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Thinking In, Around, and About The Curriculum: the role of cognitive education

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Although everybody agrees that education reform is needed, there is little agreement on the nature of the problems, and certainly not on the remedies; nevertheless, there is a central focus on curriculum issues. Three principal points are addressed in this paper: (a) new approaches in education are urgently needed, (b) new educational approaches require revised concepts of the nature and development of human abilities, and (c) those new concepts must lead inevitably to emphasis on the acquisition, growth, and application of systematic processes of logical thinking, which is to say, "cognitive" or "metacognitive" education. The author presents a "transactional perspective" on human abilities, with three principal components: intelligence, cognitive processes, and intrinsic motivation. Intelligence and cognitive processes differ with respect to their respective sources, their relative modifiability, their composition, methods of assessment, and the role of parents and teachers in their development. Individual differences in intrinsic motivation are associated with differences in learning effectiveness that are not accounted for by the other two components of the transactional model, which is transactional rather than merely interactive because the ability of any one of the three principal components to influence development of either or both of the other two changes with each effect of one upon another. Two programs of cognitive education, one for preschool children, the other for older children, adolescents, and adults, are described and data are presented showing that systematic classroom application of such programs by well trained teachers can lead to enhancement of cognitive development, intrinsic motivation, and even IQ. Further, relatively long-term evaluative studies demonstrate that there are positive and long-lasting effects of cognitive education on subsequent learning and school achievement.

Introduction

Almost everybody agrees that education reform is needed, indeed, is overdue. That statement is true whether one is in Australia, or the United States, or Canada, or South Africa, or Iran, or Russia, or Botswana. The great problem is that there is not universal agreement on the nature of the problems, and certainly not on the remedies; nevertheless, almost everyone's complaints, and most of the proposed remedies, focus

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on curriculum issues, that is, the question of how we are to spend the time of school pupils and teachers. Although the problem of effective education across societies is multi-dimensional, in this paper I address only three points.

The first is that we do indeed need new approaches in education. The second is that, if we are to have new educational approaches, we shall have to revise our concepts of the nature and development of human abilities and human development. The third, following from the first two, is that the acquisition, growth, and application of systematic processes of logical thinking must constitute the core of any successful new approach to education. I hope to persuade you that the changes in education that must come about are fundamental, extending to the very definition of the task of education, to the role of teachers, to the processes of learning, and to the anticipated outcomes of teaching and learning.

Why Do We Need New Approaches in Education?

One answer to this question is that we have always needed new approaches. That is to say, an examination of pedagogical literature over the ages will reveal that there has always been dissatisfaction with this great enterprise, at least since it has been applied on a large scale and not restricted to the very privileged few. Montaigne, for example, argued for the teaching of judgment, and declared that the prevailing educational practices of his day, consisting of exclusive reliance on the acquisition of information, made of students nothing more than "donkeys loaded down with books" (Haywood, 1995).

A somewhat more serious answer is that education is an instrument of the culture; that is, education is a primary means of intergenerational cultural transfer (e.g., Tzuriel & Haywood, 1992; Vygotsky, 1929). As societies develop and change, the body of cultural knowledge that is valued by those societies changes as well. Thus, what was good and appropriate educational practice in the past becomes inappropriate in a changed society, because the people of the society have changed their minds about what ought to be passed to the next generation, and education is thus faced with new goals and new demands.

A third answer is that we have come to regard education as a passport to vocational competence and success. This is a relatively new requirement in the history of formal education; indeed, through most of the last 3,000 years the processes of formal education have not been so constrained by considerations of how one is to make one's living. Because of this new expectation, the classical boundary between education and training is less clear than it has been.

Within the context of these three answers, let us look at some rather startling information.

Last year, in the United States, thousands of persons graduated from secondary school and were unable to read their diplomas. The rate of low literacy is actually on the increase in both Canada and the United States (Poissant, 1994). A recent wire-service story in American newspapers revealed that over forty percent of Americans are not functionally literate, i.e., do not read and write at a useful level, such as that required to make written application for employment.

In 1990, we reached the day when the time required to double the world's fund of knowledge was two years. Therefore, imparting a defined and sufficient body of knowledge is a hopeless enterprise.

Last year's high school graduates can expect to change careers—not merely their specific jobs, but entire career directions—a number of times during their working lives. Each new career will require a new set of knowledge and job-related skills, but the most important observation is that each one will require the ability and the motivation to learn new things.

Of the jobs that last year's high school graduates will hold in 10 to 20 years, 85% to 90% do not exist today (see Haywood, 1990, for a similar discussion).

Education directors of several major industrial corporations—in fact, the 5 corporations that employ 15% of the American labour force—have told me that they face enormous personnel problems at present, and expect those problems to become more acute in the immediate future. For example, in one such company the average worker must learn to produce a new product every 18 months, and in some situations in their company every 8 months! At the same time, they are faced with workers who have been trained but not educated; that is, they do well the job that they were hired to do, but the time comes, and for many rather quickly, when that job no longer needs to be done, and many workers have great difficulty with both the cognitive equipment and the motivation to learn new things. The workers expected that their job skills would keep them employed for 30 to 40 years, but they find instead that they must be continually learning new approaches, new concepts, and acquiring new skills, just in order to stay employed! The present educational system does not prepare them to do that (Haywood & Miller, 1995). My point here is that we must have new—or perhaps rediscovered—goals in education, goals that emphasise development of the ability and the motivation to keep learning new things, not simply a defined body of knowledge.

In order to develop new approaches to education, we shall have to have new concepts of human ability and development. Thus, in the next few pages, I present one such set of concepts, one that I call a "transactional perspective" on human abilities (see e.g., Haywood, 2003; Haywood & Switzky, 1992; Haywood, Tzuriel, & Vaught, 1992), and then try to show how such a revised set of concepts leads to an educational enterprise whose primary goal is the teaching and learning of thinking, *in which the ultimate goal of learning is more learning*.

A Transactional Perspective on Human Abilities

My transactional perspective emphasises the following points:

1. Intelligence is multifaceted.
2. Intelligence is multidetermined.
3. Intelligence alone is not sufficient for effective learning.

4. It is useful to distinguish between *intelligence* and *cognitive processes*.
5. Motivation, especially *task-intrinsic motivation*, plays an important role in effective learning.

Intelligence is multifaceted

Gardner (1983) is decidedly on the right track with his concept of "multiple intelligences," although a long research road lies between our present knowledge and a clear definition of the precise kinds and components of intelligence. What is quite clear is that nobody has a flat profile; that is, there is considerable variability within persons across different kinds of ability. The point for education is that we must broaden our concepts of the different kinds of ability, and educate across a more varied spectrum.

Intelligence is multi-determined

Intelligence also has multiple origins, although there is increasingly powerful and convincing evidence that individual differences in intelligence are the product of genetic variation, specifically of polygenic action. Experience may be associated with up to 20 or 25 percent of the variance in intelligence test scores, but the extent to which those scores represent variability in intelligence (the "latent" variable), rather than merely IQ (the "manifest" variable), is still a matter of considerable debate.

Intelligence is not enough

We experientialists or environmentalists should not worry too much, even if it could be shown that 100% of the variance in intelligence is associated with genetic determination. The reason is that intelligence alone is not sufficient to support effective thinking and learning. Intelligence must develop in a transactional relation with cognitive processes and motivation in order to lead to effective perceiving, thinking, learning, and problem solving. According to my transactional perspective, good environments do not create intelligence, nor do bad environments destroy intelligence. Access to and appropriate application of one's intelligence must depend upon the catalytic action of both cognitive processes and motivation. Bad environments can mask intelligence by failing to provide for the acquisition and elaboration of essential cognitive processes and motivational structures, and good environments, i.e., those that do provide those elements, can serve to unmask intelligence, to help one to gain access to one's own intelligence, and to enable one to apply one's intelligence in productive ways.

Cognitive processes must be acquired

I am using the term "cognitive processes" to refer to relatively stable and enduring modes of logical thinking. Such processes include the quite basic ones that Piaget referred to as criteria of the developmental stage of concrete operations, such as comparison, classification, class inclusion, seriation, conservation, and relations of quantity, space, and time. They include also such more formal and sophisticated modes as syllogistic thinking and transitive relations. Overall, cognitive processes help one to organise the world, to understand it in symbolic and representational terms, and ultimately to manipulate symbols, concepts, and abstractions rather than relying upon the manipulation of concrete objects in space.

Whatever the origins of intelligence, there is general agreement that cognitive processes have to be acquired. That is to say, however many IQ points one does or does not have, effective learning will not take place until and unless certain fundamental modes of logical thinking have been acquired, elaborated, and applied. Piaget (e.g., 1952) believed that every child had the rather daunting developmental task of generating his/her own personal "logic structures." He believed that the acquisition of these thinking modes was a result of children's successive encounters with environmental events, which presented children with "cognitive conflict": the necessity to resolve discrepancies between new information and knowledge that is already stored away. The late eminent Russian psychologist Lev Semanovich Vygotsky (1929) believed, on the other hand, that whatever knowledge is necessary for adequate cognitive development of children is already contained in the children's culture, so cognitive development requires the successful transmission of a culture from one generation to the next—a very comforting thought indeed, because it provides for the continuing employment of both parents and professional teachers! It is when cultural transmission fails or is done inadequately that problems arise in the children's development. Alas, it is precisely that situation that is very much on the increase worldwide! There are thus two observations that are very much in conflict with each other: adequate cognitive development requires the active participation of adults interacting with children in order either to transmit the essential elements of their culture or to help the children to acquire their own logic systems, but a sure sign of our times is that more and more children are deprived of exactly the kind of adult interaction that they need, that is, what Feuerstein (Feuerstein & Rand, 1974; Feuerstein, Rand, & Hoffman, 1979) has termed "mediated learning experience."

Table 1 shows a comparison of the concepts of intelligence and of cognitive processes, according to: their origin, their relative modifiability, their character, typical ways of assessing them, their composition, and the role of parents in their development (from Haywood, 1989). This conceptual distinction is a critical element of my transactional perspective on human ability. The most important criteria are source or origin, relative modifiability, and the role of parents in their development.

Motivation is important for learning

Daniel Goleman's (1995) book entitled "Emotional Intelligence" has become an international bestseller. He argues that certain affective aspects of consciousness can make more difference in performance and life adjustment than do individual differences in intelligence. A large part of my own research over the last 40 years has

Table 1. Comparison of intelligence and cognitive processes across several criteria of comparison

Dimension	Intelligence	Cognition
Source	Genetic (polygenic)	Acquired
Modifiability	Modest	High
Character	Global, "g"	Generalisable Specific
Assessment	Achievement	Process
Composition	Intellectual	Mix of native ability, motives, habits, attitudes
Developmental requirements	Genes, nutrition health, safety, fostering, environment	Active, directed teaching; mediation of cognitive processes

been devoted to the study of what I call "task-intrinsic motivation." The term refers to motivation that inheres in tasks themselves; in other words, the disposition to do work, especially mental work, for its own sake and as its own reward, and to seek one's satisfaction in the very business of engaging in tasks and doing mental work. On the other hand, "task-extrinsic motivation" refers to the tendency simply to avoid dissatisfaction by concentrating on environmental variables that lie outside of tasks, such as ease, comfort, safety, avoidance of effort, practicality, and material reward (see Haywood & Switzky, 1986). My students and I have been able to measure individual differences in these tendencies reliably as early as three years of age. In the course of some 40-50 studies, we have found such individual differences to be associated with a wide variety of criterion variables. For example, primary school children who are highly intrinsically motivated achieve in school at a significantly higher level than do more extrinsically motivated children who are matched with them on age, sex, and IQ. Our research suggests that intrinsic motivation can make a difference in school achievement as large as that usually associated with 20=25 IQ points. Following is a list of reliable conclusions about individual differences in intrinsic motivation that have come from 40 years of research on this topic:

- High achievers are more likely than are low achievers (same age, sex, IQ) to have intrinsic motivational orientation.
- Intrinsically motivated persons learn more efficiently and retain more of what they have learned than do extrinsically motivated persons.
- Intrinsically motivated persons work harder, persist longer in tasks, prefer self-regulation over externally imposed regulation, set "leaner" schedules of reinforcement for themselves, prefer novel, difficult, and complex tasks, are more likely to pursue new learning on their own.
- Task-extrinsic incentives and rewards interfere with intrinsic motivation and cannot lead to self-initiated learning.
- The importance of intrinsic motivation to work and learning increases with increasing task difficulty.

- Intrinsic motivational orientation is positively correlated with chronological age, mental age, IQ, and socio-economic status.

Motivational orientation appears to be a modifiable trait

The tendency to find one's satisfaction in the doing of tasks, especially learning tasks, is not genetic. We assume that all children enter the world with a motive to explore, to gain knowledge of the world around them and some mastery over it. Individual differences in this tendency are shaped by modeling after important persons in the children's lives, especially parents and older siblings, and eventually professional teachers. It is also a question of what happens to the children's successive efforts to explore and to learn. The success of those efforts depends in part on the children's native ability, that is, their intelligence, but also in some large part on how their efforts to learn about their world are treated by important adults. (For reviews of these relationships and of the development of intrinsic motivation, see Haywood, 1971, 1992; Haywood & Burke, 1977; Haywood & Switzky, 1986). Ultimately, their tendency to look for satisfaction in the doing of tasks and in learning, without reliance on task-extrinsic incentives or rewards, will determine whether they will be life-long independent learners or whether learning in any real or practical sense will stop with the end of formal education.

We can now ask what makes the relations among these three variables "transactional" (see Haywood, 2003; Haywood, Tzuriel et al., 1992). Essentially, it is the fact that each of the relevant variables is dynamic, that is, it changes both in quantity and in character over time, such that the effect of one on either of the others depends upon the stage of development of each and the history of prior interactions among them (see Haywood, Tzuriel et al., 1992, pp. 51–52; Haywood, 2002, 2003). If we accept the notion that every child is born with a predisposition to explore the world and to gain some mastery over it, then we can ask what happens to that tendency as actual exploration begins. Children who have a high level of "native" intelligence are relatively successful in their attempts to find out about their world and to gain some mastery over it. Their success leads them to explore more and to try more new things. They thereby acquire a relatively greater store of knowledge than do less intelligent children. Further, given that all of us like to do the things that we do successfully, their initial success and their new knowledge base leads them to explore even more. The feedback from their environment, including their parents, is very positive, and serves to increase their novelty seeking behaviour, which becomes intrinsically satisfying, leading to a personality trait of task-intrinsic motivation. Relatively less competent children can also become intrinsically motivated and cognitively competent by being given all the help they need to be successful and by having their efforts met with approval and encouragement. On the other hand, children who are reluctant to expose themselves to new things cannot acquire a wide knowledge base, and tend to develop task-extrinsic motivational systems; that is, not to seek satisfaction in task achievement and learning but merely to avoid dissatisfaction by concentrating their attention on non-task aspects of their environments, which is to say, by staying out of achievement and learning situations (see Haywood & Burke, 1977, for a detailed exploration of the development of intrinsic motivation as a trait variable).

The Teaching and Learning of Thinking

It must be obvious by now that I am advocating what has come to be called "cognitive education." This approach is also referred to by such terms as "thinking skills," "critical thinking," and "learning to learn," but I prefer the more generic term "cognitive education" because it can subsume a wide variety of educational programs under one broad philosophical system. In a cognitive education system, the primary goal of learning is more learning; that is, the central emphasis is on acquiring, elaborating, and applying the logic tools for learning. There is relatively greater emphasis on process than on content, so one hears often such questions as, "How did you do that?" and "What did you have to think about in order to solve that?" and "How else could that be done?" Nevertheless, content is not ignored. One cannot simply think; it is necessary to think about something! The most successful programs of cognitive education are those in which academic content is a vehicle for the teaching of thinking tools, and the teaching of thinking tools simultaneously with content teaching aids both. Cognitive education may be defined as an approach to education in which the primary goal is the teaching and learning of formal processes of logical thinking, with the objective of helping each student to become an independent life-long learner who can generate and apply his/her own cognitive strategies to a very wide variety of content.

Many formal programs of cognitive education are already well known. Here is a partial list of some familiar curricula that fall well into the cognitive domain:

- Structure of Intellect (Guilford, 1977; Meeker, 1991)
- Instrumental Enrichment (Feuerstein, Rand, Hoffman, & Miller, 1980)
- CoRT Thinking Program (de Bono, 1991)
- Philosophy for Children (Lipman, 1991)
- Process-based Instruction (Ashman & Conway, 1989)
- Odyssey: Curriculum for Thinking (Wright, 1991)
- Learning to Learn (Heiman, 1991)
- Bright Start (Haywood, Brooks, & Burns, 1992)
- Cognitive Enrichment Advantage (Greenberg, 2000)

Arthur Costa (1991) listed and described 29 formal programs for teaching thinking. Since that time, the number has increased greatly. Figures 1, 2, and 3 provide examples of the kinds of lessons that characterise cognitive education programs.

Figure 1 is a page from the curriculum unit called "Organisation of Dots" in *Instrumental Enrichment* (Feuerstein et al., 1980). The task is to find the model figures in each frame of dots and to connect the dots so as to reproduce the model figures.

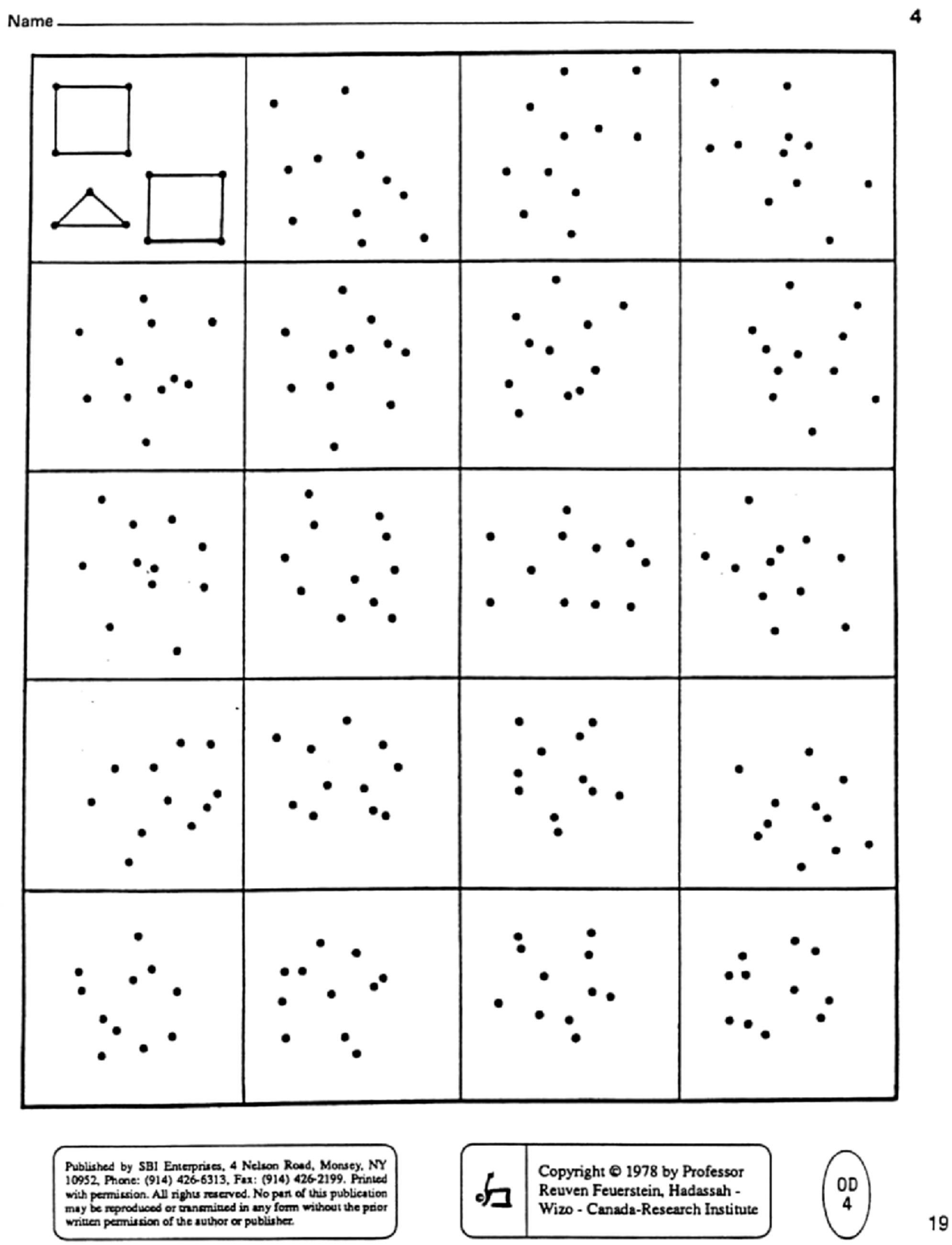

Figure 1. A page from the "Organisation of Dots" instrument, part of the *Instrumental Enrichment* program (Feuerstein et al., 1980)

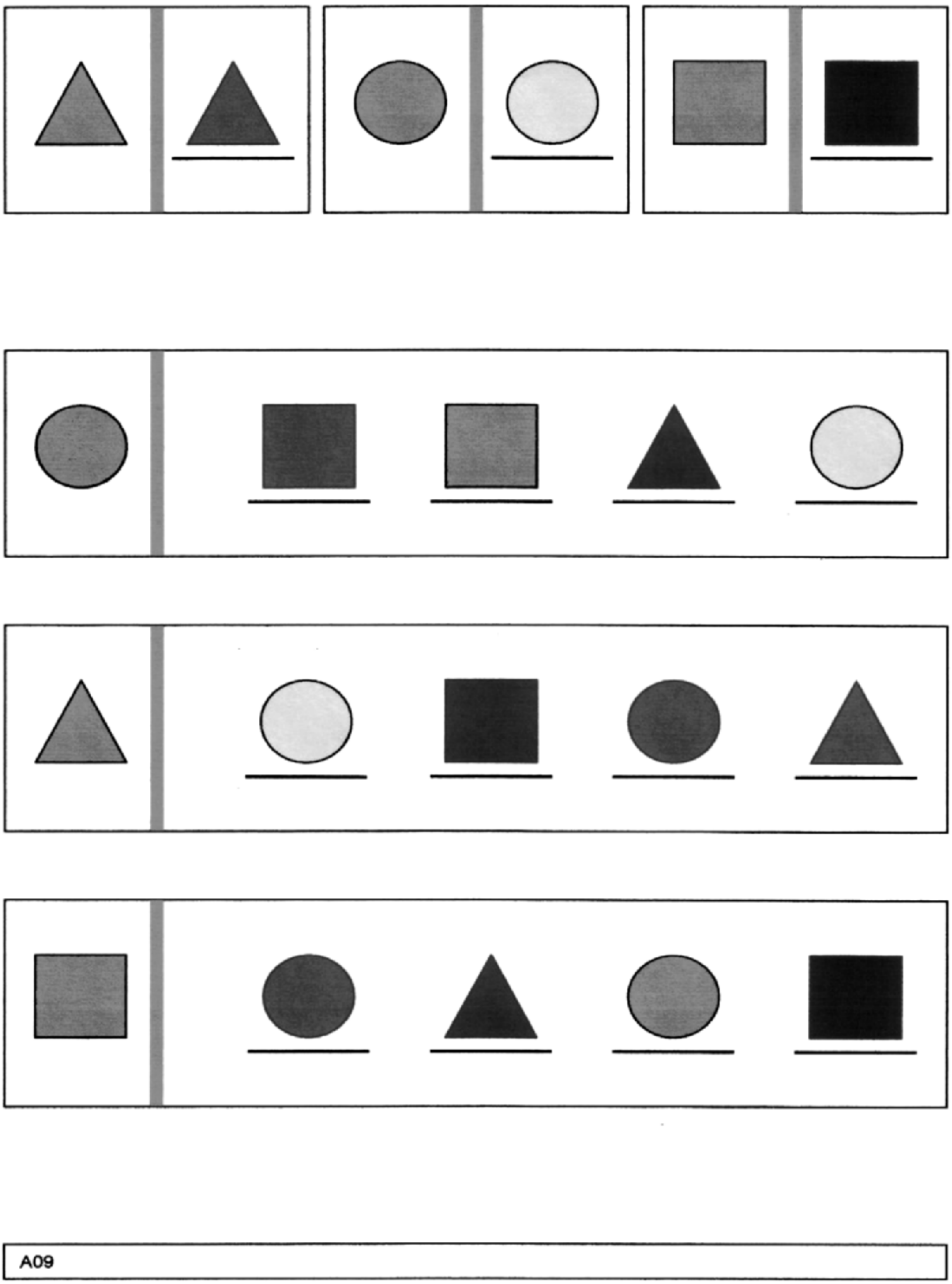

Figure 2. A "fun sheet" that constitutes part of a lesson on "Transformation", a recent addition to the *Bright Start* curriculum for preschool and primary school

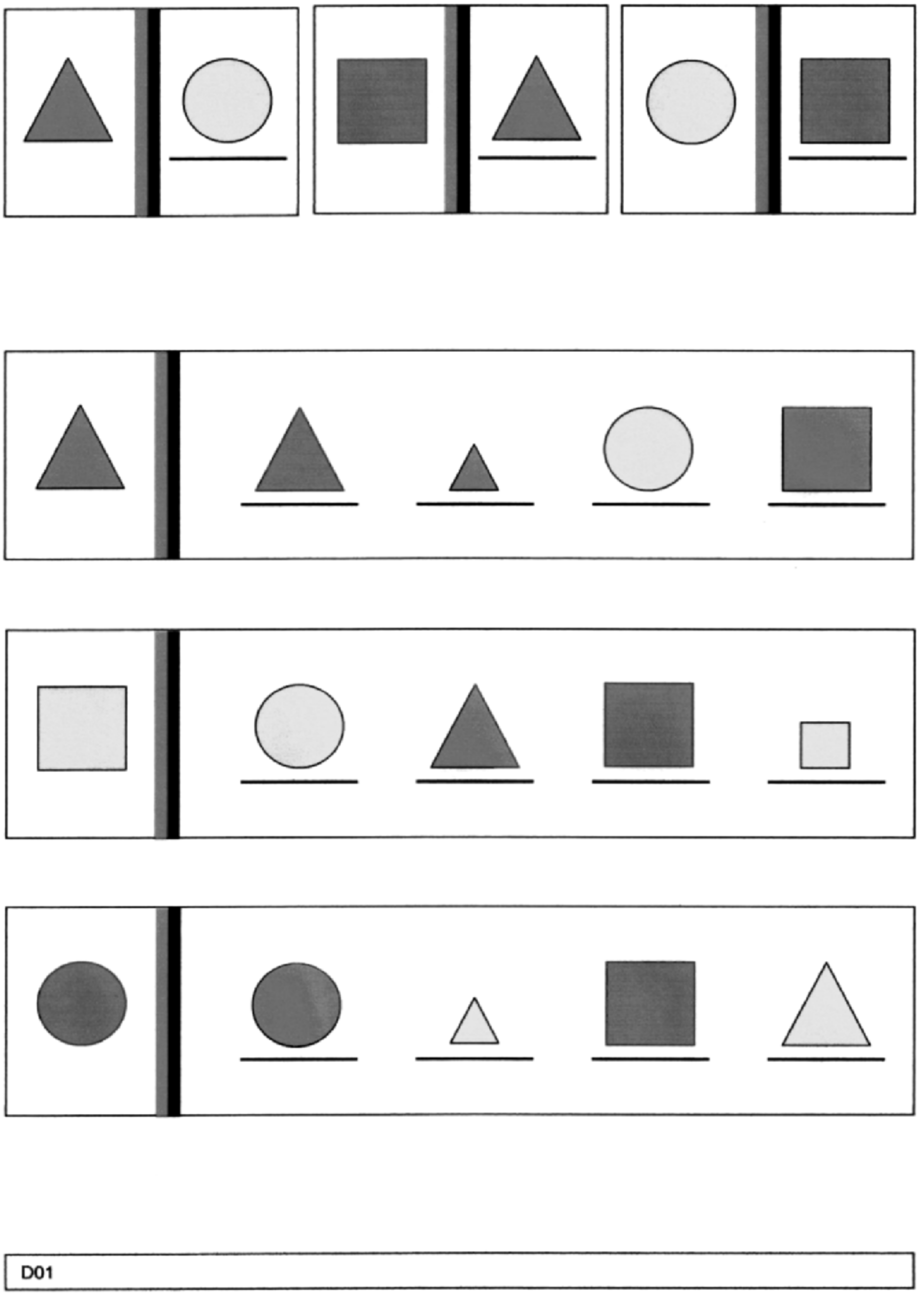

Figure 3. Another "fun sheet" from a more advanced lesson in the Transformation unit of *Bright Start*

Connecting dots is not, of course, the object. The lesson is taught in such a way that the learners acquire skill at analysing a problem and at applying defining criteria. For example, they might have to define a diamond as a geometric figure, and to know how it is different from a square that stands on one of its corners. They learn to inhibit impulsive responding in favour of locating the figures before they begin to connect dots. They learn to use models in order to know what to do, and to compare their productions to the model figures on the dual criteria of shape and size. They learn to conserve one dimension, in this case shape, in the face of variation in another, in this case orientation in space. They learn to distinguish between generalisable rules, such as "Look carefully and gather all the information you need before you begin to draw" and task-specific rules, such as "It is a good idea to start with a peripheral dot, and to do the largest figure first." They may also learn to verify their own solutions. Cognitive teachers help them to learn the value of precision and accuracy both in taking in information and in expressing their responses. By using such physical productions, the children come, over the course of many hours of such instruction, to see the immediate benefits of systematic, logical thinking and the use of cognitive strategies for organising their phenomenal worlds for learning and for solving problems. Perhaps more important, they learn metacognitive habits, that is, habits of thinking about their own thinking and acquiring the ability to regulate their own thinking processes.

In a much more advanced unit in *Instrumental Enrichment*, the unit on syllogistic thinking, the learners use Venn diagrams to help them organise their thinking about sets, about exclusive and overlapping sets, as well as to extend their knowledge of classification and class inclusion. They learn to work within a logic system that has rules; for example, using the "major premise, minor premise, conclusion" model of syllogistic thinking. They also learn that it is possible to reach a conclusion that is valid but incorrect, and that lesson can be generalised very broadly in their lives to resist social stereotypes and the messages of demagogues. For example, the formulation "All Scandinavians are blond; Lars is a Scandinavian; therefore, Lars is blond" is valid within the logic system, but potentially incorrect for two reasons: not all Scandinavians are blond, and Lars may or may not be a Scandinavian. Thus, if either the major premise or the minor premise is wrong, the conclusion, although logically valid, will be incorrect.

Figure 2 is a "fun sheet" from the latest unit, "Transformation," in the *Bright Start* (Haywood, Brooks et al., 1992) program, used with preschool and some primary children. The function of the top row is to find and establish a rule about the effect of crossing the vertical line. Some lines change colours, some change shapes, others change the nature and character of animals or other stimuli. Once the rule has been induced by observing the examples in the top row, that same rule (e.g., the red line changes colour) must be applied in each of the following rows in order to find the one stimulus figure in each row that obeys the rule. It is necessary for the children to discover not only that the red line changes the color of the figures that follow, but also that the red line does not change the shape or size of those figures.

Figure 3 demonstrates a more advanced "fun sheet" from the same unit on transformation. Vertical lines represent rules, so here, where we have two vertical lines, we must have two rules. We have already learned that the red line brings about change in colour, and in earlier lessons that the black line changes the shapes of subsequent figures. Now both rules have to operate simultaneously. It is astounding to observe how quickly and easily preschool children, including those with special educational needs, learn such rules and their applications!

In the rest of the paper I tell you a bit more about the *Bright Start* program, just as an example of cognitive education, because it is the one I know best, and then offer some evaluative data on the effectiveness of this program. Designed for children between 3 and 6 years of age, *Bright Start* has the goals of stimulating the acquisition and elaboration of cognitive structures, especially those associated with concrete operatory thinking (i.e., symbolic and representational thinking), of identifying and remediating deficient cognitive processes, and of enhancing the development of task-intrinsic motivation, as well as of preparing children with the logic tools that they will need in order to succeed in the academic and social learning of the primary grades. Its components include:

(a) a set of theory that guides its development and application
(b) a "mediational" style of teaching
(c) seven focused cognitive instructional units, including;

- self-regulation
- number concepts
- comparison
- classification
- role taking
- patterns and sequences
- letter/shape concepts

Although the daily lessons themselves are important, they are less important than is the style of teaching, called a "mediational" teaching style. Teachers as mediators function as catalysts in bringing about reactions between learners and the material that is to be learned. More than do other teachers, mediational teachers: (a) ask questions; (b) ask process-oriented questions; (c) challenge responses, whether correct or incorrect; (d) require justification of answers; (e) promote transfer and generalisation of principles; (f) emphasise order, structure, and predictability; and (g) model the joy of learning for its own sake and as its own reward. See Haywood (1993) for a more detailed discussion of mediational teaching.

Research on the Effectiveness of Instrumental Enrichment and Bright Start as examples of Cognitive Education

Because of time limits, and the fact that my paper is not just about *Bright Start*, I now summarise what program evaluation research over the last 30 years has to say about the effects of two programs of cognitive education, as illustrations of the kinds of effects that one may expect from well-constructed and applied curricula. Here are some established effects of Feuerstein's *Instrumental Enrichment* (Feuerstein et al., 1980), a program of cognitive education that is applied with children from the age of 10 years and also with adolescents and adults. There is evidence that *Instrumental Enrichment*, faithfully applied: (a) reliably increases scholastic aptitude scores; (b) enhances performance in some content learning domains; (c) increases problem solving ability; (d) increases logical reasoning, especially analogical reasoning; and (e) may enhance motivation to learn.

This list summarises effects of *Bright Start* (Haywood, Brookes et al., 1992) applied with children between 3 and 6 years of age who are typically developing or who have special educational needs. *Bright Start*, systematically applied at preschool: (a) increases IQ, (b) enhances logical reasoning and problem solving skills, (c) helps to keep children in "mainstream" classes, (d) enhances intrinsic/learning motivation, and (e) leads to higher levels of school achievement.

Jean-Louis Paour, Sylvie Cèbe, and I have been conducting research on *Bright Start* with groups of low-SES immigrant children in Marseille and nearby towns in the south of France. We study two groups of very low-SES immigrant children who rely on French at school but a different language, usually Arabic, at home, in whose community there is over 50% unemployment of the fathers, and who experience a very high rate of school failure and school drop-out. One of these groups receives one year of *Bright Start* at kindergarten, and then nothing special in subsequent years. The other group receives a regular non-cognitive kindergarten curriculum. A third group, one that also gets nothing special, is composed of native French children from affluent families in a nearby town. In general, we find that the preschool cognitive education experience is able to close most of the performance gap between children who receive this program and the more affluent and privileged "metropolitan" French children of the same age.

In our early studies, on one widely used intelligence test, Raven's Coloured Progressive Matrices (Raven, 1965), the poor immigrant *Bright Start* children exceeded the performance not only of non-*Bright Start* children from their own SES group but even of High SES children. Children who got *Bright Start* at preschool were significantly superior to comparable children who did not get *Bright Start* in such important areas as following instructions, regulating their motor behaviour, doing paper and pencil mazes, making verbal comparisons and distinguishing relevant differences, in general knowledge at the end of first grade, and in reading novel words.

Let us examine some effects that have now been replicated twice in the south of France. First (Figure 4), we see that scores on Raven's Coloured Progressive Matrices are elevated as a function of the cognitive education experience. Second, cognitive education in kindergarten led to better reading in first grade (Figure 5) and in second grade (Figure 6), in reading comprehension in second grade (Figure 7), and in third grade (Figure 8). In all cases, the poor immigrant children who did not get cognitive education were at the bottom of the heap, whereas the poor immigrant children who did get cognitive education at kindergarten were substantially closing the gap with the more privileged and affluent "metropolitan" French children.

Figures 9–12 show school achievement as assessed by standardised tests, and here again we see the familiar superiority of high-SES children, following by the

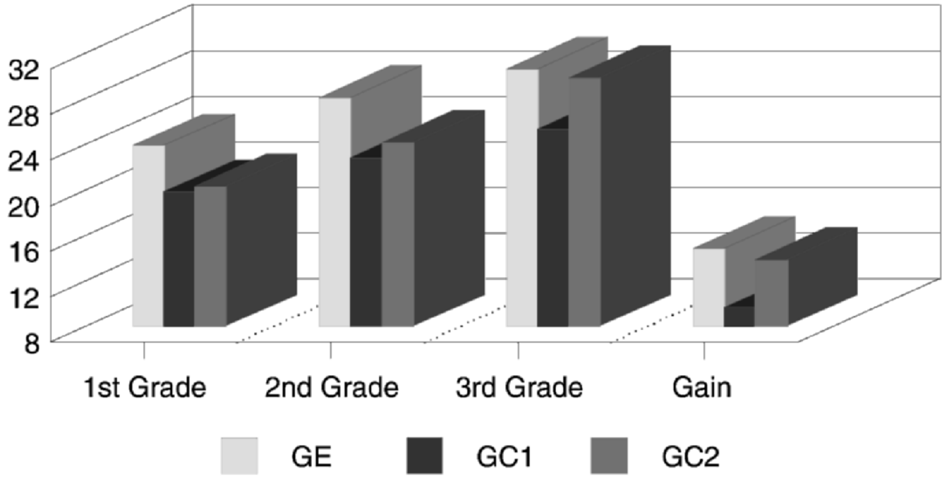

Figure 4. Scores on Raven's Coloured Progressive Matrices of children in four treatment groups when they were in first, second, and third grade, and score gain between kindergarten and third grade. GE refers to very low-SES immigrant children who received *Bright Start* during their kindergarten year. GC1 refers to similar low-SES children who did not receive *Bright Start*. GC2 refers to higher-SES non-immigrant children who did not receive *Bright Start* (Cèbe & Paour, 2000)

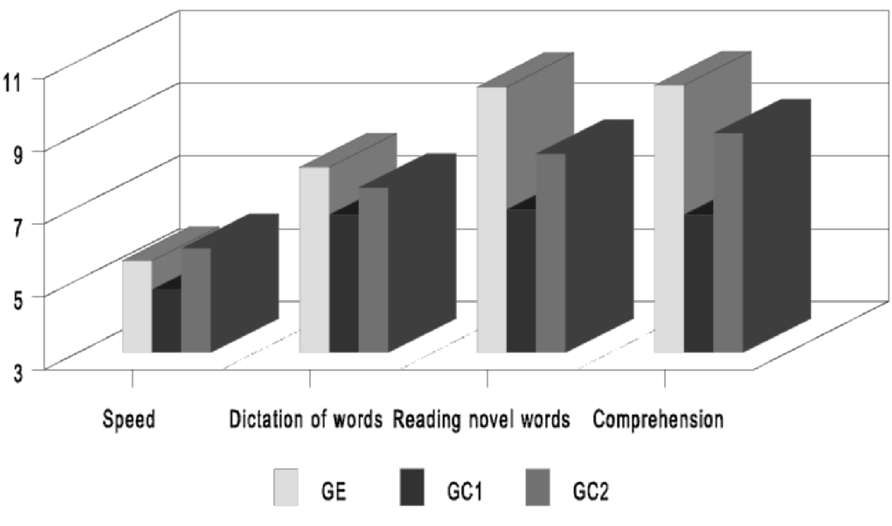

Figure 5. Reading achievement scores in first grade of the low-SES *Bright Start* (GE), low-SES control (GC1) and high-SES control children (Cèbe & Paour, 2000)

achievement of poor immigrant children who received *Bright Start* at kindergarten, with the poor immigrant control children once again bringing up the rear! These highly reliable results are shown in reading and math in Grade 1, broad areas of school achievement as differences, and on an exam administered by the National Ministry of Education at Grade 2.

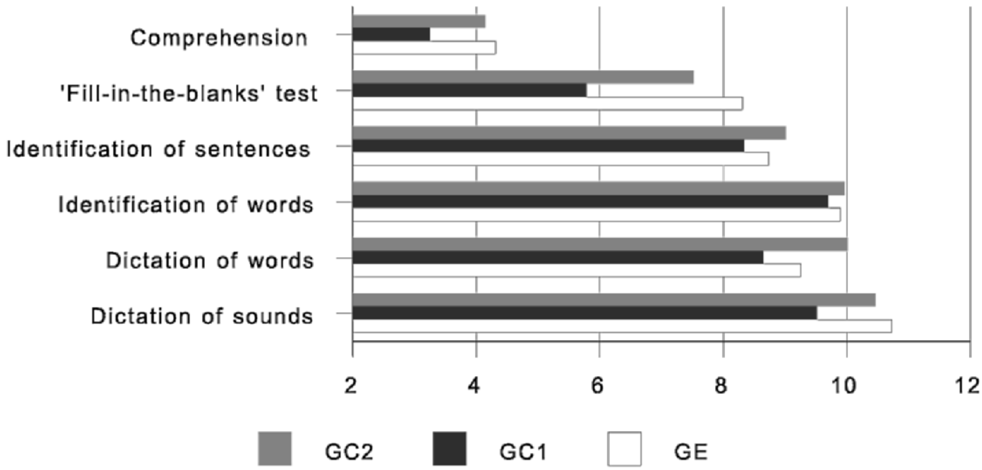

Figure 6. Second-grade reading scores (based on tests derived from ARTHUR) of the three groups: GE=low-SES *Bright Start*, GC1=low-SES control; GC2=high-SES control (Cèbe & Paour, 2000)

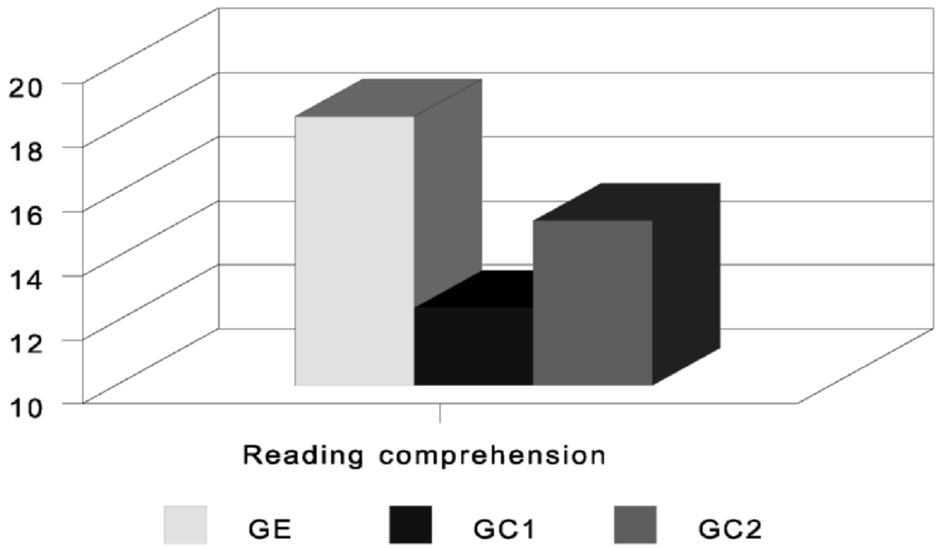

Figure 7. Second grade reading comprehension scores (based on Goigoux's test)of the three groups (Cèbe & Paour, 2000)

This is just the briefest possible summary of this body of research. For more detailed reports on the efficacy of *Bright Start*, see Brooks and Haywood (2003), Paour, Cèbe and Haywood (2000), Cèbe and Paour (2000), Tzuriel, Kaniel, Kanner, and Haywood (1999), and Tzuriel, Kaniel, Zeliger, Friedman, and Haywood (1998). Similar, if not quite so dramatic, data can be assembled with regard to other major programs of cognitive education. My point in presenting such a summary is simply to

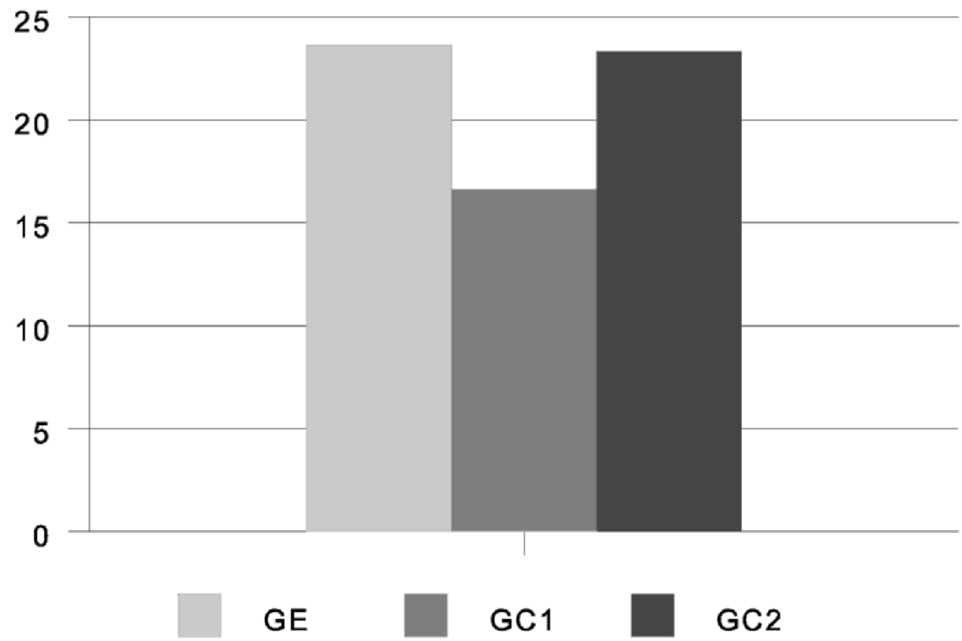

Figure 8. Third grade reading scores on Aubret & Blanchard's assessment of reading competence of the three groups (Cèbe & Paour, 2000)

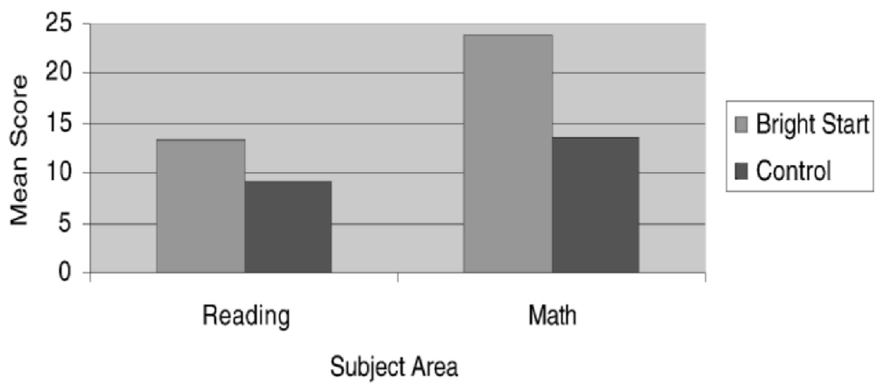

Figure 9. Standardised achievement scores in reading and math, grade 1, of *Bright Start* and low-SES control children. (Paour et al. 2000)

demonstrate that programs of cognitive education have been evaluated with scientific methods of program evaluation, that they do indeed have demonstrable positive effects on the children, and that their positive effects endure at least the three years that constitute present follow-up studies.

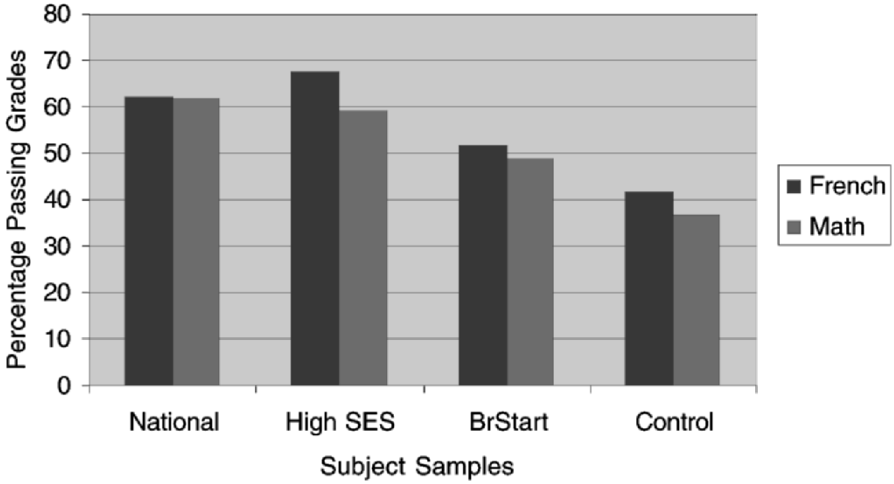

Figure 10. Percentage of passing grades in French and Math on a national examination, for the national standardisation sample, the high-SES controls, the low-SES *Bright Start* children, and the low-SES control children. (Paour et al., 2000).

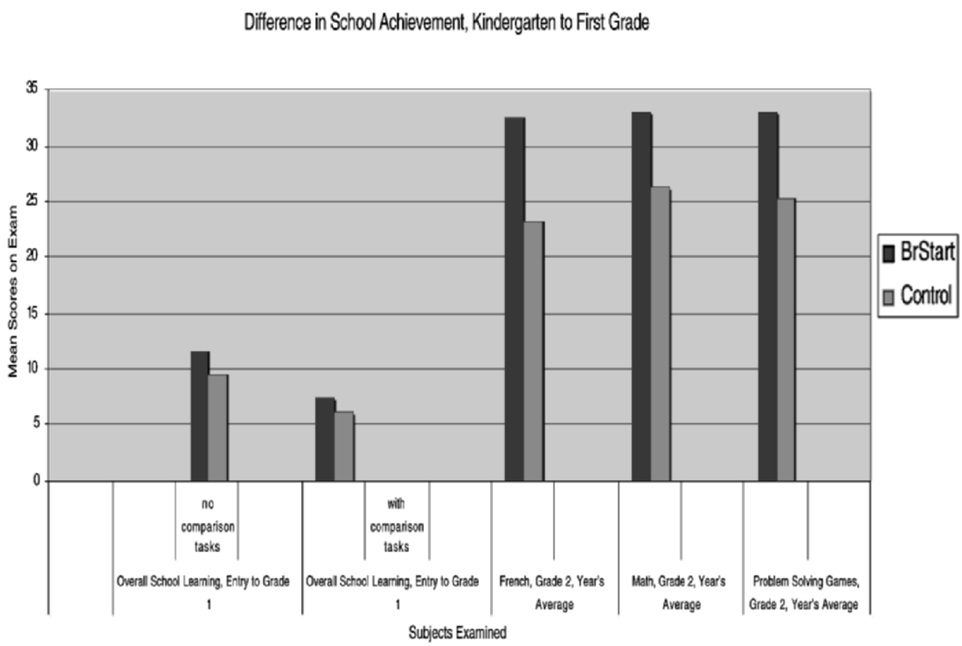

Figure 11. School achievement scores, grades 1 and 2, of *Bright Start* and low-SES control children (Paour et al., 2000).

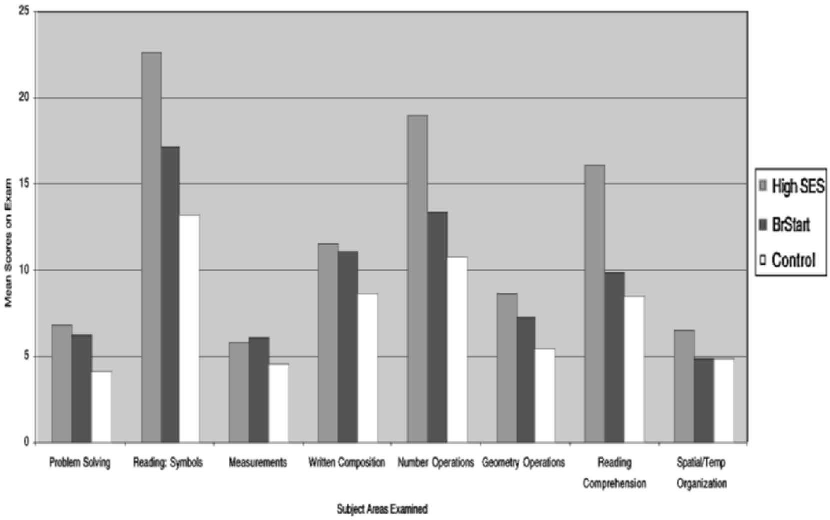

Figure 12. French national exam, given in Grade 2, in a variety of subjects (Paour et al., 2000)

Summary and Conclusions

I have tried to show that new approaches are needed in education for a variety of reasons, many deriving from our admirable goal of universal education. These reasons include the incredible burgeoning of the world's fund of knowledge, as well as a variety of circumstances whose effect is to prevent the efficient and effective transfer of culture from one generation to the next—a failure that results in inadequate cognitive development and poor learning and school achievement. I have suggested that we should redefine the goals of education itself, to include a major emphasis on preparation of life-long independent learners, and to accomplish that goal largely by focusing on the acquisition and elaboration of reliable modes of logical thinking as the tools of learning and on the development of task-intrinsic motivational orientation.

I have suggested further that in order to redefine the goals of education and to develop new approaches in education, we should consider new models of the nature and development of human abilities, and I have offered my own model, a transactional perspective on ability. The transactional perspective relies on three principal components of ability: intelligence, cognitive processes, and motivation. They are not three independent components, but each affects the development of the others in ways that differ depending upon their prior interactions. The distinction between intelligence and cognitive processes is critical to this conception, as is the role of task-intrinsic motivation, which must be developed in order for students to become life-long independent learners and to have enthusiasm for change and for learning new things.

Following these two major points, I have suggested that formal programs of "cognitive education" should be followed in schools, and have called attention to several that are already available and tested. One of these, a product of my colleagues and me, is called *Bright Start: Cognitive Curriculum for Young Children*. As an illustrative example of what I consider to be "good" programs of cognitive education that follow from the change in goals and models that I suggested earlier, I described *Bright Start* and offered empirical data to show that its application with 4–6 year old children in a preschool setting enhances their development of formal reasoning processes, raises IQ, increases task-intrinsic motivation, results in better instruction-following, and leads to higher achievement in the primary grades in school than is experienced by children who only received a good but non-cognitive curriculum. I hope you will forgive me for using my own program as an example. The last thing I want to point out is that there are currently more than 200 programs that are commercially available, all of which are called in some way "cognitive" by their authors or publishers. One needs to exercise great care in choosing among them—but that is another story, for another day.

Author Note

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