

FIE as a model for school reform

Prepared for presentation at the
Unlocking Human Potential to Learn conference
Sponsored by UNEVOC Canada and ICELP

Aug. 2001

By: Meir Ben-Hur
Director of Learning Applications
Virtual Learning Systems

Not a day passes without a critical news article on the state of public education and the urgency to fix, or even build alternatives for it. New policies, new standards, new assessment tools and other initiatives abound, along with counter arguments about their value. For one thing, students and teachers have become the focus of attention. The big premise is school reform.

Systemic reform has been defined as a comprehensive, coordinated change in a system's essential components. It is not an end-in-itself, but rather, a process that modifies the system in an irreversible way. As far as systems of education are concerned, all the recent reforms target curriculum and assessment, professional development, and student support. FIE, that is among the oldest programs that is still being used, has recently been listed by the Northwest Regional Educational Laboratory as a bona-fide school reform model¹. The balance of this article will explain why.

FIE, curriculum, and assessment

In 1994, Carl Haywood and his colleagues at Vanderbilt University tested high and low academic achieving middle school students on a test comprised of FIE tasks². He found that the level of the

¹ Catalog of School Reform Models (March, 1999)

² Arbitman-Smith, Haywood, Bransford, "Assessing Cognitive Change," in *Learning and Cognition in the*

students' performance on this test correlate with their academic achievement level. He concluded that both, the FIE and academic achievement tests challenge a great deal of the same cognitive abilities. Indeed, one can relatively easily analyze the tasks students are confronted by in their academic work, and find the similarities with FIE tasks (see Figure 1).

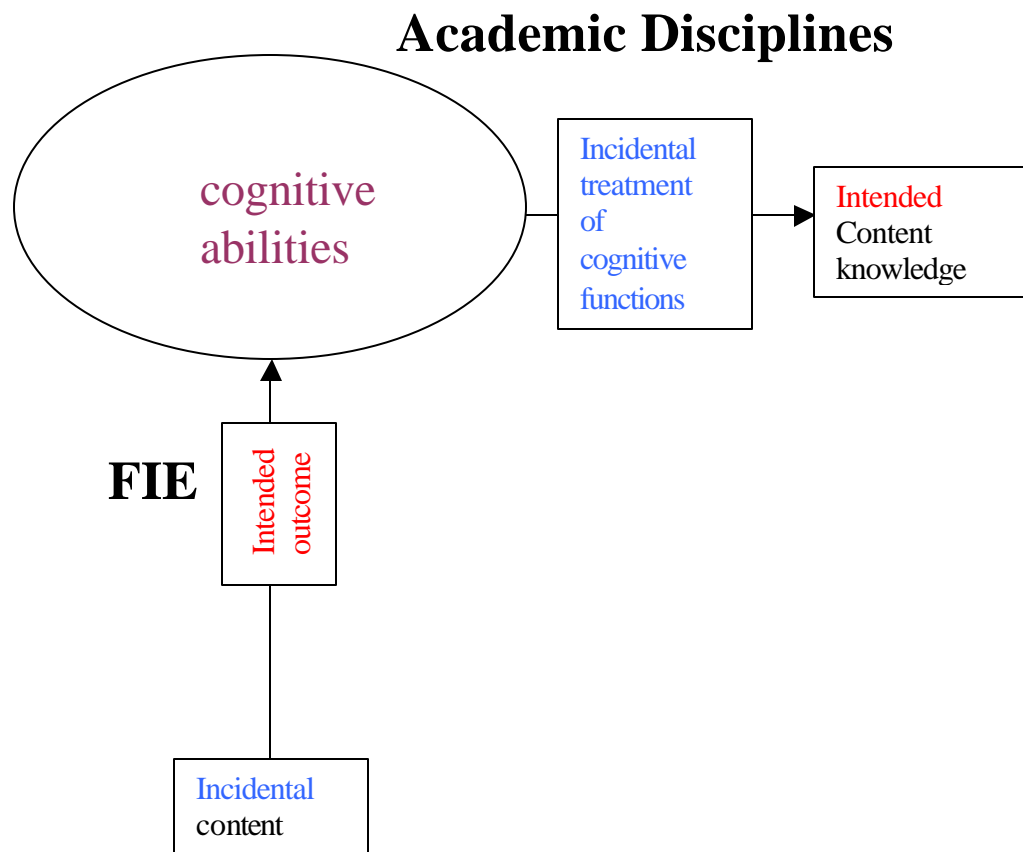
Figure 1: FIE and academic tasks challenge a great deal of the same cognitive abilities

FIE	Mathematics	Science	Language arts
<ul style="list-style-type: none"> • Record, organize • Compare, classify, represent, analyze. • Select relevant information • Register time, space. • Infer, plan, formulate and test hypotheses • Relate cause and effect, reason inductively. • Communicate clearly and precisely 	<ul style="list-style-type: none"> • Record, organize, measure • Connect, represent, analyze, compare, and order. • Select relevant information • Register time, space • Conjecture, invent and problem-solve. • Employ logic and reason • Employ evidence • Communicate clearly and precisely 	<ul style="list-style-type: none"> • Gather, identify, record, and measure. • Compare, classify, arrange. Order, sequence. • Select relevant information. • Register time, space. • Form and test hypotheses. • Conclude, extrapolate, infer. • Predict, transfer, and generalize. • Relate to real life 	<ul style="list-style-type: none"> • Inquire, identify, organize, and take notes. • Compare classify, arrange, analyze. • Select relevant information. • Register time, space • Identify cause and effect • Trace the development of a plot • Reason, assess, and conclude. • Anticipate. • Clarify, explain, reflect, summarize.

Why is it so common then, that the cognitive and affective dispositions that are necessary for higher academic achievements are not enhanced through learning that happens in the context of the academic disciplines? Evidence points to at least two contributing factors.

First, the curriculum generally follows the internal structures of the academic disciplines, while FIE targets the development of specific cognitive behaviors in a focused, systematic, and progressive way. Consequently, FIE builds students' cognitive competencies, and feelings of competence. Second, generally students' learning experiences are confined to the contexts of specific academic disciplines, while FIE attempts to develop cognitive structures that are "detached from, and independent of, the extrinsic need [the nature of the task] that initially produced [them]"³.

Figure 2: The relationship between FIE and the academic curriculum



³ Feuerstein, R., Y. Rand, M. B. Hoffman, and R. Miller. (1980). *Instrumental enrichment: An intervention program for cognitive modifiability*. University Park Press. Baltimore:

The effects of FIE have been studied and analyzed extensively by researchers around the world; there have also been several meta-analyses (See Savell, Towhig, Douglas, 1986; Burden, 1987; Adams 1989, Mayer, 2000; Ellis, 2001), and many evaluation efforts⁴. The reports are generally supportive. Taken as a whole those reports document larger gains than those produced by the so-called “remedial classes”, in virtually every academic area, and with various student populations ranging from special education to gifted students. But the results have not been consistently so. Though the program materials are designed so that mere exposure to them may have a positive effect on students, the essence of the program still lies in the combination of the materials and what Feuerstein refers to as “mediation”—that is, the quality of teaching and teacher preparation.

FIE and professional development

Professional development can have a great effect on the ethos of the profession of education – the beliefs and the behaviors of the professional community. Teachers who rely only on their personal knowledge of teaching, and their personal knowledge of the content they teach, for all their professional decisions, benefit the most: their students can enjoy much higher levels of success in school. FIE provides a strong incentive, a framework, and a magnificent vehicle for meaningful professional development.

The preparation of teachers for FIE includes very thorough analysis of theories on learning and teaching, and an introspective view of a cognitive based education. In addition to the typical three five-day in service workshops, FIE teachers often benefit from follow up mentor help throughout the program’s implementation. This preparation is aimed at strengthening the teachers’ belief in the idea that all students can reach higher levels of performance; the awareness that teachers can understand and facilitate (mediate) their growth; the development of skills they need as mediators; and the teachers’ commitment to do so.

⁴ Hartford Connecticut; New York City; San Juan, PR; Philadelphia; Detroit; Taunton, MA; Leander, TX.

Figure 3: Examples of FIE teachers' comments

“FIE helped me teach [students] how to organize their thoughts – to think things through.”

“It has given me a new light and hope where there was none.”

“Eduardo and Edward were in my I.E. class last year. They seem [now] to be more excited about learning. They never asked questions and barely participated orally. Now I can't keep them quiet.”

“Overall I find that my I.E. students come to class better prepared.”

“Some of the teachers in my department suggest that my I.E. students are a pleasure to have in class. These students were in my “infamous” sixth hour last year. When the teachers ask them who their teacher was last year, they say, ‘Mrs. Jackson [now Baker]. She taught us Instrumental Enrichment.’ ”

While not many, research studies on the effects of FIE training, and the experience of teaching it are very encouraging. They document significant changes in the teachers' beliefs about students' learning abilities, the teachers' sense of “autonomy” and “creative self-perception”, and improved teaching skills. However, the many reports on the efficacy of FIE have almost always included critical comments regarding the training of FIE teachers. Interviews and surveys indicate that FIE impacts teachers' relationships with students and parents, and the teachers' own feeling of competence. Teachers report that their FIE experiences improved their teaching skills, their understanding of the learning processes, their ability to assess learning, and their ability to develop and maintain students' interest not only for FIE classes, but also for learning other subjects (see for example, Figure 3).

But even great FIE teachers may be ineffective in teaching specific academic subjects. I have recently been asked whether FIE students are necessarily “immunized” against declining academic achievements. Obviously, not - I know “smart” FIE students who fail mathematics as much as I know students who appear to perform sufficiently well in mathematics, and could still benefit

Figure 4: Alignment of teaching standards and mediation (FIE): Example from the NCTM Standards

NCTM STANDARDS for MATHEMATICS	INSTRUMENTAL ENRICHMENT
Professional Teaching Standards	
1. Logic and evidence to verify rather than teacher as “sole source”	Connections between experiences through logic and concept development.
2. Reasoning rather than memory	Systematic development of reasoning, problem-solving skills, connections, relationships, and intrinsic motivation.
3. Conjecturing, inventing, and problem solving, rather than mechanistic solution	Change students passive recipients of knowledge into self-confident and active learners who conjecture, make analogies, and solve problems creatively.
4. Connect learning to other areas of curriculum	Connect and identify applications of new skills across the curriculum.
5. Focus on ALL students	Teach all students, especially at risk students, to learn how to learn.
Implication for teachers who must help students:	
6. Work together to make sense of new ideas	Mediate and guide students towards the discovery of solutions.
7. Encourage students rely on themselves to determine correct answers	Students are encouraged to judge whether responses are appropriate.
8. Reason	Focus on reason
9. Connect concepts, ideas, and applications	Encourage students to discuss how concepts and strategies can be related to different domains.
Decisions teachers must take:	
10. Setting goals	Students are taught to define goals, establish starting points, and outline steps by which goals can be reached.
11. Selecting and creating tasks that help students achieve these goals	Teachers are guided by the structure and sequence of the program to offer, or create tasks bridge over difficult gaps.
12. Stimulating and managing discourse to ensure students and teachers understand what is being learned	Teachers listen to students, to understand the ways in which they think, and to help them get to next steps. Student-teacher dialogues are discussed and analyzed the teacher training process.
13. Analyze student learning to make ongoing instructional decisions	Teachers continually assess students’ progress and analyze errors and refrain from moving on until students demonstrate mastery.
Assessment Standards	
Increased attention to:	
1. What students know and how they think	Break down and analyze complex thinking process and guide students carefully to next levels.
2. Using assessment as an integral part of teaching.	Constantly and in collaboration with students assess learning and progress.
3. Focusing on a broad range of tasks and taking a holistic view of the subject	Focusing on a broad range of tasks to address a core of cognitive abilities.
4. Developing problem situations that require application of various concepts	Every task carefully designed to incorporate a variety of cognitive skills.
5. Using multiple assessment techniques	Tasks vary while the underlying cognitive challenges remain constant. Teachers learn to observe, analyze student’s errors, and elicit student reflections in an ongoing dynamic process.

From FIE. Even the skeptics would agree that it takes a lot of “brain” to complete successfully the so-called “Fish page” of Organization of Dots, or some Transitive Relations pages, or Syllogisms. I saw 5th, and 6th grade students that are not successful in mathematics but could learn to complete those pages well. How come?

Let us analyze the question in relation to mathematics, and according to the sub goals of FIE:

1. *Efficient cognitive behaviors*: Is there any kind of “mathematics learning” that is independent of efficient cognitive performance? Yes – simple applications of procedural knowledge requires only memorizing and rote learning. This kind of knowing is not very useful, as opposed to understanding mathematical concepts and ideas that are borne out of, and yield complex cognitive processes.
2. *Concepts and vocabulary*: Does FIE teach all the concepts and vocabulary of middle school mathematics? Absolutely not, and the treatment that FIE gives to mathematics concepts is incidental at best (see Figure 2). For example, FIE develops such concepts as relative values (part whole relationship, frames of references etc.), and it helps students develop representational thinking. These concepts and abilities are necessary, but not sufficient for students to attain higher mathematics achievements. FIE does not teach the mathematical applications of these concepts like proportions, probability and statistics, fractions as percents, or decimal forms, or as in the four operations with fractions.
3. *Intrinsic motivation*: Is it possible that students become intrinsically motivated to think, solve problems, learn specific FIE tasks ... and not show these dispositions in the mathematics context? Yes, again! It was 14-year-old Chad who once tried to “explain” to me that he thought, “there is thinking in FIE but there is none of it in mathematics”. For Chad the motivation to do mathematics would have to be extrinsic (get the passing grade) - how else?
4. *Reflective thinking*: Can FIE students learn to reflect, and still fail to do it in mathematics? Yes they can. If academic classes ignore student work (particularly errors) as a source of instruction, then there is no context, opportunity, or encouragement for reflective thinking.
5. *Active participation and self-perception as competent source of information*: Is it possible that FIE students become active participants in classroom discussions and see themselves as potent

sources of information, but are passive and withdrawn in mathematics? Sure, if they think that there are correct, and otherwise incorrect answers in mathematics, and that they do not “remember“ the correct ones.

”Weak” thinkers can memorize and reproduce information, and pass tests that require no more than rudimentary knowledge, and students who think well do not have any advantage with these kinds of achievement standards. Thinking abilities are utilized only where instruction challenges them, and where tests measure them.

Even where teachers were well prepared, and delivered FIE successfully, the preparation for the program alone is not all they need for their professional development. Teachers need additional help in understanding the fundamental concepts they teach; and they need help in integrating the concepts they teach into the broader curriculum. Consider the cases of literacy, science and mathematics.

Literacy, or language arts standards essentially describe not contents, but rather, complex cognitive operations. It describes how students ought to be able to gather literary information effectively from variety of sources – not what information they should gather; how such information must be elaborated upon logically to produce valid new information – not how it should be reproduced; and how students’ must translate their own elaborated thoughts into effective communication. If teachers do not know how to recognize the development of these cognitive processes in their language and classes, the standards, and the achievement tests that measure them are inevitably only intimidating for them and for their students.

It is documented that students hold misconceptions about nature and science that can be altered through mediated learning. Students have difficulties understanding the relationship between theory and observations; they have difficulties understanding experimentation; they have difficulties interpreting evidence; they tend to make a causal inference based on a single concurrence of antecedent and outcome; they tend to look for or accept only evidence that is consistent with their belief and discount those that are not; they perceive knowledge in terms of “right/wrong” rather than as ideas supported by reason; they have to learn that different opinions must have reasons that can be challenged on rational grounds. The benchmarks for science literacy, as defined by the American Association for the Advancement of Science, Project 2001, describe exactly these cognitive developmental milestones – teachers do not always see them as such.

Mathematics teachers must know, and teach the formal logic of mathematics, rather than just how to manipulate numbers and symbols by unexplained rules. Instead, research shows that students’ understanding of mathematics is indeed fragmented and rudimentary; classroom discussions lack meaning that transcends the tasks at hand; imagery and spatial visualization, are often absent in classroom instruction; “drill” on one hand and “discovery learning” on the other are often ineffective; and memorization takes precedence over understanding⁶.

⁶ The National Commission on Mathematics and Science teaching for the 21st Century. Sept. 27, 2000.

Teachers of all subject areas need help in identifying and understanding the cognitive processes involved in the development of concepts. They certainly need deeper understanding the concepts they teach, sometimes they need other help as well. For example, they need to know how to use technology and other resources as soon as they become available; how to read and segregate state achievement test results; they need to research new textbooks, and more.

FIE alone can not offer all the conditions for teachers' professional development, but it helps prioritize, model, and facilitate the development of teachers and education systems that are better focused on learning and cognitive development in students.

FIE and student support – a modifying school environment

Research shows that the most significant results occur where FIE is implemented with the involvement of the entire education staff, and is institutionalized as a required curriculum for all the students in the system (from a certain grade level). This kind of effort is very difficult to initiate and sustain. However, if it does happen over time, such efforts yields the development of support mechanisms for teachers and students, including peer coaching and teaching, action research and evaluation, assessment of student growth and strategies that deal successfully with student transience, and parent involvement.

Figure 4: FIE can reform schools by cultivating

1. Professional development that focuses on learning and thinking
2. Shared vision that all students should reach higher levels of achievements.
3. Collaboration among special and regular classroom teachers.
4. Collaboration among school psychologists, social workers, teachers, and parents.
5. Improved abilities to teach diverse populations.
6. Reduced "special education" classes.

The experiences of systemic implementation of FIE that have completely succeeded are few and far in between. I can mention the Israeli experience, the Venezuelan, the Brazilian, a school district here and there, missing only a few more. But the results are always beyond expectations. The rate of students who perform at low academic levels decreases, and the rate of those who perform at high academic levels increases; student dropout rate decreases and school attendance increases; the education staff feels competent to deal successfully with exceptional children; educational placement costs decrease, and counseling costs drop. The educational system is reformed and restructures to be more effective.

Summary

“Educational reform is not an arcane business; it is not primarily a matter of great complexity, but one of will and political courage. It involves the willingness to hold institutions and individuals accountable, to make commitment to each child, and the courage when necessary to challenge and change the system.” (William J. Bennett, Secretary of Education, USA)⁶

Time and again FIE is considered a viable tool in helping schools address learning needs. It happened four decades ago as the program was designed to help mainstream young Israeli immigrants who survived the war torn Europe, and it happens today as schools world wide need to prepare more, and more diverse student populations for an increasingly intellectually charging future. How is it that a program so old finds itself repeatedly ranked high among the “educational innovations” of the day? Because it makes available a common conceptual and practical framework that address the development of cognitive skills; it facilitates an effective design of education that supports children (not programs) with the major goal that all children shall learn to learn and to think; it offers a concrete model rather than just a philosophy; it is accompanied by an effective and workable training for all teachers, including regular and special educators,

⁶ Bennet, W. J. *The Devaluing of America: The fight for our culture and our children*. New York: Summit Books. (1992), p.71

psychologists, social workers, and even parents; it establishes new patterns of collaboration among all service providers, including regular and special educators, psychologists, social workers and parents; it permits a strong evaluation design which focuses on learning; and it offers students stimulating instructional materials. FIE creates a framework and incentive for school reform.

References:

- Adams, M.J., "Thinking Skills Curricula: Their Promises and Progress," *Educational Psychologist* 24 (1989) 25–77.
- Arbitman-Smith, Haywood, Bransford, "Assessing Cognitive Change," in *Learning and Cognition in the Mentally Retarded*, ed. Brooks, P. H., Sperber, R., and McCauley, C. (Hillsdale, N.J.: Lawrence Erlbaum Associates, 1994), 453–63.
- Burden, R.L., "FIE Programme: Important Issues in Research and Evaluation," *European Journal of Psychology of Education* 11 (1987): 3–16.
- Ellis, A. K. *Research on Educational Innovations*. 3rd ed. Eye on Education, Inc., Larchmont, NY. (2001): 88-91.
- Feuerstein, R., Y. Rand, M. B. Hoffman, and R. Miller. *Instrumental enrichment: An intervention program for cognitive modifiability*. University Park Press. Baltimore. (1980).
- Liping, M., (1999). *Knowing and Teaching Elementary Mathematics: Teachers Understanding of Fundamental Mathematics in China and the United States*. Lawrence Erlbaum Associates.
- Mayer, R. "Intelligence and Education". In. R. Sternberg (Ed.) *Handbook of Intelligence*. Cambridge: Cambridge University Press.(2000): 519-533.
- Savell, J.M., P. T. Towhig, and Douglas, L.R., "Status of FIE. US Army Research Institute for the Behavioral and Social Sciences," *Review of Educational Research* 56, no. 4 (1986): 381–409.

Other documents:

The *National Commission on Mathematics and Science Teaching for The 21st Century*. Sept. 27, 2000.

Curriculum and Evaluation Standards for School Mathematics. The National Council of

Teachers of Mathematics (NCTM). 1989

Benchmarks for Science Literacy: Project 2061. The American Association for the Advancement of Science. (1993). Pp. 332-333

Catalog of School Reform Models (March, 1999)