Higher-Order Thinking for Compensatory Students

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A computer-based instructional program for Chapter I students has enabled them to learn higher-order thinking skills, improve communication skills, and increase self-esteem, dispelling the myth of their limited intellectual capacities.

The conventional approach to Chapter I education fails the test of equity. Drill and practice, the usual approach, often fails to develop even rudimentary basic skills, particularly in the upper elementary grades. This failure is usually considered as further proof of Chapter I students' limited intellectual capacity—both by staff members and by the students themselves. But even if it worked, the basic skills approach would not result in a substantial expansion of opportunity in an age in which job opportunities are increasingly linked to high levels of problem solving skills.

An alternative perspective is that these students are, in fact, quite bright but need an incentive stronger than tests to stimulate them to use formal language and reasoning. Equity concerns would suggest that, rather than postponing higher-order thinking activities until students are at grade level, educators should (a) challenge students intellectually and provide higher-order thinking activities as soon as students are developmentally capable of handling them, and should (b) teach thinking skills in a way that also improves basic skills and social confidence. These are the goals of the HOTS (Higher-Order Thinking Skills) program.

HOTS is an approach to Chapter I for grades 3–6 that completely eliminates drill and practice. It is based on four assumptions:

1. Many Chapter I students are quite intelligent.

2. Higher-order thinking skills develop semi-independently of basic skills.

3. Systematic instruction in higher-order thinking skills can be used as a basis for developing basic skills.

4. The best way to get students to feel good about themselves is to help them develop sophisticated skills that they did not feel they could achieve and that are admired by other students.

Our definition of higher-order thinking skills is based on the use of information to solve problems rather than on classifications of thinking such as Bloom's Taxonomy. A systematic review of the cognitive psychology literature suggests that there are fundamental differences between good and poor problem solvers. For instance: (a) poor problem solvers do not outgrow simplistic problem-solving strategies, and (b) good thinkers develop more sophisticated associations among concepts in the long-term memory section of the brain. For these reasons, HOTS emphasizes teaching students to develop, articulate, test, and compare the results of different strategies, and to learn to generalize the use of concepts and strategies in various situations. Learning activities are organized in a manner parallel to how the brain organizes information; this should lead to the formation of more sophisticated linkages in the mind, thereby making larger amounts of related information quickly available for problem solving.

Techniques Used in the HOTS Program

Chapter I students in the HOTS program are brought as a group to a "thinking lab" equipped with computers, which motivate students to think deeply about ideas and provide feed-

back at the rate at which they can think. Major development effort went into defining which types of instruction and curriculum development techniques best utilized the computer's unique learning environment. Computers by themselves cannot improve learning; they must be accompanied by first-rate instruction and curriculum development efforts.

Teaching techniques. Lab teachers employ a number of techniques collectively referred to as "hi-teach." Some basic techniques include the use of drama to heighten interest and curiosity, and thinking sessions before (and sometimes after) students use the computers. Time is also spent asking questions about the *concepts* illustrated by the technology, as opposed to questions about the technology itself.

The most significant departure from typical practice is in the way teachers respond to students. Even good, veteran teachers often provide more information than students need to solve problems. Most teachers are easily conned into giving more and more information until the students can come up with answers without having to think very much. Students discover this early on, and this provides an incentive for them to act helpless, further reinforcing the view of Chapter I students as having low ability.

To counter this tendency, the lab teachers are trained to almost always refuse to answer a question with an answer. If students are to improve their ability to think, they must be given the space to think. Doing this requires establishing a consistent atmosphere that conveys the message, "If you do not think, you are going to be left out." When students complain that they do not understand something or cannot do something, the teacher usually tells them to read the screen and walks away; students are never reinforced for acting helpless. When first faced with this reaction by the teacher, students may pout or try to distract others. But seeing that other students are enjoying work on the computer, they too invariably get back on task. Once students take responsibility for thinking, solving problems on their own, and helping each other, they come to appreciate their own problem-solving abilities.

The other major change is for teachers to step back from the role of judge and expert and help students examine the consequences of their ideas. "This is a good idea" is replaced by prompts such as, "Were the results what you expected? Why did it turn out differently?" In addition, teachers ask questions about the sophisticated concepts being illustrated by the computer rather than about the mechanics of using the technology. There is a fine line between the questioning and teaching techniques appropriate for providing higher-order thinking and those for learning basic skills. Falling back on familiar teaching techniques can defeat the purpose of even the most sophisticated higher-order thinking curriculum and convert it to rote learning. Lab teachers report that it takes at least a month of persistent effort on their part before students stop "acting" helpless and confused and begin to realize that they are indeed going to have to think. It takes another month for them to realize they are good at it, and most blossom thereafter.

Curriculum. The HOTS curriculum includes a day-by-day script for the lab teacher's use of commercially available software. It is less concerned with the literal intended uses of the software than with using a given program to create opportunities to link concepts across diverse pieces of software. The concept being linked is often not the task involved in using the software but some subtle issue related to the task. It is more important for students to recognize and articulate the linkage between the computer environments than to solve the literal task in a given program.

Rather than linking objective by objective to the classroom curriculum, the program enables students to bring chunks of information to the computer lab where they synthesize and integrate them into computer environments. Students learn to make decisions about the relative importance and uses of information. The linkage process helps heighten interest and indirectly reinforces the content of the classroom. This reinforcement, combined with the students' increased coping skills, improves the quality of the time they spend in regular classes. If the classroom teacher uses effective teaching techniques and the curriculum has been aligned with standardized tests, basic skill scores will rise—without any additional drill and practice. With such a linkage, a problem-solving program can enhance basic skills as it improves higher-order thinking skills. Such a linkage also makes it possible to link the HOTS curriculum to any curriculum and textbook series used in the classroom.

Social Development

Chapter I students tend to have fewer friends than normally achieving students, hence fewer opportunities to exchange ideas and use language in new ways. The HOTS curriculum creates situations in which students are forced to interact with others and to articulate sophisticated ideas and strategies to achieve a common goal. Voicing their ideas increases students' communication skills and ability to demonstrate their cognitive competence to other students—thereby widening their circle of friends and increasing communication opportunities and language development. Most important, this communication is around ideas rather than turfsmanship issues.

The curriculum also uses role reversal to increase the social confidence of Chapter I students. They become experts in the use of technology in school and are provided time to invite their non-Chapter I friends to share in its use after they have been properly tutored by the Chapter I student. Social confidence and satisfaction in linguistic competence is enhanced by opportunities for students to display or demonstrate their work in community settings. The goal of the program is to turn the students into authors and playwrights, as opposed to simply teaching them to spell or write a few sentences.

Results

Initial results from the HOTS program suggest that with appropriate teaching techniques it is possible to achieve a wide range of benefits by intellectually challenging Chapter I students and by giving them the space and responsibilty to think within a systematic curriculum. In fact, students exceeded our expectations in almost all cases. Reading scores were up in five out of six grade levels—particularly in the key upper elementary grades. Higher-order thinking skill levels were above those shown by a matched control group. (Thinking skills were measured by the standardized Raven's Colored Matrices and a series of brain teasers developed in-house.) When the students first entered the program they were very impulsive in generating ideas. The first thing that came into their minds was their undying answer.

But after only one year in the program, HOTS students generated more hypotheses and were better at disconfirming their initial ideas when faced with subsequent contrary clues than were students in the control group. Teachers and parents reported that the students had more staying power; they were better able to pay attention, did not get frustrated when their initial notions were not appropriate, and could come up with alternative ways of doing things.

HOTS students also had 50 percent more friends than students in the control schools—among both non-Chapter I and Chapter I students. The combination of (a) using Chapter I students as tutors in the use of technology, (b) their growing experience in social interaction, (c) the language development gained through lab activities, and (d) self-confidence in their cognitive competence, all led to their willingness and ability to exert social initiative. Indeed, the Chapter I HOTS students were almost as popular as the non-Chapter I students.

Enormous Challenge

The results from this project suggest that we are seriously underestimating and failing to tap much of the intellectual potential of a large number of students. Our experience suggests, however, that even with the use of new technology, tapping this potential requires different approaches to teacher training and curriculum development, as well as dedicated teaching. At the same time, preparing students equitably for the Information Age requires that education develop high levels of thinking skills in *all* students. What the Higher-Order Thinking Skills project has accomplished in grades 3–6 must also be achieved by other programs at the secondary level. This means reorienting much of the secondary curriculum, not necessarily through new units, courses, or requirements, but through shifting the emphasis of existing ones. The challenge for curriculum developers is enormous, but it probably represents the most critical need in American education.□

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