in the classroom.

It is important to know why we are not doing a better job of thinking skill instruction currently, even though so much attention has been paid to it. First, the lack of a consensus on definitions, especially when one word is often used by different experts to mean different things, causes a great deal of difficulty. Unclear or improper definitions may lead us to focus on inappropriate pupil behaviors as indicators of specific cognitive skills. Not all identified "skills," no matter to which taxonomy you subscribe, are similar in level of complexity (Paul, 1985). Science teachers should be especially aware that taxonomies are not hierarchies.

Second, we must remember that thinkers need a great deal of background knowledge in order to think. This includes, of course, content matter, but also must include operational procedures and associated knowledge. Operational procedures include such things as rules for using specific thinking skills, and clues for using each skill effectively. An example of associated knowledge used with a thinking skill is that in order to use the skill of classification, the thinker must have knowledge of potential categories.

Unfortunately, we are not very skillful at teaching thinking skills. Most of what we do in our classrooms in the name of thinking is exercising. Questions rarely teach, so the use of "higher order" questions is probably not a defensible practice. At best, by exercising their thinking skills, our students practice thinking rather than learning new skills. At worst, we are only testing student skills without teaching them previously.

Another problem is "skills overload." Teachers often subscribe to the "infection theory" of education, in which students are "exposed" to a large number of

skills in the hope that they will "catch" some. Actually, skill instruction should be developmental, sequential and integrated into the curriculum. The ASCD recommends introducing only two or three new skills a year for actual instruction (Joyce and Shavers, 1983).

A fifth problem is poor testing of thinking skills. This is a correlate of poor definitions, inappropriately identified indicating behaviors and other problems mentioned earlier. Bloom, after selling a million copies of his *Taxonomy* (1956) and after having seen it taught for twenty years in teacher training institutions throughout the country, still finds that upwards of 95 percent of questions asked on classroom tests are at the knowledge level on his scale (Bloom, 1978). Another problem with current testing is that it is dangerous to assume that measuring an isolated skill is an adequate measure of the whole thinking process. Probably what is needed is a new format for thinking skills testing, including behavioral observation checklists.

Many tactics used by classroom teachers to instruct their students in thinking skills are incomplete. Exercises such as those from Sandra Black, Anita Harnadek, and the SOI Institute are ineffective as a total thinking skills program, although they should be a part of an integrated program. Content-free skill instruction cannot work, and neither will one-shot isolated instruction. One unit a year, or even one year of instruction, is not sufficient.

The use of "higher order" questions by the teacher will not promote higher order thinking by the students, because it does not teach the necessary skills. Also, it is not possible to tell from which level the student is answering a question. The level of difficulty of a question is determined by the person answering it, not by the one posing it. Essay tests do not usually encourage "higher order" thinking by students, since they are usually evaluated at a knowledge level by the grader.

Several things can be done to improve thinking skill instruction. First, we must work to establish a common language for identifying and defining the thinking skills. Next, we must identify the components of thinking. This must include operating procedures for the thinking skills, rules for using the operating procedures, and the associated knowledge or experience base necessary to make the skills operational. Third, we must determine an appropriate sequence for instructing our students in the skills we decide they should be able to use as adults.

Fourth, we must provide our students with directed teaching of thinking skills with the goal of autonomous use in varied contexts. Effective learning research shows that students learn best when they know what they are doing and how well they're functioning. Distractions from the task at hand should be eliminated, so that attention is focused. Students need to see the skill modeled and must have frequent intermittent practice in order to improve appropriately. Feedback should occur during practice to allow each student to correct his or her own usage (Bloom, 1978). Students should be encouraged to talk through their thought processes. This is debriefing, or reflective thinking. Students will learn a new skill best through a content area when they need to perform that skill, and then should be given opportunities to practice the skill in new contexts. Several workable examples of thinking skills instruction in particular curricular areas are

given in Swartz (1986).

In addition, we must develop a sequential curriculum of thinking skill instruction. Isolated skills don't transfer outside of the context in which they are taught, and are not as likely to become functional for the student as those skills taught in a more integrated manner. Skills should be introduced, reviewed and reinforced, extended and practiced at every level in every curriculum area. One example of a thinking skills curriculum sequence is the Walla Walla, Washington, district model given in Arredondo and Marzano (1986).

Finally, we must insist on an improvement in skills testing. Teachers and testmakers must use the same definitions of thinking skills. To be valid, test items must be on novel content. It is, therefore, not appropriate for teachers to use old test items as practice problems in class.

We must also decide on the purpose of testing — are we measuring and reporting skills or thinking procedures?

Teachers have many opportunities to provide their pupils with learning experiences involving higher level mental processes. Research results have shown that almost all children can function at the highest cognitive levels if those skills are taught using appropriate materials, teaching methods and evaluation techniques. It's time we educators accepted our responsibility for developing high level thinking skills in all our students.

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