EFFECTIVE School Practices

VOLUME 12, NUMBER 3 PRICE $5.00 SUMMER, 1993

FOCUS: TOWARD WORLD CLASS STANDARDS

FORMERLY ADI NEWS

Philosophy of *Effective School Practices*

1. Teachers are responsible for student learning.
2. The curriculum is a critical variable for instructional effectiveness.
3. Effective teaching practices are identified by instructional research that compares the results of a new practice with the results of a viable alternative.
4. Experiments should not be conducted using an entire generation of Americans. The initial experimentation with a new practice should be small in scale and carefully controlled so that negative outcomes are minimized.
5. A powerful technology for teaching exists that is not being utilized in most American schools.

Effective School Practices (formerly *ADI News*) is a publication of the Association for Direct Instruction. The mission of the Association for Direct Instruction, as stated in the by-laws, is to promote the improvement of educational methods.

The name *Direct Instruction* originated with the highly effective instructional model first developed by Zig Engelmann in Project Follow Through during President Johnson's Great Society legislation. Although the evaluation of Project Follow Through showed the Direct Instruction model to be far more effective than the other models on every identified outcome, education in America remained generally unchanged.

A few educators, impressed by the extraordinary results of the original Direct Instruction model and the programs that were developed as DI evolved, formed the Association for Direct Instruction in 1981.

Today, this organization is a vanguard in promoting school practices that have been validated as effective through the use of the scientific method in educational research.

The Association for Direct Instruction was incorporated in 1981 in the state of Oregon for educational purposes. ADI is a non-profit, tax-exempt corporation under Section 501(c)3 of the Internal Revenue Code and is a publicly supported organization as defined in Sections 170(b)(1)(A)(ii) and 509(a)(1). Donations are tax-deductible.

A copy or summary of the current financial statement, or annual report, and registration filed by ADI may be obtained by contacting: ADI, PO 10252, Eugene, OR 97440 (503-485-1293). ADI is registered with the state of Oregon, Department of Justice, #79-16751. (ISSN 1068-7378).

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FOCUS: TOWARD WORLD CLASS STANDARDS

Overview

Bonnie Grossen, Editor

In this issue we describe the pedagogy that has proven itself capable of achieving world-class standards in education. Although this pedagogy differs from the currently popular "child-centered" pedagogies, it is not a "return to basics" either. Using what works best represents a "new" direction.

What Works Best? Balance.

In this edition we've reprinted two recent articles (Yates & Yates originally published in 1990; Schmidt & Bjork, in 1992) that summarize the state-of-the-art: what works best. Yates and Yates (pp. 24-35) summarize the latest "Teacher Effectiveness Research" and describe the important features of teacher presentation and communication in instruction. Schmidt and Bjork (pp. 36-48) in "New Conceptualizations of Practice" discuss how practice can be engineered to accomplish optimum generalization and transfer. To facilitate generalization and transfer, practice usually must vary across problem contexts and situations, be spaced across time, and be mixed in a random, unpredictable order.

The best practices described in these two research reviews contradict both traditional education forms and the most popular current reform (child-directed instruction, also called "developmentally appropriate practice" by the National Association for the Education of Young Children). First, the teacher presentation of traditional education has often been characterized as instruction that authoritively relegates students to passivity, often killing their motivation to learn. On the other hand, the most popular current reforms oppose teacher-directed instruction of any kind and advocate the exclusive use of voluntary small group work on thematic projects in learning centers. In contrast to both, Yates and Yates conclude that teacher-directed, large group instruction that is interactive, responsive, and provides immediate practice opportunity is not only most effective and "user-friendly," but it is also socially most rewarding, and builds self-esteem. Second, the practice component of traditional education has been known for its extensive, often mindless, repetitive worksheets. Popular current reforms take an anti-practice stance and allow practice only if students spontaneously set the practice up and do it on their own. In contrast, Schmidt and Bjork describe complexities in the engineering of effective practice for meaningful learning that may exhaust you, especially if you read the article after a day's work.

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The state-of-the-art in best teaching practice, as it is defined by scientific educational research, requires balance, not decade-by-decade flip-flopping from one extreme fad to the other extreme fad. It requires a thoughtful, intricate balance that is for the most part determined by the learner's level of competence in the instructional activity. Table 1 summarizes the interaction of learner competence with the design of the instruction. Effective initial instruction to naive learners is highly scaffolded. As the learner becomes more competent the scaffolding is removed, moving slightly ahead of the learner on this imaginary continuum. As learners grow in competence, effective instruction proceeds from teacher-directed instruction to student-directed activity, from instruction in component skills to instruction that integrates the skills into a whole, from overt descriptions of thinking processes to covert practice of those strategies, from prompted to unprompted assistance, from practice limited to a specific problem type to practice that varies widely and extensively across many problem types in an unpredictable, more naturalistic environment, and from more contrived problems to naturalistic ones.

Addenda: The ideas for the cartoons in the previous issue of *Effective School Practices* were Geoff Colvin's. The art was done by Susan Jerde.

The article by Anne McGill-Franzen entitled "What Does 'Developmentally Appropriate' Mean?" was reprinted from *The Reading Teacher*, Vol. 46, No. 1, September, 1992, pp. 56-58.

Table 1. *Continuum of Effective Instructional Practices as They Relate to the Learner's Level of Performance in the Specific Type of Learning Activity*

Completely Naive Student ⟷ Proficient Sudent	
Teacher-directed	Student-directed
Skills-based	Integrated
Overt	Covert
Prompted	Unprompted
Blocked practice	Random practice
Limited practice	Varied practice
Massed practice	Spaced practice
Contrived problems	Naturalistic problems

In contrast to this balanced continuum, educational reforms usually promote one extreme and omit or even discredit any attempt to incorporate the other extreme. The current generation of reforms promotes child-directed instruction and discredits teacher-directed, skills-based instruction. The earlier generation of reforms promoted skills-based instruction that failed to integrate skills into wholistic problem-solving activity and failed to develop practice beyond simple drills (i.e., blocked, limited, and massed practice was often all that was provided in the effort to master each specific behavioral objective). More is to be gained by rising above this to and fro.

In essence, the research says that the most user-friendly, effective instruction provides clear, explicit presentations of crucial information in an interactive format, immediately followed by well-engineered practice that deepens and expands the initial embryo of understanding into expertise. The specific type of Direct Instruction ADI offers training in is only one of many possible effective programs schools could use. Hundreds of possible programs and methods could fall within these parameters of best teaching practice.

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The conclusions presented in these two reviews are widely agreed upon by researchers around the world who subscribe to the scientific method. Yates and Yates, for example, are located in Australia. All the research reviews in Joe Freedman's annotated bibliography (pp. 50-56) are generally consistent with the two syntheses of experimental research presented here (i.e., Yates & Yates, Schmidt & Bjork). Applying these findings to classroom practice can have a dramatic effect on learning, as the Wesley Elementary Success Story (pp. 17-23) illustrates. Wesley Elementary in Houston, Texas, is NOT using the popular child-centered pedagogy, nor are they using traditional teacher-directed instruction. They are using a form of the user-friendly explicit instruction that is described in this edition as best practice.

Figure 1. *Battle lines defining the current war of "paradigms."*

MONTESSORIAN DEVELOPMENTAL PARADIGM	SCIENTIFIC PARADIGM
What are the assumptions?	
Learning must be natural. Learning must be fun.	Learning must happen. Teaching must work.
What is the goal of instruction?	
To match natural, free development	To accelerate development
How is educational theory informed?	
By observing children as they operate in a natural, free environment, unencumbered by adult restraint or influence.	By observing what works best to achieve our agreed upon goal–a population of youth with superior academic competence.
What are the conclusions?	
These assumptions and observations ("research") support child-directed instructional practices as a prescription for "natural" development.	These assumptions and observations (research) support user-friendly teacher-directed instruction with well-engineered application practice as a prescription for improved education.

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(Data comparing Wesley Elementary School's performance with 10 other schools were presented in the Winter, 1992 edition of the *ADI News*.)

Scientific Reasoning Placed in Question

A very reasonable question for you to ask is this: If researchers generally come to the same conclusions, and schools that implement these findings have students who achieve so much more than other schools, why are these ideas so conspicuously absent from educational reform rhetoric in America today? Part of the explanation lies in the distinction between researchers who subscribe to the scientific method and those who reject it. Researchers who agree with Yates and Yates and with Schmidt and Bjork will be those who subscribe to the scientific method. Those sponsoring the educational reform movement toward child-directed education do not; they reject the scientific method. This fundamental disagreement in method is referred to, in academic circles, as "the paradigm war." This war is confusing, as all wars are. However, it is very important for you to understand the issues in this war, before climbing on any current educational reform bandwagon. Table 1 summarizes important features of the two competing paradigms.

As many of you have heard, reform leaders claim repeatedly that child-centered educational reform is "research-based." Although they may cite "research," their conclusions are not based on that research. An analogy from Mrs. Johnson can help illustrate how "research" can be cited that does not provide a logical base for the conclusions reached. Mrs. Johnson is a character in *Reasoning and Writing* (SRA, 1992) who studies the growth of children who sleep on boards. Her data indicate that children who sleep on boards grow an inch every year. She concludes that all children should sleep on boards in order to grow. Because Mrs. Johnson has these data, she claims that her prescriptive conclusion is "research-based." Her data are accurate. I am sure that children who sleep on boards grow. But her *reasoning* from those data is not valid. She cannot infer a causal relationship from her data. Without identifying a causal relationship, she can make no prescription. She has "research," but her conclusions are not "based" on that research.

What evidence would be required to actually convince us that all children should sleep on boards in order to grow? If Mrs. Johnson compared the growth rate of a lot of children who sleep on boards with the growth rate of a lot of children who sleep in beds, and found that the children who slept on boards grew significantly faster than the children who slept in beds, we might be convinced. We would want to examine her sampling. For example, we'd want to make sure that the children in both groups were comparable in age, to control for the

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possibility that growth rates at certain ages might be greater than others. We would want to have some valid statistical methods in place that would factor out chance differences. In other words, the more children Mrs. Johnson uses in her sample, the less

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likely it is that differences between the two groups will be due to chance or random differences in the growth rate of children. We would probably not accept as sufficient evidence, case studies showing that one or two children who slept on boards grew more than one or two children who slept in beds. These expectations amount to an expectation that Mrs. Johnson should conduct a scientific experiment in order to prove her conclusion for us.

Now let's take the real case—the data that are claimed to support the rejection of teacher-directed instructional practices. These data are often referred to as "developmental research" and come from a developmental research tradition defined by Montessori (1912). This tradition is to study

children that are "free from adult intervention: that is in their natural state, as individual beings, uncontaminated by culture" (Walkerdine, 1984), assuming it is possible to find such children. In effect, Montessorian developmentalists study the learning growth of children in informal environments, unencumbered by adult instruction or restraint. Their data indicate that children playing in informal environments exhibit new learning. From these data, proponents of child-directed instruction conclude that playing causes learning to occur and they prescribe that all schools should incorporate informal learning environments in order for children to learn. Because they have these data, they claim that their prescriptions are "research-based." Their data may be accurate, just as Mrs. Johnson's data are accurate. But their reasoning from those data is not valid. They cannot infer a causal relationship from their data. Without identifying a causal relationship, they cannot prescribe teaching practice. They have "research," but their conclusions are NOT "based" on that research.

[Developmental] data indicate that children playing in informal environments exhibit new learning. From these data, proponents of child-directed instruction conclude that all schools should incorporate informal learning environments in order for children to learn.

Experimental research just happens to be the best available tool for uncovering causal relationships. However, in the current paradigm war, experimental research such as we would expect from Mrs. Johnson, is completely rejected by the large number of academicians who are loudly discrediting teacher-directed learning environments. This is not really surprising, because the findings of experimental research generally contradict everything these promoters recommend, as you can see by comparing the research findings described in this edition with the recommendations of Montessorian developmentalists that were described in the previous edition. Advocates of child-directed instruction must either admit they have been wrong, or reject the methodology that leads to the strong contradictions of their beliefs. The advocates with the loudest voices seem to have chosen the latter alternative: reject the scientific method.

Grappling with the arguments for this rejection is where the paradigm war gets really confusing, mostly because the arguments against experimental research are fundamentally illogical. Illogical reasoning is, by nature, very confusing to follow. I will very briefly describe two of the main arguments against experimental research.

Without identifying a causal relationship, [developmentalists] cannot prescribe teaching practice.

The first argument charges that experimental research is consumed by an interest in "product." This is believed to be bad because what educational consumers demand today is competence in important "processes"—creative processes, thinking processes, problem solving processes, processes, processes, and more processes. Therefore, research that qualitatively describes these processes serves us better and experimental research should be abandoned. The problem with this argument is that it equates teaching processes with student processes, which are not equivalent. Student processes, if they are learned in school, are a "product," or result, of schooling. It is true that experimental educational research is concerned with the result, or product, of different teaching processes. Yates and Yates, for example, refer to the scientific method as "process-product research." The expected product of teaching is new learning on the part of the students. However, that new learning can involve a complex student process, such as logical reasoning, just as readily as it can involve a student product, such as getting right answers to a set of addition problems. That process can also be assessed, using descriptive, qualitative methods that

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analyze more closely the processes students learned. These qualitative and/or quantitative evaluations can also take place at any point in time after the instruction. The shift in interest from product to process among consumers can be readily accomodated by experimental research. The criticism that experimental research limits the nature of the learning outcomes that can be studied is not valid.

The second argument charges that experimental research is "reductionist." That means it oversimplifies the complex, wondrous processes of learning into simplistic laws. Therefore, we should bow to

"As surely as constructivism needs to be treated as problematic, the assumptions of mainstream developmental psychology are in need of critical interrogation."
Michael O'Loughlin, 1992, page 805.

the mystery and dismiss the attempt to identify any teaching behaviors that might enhance learning. Instead, we should assert that teaching does not cause learning, and agree to let children figure out knowledge on their own. To simplify the rebuttal, let's just accept that the premise is true, the complexity of good teaching has very often been grossly oversimplified in the past. Now how do we solve that problem of oversimplification?

We should first ask if advocates of child-directed methods offer the desired respect for complexity. For example, many enthusiastically cite Vygotsky's theories about "the zone of proximal development" as a finding of "the most recent research on how children learn." Vygotsky's theory states simply that for learning to occur activities should be provided that are within the cognitive reach of the child. This is not a complex concept. Surely most any mother in the world quickly figured this one out. It is hardly the news flash that is capable of rescuing American education from mediocrity. The educational solutions offered by popular developmental theories are at least as simplistic as any that have been offered in the history of education.

According to [developmental studies], the meaning construction process usually begins with a rote phase where the learner acquires a few isolated facts that are not connected or related in a meaningful way.

Another slogan is often presented to discredit teacher-directed instruction: "We now know that learners construct meaning for themselves." Although we have probably known this for a long time, those opposing teacher-directed instruction use this slogan to imply that when teachers teach, learning can only be rote, and when learners figure things out on their own, their learning is always meaningful and never rote. In the case of infants and toddlers learning simple concrete concepts, direct teaching may have some serious limitations. But how do complex meanings develop in school-age subjects? Thomas Shuell gives some clues about the complexities behind this "constructivist" slogan in "Phases in Meaningful Learning" (pp. 57-65). Shuell summarizes recent descriptive research on the development of meaning, particulary complex meaning. Shuell properly limits his conclusions from the developmental data in the area of meaningful learning to descriptions of phases. He does not make prescriptions from descriptive data, as Mrs. Johnson did and as opponents of teacher-directed practices do. As Shuell points out, the descriptive research did not give any clues about what *causes* the learner to move from one phase to the next. It just indicated *how* learning occurs, that is, it described a usual, or natural, sequence.

In the scientific paradigm, the way people naturally learn is not necessarily the way that people should be taught.... Scientific educators expect to improve upon natural learning.

According to Shuell, the meaning construction process usually begins with a rote phase where the learner acquires a few isolated facts that are not connected or related in a meaningful way. This initial phase of rote learning does not prevent meaningful learning, rather it seems to be a first, natural step on the way to deeper understanding. The third and final phase of expertise in a complex domain is characterized by a high level of automaticity. Many who oppose teacher-directed instruction view automaticity as an indicator of low-level, rote learning (e.g., Solomon & Perkins, 1989) and would likely misidentify expertise as rote behavior.

According to the Montessorian developmental paradigm, instruction should now attempt to match the natural development described by Shuell and produce rote learning in the initial phase of instruction and automatic responses in the final phase. However, in the scientific paradigm, the way people naturally learn is not necessarily the way that people should be taught. By using a knowledge base that explains *what causes* that development, that is, gives us clues about how to cause learning through our teaching, scientific educators expect that carefully crafted instruction can improve upon natural learning. The environment can be arranged in such a way that the student will use everything that is encountered to construct meaning that is relevant to the larger learning purpose and avoid rote, meaningless learning. This scientific model implies that the teacher

leads the students to expertise, rather than the students finding their own way.

The problem of simple-mindedness in education is an important one to solve if we are serious about improving education.

Overcoming Simplistic Reforms

The problem of simple-mindedness in education is an important one to solve if we are serious about improving education. The complexities of human learning certainly do demand a level of understanding that goes well beyond that which can be captured in a simple-minded slogan. The experimental findings of Schmidt and Bjork in "New Conceptualizations of Practice," for example, are anything but simple. In fact, most recent experimental findings are usually so complex, that they present a new problem for education. How can such complexity be adequately communicated to the field? These findings don't reduce readily to a simple slogan, sound byte, or vaccine, so they don't travel as quickly and efficiently to the field as simplistic solutions do, such as those that are offered by opponents of teacher-directed, engineered instruction. How can teachers implement the state-of-the-art if they can't quickly understand it? Anything that takes time to understand also requires a lot of staff development time.

Instead of spending more time and money for staff development, a more efficient alternative may be to incorporate these complex findings into the design of the tools (textbooks, program guides, other curricular materials) that teachers use. In other words, make publishers spend the time and money to figure the research out. Most teachers who rate themselves on the self-assessment below will probably realize that they agree—this is quite a good idea. Many teachers would rather have tools that incorporate for them the details of complex findings about human learning than they would like to take the time themselves to understand and apply them fully.

Getting publishers to incorporate the complexities of the state-of-the-art in research-based practice into the tools they market is not an easy task. Publishers respond to the demands of the market place. The desired change in publisher behavior would require at minimum that the marketplace *prefer* tools that have demonstrated *effectiveness* with children over tools that incorporate the latest simple-minded teaching slogan. An even more powerful influence on publishers would be for the marketplace to absolutely *demand* these demonstrations of effectiveness. As Jerry Silbert (pp. 66-75) points out in "A New Direction in the Fight Against Educational Discrimination," even the obvious minimal step is far from realization. In fact, two influential states, California and Florida, that once had a legal requirement for educational tools to be validated for their effectiveness prior to being used in schools, have repealed that legislation, with hardly a dissenting vote.

Self-Assessment for Teachers and School Officials

Check the box that best indicates your response to the article "New Conceptualizations of Practice: Common Principles in Three Paradigms Suggest New Concepts for Training" by Richard A. Schmidt and Robert A. Bjork, pp. 36-48.

- ☐ 1. I don't care what the article says, I don't believe in practice anyway.
- ☐ 2. I understood most of the points made in the article and I am prepared to design my curriculum for my students so that this research is properly implemented.
- ☐ 3. I understood most of the points made in the article, but designing the materials I would need to fully implement these findings in my classroom instruction would take more time than I have.
- ☐ 4. I don't have the energy to try to figure out the important points in the article. But I would appreciate it if someone else figured it out and handed me curricular materials that made it easier and less time-consuming for me to implement.

search.

If you answered #1, you do not subscribe to the scientific method in education.
If you answered #2, you should go into curriculum design.
If you answered #3 or #4, you agree that curricular materials should be designed to incorporate the latest scientific re-

The procedures for identifying effective educational tools has to be a crucial aspect of educational reform if that reform is ever going to capture the true "complexity of human learning."

Using tools that apply research could truly place schools on the "cutting edge" of effective practice, as the success story of Wesley Elementary School indicates (pp. 17-23). Although the students at Wesley come from some of the poorest families in Houston, the students consistently outperform the students from more advantaged neighborhoods on all kinds of achievement measures. A number of schools in inner-city Chicago are beginning to replicate these results by implementing the same user-friendly explicit instruction. In this edition, we include a number of letters from teachers, students, parents, and administrators who are involved in this new direction in Chicago (see Chicago Watch, pp. 14-16). Both Wesley Elementary and these schools in Chicago are using Direct Instruction programs.

If local school communities are to be accountable for the learning that takes place in their schools, then they also need to be able to choose the tools that they will use.

The procedures for identifying effective educational tools has to be a crucial aspect of educational reform if that reform is ever going to capture the true "complexity of human learning." Those who choose the tools used in schools determine to a large extent the potential effectiveness of those schools. More and more, these choices have been centralized at the state level where one committee develops adoption lists for schools and guidelines for publishers. Schools usually select from the adoption list even if they are not legally required to do so. Publishers respond so well to the guidelines that hardly any meaningful choices in the design of curricular materials exist. When fewer and fewer people are involved in choices that involve more and more money, the target for power politics becomes clear, and hard to miss.

With this formula in place, it is not surprising that almost all the adopted tools in all the 50 states reflect the latest simplistic educational slogans, "developmentally appropriate" and "whole language," and do not incorporate the complex factors that are defined by scientific educational research. I challenge you to identify, anywhere in North America, one tool on an official state adoption list that falls within the parameters of user-friendly teacher-directed instruction immediately followed by well-engineered practice and/or that was selected because of its demonstrated effectiveness. Remember, to identify this tool you must require a demonstration of effectiveness that is at least as rigorous as you would expect from Mrs. Johnson, if she were to convince you that children should sleep on boards in order to grow.

Accountability rests on the shoulders of those who make the decisions. If local school communities are to be accountable for the learning that takes place in their schools, then they also need to be able to choose the tools that they will use. "Charter Schools Offer Another Choice" by Laurel Shaper Walters (pp. 76-77) describes legislation that might allow this flexibility. However, it is somewhat disheartening to see that all the "alternatives" that were named in the article were Montessori schools. "Montessori school" is another name for "developmentally appropriate practice" or "child-directed learning." All of these models are the same and they are identical to the most popular mainstream reform today. If some "user-friendly explicit instruction with well-engineered practice" models were among the "alternatives," we might be convinced that the legislation does seriously "offer another choice."

The knowledge base defined by the scientific method never offers any guarantees.... The teacher who implements research findings must also continute to apply science in the classroom.

Using Scientific Reasoning in the Classroom

There's one more important part to the scientific paradigm, especially as it applies to human learning. The knowledge base defined by the scientific method never offers any guarantees. The principles that are derived through the research indicate only practices with the greatest probability of resulting in the best learning. And these best practices are only "best" among the practices and visions that have been evaluated.

This caveat cannot be taken as support for adopting the currently popular child-directed methods, which research has shown to have the little likelihood for success with children who typically have trouble in school. It does mean that the teacher who implements research findings must also continue to apply science in the classroom. In "Using the Scientific Method in a Japanese Elementary Classroom" (pp. 80-82), Yuji Anjo describes how he applied the scientific method in his own classroom. He implemented some effective practices he had read about, and very carefully observed their effects on his own students' learning success. He reflected on these results to arrive at additional hypotheses for what

he might do to be more effective in the future. But he always verified his teaching decisions by observing his students' subsequent learning.

Learning to use the scientific method in the classroom seems the first and best place to focus precious staff development time. It is the most important piece of all in the scientific paradigm, the essence of which is aptly captured in that old cliché: The proof of the pudding is in the eating.

References

Montessori, M. (1912). *The Montessori Method.* London: Heinemann.

O'Loughlin, M. (1992). Rethinking science education: Beyond Piagetian constructivism toward a sociocultural model of teaching and learning. *Journal of Research in Science Teaching, 29*(8), 791-820.

Salomon, G., & Perkins, D. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist, 24*(2), 113-142.

Science Research Associates. (1992). *Reasoning and Writing* (Level D). Blacklick, OH: Author.

Walkerdine, V. (1984). Developmental psychology and the child-centred pedagogy: the insertion of Piaget into early education. In J. Henriques, W. Hollway, C. Urwin, C. Venn, & V. Walkerdine (Eds.), *Changing the subject: Psychology, social regulation and subjectivity,* (pp. 153-202). London, England: Methuen & Co., Ltd.

The Nongraded (Mixed Age) Primary: Important Questions and the Research-based Answers

The National Association for the Education of Young Children (NAEYC) has defined a set of specific teaching practices that many school officials have come to believe are an important part of a nongraded primary. But they are not. These controversial teaching practices are widely referred to as "developmentally appropriate practices" (DAP). Many of the specific recommendations contained in DAP are NOT based on research; some are even contradicted by scientific educational research and are likely to result in less learning, especially for disadvantaged children and children with special needs. The following questions highlight the features of a Nongraded primary that are most controversial. Two answers are provided, one that research indicates will take us closer to world class standards, and one that is promoted as part of the current school reform philosophy (DAP).

1. The nongraded (also called mixed-age) primary is a primary program where children are NOT grouped for instruction according to their age.
Should a primary school move to a nongraded organization?
DAP—Yes.
Research—Sometimes better achievement scores are attained in nongraded primaries. However, the overall effects of nongraded organizations on school achievement are very inconsistent. This inconsistency is probably explained by the fact that there are many other factors that are more important for achievement than simply not grouping by age.

2. If children are not grouped according to age, how should they be grouped?
DAP—Group as *heterogeneously* as possible, with some homogeneous grouping by interest. Homogeneous grouping by skill needs is considered inappropriate practice.
Research—Place children into *subject-specific homogeneous groups* for instruction. Children should be grouped homogeneously according to their skill level in subjects that are skills-based, such as reading, writing, and mathematics. Schools that use the flexibility of mixed-age grouping in order to provide more teacher-directed instruction to students who are grouped according to their skill level have reported the greatest learning gains. Schools that used individualized instruction or learning centers (practices most similar to DAP) have had much lower learning gains. (DAP itself has never been evaluated as part of a Nongraded Model.) This is not to say that students cannot be grouped heterogeneously for assignments that do not require special skills, such as might occur with a field trip or an art project.

3. Should instruction follow the intent of the teacher or the intent of the children?
DAP—The intent of the children. Instruction that follows the intent of the teacher is inappropriate.
Research—The intent of the teacher. The teacher should lead the class toward the learning goal, constantly adjusting instruction based on the students' responses to the lesson. The teacher should also plan culminating projects that provide opportunity to integrate and apply the knowledge students have acquired. Instruction that expects children to learn entirely by pursuing their own interests in learning centers is discriminatory in its effectiveness. In such environments, minority children and children with special learning needs have lower self-esteem and are much less likely to acquire the tools they will need for later economic success and for problem solving (e.g., literacy, numeracy).

4. Can problem solving be improved by acquiring more knowledge?
DAP—No.
Research—A resounding YES. The main difference between expert problem solvers and poor problem solvers is a well-organized knowledge base in the subject area that is relevant to the problem. Instruction in general problem solving strategies of various types has not resulted in better problem solving unless the instruction also considered or taught relevant knowledge.

5. Should students invent their own learning or should the teacher communicate knowledge?
DAP—*Students should invent their own learning* as they manipulate objects in learning centers or learn

from each other in small groups. Teacher-directed instruction in small groups is viewed as inappropriate.

Research—In a highly interactive format, *the teacher should communicate knowledge* that consists primarily of generalizable concepts and strategies. The teacher should also provide students with practice that is engineered to result in generalization and transfer.

6. Should specific skills be taught and should practice be provided?

DAP—No. Instruction should be wholistic in reading and provide a developmental progression of authentic problem solving activities in mathematics.

Research—Yes. Research shows that learning written language as a whole is not within the immediate cognitive reach of any illiterate child. Content should be analyzed and broken down to the point where virtually all the students in the class experience daily success in learning something they view as difficult or significant. On-going application practice should also integrate the specific skills that are taught into relevant, authentic performance. This practice can be in the form of group projects.

7. Should instruction be divided into specific subjects for instruction, such as reading, mathematics, science, or history?

DAP—No. Instruction should be integrated into themes and not be broken down into specific subjects.

Research—Yes. Erasing traditional subject boundaries for wholistic treatment in "themes" has had negative effects on learning. However, non-traditional analyses of content within a subject area have dramatically improved learning. These reanalyses involve identifying the "big ideas" of each subject area and presenting them coherently. Linking these big ideas across subject areas can also add instructional power.

8. Should there be common standards for measuring progress? (Research cannot really answer this question. It is better determined by a consensus among the consumers of education.)

DAP—No. Standards imply the same expectations for all learners and this expectation does not appropriately respect individual diversity.

Counter Point of View—Yes. Certain basic tools (reading, mathematics) are required for economic success in our society. Standards should be based on the attainment of those tools. Using assessments derived from these standards, schools can evaluate the effectiveness of the instructional programs they use and the quality of the service they provide to the community. (Research documents that this alternative is realistic and attainable.)

Bonnie Grossen

Research Citations Referenced to Each Question Number

Note: For the sake of brevity, the following citations refer primarily to research summaries that have appeared in *Effective School Practices*, either as reprints or as original contributions. Within the documents listed below, numerous references to primary research can be found.

1. Gutiérrez, R., & Slavin, R. (1993). Achievement effects of the nongraded elementary school: Summary of a best evidence synthesis. *Effective School Practices, 12*(2), 21-28.

2. Gutiérrez, R., & Slavin, R. (1993). Achievement effects of the nongraded elementary school: Summary of a best evidence synthesis. *Effective School Practices, 12*(2), 21-28.

See also the Winter, 1993 edition for an overview of the research and issues involved in grouping.

3. Carta, J., Schwartz, I., Atwater, J., McConnell, S. R. (1993). Developmentally appropriate practice: Appraising its usefulness for young children with disabilities. *Effective School Practices, 12*(2), 37-41.

Delpit, L. (1993). Skills and other dilemmas of a progressive black educator. *Effective School Practices, 12*(2), 37-41.

Delpit, L. (1993). The silenced dialogue: Power and pedagogy in educating other people's children. *Effective School Practices, 12*(2), 37-41.

Grossen, B. (1993). Child-directed teaching methods: A discriminatory practice of western education. *Effective School Practices, 12*(2), 9-20.

Yates, G. C. R., & Yates, S. M. (this issue). Teacher effectiveness research: Towards describing user-friendly classroom instruction, 24-35.

4. Yates, G. C. R., & Yates, S. M. (this issue). Teacher effectiveness research: Towards describing user-friendly classroom instruction, 24-35.

5. Freedman, J. (this issue). Annotated bibliography of educational research syntheses.

Yates, G. C. R., & Yates, S. M. (this issue). Teacher effectiveness research: Towards describing user-friendly classroom instruction, 50-56.

6. Chall, J. (1993). Why poor children fall behind in reading: What schools can do about it. *Effective School Practices*, 12(2), 37-41.
Freedman, J. (this issue). Anotated bibliography of educational research syntheses, 50-56.
Schmidt, R., & Bjork, R. (this issue). New conceptualizations of practice: common principles in three paradigms suggest new concepts for training, 36-48.
Yates, G. C. R., & Yates, S. M. (this issue). Teacher effectiveness research: Towards describing user-friendly classroom instruction, 24-35.
Also see focus section "wholistic methods" of the *ADI News*, Summer, 1992.

7. Carnine, D. & Kameenui, E. (1992). Higher order thinking: Designing curriculum for mainstreamed students. Austin, TX: Pro-Ed. (See advertisement on page 8.)
Grossen, B. (1993). Child-directed teaching methods: A discriminatory practice of western education. *Effective School Practices*, 12(2), 9-20.

FROM THE FIELD

Dear Editor:

I am confused. The state of Oregon is moving to a Nongraded Primary that incorporates "developmentally appropriate practices" (DAP). According to a research review on the topic of "The Nongraded Primary" from the Northwest Regional Lab (NWRL), these practices are supported by the research. However, the information you reported on "developmentally appropriate practices" in the last issue (Spring, 1992) was extremely alarming and indicated that there is no research basis for DAP. Can you explain these contradictions?

An Oregon administrator

Dear Oregon Administrator:

"Nongraded" simply means that children are not assigned to classes based on their ages. The research review from the NWRL (Close-Up #14) concludes that achievement outcomes from nongraded primaries are inconsistent and makes no attempt to explain these inconsistencies by looking at the specific features of the various nongraded models that have been evaluated. How children are assigned to instructional groups and how that instruction is delivered seem to be much more relevant to the effectiveness of the school than the fact that it uses a nongraded organization. DAP is only one of many possible ways to set up a nongraded primary. Of all the models that have been tried in the past and evaluated in various research reviews, none have used DAP. Of the models that have been tested, the ones most similar to DAP were the weakest, while the models that used the nongraded structure to allow teachers to provide more direct instruction to students achieved the best results (see Gutiérrez and Slavin, Spring, 1992). The **Questions and Answers about the Nongraded Primary** on pages 9-11 in this edition may help you clarify the important differences between "nongraded primaries," "developmentally appropriate practice," and the "practices that research supports." You should also be aware that many DAP supporters cite "research" data but do not subscribe to the scientific method. This creates confusion for readers who assume that "research" is interpreted according to the laws of scientific reasoning. Some of these important current issues in interpreting research are discussed in the **Overview** to this edition.

Bonnie Grossen, Editor

Dear Editor:

I would like to respond to some statements made in Lisa Delpit's article: *The Silenced Dialogue: Power and Pedagogy in Educating Other People's Children* in the most recent issue of *Effective School Practices* (pp. 42-54). Specifically I would like to respond to her comments about the Distar Reading program. I agree totally with her initial statement, "Perhaps the ultimate expression of explicitness and direct instruction in the primary classroom is Distar" (p. 45). However, I believe some of her subsequent statements are not quite accurate. I will take three of her statements in turn and try to clarify each point.

1. "This [Distar] reading program is based on a behaviorist model" (p. 45).

While Distar reading (and other Direct Instruction programs) incorporate some behavioral elements (e.g., frequent positive feedback, point systems), the programs are based on a careful logical analysis of the content area to be taught and theoretical principles of clear communication. This, not behaviorism, is the heart of the model upon which Direct Instruction programs are based.

2. "The teacher's role is to maintain the full attention of the group by ... finger snaps, hand-claps and other gestures" (p. 45).

The teacher's role when implementing a Direct Instruction program goes far beyond maintaining attention. The teacher responds to individual and group performance on a moment-by-moment basis to ensure mastery of the program content. The purpose of the teacher's signal (finger snap, hand-clap or other gesture) is solely for the purpose of eliciting a choral response, so that all students have the opportunity to practice, and so that the teacher receives continuous information about the level of understanding for all students.

3. Delpit contrasts a "progressive" reading system with the Distar Reading program. In one of the progressive reading lessons, the letter names and sounds for the letters *m* and *e* are introduced. In the same lesson students are also taught how to write these two letters, and that the letters *m* and *e* produce the word *me* when blended. While acknowledging that the progressive system would be overwhelming and "a disaster" for some children, Delpit argues that the Distar program "presents the same information [as the single progressive lesson] in about 40 lessons" and that "the pace of the Distar lessons would only bore most kids" (p. 45).

First of all, Distar Reading is not designed for "most kids." It is for low-performing kindergarten children. For most students, who learn at a faster rate, there is a *Fast Cycle* program which proceeds at more than twice the rate of the regular Distar program. Furthermore, an analysis of the first 40 lessons of the Distar program reveals that a great deal more than 2 letter sounds, 2 letter names, and the blending for the single word *me* is taught. Children are taught to recognize and write 9 sounds, read 15 words, and many prereading skills, including rhyming, and a generalizable blending strategy that will enable them to read words that they have never seen before as they continue to learn new sounds.

As far as the pace of the lessons "boring most kids," if the teacher is responding to ongoing student performance, the lessons proceed rapidly; students are successful yet challenged because the are *learning*. As Ms. Delpit correctly observed, "Distar was 'successful' because it actually *taught* new information to children who had not already acquired it at home."

I do not wish to detract from Ms. Delpit's main message, which I believe is a valid one. I want only to correct what I believe to be a misrepresentation of the Distar Reading program and its intended implementation.

B.F. Kelly, Ph.D.
Research Associate,
University of Oregon

Chicago Watch

Goldblatt, Hayt, Lathrop, Scanlan, Smyth Elementaries and Creiger High school, with help from the Interfaith Organizing Project (IOP) have begun work to increase the academic skills of their students. They've implemented the reading portion of a curriculum called Direct Instruction (math, spelling, social studies and writing will be added in the fall). This program is the most thoroughly researched in the history of American education. Its basic philosophy is that "all children can learn." Principals and administrators from these schools have been to Houston, Texas to visit the Wesley Elementary School, where the method has been in use for the past sixteen years. Located in one of Houston's poorest neighborhoods, Wesley ranks academically in the top 20% of all elementary schools in the state.

What does a Direct Instruction classroom look like? The most obvious feature of the Direct Instruction method is the high involvement of both the teachers and the students in teaching and learning. Other features include:

- Students participating in fast paced, small group instruction;
- Teachers and students using materials which are field-tested and proven to have worked with children;
- Students receiving daily feedback about their achievements and progress; and
- The presence of positive attitudes toward learning exhibited by both students and their teachers.

How successful has Direct Instruction been in this year? Well as it is said, "The proof of the pudding is in the eating." So enjoy the following success stories from the teachers, students, parents, principals and administrators who are changing the educational landscape in Chicago. As you read, keep in mind that we have not yet implemented the Direct Instruction writing program in any of the participating schools.

Reverend Darryl S. Moore
Education Coordinator, IOP

Goldblatt School

This year at Goldblatt a reading program has been implemented in an attempt to improve our children's reading ability. In observing DIRECT INSTRUCTION, a change in student participation has been noted. D.I. is a program which allows all students to answer questions in unison in response to a signal. This practice allows children to respond correctly while at the same time correcting the errors of those children who may be struggling with the concept. The numerous repetitions reinforce learning in a way that removes the added pressure of having to be singled out for responses. More time is needed to fully evaluate the success of the program, but the children seem to be progressing well. It is our hope that just one year of instruction utilizing the D.I. approach to the teaching of reading will show positive growth in testing performance and reading ability.

Ms. Jessie Rivers, Local School Council Member

Direct Instruction was implemented in the fall of 1992 at Goldblatt School. D.I. in reading provides a model for clear, logical thinking. Students are successful. As they learn a new skill in one task, they apply it to another, and review it in another. My students are definitely benefiting from the repetition, the sequencing, the progression of skills that are offered in the program.

Lastly, I see a positive change taking place in my students. They're showing confidence in achievement and displaying high self-esteem.

Debra Evans, Teacher, 3rd Grade, Room 202

I believe the DISTAR program is very educational because it can teach you things you didn't know already. You can learn a lot of things. It is exciting to learn and I enjoy reading the textbooks by myself. You can learn some words that you didn't even know before. I like it because it gives me the advantage of learning new things. I have learned about insects, waterdrops, canoes, the wind, air, small animals, etc. I even learned that water has skin—that's amazing. I love the fact games and getting my bonus points. I love this program and you would too.

Victoria Dortch, student, 3rd grade, Room 202

Hayt Elementary School

For the past several months, I have been teaching DIRECT INSTRUCTION to my second grade class. I have seen a complete change in my reading groups. My students are very attentive to each lesson that I present to them. They enjoy going over new vocabu-

lary words. The stories are very short and to the point. The children really enjoy the points that are given out for good behavior in the reading group and for getting the most correct answers. The groups that has the most points gets a treat for that day.

The most rewarding experience that I have had is to see the children pretending that they are the teacher giving a lesson on DIRECT INSTRUCTION.

Stephanie A. Favors, Teacher, 2nd Grade

Lathrop Academy

Students in DIRECT INSTRUCTION are all learning to read and loving it. As they have developed a more positive attitude toward learning, their self-confidence and self-discipline have also greatly improved.

D.I. teachers give their heart and soul to this program as they each strive for perfection. Thanks to the hard work and increased efforts of our dedicated instructors, the students are making marvelous gains.

Ms. Chivari, Curriculum Coordinator

I would like to thank the teachers at Lathrop, who have been involved with my child's learning, especially the teachers involved with the reading program. When Marcos started at Lathrop, he could not read. Now he comes home and reads to me and his brothers and sisters. He is very proud that he can read and he teaches the other children at home the same learning technique. Since my son Marcos

When Marcos started at Lathrop, he could not read. Now he comes home and reads to me and his brothers and sisters. He is very proud that he can read.

became involved in the program, he has learned to read very well. Now he can write sentences and read them to you as well. I know he'll be reading at his grade level very soon. I am very much impressed with his progress. Thank you teachers once again.

Ms. Guzman, Parent

I like DIRECT INSTRUCTION because it expands my vocabulary. It also opens my brain to new things such as how to answer questions correctly and in a correct form of sentences.

It helps us learn faster and answer questions very quickly. Our classroom uses DIRECT INSTRUCTION with mostly everything.

Last year when I was in the 7th Grades, I did not learn as much as I do now. My grades are better too; I use to get C's, and B's, but now I get A's, and B's. The little things I learned last year, I now know better.

Brigget Crott, 8th grade, Room 300

Scanlan School

We are using the D.I. reading model in grades K-8 and special education programs. Initially, the program seemed a bit overwhelming. But now that some time has gone by and we all have had time to practice and master the techniques, we are comfortable and excited about this new teaching experience. DIRECT INSTRUCTION is an inclusive program and so more of our students are learning to read.

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The DIRECT INSTRUCTION materials are systematically developed and are rich with activities that focus on specific objectives. These activities are practiced, reviewed, reinforced through written activities and assessed on a timely basis. The D.I. materials provide step-by-step plans that link successful teaching to successful learning. Our students actively participate in the learning activity and enjoy the lessons.

Our enthusiasm and professional observations about the D.I. Program has caused some of our colleagues, who are using traditional materials, to inquire about DIRECT INSTRUCTION. They have requested the DIRECT INSTRUCTION materials for the 1993-1994 school year.

Loesther Foley, Principal
and
Sirretta Vincent, Reading Coordinator

Smyth Elementary School

Our school, John M. Smyth Elementary began using the DIRECT INSTRUCTION program in September 1992.

This reading program like any other change requires commitment, consistency and the time to allow the concept to take hold.

The Reading Mastery III level of this program focuses on comprehension and thinking skills. The lessons of Reading Mastery III cover a wide spectrum of topics from insects to global travel, focusing on direction, temperature and the identification of states and countries on the map. These concepts are taught in terms that children can relate to, while developing their vocabulary.

There are some basic components to Reading Mastery III including:

1. Word Attack—each lesson begins with an in-depth vocabulary review, allowing the children to become familiar with new words prior to reading the selection.
2. Group Reading—during this segment of the lesson, children take turns reading aloud and answering comprehension questions. If through their responses, any difficulty is detected, the material is gone over again and firmed up.
3. Workbook Activities—after reading the story, the children work independently to answer written questions about the story.
4. Checkout Reading—the children are paired off for timed readings to increase their reading rate.

Another exciting feature of this level is the intertwining of the lessons so that review questions about previous stories appear regularly. As concepts are introduced the information learned appears again in later selections.

Just in case it isn't evident by now, my third graders and I truly enjoy this program. There are times when I think I enjoy teaching it more than they enjoy their participation.

Ruby Roberson, Teacher, 3rd grade, Room 214

The Direct Instruction Reading Program has been very helpful to the students at John M. Smyth School. Dr. Casselle, Reverend Moore and the reading specialist staff have been extremely consistent and dedicated in monitoring and improving the effectiveness of this program. One way of improving the overall effectiveness is by using parent volunteers, such as myself to "tutor" the lower students on a one-on-one basis. In this way, we are able to zero in on each child's individual needs and/or problem. Several more repetitions of the lesson material may be necessary before any progress can be made. However, a teacher cannot provide this amount of extra time needed; thus a tutoring program is necessary.

It has also been brought to my attention that D.I. could be more effective if the classrooms weren't quite as large and if they only had 1 reading group at 1 level versus 3 different reading levels.

On a personal level, I am using the D.I. Reading Manual to teach my 5 yr. old pre-schooler how to read. She has made excellent progress.

Sandra Gunn, Parent/Volunteer Tutor

Sponsoring Agencies

Chicago White Sox Charities

University of Oregon Follow Through Project

John D. & Catherine T. MacArthur Foundation

Malcolm X College

Participating Schools

Creiger High

Goldblatt

Hayt

Lathrop Academy

Scanlan

Smyth

Special Thanks to
Mable Wesley Elementary School,
Houston, Texas

For information on the
IOP School Enhancement Project
contact Rev. Darryl S. Moore at (312) 243-3328

A Whole Lotta Learning Going On

Theis
e *Houston Press*

October 3-9, 1991, with permission.

downward national trend in education, Wesley shows Houston Independent School District how

he apparently visits his classrooms so frequently, and keeps such a watchful eye on everything that goes on at Wesley, that this morning's tour may have been his routine.

Once inside the various classrooms, Wesley appears a spectacular school. Our first stop was Earlene Alexander's first grade. I counted 20 kids. She was working on a phonics reading and spelling drill with half of them, and those ten responded lustily to every slashing motion of her hands. Fine. It was the other ten kids who startled me. They had been given a writing assignment, copying words over and over, and every one of them was working without supervision. And they weren't showing off for the reporter. They get so many visitors at Wesley that the kids are pretty blasé about us. They scarcely looked up when we came in.

Well, I thought, Alexander is certainly one bodacious teacher, and no doubt she is. But in every class we visited, I found the same thing. Groups firing on all cylinders, individuals diligently at work. And on the level of sheer vibe, they seemed happy to be hard at it. For all its discipline, Wesley doesn't feel like a prison camp. The kids compete to get to answer. The teachers look happy to reward.

And the kids are extraordinarily well-drilled. I heard this in several classes: Teacher: "What do you do if you can't read a word?" All students: "Sound it out!" In drill after drill, I found that every student was responding. Oh, I did see the occasional first-grader skip one group response, but he was back at work soon, drawn in by the power of the chants.

This eagerness to learn has to be largely due to Thaddeus Lott. He's a renowned disciplinarian, with students and teachers alike. But when a group was doing particularly well, he'd look at me and his broad shoulders would start to shake. He would start giggling with ill-disguised glee.

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A Whole Lotta Learning Going On

David Theis
Staff writer for the *Houston Press*

Reprinted from The Houston Press, *October 3-9, 1991, with permission.*

ABSTRACT: *After successfully battling every downward national trend in education, Wesley Elementary's demanding principal, Thaddeus Lott, shows Houston Independent School District how it's done.*

SUCCESS STORY

To look at Wesley Elementary from the street, you wouldn't guess that there was anything *too* extraordinary about the place. It's a long, low, red-brick one-story building with a flagpole in the front and the name Mabel B. Wesley up on the wall. If you really stopped and looked, you might remark on the building's neatness. No broken windows, no trash in the yard.

The homes around the school are mostly wooden and painted white. Acres Homes is hardly a middle-class neighborhood, but to tell the truth, it doesn't look so bad. Unlike, say, the beleaguered Fourth Ward, Acres Homes hasn't been trashed.

Unless you're unusually inattentive, Wesley Elementary's first sign is the sound of kids at work. I expected to hear oral work at an elementary, but at Wesley the sound of kids spelling and reciting reaches all the way out to the street. Once inside the school, this first taste of how unusual Wesley might be intensifies. I heard more classes at work, and saw how clean and freshly polished the halls look. You might expect a West University elementary to be spotless, but a poor school in a poor neighborhood? And after working as a high-school English teacher in Houston Independent School District (HISD), and as a visiting teacher at every level, I have to say that any spic-and-span school comes as a bit of a surprise. As did the school's pleasant air of bustle.

But the surprises that Wesley Elementary offers multiplied after the school's national celebrity of a principal, Thaddeus Lott, greeted me and we began our tour of the school. First of all, Lott doesn't look like a man who helped bring down an autocratic superintendent. He's short and heavy, and his face doesn't betray much as he describes his school's triumphs and vicissitudes. Maybe he's just dealt with reporters so much lately that we're yesterday's news to him now.

This isn't to say that he wasn't pleasant and happy to take a few hours out of his busy schedule to show a photographer and me around. On the other hand, he apparently visits his classrooms so frequently, and keeps such a watchful eye on everything that goes on at Wesley, that this morning's tour may have been his routine.

Once inside the various classrooms, Wesley appears a spectacular school. Our first stop was Earlene Alexander's first grade. I counted 20 kids. She was working on a phonics reading and spelling drill with half of them, and those ten responded lustily to every slashing motion of her hands. Fine. It was the other ten kids who startled me. They had been given a writing assignment, copying words over and over, and every one of them was working without supervision. And they weren't showing off for the reporter. They get so many visitors at Wesley that the kids are pretty blasé about us. They scarcely looked up when we came in.

Well, I thought, Alexander is certainly one bodacious teacher, and no doubt she is. But in every class we visited, I found the same thing. Groups firing on all cylinders, individuals diligently at work. And on the level of sheer vibe, they seemed happy to be hard at it. For all its discipline, Wesley doesn't feel like a prison camp. The kids compete to get to answer. The teachers look happy to reward.

And the kids are extraordinarily well-drilled. I heard this in several classes: Teacher: "What do you do if you can't read a word?" All students: "Sound it out!" In drill after drill, I found that every student was responding. Oh, I did see the occasional first-grader skip one group response, but he was back at work soon, drawn in by the power of the chants.

This eagerness to learn has to be largely due to Thaddeus Lott. He's a renowned disciplinarian, with students and teachers alike. But when a group was doing particularly well, he'd look at me and his broad shoulders would start to shake. He would start giggling with ill-disguised glee.

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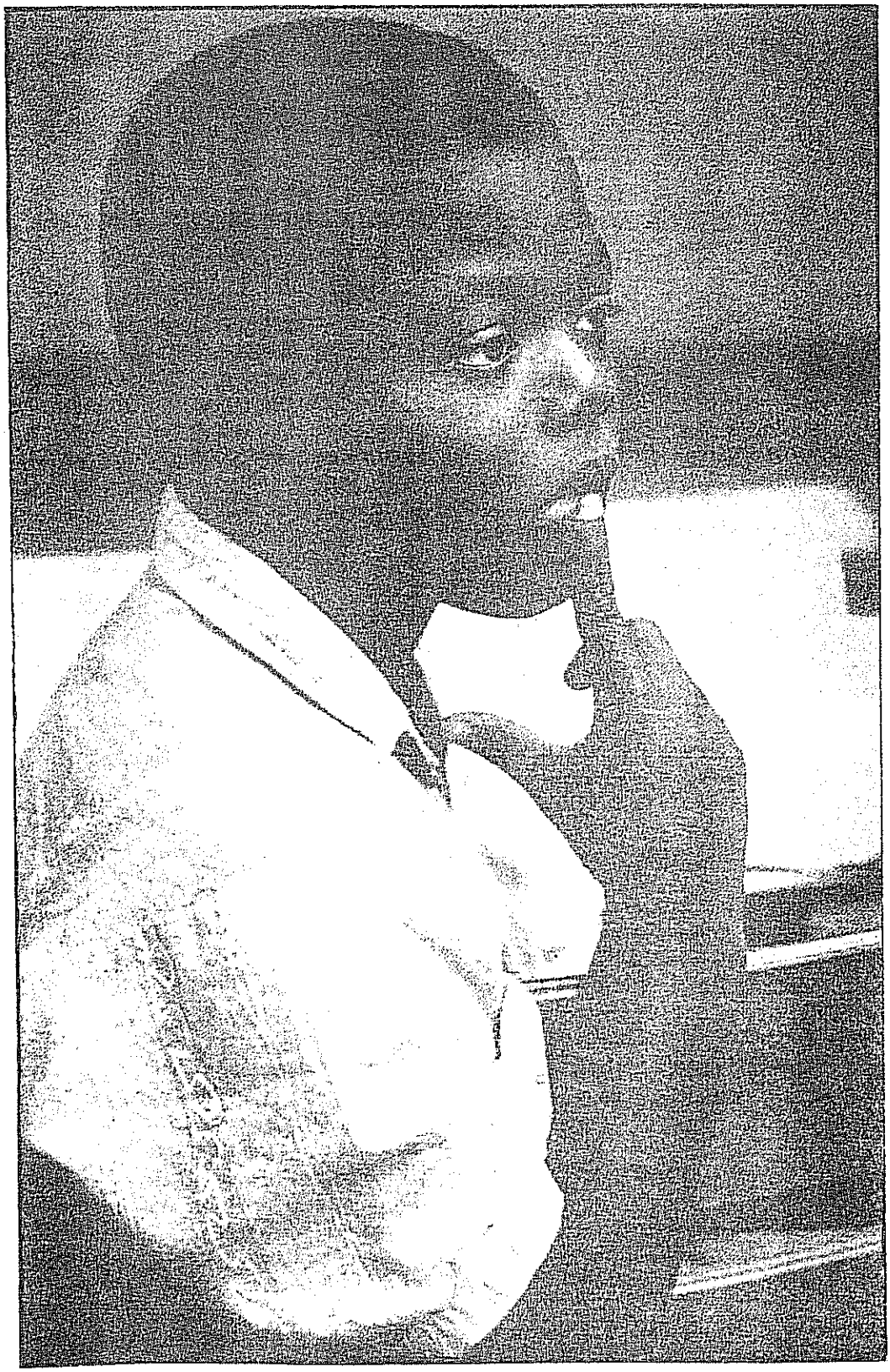

Photo: Earlie Hudnall, Jr.

They scarcely looked up when we came in.

she was Wesley's sworn but secret enemy would have been incredible. After all, here's a school that is an indisputable success. Despite its negative socioeconomics—95 percent black, 85 percent on government lunch—the school was competing successfully with the likes of West U. Given the obsessive amount of attention that test scores generate, you would have thought that Raymond would have routinely trotted Wesley out as proof of her administration's effectiveness. Maybe even help the school out a little with materials and sponsors.

But in every class we visited, I found the same thing. Groups firing on all cylinders, individuals diligently at work. And on the level of sheer vibe, they seemed happy to be hard at it. For all its discipline, Wesley doesn't feel like a prison camp. The kids compete to get to answer. The teachers look happy to reward.

When I suggested as much to Lott, this usually understated man couldn't restrain himself. He sneered, "maybe if she'd gotten off her ass and come down here, she would have seen that the school worked. That we weren't cheating."

See, this is how the names Wesley Elementary and Thaddeus Lott may ring a bell for you. Wesley was an indisputable success to everyone *but* the administration at HISD, who disputed the praise the school had earned every chance they got. In secret, of course, they spread rumors that the school scored so well because "they cheat." When one of Raymond's administrators decided to take matters into his own hands, and came to the school to conduct a search for the school's cheat sheet, the already wobbly Raymond administration committed a fatal mistake. They pushed Lott, his school, and their many admirers too far.

It's not as if HISD had never attracted any national publicity before. Back in the early 80's, superintendent Billy Reagan was saluted on *60 Minutes* for his innovative and demanding approach to education. But last summer ABC's *Prime Time* came to bury, not to praise. Joan Raymond was left extraordinarily red-faced as she tried to answer Chris Wallace's questions on how the district could have refused to support Wesley.

Raymond's face turned more red still when she insisted that she and Lott got along just fine. But the time Wallace asked her to respond to charges that her administration had adopted an at best unconditionally racist attitude toward the almost entirely black school, Raymond was as red as a bullfighter's cape. And of course, Wallace kept right on charging.

Raymond was in an indefensible position. Much of HISD has groaned under the weight of her bosses-know-best approach to education, in which the opinions of principals, and, above all, teachers, played very distant second and third fiddles to those of herself and the curriculum experts she had surrounded herself with over at the Taj Mahal (as teachers routinely refer to HISD administration building). But the Wesley story was downright startling. It sounded exactly like the stories of bureaucracy-induced death-in-life we used to read about in the old Soviet Union.

When Raymond replaced Billy Reagan in 1986, Wesley was ending over a decade's worth of steady academic growth, as measured by test scores. Wesley first-graders ranked fourth in reading scores behind schools such as River Oaks Elementary. Schools from such impoverished and largely black areas as Acres Homes are just not supposed to compete with the River Oakses of this world, but Wesley was. After the first grade, Wesley's scores dipped just a little, largely because Lott had not found the equivalent of his beloved Distar, which was designed for kindergarten and first grade.

Simply put, Distar is a phonics-based reading program. Its designer, Siegfried Engelmann, took the phonetic approach, in which children learn to associate sounds with letters, and built an almost fantastically structured curriculum. Distar was only in favor briefly, though children who learned under this system scored significantly higher than those under various other programs. Teachers complained that Distar was too much work, and administrators and curriculum developers found its repetition and group drills demeaning.

Lott and his teachers had no way to systematically implement the highly structured Distar drills in grades two through five, but Wesley still ranked eighth out of all HISD elementaries in terms of the number of students who read above grade level.

What's more, under Lott's firm (too firm, some felt) hand, Wesley had become a clean and proud place of learning, a source of pride for a community badly in need of good news. But far from seeking Lott out to congratulate him on a job well done, Raymond and her administration started laboring mightily to fix that which wasn't broken. As part of her district-wide make-over, she leaned on elementary principals all across HISD to drop the phonics-based Distar.

Except for Thaddeus Lott, all the principals complied. Raymond and her administrative team were

down on Distar for the same reason as education administrators all over the county. Despite its proven success at teaching kids to read, education theorists seemed personally offended by the system, with its emphasis on the memorization of sounds and group repetitions. The general drift of their objections ran something like *this is how you would teach chimpanzees.*

Distar was only in favor briefly, though children who learned under this system scored significantly higher than those under various other programs. Teachers complained that Distar was too much work, and administrators and curriculum developers found its repetition and group drills demeaning.

Under Raymond, the whole-language approach in reading was supposed to be incorporated into the whole day's curriculum, and it was supposed to have a strong base in literature. You learn to read by reading, which in the case of a kid who grows up around books will likely work just fine. But for Lott there was never any question about changing his curriculum. He knew that he had to teach his kids to read before turning them loose with books for self-paced work, and he insisted on sticking with Distar. The strange battle was joined, in which a principal who had successfully defied almost every national downward trend in education now had to fight his own administration as well.

The district stopped giving Distar workshops, so that after the pool of experienced Distar teachers began to dry up Lott had to train his own teachers. What's more, Lott says that under Raymond, the district had more "warm bodies," that is, unmotivated teachers, than ever before. If there's one thing the stocky, straight-talking Lott dislikes more than authoritative administrators, it's a teacher who isn't willing to work him or herself down to the nub, if need be.

[Lott] knew that he had to teach his kids to read before turning them loose with books for self-paced work, and he insisted on sticking with Distar.

The district began complaining that Wesley's hard-working students were using too many notebooks. According to Lott, "Wesley was shut out" by the administration when it came to corporate sponsors. Over 100 schools in HISD have sponsors that help them obtain supplies and run special programs. It is likely that corporations would have jumped at the chance to work with an overachieving school such as Wesley, but it never happened under Raymond. And as Lott sees it, this wasn't an accident. "She kept a grant away from the school, said it had to go to another principal," he says. Last year, in fact, Lott says he came near losing hope when his school "had to turn to children in Katy for charity."

But despite these handicaps, Wesley continued to outperform many white suburban schools. Though she denied it to Chris Wallace (her face growing redder still), this fact must have stuck in the craw of Raymond and the bureaucrats around her.

Gayle Fallon, head of the Houston Federation of Teachers, said various administrators would come to her and say, "We know they're cheating." Fallon acquitted herself well on national television, calling the district's attitude by its rightful name—racism. In Joan Raymond's tightly controlled world, there was a proper place in the hierarchy for everyone. For African-American kids (and their principal) who didn't do things her way, that place was near the bottom.

But despite these handicaps, Wesley continued to outperform many white suburban schools.

When Chris Wallace repeated Fallon's accusation to Raymond, she could scarcely stammer out a denial, one that she no doubt believed to be true. She was still stammering when she started defending her relationship with Lott, claiming that they got along very well.

Thaddeus Lott had been studiously avoiding the television screen as I watched this replay of the *Prime Time* broadcast in his office after that first day's tour. He's a busy man, after all, and he was engrossed in his paper work. He didn't even look up when Raymond made her claim of camaraderie, but he did start giggling. This perhaps subconscious laugh of his had just a little more edge to it than the one I'd heard in the various classrooms.

When the tape ended, he did look up. His big, squarish face didn't give away too much, but he said, "She was a witch with a 'B'," then shook his head, as if still in disbelief.

Thaddeus Lott certainly generates strong passions, from friend and enemy alike. While the HISD

administration thought he was a cheater, supporters such as George Scott, of Tax Research Assistance (a taxpayers' watchdog group) praise him with something approaching reverence. While drawing an extended analogy between Joan Raymond's tenure and the old Soviet establishment, George Scott's voice gets all juicy with sarcasm. Her educational *apparatchiks*. Her *educrats*. Her *pile of horseshit* criticisms of Wesley. Her five years of *tyranny*. But when Scott switches his attention to Lott, his tone changes. "Thaddeus will be embarrassed to read this, but he's a saint," Scott says after having worked with Lott for just over a year. And, more to the point, Lott is "Boris Yeltsin, standing on a tank, telling the coupers to go to hell. He held it together until time caught up to him."

Last year she had her first-graders reading on a fifth-grade level.

It's not hard to understand Scott's enthusiasm. Anyone who spends much time looking into the state of public education in America will get real hungry, real quickly, for some good news, for news of someone who says, and proves, that virtually every kid in our multicultural, chaotic-to-the-point-of-desperation country, can be educated. And by succeeding in Acres Homes, a community that suffers most of the deprivations of urban America, Lott has done just that.

There is a kind of poetic justice to the fact that he's performed his Herculean labors in the same Acres Homes where he grew up in the late '30s (he's 57). Acres Homes was then a "totally rural" community about ten miles from downtown. According to a clipping from a black newspaper of the period, Acres Homes was the "largest negro community in the United states." It was one of the few places where black renters could buy some property (hence the name) and build their own homes. "You built what you could afford, but it was yours," Lott remembers, warming to the task of recalling the past.

"There was no door-to-door mail delivery. You had to go to the mailboxes on West Montgomery to get your letters. Montgomery was the only black-topped street, the rest were dirt. After a rain you'd see the bread truck bogged down."

Lott grew up with three sisters and four brothers. His father, the Reverend Andrew A. Lott, founded Wright Grove Missionary Baptist Church, and spent long hours trying to help the community develop. While listening to Lott describe his upbringing, it's surprisingly easy to see how his life has developed the way it has. His roots are clearly visible.

"My father was involved in every aspect of the community," says Lott. "He was very involved in education. He helped get the first lights put in Acres Homes." Moreover, "he was involved in shaping and building lives and mores. He dedicated his whole life to building a church and a congregation."

But beyond a sense of service, Lott learned a deep spirituality from his parents, one that he is, in the African-American manner, quite at ease about discussing. "Faith in God enables me to do what I do," he says. "I think sometimes that there's a fence of protection around me, or a seeing eye that goes ahead of me that helps me around pitfalls."

Reverend Lott died at 47. At 17, Thaddeus was the oldest of the children still at home, and true to form, he offered to give up going to college so that he could work and help support the family. Just as true to form, his mother, whom he credits with being "the best and toughest teacher I ever had," told him she would do whatever amount of work that it took to get him through Texas State University.

He remembers hearing people talking negatively about the Lott family after his father's death. "Now that Reverend Lott is dead," they would say, "his children won't amount to anything." He also remembers that the church's parishioners agreed to continue giving his mother half of her dead husband's salary, that is, $30 a month, but that they never came through. Experiences such as these no doubt prepared him for his experience with an ungrateful administration.

Now, he says, "people remember the rough times, and they'll do anything to keep their kids from suffering, so they give them more than they should. More than is required. Now kids sleep while their parents mow the lawn, or pay someone else to."

Lott also recalls having to travel on unreliable private buses, or jitneys, all the way into the Fourth Ward after finishing junior high, because the high schools that were closer to him were all segregated. There is still a low, smoldering anger in his voice when he talks about "going to Prince's and getting your hamburger out the side door, if they would serve you at all," the whites-only water fountains, and all the other fine details of the segregated life. As Lott sees it, however, the foundation that his parents supplied made him strong enough to turn racism to his advantage: "I was just that much more determined to excel."

Ironically, Lott almost looks back on the great difficulties blacks faced in those days with a certain longing. Which isn't to say that he's nostalgic for them, but back then, as he sees it, people knew how hard they had to work to achieve something. People knew the value of things.

Now, he says, "people remember the rough times, and they'll do anything to keep their kids from suffering, so they give them more than they should. More than is required. Now kids sleep while their parents mow the lawn, or pay someone else to." His eyes hidden behind his tinted shades, Lott muses, "Parents don't want their kids to face adversity, but it is the very thing that made them [the parents]. Kids don't know why they're receiving so much, and it confuses them."

Lott doesn't spare himself criticism as a parent. He and his wife Frader (who teaches in Aldine) have seven children. Lott says "it was hard not to fall in the same trap" with them, "of giving them things instead of yourself." As he sees it, he wasn't quite the parent that his own father and mother were.

Lott requires that his teachers give each student a grade every day in every subject, so there is a good deal of grading and test preparation.

He studied Industrial Arts at TSU, graduating in 1956. He wanted to go into electronics, but couldn't find a decent job. "I tried house wiring once, and knew that wasn't for me," he says with a wry laugh. So he went to work for the post office, and while there, started some elementary-school subbing. By 1959 he'd become a full-time teacher at his old elementary, Highland Heights. By 1964 he was an assistant principal at Bruce Elementary, and in 1975 he took over at Wesley. Once there, he began cleaning house, literally and figuratively.

He has said that he found "the kids running the school," and he pushed teachers so hard to regain control that some began grumbling and moved on. Gayle Fallon says that "years ago, we had a lot of teacher complaints against him, but now there are very few. He's got teachers in place now who knew what to expect going in."

What they should expect is a lot of hard work. According to Toni Newsome, who is at Wesley as part of Teach for America (a new program that puts college grads without teaching certificates into the schools), both she and her roommate started elementary-school jobs this year. But her roommate "gets home at four o'clock, and I get home at seven." She figures that she routinely puts in twelve-hour days, and that's not just because she's an inexperienced teacher. "Almost everyone is here until six," she says, even though school lets out at three-thirty. Lott requires that his teachers give each student a grade every day in every subject, so there is a good deal of grading and test preparation.

But Wesley's curriculum alone is very demanding. As an ex-teacher myself, I'm not sure how the teachers here can handle the sheer physical demands of Distar.

First of all, Lott expects his teachers to be on their feet, and indeed, they couldn't run the program's many drills any other way. They repeat the rote drills over and over, all day, and have to listen to the enthusiastically shouted responses at the same time, all the time listening intently to make sure that every child answered correctly. If a kid mispronounces a word, the whole group makes the correction. According to Gayle Fallon, Distar is "a high-burnout program" for teachers.

For Lott, there's only one way to handle the job's demands. "I consider myself to be on a mission," he says. "And I want teachers who are on missions as well. I'd say that 95 percent of my teachers are."

I didn't meet with or observe everyone, but those teachers I did watch seemed as engrossed in their work as were the kids. Fifth-grade chair Susan Gunnewig, for example, lives in Klein, where she taught for 14 years. Finally too bored to continue teaching in suburbia, she decided to look for a challenge. "I came here for Mr. Lott," she says. "He has extremely high expectations. Other principals will say, 'These poor children. Their mama's on crack. They live in a shack.' Mr. Lott says, 'We know about that. Let's teach them to read.'"

Gunnewig has just returned to Wesley after a three-year appointment at Gregory Lincoln, a combination elementary and middle school which also serves as the teacher's academy, where student teachers do their hard time. After her three years up there, she told Lott that she was "willing to clean the floors to come back" to Wesley. "This should be the teaching academy," says Gunnewig. "In Gregory Lincoln, the kids run the school. Here the kids are scared of him [Lott] and they respect him."

Lott can scarcely suppress his giggles of pride at the sight and sound of these kindergartners reading a very short story aloud.

By the way, Gunnewig's fellow teachers in Klein thought, and still think, that she's crazy. And you'd have to be, right? To drive 60 miles a day to work in a poor school. Crazy. Or on a mission. Or both.

The respect goes both ways. In Earlene Alexander's first-grade class, Lott whispered to me, "She's a teaching machine," as she led her charges through an ear-blasting set of drills. "Last year she had her first-graders reading on a fifth-grade level."

He seemed especially eager for me to see Annabell Cheng's kindergarten class. She too comes in from the suburbs (Spring Branch) to teach. When she saw that her first-grade son wasn't reading as much as her kindergarten students, she transferred him to Wesley. After finishing there, he moved on to Kincaid.

Lott points out the badly needed new restrooms that are almost finished. All the outside classes still have to come back into the main building to "use it," as the kids say.

Lott can scarcely suppress his giggles of pride at the sight and sound of these kindergartners reading a very short story aloud. *A rat sat on a rock. The rock is fat. The rat is not sad.* Written phonetically, the *k* of rock is in much smaller print, because it is silent. There is a line over the *a* of *ate* to show that vowel is long. Here Lott whispered, "By the end of K they'll be at second-grade level."

Cheng, who refers to herself in third person to her kids, seems less in awe of Lott than do the other teachers I talked to. "Nothing bothers me," is the way she explains her seven-year tenure. "I can put up with anything."

Outside her classroom, which is in a temporary building, Lott points out the badly needed new restrooms that are almost finished. All the outside classes still have to come back into the main building to "use it," as the kids say.

"They started working on them [the restrooms] the day Joan Raymond left," Lott says. "I'm serious."

But if the old administration was reluctant to give Wesley a pot to pee in, the future generally looks much brighter for both the school and Thaddeus Lott these days. He's become a prophet with honor in his own 'hood. When new superintendent Frank Petruzielo visited Houston last June, he gave Lott a very public show of support, appearing with a couple of board members at the church Lott attends, Northwest Community Baptist, for "Wesley Appreciation Day." Petruzielo is committed to site-based management in the schools, that is, to letting the principals run and be accountable for their schools, and he has agreed to extend the Distar program to seven other elementary schools.

By the end of kindergarten they'll be at second-grade level.

"He's someone you can talk to," Lott says of the new superintendent. "He's a people person. If you put out your hand, he'll shake it. I swear, with Raymond, you'd put out your hand and she'd act like she didn't see you."

Lott was particularly enthused about a recent visit to the superintendent's office. "I never thought I could come out of that room feeling so good," he says. "The last time I was getting reprimanded. It was about a week before Raymond left, and she was accusing me of costing her the Boston [superintendent's] job." When asked if that were true, Lott just giggles. "You'll have to ask her."

But Lott knows that whoever sits in the Taj Mahal, it's what goes on inside the Wesley classroom that counts.

American education will probably remain in crisis until we find thousands of men and women who are willing to work as hard at it as Lott has. If I hadn't met his current staff, I'd say that was impossible. After a week at Wesley, I'd have to say it was merely difficult.

There's hope.

To arrange a visit contact:

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Houston, Texas 77091
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"Our progress as a nation can be no swifter than our progress in education."

John F. Kennedy

Teacher Effectiveness Research: Towards Describing User-friendly Classroom Instruction

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Reprinted from Educational Psychology, *Vol.10, No. 3, pp. 225-238, 1990, with permission.*

ABSTRACT: *In this article we examine the teacher's role as a mediator of knowledge and cognitive learning in the classroom. We cite findings from the research areas of teacher effectiveness, teacher expertise, and curriculum knowledge. These data strongly support user-friendly explicit methods of classroom teaching. We also discuss issues raised in conjunction with alternative conceptions of the teaching process. Finally, we note the importance of incorporating teacher effectiveness research findings into teacher education programs, and of identifying the various misconceptions that have been used to criticize this body of information.*

What is it that classroom teachers actually do that results in academic achievement and genuine knowledge accumulation in their students? This provocative question can be answered in many different ways. Indeed, there are many viable answers. However, in the present article we attempt to synthesize research findings, relevant to this topic, that have been published particularly over the past decade. In particular, we will review findings that have emerged from research conducted in the teacher effectiveness/process-product research tradition. These data describe various classroom instructional practices (which we characterize as *user-friendly*) that prepare students for successful task engagement and subsequent achievement. We conclude by noting that these findings provide one fundamental base point for teacher education.

The Social Mediation of Academic Learning

Schooling represents one of the major vehicles of knowledge transmission. Students learn from direct exposure to resources such as textbooks, articles, program kits, computers and films. At times the medium is print, but very often it involves exposure to a human being who organizes and presents new knowledge to be assimilated and hence reconstructed in the mind of the student. The acquisition of knowledge is a remarkably slow process involving hours of practice on component skills and, as in the case of mathematics, on procedural operations involving scores of decision elements. In a significant review of the cognitive learning literature, Anderson (1982) noted that, "It requires at least 100 hours of learning and practice to acquire any significant cognitive skill to reasonable degree of proficiency" (p. 369). Motivating children through extended sequences of necessary practice and subskill development entails considerable knowledge and skill in itself—we call this pedagogical knowledge, i.e. the skills and practices of the effective teacher.

Perhaps the relative failure of various educational innovations to change traditional educational practices stems from the possibility that the acquisition of knowledge in the classroom is, in fact, readily accomplished through *social mediation.* Thinking processes in another person are readily inferred from indicators such as spoken words, discourse pacing, facial expression and so on. Indeed, one factor accounting for the persistence of traditional group teaching arrangements in classroom life resides in the relative efficiency of human mediation in the learning process itself. This argument may help to account for the failure of the individualized education movement to obtain a supportive data base within the research literature. Learning from

individually programmed materials may be unrealistic if this implies depriving the student of the benefit of teacher-mediated presentations within whole-class contexts.

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The notion that knowledge transmission is essentially a social process has been promoted by psychologists from the social learning tradition and also by noted clinical psychologist Reuven Feuerstein whose work has had a significant impact in the field of special education (see Yates, 1987). Social learning theories postulate that the key element in information acquisition is the opportunity to observe and learn from another, more knowledgeable, person (Yates & Yates, 1978). Feuerstein has advanced the theory that retarded mental development often stems from a lack of mediated learning experience. Mental deficiencies arise not from a lack of interactions with the environment as such, but from a lack of socially mediated instruction concerning the meanings of those interactions. Mediated learning experience occurs when a more knowledgeable person intervenes between the child and the environmental experience. The mediator serves to draw the child's attention to significant aspects of the experience, perhaps transforming, reorganizing or totally realigning its mental significance. Any experience can be said to be mediated when someone else intervenes to order or classify it, or relate it to some other event, past present or future.

Social learning theories postulate that the key element in information acquisition is the opportunity to observe and learn from another, more knowledgeable, person (Yates & Yates, 1978).

Writing within the field of teacher education, White (1987) suggested that classroom teachers can be described as *cultural brokers*. Brokers are pivotal human beings who mediate between two worlds: the world of scholarly knowledge and the world of the classroom. The concept of broker stems from the writings of cultural anthropologists who describe brokers as individuals who liaise between local communities and larger political or religious structures. This metaphor applies in education in that teachers actively transform academic knowledge into ideas, activities and beliefs that will work within the local culture of the classroom. White asserts directly:

> Teachers are the active agents who bring knowledge from the outside world inside to the students' world. The main task of teachers is to connect bodies of public knowledge with the private knowledge of students.... They (teachers) provide scaffolding by which students can move in their construction of knowledge from the ideographic and personal towards the abstract and public (p. 20).

In her proposals for reformulating the goals of teacher education, White explicitly focuses on the need for teachers to be "owners and users of scholarly knowledge" (p. 20). She also exhibits a keen awareness of social learning and modelling principles in noting that:

> Students need to see teachers speaking, reading, and writing within the disciplines. If teachers are to be a guide for scholarly adventures for others, they must be able to communicate the intensity of their involvements, when gathering data, dealing in the currency of big ideas and using a variety of forms of research (p.20).

In school contexts it is apparent that learning is indeed more meaningful, more motivating, and more enjoyable, when guided directly by a sensitive and knowledgeable teacher, in contrast to being directed by impersonal media such as VDU screens or printed texts. But what do teachers actually do to promote knowledge acquisition in students? What pedagogical skills are associated with enhanced learning outcomes in school contexts? The research enterprise known as teacher effectiveness provides some remarkably clear and coherent answers to such questions. In the next section we will briefly review findings form this now large body of evidence.

Research in Classroom Teaching

The Effective Teaching Movement

Within the last 20 years an important body of research has been published concerned with effective teaching practices and student learning gains, as indexed by academic achievement data. Earlier

research helped to establish that student achievement was not strongly related to presage factors such as the teacher's training, intelligence or personality. However, recent studies, particularly those using variations of the 'process-product' research design, have found moderate to strong relationships

Classroom teachers can be described as *cultural brokers.*

between student achievement and aspects of teacher behavior. This research has specifically focused upon instructional skills (Rosenshine & Stevens, 1986; Roehler & Duffy, 1986), classroom management (Good & Brophy, 1987), and the analysis of time factors in learning (Fisher & Berliner, 1985). Effective classroom teachers tend to be well organized managers in control of the class as a whole, to anticipate rather than merely respond towards disruptive factors in classroom life, to be academically task-orientated and to use a high level of direct instructional verbalization in order to elicit a high level of active student response.

Effective classroom teachers tend to be well organised managers in control of the class as a whole, to anticipate rather than merely respond towards disruptive factors in classroom life, to be academically task-orientated and to use a high level of direct instructional verbalization in order to elicit a high level of active student response.

Review functions. In analyzing teachers' instructional practices it has been found that effective teachers are more likely than other teachers to begin lessons by briefly reviewing the previous day's work and by explicitly stating the goals of the current lesson (Rosenshine & Stevens, 1986). Daily reviews are important in activating relevant schemata and in helping a learner get prepared for understanding the new material. Stated goals are a source of information and motivation of considerable value to a different learner. Short term goals convey positive expectations with regard to the immediate lesson and requisite performance level (Bandura & Schunk, 1981). Review functions also serve to reduce student anxiety. In Helmke's study (cited in Berliner, 1988) mathematics teachers who employed careful review procedures were found to have students who reported low levels of evaluation anxiety in addition to high attainment.

Using instruction to elicit active student responses. Effective teachers tend to be especially careful and thorough in conveying new information to children. Their lesson presentations use very clear and coherent sentence-to-sentence language structures (Smith & Hodgin, 1985). In essence they teach in small, explicit steps using repeated demonstrations. Such demonstrations typically involve the modelling of specific mental skills through task-orienting statements including coping and error-correction strategies. Effective teachers operate on the principle that not only is knowledge acquired gradually, in a sequential fashion, but that it has to be put into practice immediately (for example on a written worksheet) for it to be meaningfully assimilated into the student's own knowledge base. The students of such teachers have been shown to accumulate *academic learning time* (ALT), i.e., independent practice at a relatively error free level (Marliave & Filby, 1985).

It is apparent that only through accumulating ALT will the fragile cognitive filigree resulting from instruction be firmly consolidated into the individual student's procedural competencies. In the existing research data ALT is perhaps the operational variable closest in meaning to the layman's concept of 'the getting of wisdom.' Further, it is apparent that the accumulation of ALT can produce positive emotional gains in learners as well as cognitive gains (Marliave & Filby, 1985).

Effective teachers have been observed to introduce new ideas into lesson structures gradually and logically, specifically avoiding large or insightful mental leaps. However, measures taken of their actual teaching speed, such as their speech rate and the amount of information covered over time, have indicated that these teachers often teach at a relatively fast pace. Skillful teachers employ orderly but fast presentations in order to command maximum attention from the class as a whole and so maintain lesson momentum. Such pacing would appear to be

Earlier research helped to establish that student achievement was not strongly related to presage factors such as the teacher's training, intelligence or personality.

beneficial to the extent to which a high level of success is maintained (Marliave & Filby, 1985).

Although they employ reasonable fast presentations, studies into expert teachers' skills (e.g., Leindhardt & Greeno, 1986) indicated that these teachers continuously monitor student attention levels during the course of a lesson and make subtle changes in presentations in order to help individuals follow the lesson. In other words, they use feedback from students to tell them how fast to proceed with their rate of speech and follow of ideas and when to repeat information.

Effective teachers operate on the principle that not only is knowledge acquired gradually, in a sequential fashion, but that it has to be put into practice immediately.

Skillful teachers employ orderly but fast presentations in order to command maximum attention from the class as a whole and so maintain lesson momentum. Such pacing would appear to be beneficial to the extent to which a high level of success is maintained.

Other instructional skills observed in effective teachers include the tendency to introduce a new topic through naturally relating it to previously mastered ones to show how a meaningful picture (the 'big idea') is constructed, the tendency to allow students sufficient time to think before having to answer a question and the tendency to move the class into independent practice activities in a graduated rather than a sudden fashion (Roehler & Duffy, 1986; Tobin, 1987). In one study, the most effective teachers were found to possess a higher level of declarative knowledge about behavioral learning principles (Cantrell, Stenner, & Katzenmeyer, 1977).

Diagnostic sensitivity. In addition to using active teaching strategies, effective teachers have been found to be relatively more familiar than other teachers with the actual academic strengths and weaknesses of individual children within their classes (Helmke & Schrader, 1988; Peterson, Carpenter, & Fennema, 1989). However, as a teacher variable, diagnostic sensitivity appears to interact in a coherent manner with active teaching strategies. In a German study of 5th-grade mathematics teachers, Helmke and Schrader (1988) reported that high diagnostic sensitivity was associated with high student achievement gain only in the case of classes in which the teacher had been observed using high levels of direct instructional support. In their factorial design the lowest levels of achievement gain were evident when teachers combined high diagnostic sensitivity with low levels of instructional support. Thus, Helmke and Schrader concluded that, "...a teacher with good diagnostic sensitivity who provides insufficient support could discourage his or her students. Such students may become sensitized to their own weaknesses but do not receive sufficient support in overcoming these weaknesses" (p. 73).

Expertise in Teaching

In the language of cognitive psychology, 'experts' are individuals who are extremely highly skilled within their field. Recent studies have now begun to identify the nature of expertise in classroom teaching through identifying teachers whose students regularly evidence superior gains on achievement criteria (Berliner, 1986). Expert teachers possess a good deal of knowledge in the form of elaborated lesson scripts and action sequences concerning the teaching process. For example, they are readily able to describe mental plans regarding their actual teaching that relate to several different instructional goals concurrently (Leinhardt & Greeno, 1986). Observational data indicate that highly skilled teachers monitor their pupils' performance continuously and engage in a good deal of additional instruction or further explication in response to cues from the pupils that are suggestive of difficulties (Duffy & Roehler, 1986). By contrast, novice teachers exhibit less complex planning strategies which provide fewer alternatives in the event of a lesson not running to plan or students failing to attend satisfactorily.

Diagnostic sensitivity appears to interact in a coherent manner with active teaching strategies.

The organization of instruction. Interview data indicate that expert teachers describe their instructional strategies with a degree of logical integration and coherence (i.e., knowledge structures) typically not found in protocols from other competent teachers (Roehler, Duffy, Herrmann, Conley, and Johnson, 1988). In a recent experimental study, Carter, Cushing, Sabers, Stein, and Berlinger (1988) asked teachers to respond towards photographs of classroom situations. Teachers previously identified as

experts were able to comprehend and elaborate upon these stimuli far more coherently than other competent teachers. In a study of primary school mathematics teaching, Leinhardt (1989) found that expert teachers provided students with remarkably complete and integrated verbal explanations and direct modelling of key operations. However, these characteristics were seldom found in the lesson protocols of other competent, but less experienced teachers. An excellent case-study description of the highly organized instructional strategies of one individual expert teacher can be found in Leinhardt (1986).

Novice teachers also tend to be relatively more sensitive than experienced teachers to affective feedback from their students. Inexperienced teachers appear relatively more concerned with their students' feelings, wants and non-academic requests (Housner & Griffey, 1985). In reviewing this research Gagne (1985) noted that, "The experienced teachers act as if they have procedural knowledge that is activated by student performance...In contrast,...the inexperienced teachers act as if they are using some procedural knowledge that is relevant to many social situations but is not relevant to teaching" (pp. 329-330). Carter, Sabers, Cushing, Pinnegar, and Berliner (1987) found that novice teachers, when compared with experts, were more eager to learn all they could about their students before actually meeting them.

Inexperienced teachers appear relatively more concerned with their students' feelings, wants and non-academic requests.

Research into the instructional skills of expert teachers is highly consistent with the data on expert problem solving tactics described in the literature of cognitive psychology (Gagne, 1985; Berliner, 1986). As skill is acquired a successful problem solver abandons generalized strategies in favor of domain-specific ones that arise from a substantial knowledge base. In the context of classroom instruction, the expert teacher has learned to go beyond generalized humanistic interpersonal skills and employs goal-oriented instructional procedures involving specific tactics such as task-focusing verbalisation, monitoring of student comprehension and the immediate remediation of difficulties in understanding. Fogarty, Wang, and Creek (1983) found that experienced teachers tended to base their instructional decision making more readily than novice teachers upon awareness of their students' actual capabilities and specific prior knowledge. An additional fascinating finding is that, in common with experts from other areas, expert teachers may at times tend to take *more* time before making significant domain-relevant decisions than do less skillful teachers (Berliner, 1986; Hanninen, 1988).

Expert teachers...establish very stable *routines*, both in their own actions and in their students' behavior. A good deal of classroom life under such teachers consists of a series of predictable scripted activities involving a high level of active student responses elicited through subtle teacher cueing.

The role of routines. The research has also documented ways in which expert teachers organize and integrate their basic classroom management skills. One recurring finding has been that these teachers establish very stable *routines*, both in their own actions and in their students' behavior. A good deal of classroom life under such teachers consists of a series of predictable scripted activities involving a high level of active student responses elicited through subtle teacher cueing (Leinhardt & Greeno, 1986). Expert teachers are adept at directly teaching these activity structures so that, over time, the procedures become stable and familiar (Tobin & Fraser, 1988). As the routines become automatic, teacher thinking is freed, allowing more attention to be paid to individual monitoring and to manipulating subroutines to achieve multiple lesson goals (i.e. the 'overlapping', and 'flexibility' aspects of teaching as described in teacher effectiveness research). Leindhardt and Putnam (1987) have speculated that the relative predictability of activity structures found in experts' classrooms also serves to promote learning through reducing the cognitive processing demands placed on the students.

Curriculum knowledge. It is apparent that the expert teacher achieves success in the classroom through implicitly drawing upon his or her extensive procedural knowledge base concerning the nature of children's motivation and information processing in relation to the curriculum materials. The analysis of expertise in instructional strategies should not lead us to overlook the role of basic curriculum knowledge in the teaching process. Recent research now clearly indicates that teachers with poor or incomplete knowledge in a given topic are relatively handicapped in their planning, their presentation

strategies, their discourse clarity and fluency, their question-asking skills and in their general control over the teaching interaction process (Hiller, 1971; Dobey & Schafer, 1984; Housner & Griffey, 1985; Leinhardt & Smith, 1985).

It has been appreciated for many years that teachers' attitudes, mannerisms, language patterns and knowledge structures can often be reflected in data taken from their students (e.g., Yando & Kagan, 1968; Yates & Yates, 1978; Zeidler & Lederman, 1989). But we now appreciate that curriculum knowledge, as a measurable teacher variable, influences the major classroom variable of 'opportunity to learn' on a lesson-to-lesson basis. Hashweh (1987) found that teachers who possessed a high level of relevant curriculum knowledge planned their lesson in ways that transformed (i.e., chunked, extended and elaborated upon) their students' textbook readings. Tobin and Fraser (1990) reported that although 'exemplary' teachers exhibited excellent instructional management strategies when teaching in their subject areas, they clearly did not teach in an exemplary fashion when giving lessons on relatively unfamiliar topics. Needels (1988), using the within-class process-product design, found that student's understandings of specific scientific topics were severely impaired when their teachers' presentations failed to follow logical information sequences on these specific topics.

Curriculum knowledge, as a measurable teacher variable, influences the major classroom variable of 'opportunity to learn' on a lesson-to-lesson basis.

The knowledge a teacher has of the curriculum influences not only how material is taught, but also what is taught, i.e. the content and dialogue of instruction. Eaton, Anderson, and Smith (1984) found that teachers with limited background knowledge in science may, at times, teach incorrect content. More significantly, however, they noted that such teachers typically fail to recognize and correct their students' distorted understandings (i.e., misconceptions) of specific topics. Carnine (1980) found that misconceptions could be created in the minds of young children through their teachers failing to cover topics adequately or to define concept boundaries. At the pre-service level, Shefelbine and Hollingsworth (1987) found that scores on a college examination paper concerned with the 'psychology of reading' predicted student teachers' ability to make sensible instructional decisions within their teaching practice.

It has been documented that a teacher's confidence in his or her ability to teach a lesson is closely tied to his or her perception of knowledgeability within the area to be taught (Fresko & Ben-Chaim, 1986). Feeling a degree of confidence and mastery within a topic area is an essential component or prerequisite of fine teaching (Gibson & Dembo, 1984). However, the hallmark of the 'expert pedagogue' (Berliner, 1986) resides in being able to integrate subject matter knowledge with active knowledge concerning pupil characteristics, classroom dynamics, instructional methods and, specifically, how to adjust instruction in relation to student responses (Leinhardt & Greeno, 1986; Roehler & Duffy, 1986).

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Conceptions of the Teaching Process

User-friendly Explicit Teaching

In perspective, classroom-based research has built up a conception of the teaching process which is remarkably consistent with the principles and findings of cognitive psychology (Gagne, 1985). Students in classrooms benefit considerably from interaction with teachers who confidently portray the schematic organization of academic knowledge disciplines within their lesson contents. But more significantly, good teachers are adept in helping novices negotiate the early and intermediate (pre-automaticity) phases of learning prior to the emergence of more mature, independent, expert-like knowledge achievements. We now know that effective classroom teachers use cueing, fading and other direct instructional methods, rather than relying on discovery learning principles, to actively erect scaffolds around their students' thinking in relation to academic tasks. These scaffolds serve to both stimulate and to support learners' initial insecure responses which can then be encouraged directly with facilitative feedback.

Correctly pitched cognitive stimulation, coupled with a high level of encouraging feedback, and occasional individual attention to class-members who have some difficulty in following large group lessons,

enables a teacher to create a *user-friendly instructional environment.* One of the noteworthy skills of the expert teacher (see Leinhardt & Greeno, 1986) is the ability to target appropriately timed learning supports (e.g., cues, instructions, clarifications) at individual students within the course of a full-class lesson. Through anticipating individual problems in advance, the expert teacher responds pro-actively in such a manner as to help less able students remain task-involved and thus negotiate (i.e., respond actively towards) the same instructional sequence as the rest of the class.

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On the personal level, we arrived at the user-friendly conceptualization several years ago after informally observing two highly experienced upper primary teachers. Both teachers presented material at what we regarded as an excessively fast pace. We doubted whether such instruction was appropriate for slow learners. However, in discussion with one of these teachers it became apparent that she was well aware of the responses she was creating in her students' minds and that she was actively monitoring several key students. It became obvious that she had considerably greater awareness of the classroom context, of the genuine capabilities of individual students and of how they responded towards her instruction, than we had given her credit for.

Having had misconceptions remediated we observed again and began to notice how these teachers evidenced a very high level of forward movement in their teaching. Certain goals were being worked towards progressively and there was a high level of continuity across lessons and across days. Individual children were actively responding and learning a good deal in a context where goal attainment was a natural, regular and unforced experience. Besides informing us about the nature of skillfulness, this interaction taught us never to judge individual teachers on the basis of brief observations which fail to sample the total picture.

In relation to effective teaching, the user-friendly image is especially appropriate. Explicit instructional practices are user-friendly in that a novice learner is offered direct cognitive guidance, supportive modelling, a relatively complete analysis of covert steps and attack strategies, error correction and extended opportunities for practice prior to being expected to think and perform at the level of a knowledgeable expert. The elements of good instruction are thus intrinsically user-friendly and excellent teachers are adept at incorporating these elements into their own classroom practices.

Additional support for the user-friendly characterization, as a way of analyzing teacher practices, stems from writers in the field of special education (Kavale & Forness, 1986; Morsink, Soar, Soar, & Thomas, 1986; Yates, 1988). Indeed, Fields (1988) found that, as a group, special education teachers strongly endorse teacher effectiveness findings as valid means of teaching and motivating children in their work. Educational attainment in disadvantaged groups and in children with special needs, has been shown to be strongly linked to the quality of their instructional environment (Bereiter & Kurland, 1981; Bereiter, 1985; Reynolds, 1989).

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The Delpit Critique

The user-friendly qualities of explicit teaching can be further viewed in the light of Delpit's (1988) analysis of ways in which indirect or 'process-oriented' teaching methods of literacy instruction can operate against the expressed interest of colored and disadvantaged children, and their parents' aspirations. Delpit, an experienced literacy teacher in the United States, writes, "In some instances adherents of process approaches to writing create situations in which students ultimately find themselves accountable for knowing a set of rules about which no one has ever directly informed them" (p. 287). Further, in discussing why black children frequently become disillusioned with process-oriented teachers, she observed, "The students I have spoken to seem to be saying that the teacher has denied them access to

herself as a source of knowledge necessary to learn forms they need to succeed" (p. 288).

Child-centered approaches have evolved sophisticated ways of managing informal educational activities but have remained at a primitive level in the design of means to achieve learning objectives.

Delpit's observations are obviously consistent with the theories of social mediation cited in the introductory section of this paper. It seems ironic to appreciate that child-centered teaching methods could be implicated in actively reducing the learning opportunities of the disadvantaged. Such methods may inadvertently deny these children access to the 'power code,' i.e., the language conventions spoken and written by the dominant, more affluent, middle classes. Delpit casts this issue into a political perspective in noting that, "Several black teachers have said to me...they cannot help but conclude that many of the 'progressive' education strategies imposed by liberals upon blacks and poor children could only be based on a desire to ensure that the liberals' children get sole access to the dwindling pool of American jobs" (p. 285).

Delpit's comments are reminiscent of an earlier paper by Bereiter and Kurland (1981). They accounted for the relatively poor effects, on achievement test data, associated with open education models in the United States Follow Through program, in the following terms:

> Child-centered approaches have evolved sophisticated ways of managing informal educational activities but have remained at a primitive level in the design of means to achieve learning objectives.... The conceptual analysis of learning problems tends to be vague and irrelevant, big on name-dropping and low in incisiveness.... Child-centered educators have evolved a style of school life that has much in its favor. Until they develop an effective pedagogy to go with it, however, it does not appear to be an acceptable way of teaching disadvantaged children (pp. 20-21).

Child development research conducted under the rubric of attribution theory also has found that when students fail on allocated tasks following on from incomplete instruction they readily attribute their failure to lack of ability rather than poor instruction (Lepper, Ross, & Lau, 1986), and that expressing warmth and sympathy towards students when they fail to succeed on school tasks serves to reduce further the students' beliefs in their own capabilities (Graham, 1984). Expecting children to 'discover' new knowledge by themselves and being sympathetic when they fail to do so would seem to be entirely at variance with the goals of education and social equity.

Child-centered educators have evolved a style of school life that has much in its favor. Until they develop an effective pedagogy to go with it, however, it does not appear to be an acceptable way of teaching disadvantaged children.

Discussion: Implications for Teacher Education

Researchers working in the broad area of teacher effectiveness have established a strong knowledge claim: that is, there is in existence a considerable body of evidence concerning the definition, description and analysis of teacher variables that link in a sensible, coherent manner to students' academic learning gains.

When students fail on allocated tasks following on from incomplete instruction they readily attribute their failure to lack of ability rather than poor instruction, and...expressing warmth and sympathy towards students when they fail to succeed on school tasks serves to reduce further the students' beliefs in their own capabilities.

The most obvious implication for teacher education is that pre-service and in-service students should be encouraged to read and reflect upon this sizeable knowledge base. At the introductory level, for example, readable accounts can be found in general texts such as Gage and Berliner (1988), and Good and Brophy (1990), and also in skill-oriented monographs such as Cole and Chan (1987) and Good and Brophy (1987). Graduate level students can be encouraged to read more widely within the periodical literature into topics such as questioning skills, wait-time, discourse clarity and expert-novice comparisons.

An additional recommendation is that educational psychologists working within the field of teacher preparation should be familiar with actual classroom research findings. At the professional level, major literature reviews can be found in Brophy and Good (1986) and Rosenshine and Stevens (1986). A notable feature of the Brophy and Good chapter is a project-by-project breakdown of major studies published prior to 1984. Accordingly, in this present article we have attempted to draw attention to findings published after this date. Also at the professional level, Anderson and Burns (1989) have recently published a book-length treatment focusing upon the research methods and historical background of contemporary work in their area.

Given a sensible treatment, knowledge of the teacher effectiveness findings can help a trainee to develop appropriate instructional and managerial techniques in dealing with children at the whole class level. Brophy suggests that the research now helps in the definition of a 'starter set' (1988, p. 17) of fundamental instructional and managerial skills which can be developed to the point of automaticity before experimentation with highly demanding variations such as individualized instruction, mastery models, learning centers and developing new curricula.

Contrary to some opinions, there is no necessary contradiction between receiving instruction and achieving higher-order thought processes. Explicit instructional methods can be targeted upon genuine human achievements at all levels of cognitive complexity.

In this sense, learning to teach in front of a large class of children can be viewed as a learnable achievement subject to two major types of training variables: (a) acquisition factors such as modelling, verbal instruction, feedback, practice and response compilation and (b) motivational variables such as graduated goal structures, self-efficacy and mental cost-benefit analyses. User-friendly teacher education programs can thus be based upon the principles of cognitive learning theory and skill development.

A further major consideration is for education students to become familiar with the criticisms of teacher effectiveness research advanced by various writers. A compilation and analysis of these criticisms has now been published by Gage and Needels (1989). Within Australian outlets such criticisms have ranged from the benign and glib to the philosophical and technical (e.g., Osborne, 1987), through to the emotional and derisory (e.g., Reid, 1989). Gage and Needels classified the various criticisms, answering them point-by-point. A related (but whimsical) account of the 'paradigm wars' ranging at the level of educational theory is also highly recommended reading for graduate level students (Gage, 1989).

Obviously we cannot review these criticisms in the present article but one salient point is that many critics over-interpret the teacher effectiveness findings through inferring a series of negative attributes such as authoritarian positions, hidden agendas and even 'sinister implications' (Reid, 1989, p. 15). Issues surrounding the potential value and genuine limits of the teacher effectiveness data base are reviewed by Brophy (1988). We merely wish to conclude this article by acknowledging two of the various misconceptions we encounter frequently: (a) 'explicit teaching is good only for lower level skills'—we call this the complexity issue and (b) 'the teacher effectiveness/direct teaching model says there is a single best way to teach'—we call this the prescriptive issue. These two issues are drawn from a listing of ten such misconceptions we use in tutorial work on this topic.

The Complexity Issue

Contrary to some opinions, there is no necessary contradiction between receiving instruction and achieving higher-order thought processes. Explicit instructional methods can be targeted upon genuine human achievements at all levels of cognitive complexity. Thinking strategies, reading comprehension methods, metacognitive strategies, self-correction skills, writing techniques and other self-control methods have been successfully taught via explicit methods to children in laboratory and classroom contexts (Bereiter & Scardemalia, 1987; Duffy & Roehler, 1989; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989; Wang & Palincsar, 1989). Bereiter and Scardemalia further argue that in the absence of some form of explicit instruction from some form of socializing agency, high level literacy simply does not develop.

The Prescriptive Issues

Does the teacher effectiveness model imply there is a single 'best' way to teach? Certainly not! The obtained correlations between discrete teaching acts and outcome measures, as reported in the major projects published in the 1970's, were fundamentally of a significant but *low* level of magnitude.

Teaching acts are merely the means towards the crucial variables of student response, task-engagement, and academic learning time. Rosenshine and Stevens (1986) have advanced the salient point that teaching has to be analyzed in terms of the *functions* that are achieved through instruction, rather than the specific acts that may serve these functions.

Teaching has to be analyzed in terms of the *functions* that are achieved through instruction, rather than the specific acts that may serve these functions.

In a series of research studies, Duffy and Roehler (1989) noted remarkable differences in the manner junior primary teachers were able to employ the explicit instruction model in teaching comprehension strategies within reading lessons. The relatively less effective teachers were more firmly rooted in skills-based thinking (e.g., fixed algorithms). But the relatively more effective teachers operated more in accord with higher-order strategies and flexible action schemata that allowed sensible departures from set procedures. In essence, their teaching displayed the metacognitive and forward goal-driven properties of advanced levels of information processing; the characteristics of expertise.

A number of other classroom researchers have reported on a related phenomenon. At times, individual teachers may employ apparently 'good teaching skills' in the course of lessons dominated by specious instructions, excessive procedural requirements or perhaps by relatively mindless busy-work (Bereiter, 1985; Good & Grouws, 1987; Burns & Lash, 1988; Schoenfeld, 1988). When surface demands take precedence over deeper conceptual involvements so-called 'good teaching' plainly is targeted upon inappropriate goals.

There cannot be a science of classroom teaching, but the methods of science can be used to yield information that helps the practitioner improve the art of teaching.

A further common pattern is that of spending excessive time on one particular component of the instructional process (e.g., whole class level questions and answers). To a casual observer this may appear as 'well-managed teaching' but this situation easily creates imbalance in lesson structure if the natural skill development sequence, as identified by researchers such as Rosenshine and Leinhardt, is violated. One specific value in teaching Rosenshine's list of functions to beginning preservice teachers is in helping them acquire higher-level organizing schemata for use in both lesson planning and in reflective analysis of their actual teaching performances.

These points collectively give additional credence to Berliners's (1983) assertion that the classroom teacher has to operate as a decision making *executive*, continually being obliged to make selections from amongst multiple alternatives. The executive model provides one possible base for helping preservice students in particular to understand the role of research in advancing knowledge of pedagogy, and of their role as interpreters of this knowledge. As Professor Gage has informed us regularly over the years, there cannot be a science of classroom teaching, but the methods of science can be used to yield information that helps the practitioner improve the art of teaching.

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References

Anderson, L.W., & Burns, R.B. (1989). *Research in Classrooms.* Oxford: Pergamon.

Bandura, A., & Schunk, D.H. (1981). Cultivating competence, self-efficacy and intrinsic motivation through proximal self-motivation. *Journal of Personality and Social Psychology,* (pp. 586-598).

Bereiter, C. (1985). The changing face of educational disadvantage. *Phi Delta Kappan, 66,* 538-541.

Bereiter, C., & Kurland, M. (1981). A constructive look at follow through results. *Interchange, 12,* 1-21.

Bereiter, C., & Scardemalia, M. (1987). An attainable version of high literacy: approaches to teaching higher-order skills in reading and writing. *Curriculum Inquiry, 17,* 9-30.

Berliner D.C. (1983). The executive functions of teaching. *Instructor, 93*(2), 29-40.

Berliner, D.C. (1986). In pursuit of the expert pedagogue. *Educational Researcher, 15,* 5-13.

Berliner, D.C. (1988). How do we balance text anxiety and achievement? *Instructor, 97*(8), 14-15.

Brophy, J. (1988). Research on teacher effects: uses and abuses. *Elementary School Journal, 89,* 3-21.

Brophy, J., & Good, T.L. (1986). Teacher behavior and student achievement. In M.C. Wittrock (Ed.), *Handbook of Research on Teaching*: (3rd ed.), (pp. 328-375). London: MacMillan.

Burns, R.B., & Lash, A.A. (1988). Nine seventh-grade teachers' knowledge of planning of problem-solving instruction. *Elementary School Journal, 88*, 369-386.

Cantrell, R.P., Stenner, A.J., & Katzenmeyer, W.G. (1977). Teacher knowledge, attitudes and classroom teaching correlates of student achievement. *Journal of Educational Psychology, 61*, 180-190.

Carnine, D. (1980). Relationships between stimulus variations and the formation of misconceptions. *Journal of Educational Research, 74*, 106-110.

Carter, K., Cushing, K., Sabers, D., Stein, P., & Berliner, D. (1988). Expert-novice differences in perceiving and processing visual classroom information. *Journal of Teacher Education, 39*(3), 25-31.

Carter, K., Sabers, D., Cushing, K., Pinnegar, S., & Berliner, D.C. (1987). Processing and using information about students: A study of expert, novice and postulant teachers. *Teaching and Teacher Education, 3*, 147-157.

Cole, P.G., & Chan, L.K.S. (1987). *Teaching Principles and Practice.* New York: Prentice Hall.

Delpit, L.D. (1988). The silenced dialogue: power and pedagogy in educating other people's children. *Harvard Educational Review, 58*, 280-298.

Dobey, D.C., & Schafer, L.E. (1984). The effects of knowledge on science inquiry teaching. *Science Education, 68*, 39-51.

Duffy, G.G., & Roehler, L.R. (1986). The subtleties of instructional mediation. *Educational Leadership, 43*(7), 23-27.

Duffy, G.G., & Roehler, L.R. (1989). Why strategy instruction is so difficult and what we need to do about it. In C.B. McCormick, G. Miller, and M. Pressley (Eds.), *Cognitive Strategy Research: from basic research to educational applications* (pp. 133-154). New York: Springer-Verlag.

Eaton, J.F., Anderson, C.E., & Smith, E.L. (1984). Students' misconceptions interfere with science learning: case studies of fifth-grade students. *Elementary School Journal, 84*, 365-379.

Fogarty, J.L., Wang, M.C., & Creek, R. (1983). A descriptive study of experienced and novice teachers' interactive thoughts and actions. *Journal of Educational Research, 77*, 22-32.

Fields, B.A. (1988). Research on teacher effectiveness: implications of remedial education. *The Exceptional Child, 34*, 117-132.

Fisher, C.W., & Berliner, D.C. (Eds.). (1985). *Perspectives on Instructional Time.* London: Longman.

Fresko, B., & Ben-Chaim, D. (1986). Competence, confidence and inservice education for mathematics teachers. *Journal of Education for Teaching, 12*, 285-294.

Gage, N.L. (1989). The paradigm wars: a 'historical' sketch of research on teaching since 1989. *Educational Researcher, 18*, 4-10.

Gage, N.L., & Berliner, D.C. (1988). *Educational Psychology* (4th ed.). Boston: Houghton Mifflin.

Gage, N.L., & Needels, M.C. (1989). Process-product research on teaching: a review of criticisms. *Elementary School Journal, 89*, 253-300.

Gagne, E.D. (1985). *The Cognitive Psychology of School Learning.* Boston: Little Brown.

Gibson, S., & Dembo, M.H. (1984). Teacher efficacy: a construct validation. *Journal of Educational Psychology, 76*, 569-582.

Good, T.L., & Brophy, J.E. (1987). *Looking in Classrooms* (4th ed.). New York: Harper and Row.

Good, T.L., & Brophy, J.E. (1990). *Educational Psychology: a realistic approach* (4th ed.). London: Longman.

Good, T.L., & Grouws, D.A. (1987). Increasing teachers' understanding of mathematical ideas through inservice training. *Phi Delta Kappan, 68*, 778-783.

Graham, S. (1984). Teacher feelings and student thought: an attributional approach to affect in the classroom. *Elementary School Journal, 85*, 91-104.

Hanninen, G.E. (1988). A study of teacher training in gifted education. *Roeper Review, 10*, 139-144.

Hashweh, M.Z. (1987). Effects of subject-matter knowledge in the teaching of biology and physics. *Teaching and Teacher Education, 3*, 109-120.

Helmke, A., & Schrader, F.W. (1988). Successful student practice during seatwork: efficient management and active supervision not enough. *Journal of Educational Research, 82*, 70-75.

Hiller, J.H. (1971). Verbal response indicators of conceptual vagueness. *American Journal of Educational Research, 8*, 151-161.

Housner, L.D., & Griffey, D.C. (1985). Teacher cognition: Differences in planning and interactive decision-making between experienced and inexperienced teachers. *Research Quarterly for Exercise and Sport, 56*, 45-53.

Kavale, K.A., & Forness, S.R. (1986). School learning, time and learning disabilities: the disassociated learner. *Journal of Learning Disabilities, 19*, 130-138.

Leinhardt, G. (1986). Expertise in mathematics teaching. *Educational Leadership, 43*(7), 28-33.

Leinhardt, G. (1989). Math lessons: a contrast of novice and expert competence. *Journal of Research in Mathematics Education, 20*, 52-75.

Leinhardt, G., & Greeno, J.G. (1986). The cognitive skill of teaching. *Journal of Educational Psychology, 78*, 75-95.

Leinhardt, G., & Putman, R.T. (1987). The skill of learning from classroom lessons. *American Educational Research Journal, 24*, 557-587.

Leinhardt, G., & Smith, D. (1985). Expertise in mathematics instruction: subject matter knowledge. *Journal of Educational Psychology, 27*, 247-271.

Lepper, M.R., Ross, L., & Lau, R.R. (1986). Persistence of inaccurate beliefs about the self: effects in the classroom. *Journal of Personality and Social Psychology, 50*, 482-491.

Marliave, R., & Filby, N.N. (1985). Success rate: a measure of task appropriateness. In C.W. Fisher and D.C. Berliner (Eds.), *Perspectives on Instructional Time* (pp. 217-235). London: Longman.

Morsink, C.V., Soar, R.S., Soar, R.M., & Thomas, R. (1986). Research on teaching: opening the door to special education classrooms. *Exceptional Children, 53*, 32-40.

Needels, M.C. (1988). A new design for process-product research on the quality of discourse in teaching. *American Educational Research Journal, 25*, 503-526.

Osborne, B. (1987). The search for a paradigm to inform cross-cultural classroom research. *Australian Journal of Education, 31*, 99-128.

Peterson P.L., Carpenter, T., & Fennema, E. (1989). Teachers' knowledge of students' knowledge in mathematics problem solving: Correlational and case analyses. *Journal of Education Psychology, 81*, 558-569.

Pressley, P.L., Goodchild, F., Fleet, J., Jajchowski, R., & Evans, E. D. (1989). The challenges of classroom strategy instruction. *Elementary School Journal, 89*, 301-342.

Reid A. (1989). Teachers are not technicians. *South Australian Teachers' Journal, 21*(10), 15.

Reynolds, M.C. (1989). Students with special needs. In M.C. Reynolds (Ed.), *Knowledge Base for the Beginning Teacher* (pp. 129-142). Oxford: Pergamon.

Roehler, L.R., & Duffy, G.G. (1986). What makes one teacher a better explainer than another. *Journal of Education for Teaching, 12*, 273-284.

Roehler, L.R., Duffy, G.G., Herrmann, B.A., Conley, M., & Johnson, J. (1988). Knowledge structures as evidence of the 'personal': bridging the gap from thought to practice. *Journal of Curriculum Studies, 20*, 159-165.

Rosenshine, B., & Stevens, R. (1986). Teaching function. In M.C. Wittrock (Ed.), *Handbook of Research on Teaching* (3rd ed.), (pp. 376-391). London: MacMillan.

Schoenfeld, A.H. (1988). When good teaching leads to bad results: the disasters of 'well-taught' mathematics classes. *Educational Psycholbgist, 23*, 145-166.

Shelfelbine, J.L., & Hollingsworth, S. (1987). The instructional decisions of preservice teachers during a reading practicum. *Journal of Teacher Education, 38*(1), 36-42.

Smith, L.R., & Hodgin, B.N. (1985). A low-inference indicator of lesson structure in mathematics. *Journal of Experimental Education , 53*, 102-105.

Tobin, K. (1987). The role of wait time in higher cognitive level learning. *Review of Educational Research, 57*, 69-95.

Tobin, K., & Fraser, B.J. (1988). Investigations of exemplary practice in high school Science and Mathematics. *Australian Journal of Education, 32*, 75-94.

Tobin, K., & Fraser, B.J. (1990). What does it mean to be an exemplary science teacher? *Journal of Research in Science Teaching, 27*, 3-25.

Wang, M.C., & Palincsar, A.S. (1989). Teaching students to assume an active role in their learning. In M.C. Reynolds (Ed.), *Knowledge Base for the Beginning Teacher* (pp. 71-84). Oxford: Pergamon.

White, J.J. (1987). The teacher as broker of scholarly knowledge. *Journal of Teacher Education, 38*(4), 19-24.

Yando, R.M., & Kagan, J. (1968). The effect of teacher tempo on the child. *Child Development, 39*, 27-34.

Yates, G. C. R. (1988). Classroom research into effective teaching. *Australian Journal of Remedial Education, 20*(1), 4-9.

Yates, G.C.R., & Yates, S.M. (1978). The implications of social modelling research for education. *Australian Journal of Education, 22*, 161-178.

Yates, S.M. (1987). Instrumental enrichment: a strategy for modifying cognitive ability. *Australian Journal of Special Education, 11*(1), 15-27.

Zeidler, D.L., & Lederman N.G. (1989). The effects of teachers' language on student's conceptions of the nature of science. *Journal of Research in Science Teaching, 26*, 771-783.

NEW CONCEPTUALIZATIONS OF PRACTICE: Common Principles in Three Paradigms Suggest New Concepts for Training

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ABSTRACT: *We argue herein that typical training procedures are far from optimal. The goal of training in real-world settings is, or should be, to support two aspects of posttraining performance: (a) the level of performance in the long term and (b) the capability to transfer that training to related tasks and altered contexts. The implicit or explicit assumption of those persons responsible for training is that the procedures that enhance performance and speed improvement during training will necessarily achieve these two goals. However, a variety of experiments on motor and verbal learning indicate that this assumption is often incorrect. Manipulations that maximize performance during training can be detrimental in the long term; conversely, manipulations that degrade the speed of acquisition can support the long-term goals of training. The fact that there are parallel findings in the motor and verbal domains suggests that principles of considerable generality can be deduced to upgrade training procedures.*

Over the past several years, through the normal process of conducting our own individual research programs (in movement learning and human memory, respectively), and as a consequence of listening to and reading reports of each other's work, we have repeatedly encountered research findings that seem to violate some basic assumptions about how to optimize learning in real-world settings. For example, increasing the frequency of information presented to learners about performance errors during practice improves performance during training, yet can degrade performance on a test of long-term retention or transfer. Increasing the amount of task variability required during practice, in contrast, depresses performance during training, yet facilitates performance on later tests of the ability to generalize training to altered conditions. Such findings challenge common views of skill learning. Compared with some baseline training condition, how can a factor that enhances performance in practice interfere with retention or transfer performance? Even more intriguing, how can another factor that degrades performance in practice enhance retention performance?

These findings—and others we discuss below—are obtained from diverse research paradigms that employ several different verbal and motor tasks, and the theoretical motivations guiding those research efforts are often different as well. Taken together, however, these findings suggest that certain conceptualizations about how and when to practice are at best incomplete, and at worst incorrect. These findings also have some theoretical implications with respect to the processes involved in practice, particularly as they relate to the acquisition of real-world skills.

In this article, we first describe what we regard as some of the view points, assumptions, and paradigms that, implicitly or explicitly, have provided the foundation for the typical procedures that guide practice and skill acquisition. These views of learning, though flawed in our opinion, have had a strong influence on the design of learning environments in educational, industrial, and military contexts. We

then illustrate those flaws with examples from three different research paradigms, and we argue for a set of processes occurring during practice that can, at least in general terms, account for such findings.

Some Common Assumptions About Practice

When researchers conduct studies of practice and learning, they generally ask learners to engage in practice at some task in an *acquisition phase*, and some independent variable is manipulated. The independent variable of interest can be of various types, such as the nature of instructions, the type of feedback, or the scheduling of practice, and the performance on some task is typically charted as a function of practice trials for groups operating with different levels of this variable. The logic of such paradigms, of course, is that those acquisition conditions that speed the rate of improvement, or cause subjects to reach criterion more quickly, or in general result in more effective performance in practice, are expected to be the most effective for learning this particular task. Learning, after all, can be indexed by the improvements in skill across practice; it seems unavoidable, therefore, to conclude that those conditions in acquisition that speed gains in performance have done so because they have enhanced the processes of learning in some way. There are two related problems with this view of the learning process.

Problem 1: Acquisition Performance Is an Imperfect Indicator of Learning

In the recent era of research on the processes of learning, memory, and performance, researchers seem to have lost track of a critical distinction between the momentary strength or accessibility of a response and the underlying habit strength of that response. The major learning theorists of an earlier era recognized decades ago that experimental variables applied during training can have two distinct kinds of effects (see, e.g., Estes, 1955; Guthrie, 1952; Hull, 1942; Skinner, 1938; Tolman, 1932). First, of course, such variables can have the relatively permanent effects that are the usual focus when learning is examined. That is, these variables might speed the development of some relatively permanent capability for responding (the usual definition of learning, and the one we use here), so that a group of subjects with more of this capability will usually perform more effectively during practice than a group with less of this capability. Second, however, there may also be temporary effects of such experimental manipulations—effects that exaggerate or diminish performance differences while the variables are operating, with these performance differences vanishing or being markedly altered as soon as the subjects are allowed to rest, or when the manipulation is removed. Such performance effects can be mediated by a host of factors, such as the elevating effects of motivational instructions or the administration of feedback, as well as the depressing effects of physical (or mental) fatigue and boredom. A given experimental manipulation can have either or both of these learning and performance effects.

The important point is that only certain kinds of performance changes can qualify for the label *learning effects*.

This important distinction has been mostly ignored since the late 1950's (see, e.g., Salmoni, Schmidt, & Walter, 1984, in the area of feedback and skill learning), and it is interesting to speculate why that might be the case. In our opinion, the information processing metaphor, which has dominated much of the modern era of research, has led theorists away from such a distinction. That metaphor, based as it is on the architecture of the typical digital computer, does not readily suggest the kind of dual memory representation implied by, for example, habit strength and reaction potential (Hull, 1943). (For more on these and related arguments, see Bjork, 1989, and Bjork & Bjork, 1992.)

For present purposes, the important point is that only certain kinds of performance changes can qualify for the label *learning effects*. For us to agree that one level of some variable has produced more learning than another, we usually demand that these differences have some permanence across time, or that the differences be able to survive the removal of the manipulation in question. The problem is to discover which of many possible practice variables produce learning effects in the sense just defined—that is, to determine whether a given independent variable has effects that are relatively permanent or are merely transitory.

Testing posttraining retention and transfer. The standard approach to this problem is to use various kinds of transfer or retention tests as a means of evaluating the extent to which true learning has taken place. Assume that two groups of subjects practice under different levels of some independent variable during an acquisition phase. For example, they might be learning foreign vocabulary words, with frequency of feedback being manipulated (after every trial vs. after every fifth trial). Differences between groups during the acquisition phase could

reflect differences in learning or performance (or both). It is critical, therefore, to add a *retention phase* (sometimes called a *transfer phase*), conducted after an interpolated interval that is long enough to ensure that any temporary effects of the independent variable have been dissipated. If subjects are then tested on the same (or similar) task again under equated levels of the independent variable (so that differential temporary effects cannot reappear across trials), relative performance differences between the two groups can be viewed with some confidence as reflecting differential learning that occurred during the acquisition phase.

Without even giving the matter much thought, trainers might easily assume that maximizing performance during training is their major goal.

Special considerations in real-world training. Measuring the actual level of learning that results from a training regimen of some kind may not seem to be a particularly serious problem for scientists or scientifically trained professionals involved in training, as these issues have been (or should have been) familiar to us for several decades. But the problem is far more serious for the typical person who is actually doing the training in some real-world setting. Here, it is easy to imagine that trainers would make every effort to adjust the training context to maximize the learner's performance in training (measured as either speed of acquisition, that is, the trials or time necessary to reach some specified performance goal, or the level of performance achieved after a fixed amount of training time or trials). Without even giving the matter much thought, trainers might easily assume that maximizing performance during training is their major goal; trainers may themselves even be evaluated in terms of their trainees' performance during training.

Two other considerations exacerbate the problem in real-world settings. First, while instructors have ample opportunity to view their students during practice, they frequently do not have a chance to examine their learners on the transfer or retention tests that are the real goal of training. Such posttraining performance is often delayed or in a different location than the original training. Second, instructors can also be misled by their own trainees: In a study of learning keyboard skills under different practice schedules (Baddeley & Longman, 1978), for example, the schedules that were most preferred by subjects produced the least learning.

First...instructors...frequently do not have a chance to examine their learners on the transfer or retention tests that are the real goal of training. Second, instructors can also be misled by their own trainees.

Problem 2: Acquisition and Retention Phenomena Are Not Separable

Learning processes versus retention processes. Our basic argument is that relative amount learned should be measured by performance on retention tests of various kinds, and that performance levels in acquisition are "flawed," or at least ambiguous, with respect to the amount learned. Note that this is quite a different view from that often taken in educational and training settings, where learning and retention are seen as two different phenomena. "Learning" is assumed to refer to that set of processes occurring during the actual practice on the tasks of interest, as assessed by performance measures taken at that time, whereas "retention" is seen to involve the set of processes that occur after practice is completed, during some retention interval, and prior to a retention test. Because learning and retention are thought to be different phenomena, they tend to be studied with separate methods, by different scientists, and even in different laboratories. Rather than viewing learning and posttraining retention as separable phenomena, however, we argue that the effectiveness of learning is revealed by, or measured by, the level of retention shown.

Criteria against which training should be evaluated. In most educational, military, and industrial settings, the effectiveness of a training program can be evaluated by several criteria, depending on what we would like our learners to be able to do. Certainly, one of the most important of these is posttraining performance; we want trainees to be able, many months after the training program is completed, to perform well, or at least adequately. This criterion is especially important in times of natural disasters and man-made emergencies, when key people must perform critical functions in situations that reoccur, typically, only after very great delays. A crisis in a nuclear power plant would be a prime example. This criterion is also important in minimizing the time and money spent on retraining or refresher courses.

Another criterion is generalization. Whereas it is important to be able to perform the specific skill

acquired in practice some months later in a retention test, it is also important to be able to *generalize* to variations of that skill, perhaps to be performed in contexts different from those experienced in acquisition. For example, the trainee might have to generalize the skill acquired under quiet, controlled conditions in a classroom to a noisy, hot, and cluttered environment in the workplace. The capability to perform in the presence of stress, sleep loss, or fatigue may be critical in some situations, and the need to perform a simultaneous secondary task effectively may be important as well. There may also be a need to have learning generalize to other learning environments, allowing new tasks to be learned more quickly and easily. The acquisition condition that is most effective—given these criteria—is the one leading to the highest performance on a novel version of the task, or on a task performed or practiced under novel conditions. Thus, rather than thinking of learning and generalizability as separate concepts—as is often done—we interpret the capability to generalize as one measure of learning, and as a basis for selecting among various training conditions.

It is also important to be able to *generalize* to variations of that skill, perhaps to be performed in contexts different from those experienced in acquisition.

It is perhaps not new to suggest that there are several goals of training and instruction—such as long-term retention, generalizability, and resistance to altered contexts. What is new, however, is the notion that the training conditions to achieve these training goals are not necessarily those that maximize performance in the acquisition phase. In fact, as we show next, there can be conditions for which the effectiveness of training—as measured by one or another of these alternative criteria—is best achieved by a condition that produces relatively poor performances during training.

Introducing Difficulties for the Learner Can Enhance Training: Three Illustrations

In this section, we discuss three broad situations in which, relative to a "standard" practice condition, some condition in acquisition that slows the rate of improvement or decreases performance at the end of practice nonetheless yields enhanced posttraining performance. One of these examples involves variations in the way tasks can be ordered for practice, with the focus on the criterion of producing effective skill retention. A second example involves variations in the nature and scheduling of feedback for learning, again with the emphasis on enhancing a retention criterion. Finally, a third example involves inducing variation among versions of the tasks to be practiced, with the focus on a criterion of generalizability.

Scheduling of Tasks During Practice

Consider the general problem in which several different tasks or items are to be learned in a practice session of a fixed length. How should the practice on these tasks or items be organized to maximize learning and retention?

Experiments with motor tasks. Many variations in practice scheduling are possible. Shea and Morgan (1979) contrasted random and blocked schedules of practice, two schedules that differ substantially in terms of what Battig (1966) referred to as "contextual interference." In Shea and Morgan's study, blocked practice involved sequential trials at Task 1, Task 2, and Task 3, with all trials for a given task being completed before moving on to the next. Random practice, in contrast, involved the same number of trials as the three tasks, but the order was randomized so that a given task was never practiced on successive trials. Thus, block practice resembles what we usually term *drill*. The tasks required rapid, multiple-component arm movements, with the goal of minimizing response time, and different tasks had different patterns. After practice in an acquisition phase, retention tests were given under either random or blocked conditions. The experiment, therefore, was designed to assess the effect of random versus block practice on performance measured under blocked or random conditions.

The results are shown in Figure 1. During the acquisition phase, at the left, there was a clear advantage for the subjects who practiced under the blocked conditions, especially in the initial phases of practice, but continuing until the last acquisition block. Amount of learning, however, as measured by the tests of posttraining retention, tells a different story. Consider first the tests given under the random conditions, shown as the filled and open squares. There was a strong advantage for retention for the subjects who practiced under the random conditions in acquisition. That is, even though the random conditions were less effective during the acquisition phase, they were better than the blocked conditions on the random retention test. These

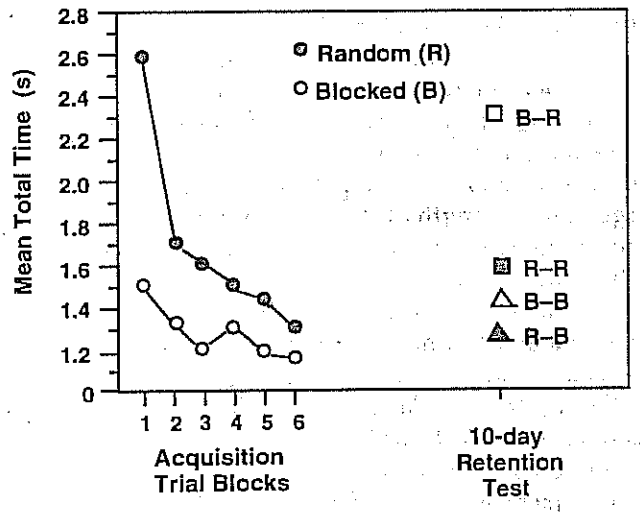

Fig. 1. Performance on movement speed tasks under random (R) and blocked (B) conditions in acquisition and, after 10 days, in retention tests under random or blocked conditions; in retention, the first letter indicates the acquisition condition, and the second represents the retention condition. Redrawn from Shea and Morgan (1979).

differences are especially impressive given the ecological validity of random tests; that is, most real-world behaviors are not produced in blocked contexts.

An alternative interpretation of the advantage of random practice for random retention conditions is that the practice conditions in the acquisition and test phases were identical for the random subjects, but were different for the blocked subjects. This is, in effect, a kind of "identical elements," specificity-of-learning, or similarity argument. This relatively uninteresting interpretation cannot, however, explain the retention performance observed under the blocked conditions (shown as open and filled triangles). Once again, there was an advantage—though much reduced—for the subjects who practiced under random conditions during acquisition.

At minimal levels of practice, blocked practice produces better retention than does random practice, but this effect is reversed with additional levels of practice.

Regardless of whether the retention test was itself random or blocked, then, it was always more effective to have practiced under random conditions than under blocked conditions. Remarkably, this was the case even though the random condition was detrimental to performance during acquisition. Relative to blocked practice—a schedule that most people would feel was "natural" or optimal—random practice is, then, a first example of a manipulation that degrades performance in acquisition, yet enhances performance at retention and contributes to the capability to perform in different contexts (see also Wulf & Schmidt, 1988).

Similar effects have been found in several other experiments using real-world skills (serving in badminton, Goode & Magill, 1986; keyboard skills, Baddeley & Longman, 1978), as well as laboratory tasks (Lee, 1988; Lee & Magill, 1983). One exception is that at minimal levels of practice, blocked practice produces better retention than does random practice, but this effect is reversed with additional levels of practice (Shea, Kohl, & Indermill, 1990). These phenomena, and various theoretical interpretations thereof, have been reviewed recently by Magill and Hall (1990).

Experiments with verbal tasks. The effects of blocked versus random practice in the motor skills literature are analogous to certain verbal-learning phenomena typically studied under the heading of *spacing effects* (Melton, 1967). Here the general problem is that distinct items presented serially are to be learned, and the question is how the study trials on a given item should be interleaved with the study trials on other items to generate maximal retention. In general, spacing of repetitions yields better long-term retention than does massing of repetitions—often much better. If the final retention interval is short, however, massed repetitions can yield better performance than spaced repetitions. (For examples of such interactions involving intervals ranging from seconds to minutes to days, respectively, see Peterson, Hillner, & Saltzman, 1962; Glenberg, 1979; Glenberg & Lehmann, 1980; and Bahrick, 1979.) The interaction of spacing interval and retention interval may again mislead people responsible for training; on the basis of performance during acquisition alone, massed repetitions may appear to be superior to spaced repetitions.

In a variety of real-world situations, the question is not how one should distribute the repetitions of items, but rather how one should distribute one's effort to practice the retrieval of those items. Two experiments (Landauer & Bjork, 1978) examined how such retrieval efforts should be scheduled to optimize long-term retention. In the first experiment, subjects were asked to learn a number of names of hypothetical people. During the study phase, a given name was presented once and then tested three times (by presenting the first name as a cue for the last name or the last name as a cue for the first name). The intervals from the initial presentation of a given name to each successive test of that

name were filled with different numbers of intervening presentations and tests of other names. Following the study phase, there was a 30-minute retention interval filled with a distracting activity prior to a final retention test for all the names.

In general, spacing of repetitions yields better long-term retention than does massing of repetitions—often much better.

Two aspects of the results of this experiment are of interest. First, as shown in Figure 2, the conditions that yielded optimal performance on the tests during acquisition yielded the poorest long-term retention. In a condition with 0 items intervening between successive tests, performance on those tests averaged about 95%, but performance dropped to 33% on the final retention test. Other uniform-spacing conditions, with 4 or 5 intervening items between successive tests, yielded poorer performance during acquisition (about 43% correct), but better final retention (41% correct). Second, an expanding sequence of intervals prior to each successive test on a given name during acquisition (0, 3, and 9 intervening items, or 1, 4, and 10 items) appeared to yield optimal retention performance (48% correct).

In the second experiment, subjects were asked to memorize a first and last name corresponding to each of a set of facial photographs. During the acquisition phase, after an initial pairing of a given name and face, there were four subsequent tests of that face-name combination, each of which consisted of presenting the face and the first (or second) name as a cue for the missing name. The intervals separating the successive tests of a given name formed an expanding sequence (0, 1, 3, and 8 intervening events) or a uniform sequence with the same average interval length (3, 3, 3, and 3 intervening items), and there was again a test of final retention after a 30-minute delay. On the final test, each face was shown alone, and subjects were asked to recall both the first and last name corresponding to that face.

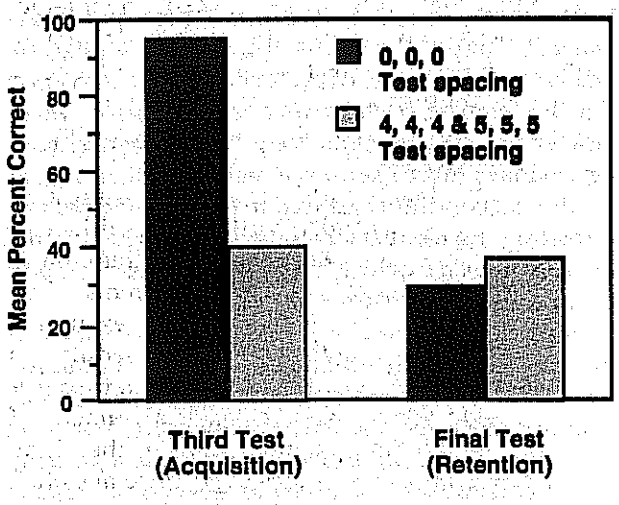

Fig. 2. Percentage correct name recall on the third of three tests embedded in a study phase and on a 30-min delayed retention test, as a function of the spacing of the three study-phase tests. Redrawn from Landauer and Bjork (1978).

Once again, an expanding sequence was more effective than a uniform sequence for long-term retention. In fact, for the expanding condition, the retention of a name presented only once (and tested four times) was greater than retention of a name presented—together with a given face—five times (66% vs. 58% correct). This result illustrates the general principle that tests are potent learning events—often more potent than presentations—particularly when the tests are difficult enough to constitute a type of retrieval practice with respect to the criterial retention test. There are analogous results in the motor memory literature. For example, Hagman (1983), using an arm-positioning task, found that four test trials that involved attempting to repeat a once-presented position were more effective for retention than were four presentation trials in which the subject moved to a stop defining the target position.

In terms of the goal of enhancing long-term retention, expanding-interval retrieval practice may well be an important component of an optimal training program. Rea and Modigliani (1985), for example, have gone on to show that expanding retrieval practice is about twice as effective as massed practice in children's memorization of multiplication facts and spelling words. Such effects of expanding-interval retrieval practice in the verbal domain seem quite closely related to another effect we discuss in the next major section—namely, the scheduling of the number of practice trials between presentations of feedback in skill learning.

Common principles. In each of the foregoing paradigms, the condition that produced the best retention performance seemed to have the characteristic that it provided added "difficulty" for the learner during the acquisition phase, reflected in poorer performance at that time. Thus, as we view it, random practice serves to keep the performer from generating a stable "set" for a particular task, and forces the learner to retrieve and organize a different outcome on every trial. Similarly, the spacing of repetitions may prevent superficial massed rehearsal.

It is clearly too extreme to argue that every manipulation causing difficulty for the learner during practice will enhance retention performance.

These notions suggest that retrieval practice (Bjork, 1975, 1988), in which the learner is actually given practice at the process of retrieving information from memory, may be an important factor in all of these paradigms. Indeed, other information processing activities that cause forgetting of the to-be-remembered information, and thus require practice at retrieving it again on a subsequent trial, are beneficial for retention (Bjork & Allen, 1970; Cuddy & Jacoby, 1982).

We view retrieval practice as a specific case of transfer-appropriate processing (Morris, Bransford, & Franks, 1977); practice at retrieving in acquisition is appropriate for the need to retrieve during retention or transfer tests. Consistent with this view, there are results in the literature (Allen, Mahler, & Estes, 1969; Hogan & Kintsch, 1971) suggesting that tests as learning events—relative to presentations as learning events—become more effective as (a) the retention interval preceding a criterion test is increased and (b) the criterion test stresses recall rather than recognition.

It is clearly too extreme to argue that every manipulation causing difficulty for the learner during practice will enhance retention performance (see, e.g., Shea & Upton, 1976, who showed that interpolated processing tasks degrade performance both during practice and on retention tests); but if the manipulation demands other kinds of information processing—such as retrieval practice—that are also needed for retention performance, then such added difficulty can be expected to enhance retention performance.

Feedback During Skill Acquisition

A second illustration involves the nature and scheduling of feedback presented to learners during an acquisition phase. It has generally been understood that any variation of feedback in practice that makes the information more immediate, more accurate, more frequent, or more useful for modifying behavior will contribute to learning, as measured during the acquisition phase. This view of the relationship of feedback and learning has served as the basis for instructional practice in many settings, as well as for the design of simulators. Recent evidence, however, suggests that this generalization must be qualified.

Experiments with motor tasks. In one study (Schmidt, Young, Swinnen, & Shapiro, 1989), subjects were asked to learn a relatively complex arm movement in which the subject was to produce two reversals in direction such that the time of the action was as close to a set goal as possible. In one condition, feedback about the movement-time error was given after each trial, a more or less standard schedule typically thought to optimize learning. Feedback was also given in *summary* form (see Lavery, 1962), in which the subject received feedback about each of a set of trials (e.g., 5) only after the last trial in the set was completed. This feedback was given in the form of a graph of performance against each of the trials in the set, so that the subject could see the error on each of the previous trials. The summary length—the number of trials summarized on the graph—was either 1 (the every-trial feedback condition mentioned earlier), 5, or 15 trials. After practice under these conditions in an acquisition phase, subjects were given tests of posttraining retention (without any feedback) after 10 minutes and 2 days.

The results of this experiment are shown in Figure 3. In the acquisition phase, subjects in the 1-trial summary condition performed more accurately throughout practice than the other groups, with generally larger errors being produced as the summary length increased. It is clear that increased summary length interfered with performance during training, both in slowing the rate of approach to the asymptote and in generating larger errors near the end of practice. However, when performance was evaluated on the delayed retention test, the most effective performance was generated by the 15-trial group, with generally increasing errors as the summary length in the acquisition phase decreased. That is, there was clear negative relationship between the level of performance in acquisition and the level of performance in retention. These data tend to contradict the long-held view that making feedback more useful is effective for learning, as the 15-trial condition seemed to provide difficulties in relating the feedback received in the graph to the error on the trial to which it referred (see also Schmidt, Lange, & Young, 1990).

Similar effects were obtained when feedback was given in acquisition either on every trial (100% condition) or on only half of the trials (Winstein & Schmidt, 1990; see also Wulf & Schmidt, 1989). In the latter, 50%, condition, the feedback was *faded*, such that feedback was given on every trial early in practice and gradually withdrawn across practice. Retention performance was measured after 10 minutes and 2 days, either with or without feedback being presented (in separate experiments). In both

experiments, the 100% and 50%-faded groups were essentially similar in the acquisition phase. But on the posttraining retention tests, the 50%-faded group had more effective performance, with the differences becoming larger as the retention interval increased. These data contradict traditional views of feedback operation in that providing half the number of feedback presentations in acquisition produced more effective retention performance. The general finding that expanded spacing of feedback presentations enhanced retention is analogous to the finding (Landauer & Bjork, 1978) that expanded spacing of repetitions was more effective for name learning, suggesting again that some common features underlie these two paradigms.

The *faded* feedback given on every trial early in practice and gradually withdrawn across practice [was] more effective.

Experiments with verbal tasks. During the 1960's, a dozen or so paired-associate experiments were conducted in which the proportion of responses that received feedback was manipulated during the acquisition phase. The percentage of occurrence of response members (% ORM) was defined by the percentage of trials on which the correct response term was shown after the subject had responded to the stimulus term. All of these studies, unfortunately, have characteristics that prevent them from being compared directly with the work just mentioned on motor behavior. For example, practice was always provided until a particular criterion was reached (e.g., 100% correct); because improvement in acquisition was faster with more frequent feedback, this procedure confounded the percentage feedback in acquisition with the amount of practice. Also, delayed retention tests were never given, which is unfortunate in view of the motor findings that the benefits of infrequent feedback seem to increase with the longer retention intervals (see, e.g., Fig. 3). Even so, several of these studies suggest that reducing the percentage feedback in acquisition—in some cases from 100% to 0%—has negligible effects on performance in immediate retention (Krumboltz & Weisman, 1962; Schulz & Runquist, 1960), suggesting a rough parallel to the work in motor behavior.

Recently, Schooler and Anderson (1990) examined feedback frequency effects in learning the computer language LISP, showing that (relative to frequent feedback) decreasing the number of feedback presentations depressed performance in acquisition, but facilitated retention performance. This work suggests that these effects might be generalizable to a variety of cognitive activities as well as to the motor behaviors discussed in the previous section.

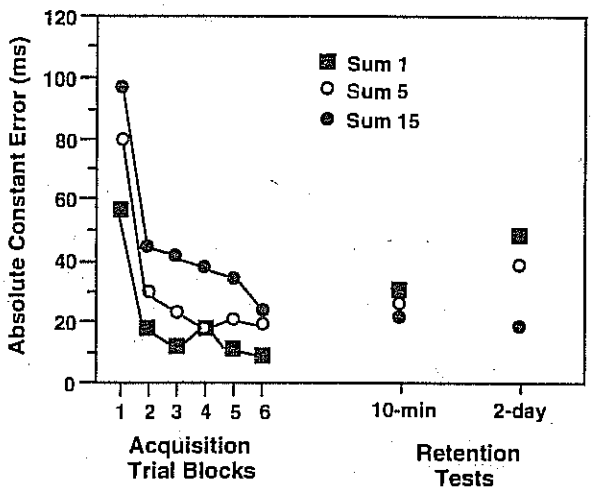

Fig. 3. Mean errors in a movement-patterning task for three different summary-feedback lengths in acquisition, and on no-feedback retention tests given after 10 min or 2 days. Redrawn from Schmidt, Young, Swinnen, and Shapiro (1989).

Common principles. One interpretation of this work is that frequent feedback during the acquisition phase provides several advantages, one of which is the guidance toward the correct behavior. But it also provides some disadvantages (see Schmidt, 1991a). One possibility is that frequent feedback comes to be a part of the task, so that performance is disrupted in retention when the feedback is removed or altered. Also, frequent feedback could block information processing activities that are important during the acquisition phase for acquiring the capability to produce effective performance at retention. One possibility is that frequent feedback blocks the processing of response-produced (kinesthetic) feedback, leading to less effective error-detection capabilities for use in retention (Schmidt et al., 1989). Another possibility is that frequent feedback makes performance too variable during practice, preventing the learning of a stabilized representation of the kind necessary to sustain performance on a later retention test.

This work suggests that these effects might be generalizable to a variety of cognitive activities as well as to the motor behaviors discussed in the previous section.

Notice that, except for the particular terminology used, these accounts are very similar to those offered with respect to the spacing paradigms in the previous section. The general point is that certain "difficult" training conditions may foster various kinds of processing activities that are required for effective retention performance.

Induced Variability of Practice

A final example involves the intentional variation, along a single dimension, of the task to be learned in acquisition. In this case, the criterion test performance typically requires performance on some novel variation not experienced in the acquisition session. The question is whether this intentional variation during practice, versus a consistent practice schedule, is effective for transfer to some novel retention test.

Experiments with motor tasks. Numerous experimenters have dealt with this issue, but Catalano and Kleiner (1984) made the point very well. They used a coincident-timing task in which subjects responded to a simulated moving object by pressing a button when it reached a predefined coincidence-point. Subjects received either constant practice at one target speed (either 5, 7, 9, or 11 m.p.h.) or variable practice at all four of these speeds for the same number of total trials. Learning was evaluated on a retention test in which novel speeds that lay outside the range of the subjects' previous experiences were presented (1, 3, 13, and 15 m.p.h.).

In acquisition, performance in the variable condition was generally less accurate than performance in the constant condition (52 vs. 38 ms absolute error, on average), perhaps reflecting the common view that performing one thing repeatedly is generally more effective than performing four different things. But results for the retention test of generalization to novel speeds, shown in Figure 4, show the variable group was more accurate than the constant group.

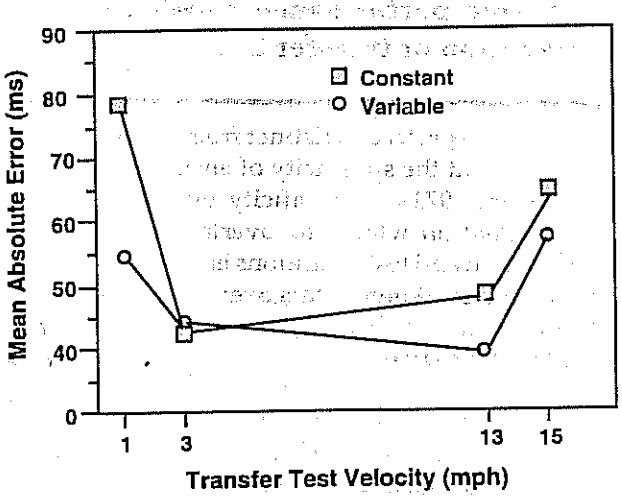

Fig. 4. Mean timing error for transfer tests to novel target speeds after variable or constant practice in the acquisition phase. Redrawn from Catalano and Kleiner (1984).

Many other experiments in the motor skills literature demonstrate similar findings (see Shapiro & Schmidt, 1982, for a review), with especially strong effects for children. For example, Kerr and Booth (1978) had 8-year-old subjects toss beanbags to targets 2 feet and 4 feet away (variable groups) or only to a target 3 feet away (constant group). On a subsequent test using the 3-foot target—the distance practiced by the constant group, but never practiced by the variable group—the variable group performed with greater accuracy than the constant group. This result suggests that learning how to modulate the relationships among the target distances was more important for a test at any one target than was specific experience, even at the particular target distance used at test.

Constant contexts were more effective than variable contexts for enabling subjects to identify the concept in the same context as it was presented earlier, and were probably more effective in the acquisition phase as well. However, when the subjects were asked to recognize novel examples of the concept, variable practice was more effective than constant practice.

This collection of results about variable practice is usually interpreted in terms of schema theory (Schmidt, 1975; Wulf & Schmidt, 1988). The idea is that practice variability enhances the effectiveness of rules (schemata) that relate the external task requirements to the internal movement commands. But in terms of the arguments raised in the present article, these experiments suggest that variable practice alters the practice context to force a change in behavior from trial to trial, encouraging additional information processing activities about the lawful relationships among the task variants. The result is learning that contributes to performance on the test of retention or generalizability, even though these activities detract from momentary performance during the acquisition phase.

Experiments with verbal tasks. Several investigations in the concept formation literature provide analogous findings to those seen in the motor literature. For example, Nitsch (1977; see Bransford,

Franks, Morris, & Stein, 1979) had subjects learn novel concept-words (e.g., to "crinch" was to offend someone) by providing several uses of the word that were in either a constant context (all in a restaurant) or a variable context (in numerous settings). Constant contexts were more effective than variable contexts for enabling subjects to identify the concept in the same context as it was presented earlier, and were probably more effective in the acquisition phase as well. However, when the subjects were asked to recognize novel examples of the concept, variable practice was more effective than constant practice.

With a different paradigm, Mannes and Kintsch (1987) asked subjects to study a passage of text, preceded by an outline that was in either the same or a different organization as the text materials. The different-organization outline can be thought of as a kind of variable practice, and the same-organization outline a form of constant practice. When the subjects were asked to recall the original text materials, the same-organization outline was more effective. But when the subjects were asked to do creative problem-solving tasks that required a deeper understanding of the text materials, the different-organization outline was more effective.

Both of these examples, together with the motor examples discussed above, suggest that even though constant practice may lead to more effective performance in the acquisition phase, and often more accurate verbatim recall of the materials presented, constant practice produces less effective capabilities to generalize knowledge to novel situations than does variable practice.

Concluding Comments

A fundamental concern here has been the characterization of learning, its measurement, and the interpretations that are to be drawn from investigations of acquisition phenomena. Learning is obscured during the acquisition (or practice) phase because relatively permanent effects may be confounded with temporary performance effects that disappear quickly after the practice session is finished, or when the test conditions are changed. We advocate, therefore, the use of various kinds of transfer or retention tests on which (and only on which) the relatively permanent effects of the conditions in acquisition are evaluated. We have provided three experimental variations of practice in which conditions that facilitate performance during the acquisition phase are ineffective for learning as measured on a retention or transfer test. In each of those cases, there appear to be analogous effects across markedly different motor- and verbal-learning paradigms.

We are struck by the common features that underlie these counterintuitive phenomena in such a wide range of skill-learning situations. At the most superficial level, it appears that systematically altering practice so as to encourage additional, or at least different, information processing activities can degrade performance during practice, but can at the same time have the effect of generating greater performance capabilities in retention or transfer tests. If these processing activities are selected so that they are also needed for success at a test of retention or generalizability, then such conditions will facilitate learning.

What are the processes underlying these empirical effects? We have only begun to ask this question, and answers are necessarily very tentative at present. Many possible information processing activities have been postulated in the different tasks and paradigms mentioned here, such as the need to retrieve information that has faded from memory in name learning, the need to evaluate one's own response-produced feedback in motor learning, and the need to associate various different facts or actions into a single concept or schema. Other such processes have been suggested as well, and each of these paradigms has an active literature in which these various possibilities are argued and contrasted.

Systematically altering practice so as to encourage additional, or at least different, information processing activities can degrade performance during practice, but can at the same time have the effect of generating greater performance capabilities in retention or transfer tests.

This perspective is distinct from the earlier viewpoints about the specificity of encoding (Tulving & Thomson, 1971) or specificity of abilities (Henry, 1958/1968), in which the overlap of the objective acquisition and test conditions is the critical variable for learning. Whereas this overlap is undeniably of some importance for test performance, there is ample evidence presented here and elsewhere that this is not the only factor, and perhaps is not even the major factor, for test performance: For example, if the test is given under a blocked condition, random practice in acquisition is more effective for this test than is practice with the identical blocked condition (Shea & Morgan, 1979; see Fig. 1 here). Also, even if the test is given under identical 100% feedback

conditions, a 50%-faded condition in acquisition is better at test than practice under the identical 100% condition (Winstein & Schmidt, 1990, Experiment 3). Finally, when test performance requires a bean-bag toss of 3 feet, varied practice at 2- and 4-foot distances is better than practice at the identical 3-foot distance. All of these examples—taken from each of the paradigms mentioned here—tend to violate the specificity view that the simple overlap of conditions between acquisition and test contexts determines test effectiveness.

From a practical perspective, this framework would stress that a trainer's major goal is to focus clearly on the criterion performance, and to understand what kinds of processes are required for its proficiency.

We prefer to suggest that the more important principle is the overlap of the processes necessary for performance at the test and the processes practiced during acquisition, refined from the ideas of transfer-appropriate processing (Bransford et al., 1979). Note that the overlap of relevant processes does not necessarily mean that there is overlap of the objective conditions of practice, as we have shown here several times already. If certain acquisition conditions force the learner to engage in processes that are also critical for test performance, then those conditions will be judged as effective for learning (because they facilitate test performance), even though they may exhibit different superficial conditions. Also, these conditions that maximize learning may not be very effective for performance during the acquisition phase, as they provide various "difficulties" for the learners. Random practice, reduced feedback, and variable practice all degrade performance during practice relative to more "ideal" conditions in acquisition, yet all can be argued to exercise information processing activities that are critical for performance at the test. In other words, these conditions can be considered as effective for learning because they prepare the learner for the processing that will be required at test.

Certainly, then, no single type of extra information processing activity will be expected to underlie all of the tasks and paradigms discussed here. Even so, these data suggest a new conceptualization, or framework, for learning and training that has broad implications for educational practice (see, e.g., Christina & Bjork, 1991). From a practical perspective, this framework would stress that a trainer's major goal is to focus clearly on the criterion performance, and to understand what kinds of processes are required for its proficiency. Then, practice activities that exercise these particular processes could be designed (see, e.g., Schmidt, 1991b, chap. 11). The criterial version of many tasks, for example, involves the execution of an essentially novel response that cannot have been practiced previously, such as the solution of a particular mathematical word problem on the job, or the execution of a basketball shot from a location never before experienced. In such cases, practice could be organized in a way to facilitate transfer and generalization, and a form of variable practice would be recommended. Other practice conditions would optimize performance in other contexts, as we have argued here.

Acknowledgments

This article was based in part on a concept paper submitted to the U.S. Army Research Institute (ARI), Basic Research (Schmidt & Bjork, 1989), and was supported in part by Contract No. MDA 903-85-K-0225 from ARI to R.A. Schmidt and D.C. Shapiro. Thanks to William Estes and Tim Lee for valuable comments on an earlier draft, and to Jack Adams for pointing us to the research on % ORMs.

References

Allen, G.A., Mahler, W.A., & Estes, W.K. (1969). Effects of recall tests on long-term retention of paired associates. *Journal of Verbal Learning and Verbal Behavior, 17*, 573-585.

Baddeley, A.D., & Longman, D.J.A. (1978). The influence of length and frequency of training session on the rate of learning to type. *Ergonomics, 21*, 627-635.

Bahrick, H.P. (1979). Maintenance of knowledge: Questions about memory we forgot to ask. *Journal of Experimental Psychology: General, 108*, 296-308.

Battig, W.F. (1966). Facilitation and interference: In E.A. Bilodeau (Ed.), *Acquisition of skill* (pp. 215-244). New York: Academic Press.

Bjork, R.A. (1975). Retrieval as a memory modifier. In R. Solso (Ed.), *Information processing and cognition: The Loyola Symposium* (pp. 123-144). Hillsdale, NJ: Erlbaum.

Bjork, R.A. (1988). Retrieval practice and the maintenance of knowledge. In M.M. Gruneberg, P.E. Morris, and R.N. Sykes (Eds.), *Practical aspects of memory II* (pp. 396-401). London: Wiley.

Bjork, R.A. (1989). Retrieval inhibition as an adaptive mechanism in human memory. In H.L. Roediger and F.I.M. Craik (Eds.), *Varieties of*

memory and consciousness: Essays in honor of Endel Tulving (pp. 195-210). Hillsdale, NJ; Erlbaum.

Bjork, R.A., & Allen, T.W. (1970). The spacing effect: Consolidation of differential encoding? *Journal of Verbal Learning and Verbal Behavior, 9,* 567-572.

Bjork, R.A., & Bjork, E.L. (1992). A new theory of disuse and an old theory of stimulation fluctuation. In A.F. Healy, S.M. Kosslyn, and R.M. Shiffrin (Eds.), *From learning processes to cognitive processes: Essays in honor of William K. Estes* (Vol. 2, pp. 35-67). Hillsdale, NJ: Erlbaum.

Bransford, J.D., Franks, J.J., Morris, C.D., & Stein, B.S. (1979). Some general constraints on learning and memory research. In L.S. Cermack and F.I.M. Craik (Eds.), *Levels of processing in human memory* (pp. 331-354). Hillsdale, NJ: Erlbaum.

Catalano, J.F., & Kleiner, B.M. (1984). Distant transfer in coincident timing as a function of variability of practice. *Perceptual and Motor Skills, 58,* 851-856.

Christina, R.W., & Bjork, R.A. (1991). Optimizing long-term retention and transfer. In D. Druchman and R.A. Bjork (Eds.), *In the mind's eye: Enhancing human performance* (pp. 23-56). Washington, DC: National Academy Press.

Cuddy, L.J., & Jacoby, L.L. (1982). When forgetting helps memory: Analysis of repetition effects. *Journal of Verbal Learning and Verbal Behavior, 21,* 451-467.

Estes, W.K. (1955). Statistical theory of distributional phenomena in learning. *Psychological Review, 62,* 369-377.

Glenberg, A.M. (1979). Component-levels theory of the effects of spacing of repetitions on recall and recognition. *Memory & Cognition, 7,* 95-112.

Glenberg, A.M., & Lehmann, T.S. (1980). Spacing repetitions over 1 week. *Memory & Cognition, 8,* 528-538.

Goode, S., & Magill, R.A. (1986). The contextual interference effects in learning three badminton serves. *Research Quarterly for Exercise and Sport, 57,* 308-314.

Guthrie, E.R. (1952). *The psychology of learning.* New York: Harper and Row.

Hagman, J.D. (1983). Presentation- and test-trial effects on acquisition and retention of distance and location. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 334-345.

Henry, F.M. (1968). Specificity vs. generality in learning motor skill. In R.C. Brown and G.S. Kenyon (Eds.), *Classical studies on physical activity* (pp. 331-340). Englewood Cliffs, NJ: Prentice-Hall. (Original work published 1958).

Hogan, R.M., & Kintsch, W. (1971). Differential effects of study and test trials on long-term recognition and recall. *Journal of Verbal Learning and Verbal Behavior, 10,* 562-567.

Hull, C.L. (1943). *Principles of behavior.* New York: Appleton-Century-Crofts.

Kerr, R., & Booth, B. (1978). Specific and varied practice of a motor skill. *Perceptual and Motor skills, 46,* 395-401.

Krumboltz, J.D., & Weisman, R.G. (1962). The effect of intermittent confirmation in programmed instruction. *Journal of Educational Psychology, 53,* 250-253.

Landauer, T.K., & Bjork, R.A. (1978). Optimum rehearsal patterns and name learning. In M.M. Gruneberg, P.E. Morris, and R.N. Sykes (Eds.), *Practical aspects of learning* (pp. 625-632). London: Academic Press.

Lavery, J.J. (1962). Retention of simple motor skills as a function of type of knowledge of results. *Canadian Journal of Psychology, 16,* 300-311.

Lee, T.D. (1988). Transfer-appropriate processing: A framework for conceptualizing practice effects in motor learning. In O.G. Meijer and K. Roth (Eds.), *Complex motor behavior: 'The' motor-action controversy* (pp. 201-215). Amsterdam: Elsevier Science.

Lee, T.D., & Magill, R.A. (1983). The locus of contextual interference in motor-skill acquisition. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 730-746.

Magill, R.A., & Hall, K.G. (1990). A review of the contextual interference effect in motor skill acquisition. *Human Movement Science, 9,* 241-289.

Mannes, S.M., & Kintsch, W. (1987). Knowledge organization and text organization. *Cognition and Instruction, 4,* 91-115.

Melton, A.W. (1967). Repetition and retrieval from memory. *Science, 158,* 532.

Morris, C.D., Bransford, J.D., & Franks, J.J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning and Verbal Behavior, 16,* 519-533.

Nitsch, K.E. (1977). *Structuring decontextualized forms of knowledge.* Unpublished doctoral dissertation, Vanderbilt University, Nashville.

Peterson, L.R., Hillner, K., & Saltzman, D. (1962). Time between pairings and short-term retention. *Journal of Experimental Psychology, 64,* 550-551.

Rea, C.P., & Modigliani, V. (1985). The effect of expanded versus massed practice on the retention of multiplication facts and spelling lists. *Human Learning, 4,* 11-18.

Salmoni, A.W., Schmidt, R.A., & Walter, C.B. (1984). Knowledge of results and motor learning: A review and critical reappraisal. *Psychological Bulletin, 95,* 355-386.

Schmidt, R.A. (1975). A schema theory of discrete motor skill learning. *Psychological Review, 82,* 225-260.

Schmidt, R.A. (1991a). Frequent augmented feedback can degrade learning: Evidence and interpretations. In G.E. Stelmach and J. Requin (Eds.), *Tutorials in motor neuroscience* (pp. 59-75). Dordrecht, The Netherlands: Kluwer.

Schmidt, R.A. (1991b). *Motor learning and performance: From principles to practice.* Champaign, IL: Human Kinetics.

Schmidt, R.A., & Bjork, R.A. (1989). *New conceptualizations of practice: Common principles in three research paradigms suggest important new concepts for practice.* Concept paper submitted to the U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA.

Schmidt, R.A., Lange, C.A., & Young, D.E. (1990). Optimizing summary knowledge of results for skill learning. *Human Movement Science, 9,* 325-348.

Schmidt, R.A., Young, D.E., Swinnen, S., & Shapiro, D.C. (1989). Summary knowledge of results for skill acquisition: Support for the guidance hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 352-359.

Schooler, L.J., & Anderson, J.R. (1990). The disruptive potential of immediate feedback. In *Proceedings of the Cognitive Science Society.* Hillsdale, NJ: Erlbaum.

Schulz, R.W., & Runquist, W.N. (1960). Learning and retention of paired adjectives as a function of percentage occurrence of response members. *Journal of Experimental Psychology, 59,* 409-412.

Shapiro, D.C., & Schmidt, R.A. (1982). The schema theory: Recent evidence and developmental implications. In J.A.S. Kelso and J.E. Clark (Eds.), *The development of movement control and coordination* (pp. 113-150). New York: Wiley.

Shea, C.H., Kohl, R., & Indermill, C. (1990). Contextual interference: Contributions of practice. *Acta Psychologica, 73,* 145-157.

Shea, J.B., & Morgan, R.L. (1979). Contextual interference effects on the acquisition, retention, and transfer of a motor skill. *Journal of Experimental Psychology: Human Learning and Memory, 5,* 179-187.

Shea, J.B., & Upton, G. (1976). The effects on skill acquisition of an interpolated motor short-term memory task during the KR-delay interval. *Journal of Motor Behavior, 8,* 277-281.

Skinner, B.F. (1938). *The behavior of organisms.* New York: Appleton-Century-Crofts.

Tolman, E.C. (1932). *Purposive behavior of animals and men.* New York: Century.

Tulving, E., & Thomson, D.M. (1971). Retrieval processes in recognition memory: Effects of associative context. *Journal of Experimental Psychology, 87,* 116-124.

Winstein, C.J., & Schmidt, R.A. (1990). Reduced frequency of knowledge of results enhances motor skill learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 16,* 677-691.

Wulf, G., & Schmidt, R.A. (1988). Variability in practice: Facilitation in retention and transfer through schema formation or context effects? *Journal of Motor Behavior, 20,* 122-149.

Wulf, G., & Schmidt, R.A. (1989). The learning of generalized motor programs: Reducing the relative frequency of knowledge of results enhances memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 748-757.

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Annotated Bibliography of Educational Research Syntheses

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Instructional Practice

Adams, Marilyn Jager. *Beginning to Read: Thinking and Learning About Print.* Cambridge, MA: MIT Press, 1990.

This is the latest and most thorough review of the research of the scientific literature on how children learn to read and use print.

Beginning to Read: *Thinking and Learning About Print (A Summary).* Chicago: The University of Illinois, Center for the Study of Reading, 1990.

This is a much shorter version of the above, which is best for parents and teachers. Provides practical details on why phonemics works and how to introduce phonemics most effectively. Thoroughly explains phonemic awareness, a new and critical concept. For ordering information, please call the Center for the Study of Reading at (217) 244-4083. Highly recommended!

Bereiter, C., and M. Kurland. "A Constructive Look at Follow Through Results." *Interchange* 12.1 (1981): 1-30.

Chall, Jeanne S. *Learning to Read: The Great Debate.* Revised edition. New York: McGraw-Hill, 1983.

This is a classic review of the research.

Cooley, William W., and Gaea Leinhardt. "The Instructional Dimensions Study." *Educational Evaluation and Policy Analysis* 2.1 (1980): 7-25.

A study based on 400 classrooms to determine if individualized instruction is the best route to provide compensatory programs for disadvantaged children in basic skills. No evidence was found to justify individualization of instruction.

Engelmann, Siegfried, Wesley C. Becker, Douglas Carnine, and Russell Gersten. "The Direct Instruction Follow Through Model: Design and Outcomes." *Education and Treatment of Children* 11.4 (1988): 303-317.

This article is recommended for teachers so that they may have some exposure to the efficacy of direct instruction, how it works best for the disadvantaged child and how successful learning boosts self-esteem (and not the reverse). Highly recommended!

Hillocks, George, Jr. "Synthesis of Research on Teaching Writing." *Educational Leadership* May 1987: N. pag.

Hillocks summarizes his ideas on what works.

"What Works in Teaching Composition: A Meta-Analysis of Experimental Treatment Studies." *American Journal of Education* 93.1 (1984): 132-170.

The major review of empirical research on teaching writing.

Holmes, Mark, Rev. of: *Early Childhood Study Project Evaluation,* by Brian R. Usher and Mary Ann Evans. Toronto: Department of Educational Administration, OISE, 1989.

A review of a comparison of the measured outcomes of 10 innovative child-centered classrooms and 10 more traditional class-

rooms. The results did not favor the child-centered methods in any area, yet the methods were implemented by the involved board. Highly recommended!

Leinhardt, Gaea, C. Weidman, and K.M. Hammond. "Introduction and Integration of Classroom Routines by Expert Teachers." *Curriculum Inquiry* 17.2 (1987): 135-176.

Successful teachers use the first days of school to establish and rehearse routines that permit instruction to proceed fluidly and efficiently.

Medley, D.M. *Teacher Competence and Teacher Effectiveness: A Review of Process-Product Research.* Washington: American Association of Colleges for Teacher Education, ERIC ED 143629, 1978.

An early synthesis of instructional research. Medley found what later became familiar: effective reading teachers initiate more, respond less to pupil initiation; with weak pupils, use low level, narrow questions and provide quick feedback; control without criticism; maintain on-task behavior; encourage pupils to get help from the teacher; praise good work. They do not: ignore inappropriate behavior, permit pupils to speak freely, give pupils choice of activity, provide rewards based on pupils' self-reports.

O'Neill, G. Patrick. "Teaching Effectiveness: A Review of the Research." *Canadian Journal of Education* 8.13 (1988): 162-185.

A good overall synthesis of research into effective instruction in the basic skills, mainly reading and math.

Rosenshine, B. "Teaching Functions." *The Elementary School Journal* 83.4 (1983): 335-351.

Direct teaching of a (single) curriculum to large groups or the whole class makes more efficient use of the teacher's time, and the students learn more.

Scheirer, Mary Ann, and Robert E. Kraut. "Increasing Educational Achievement Via Self Concept Change." *Review of Educational Research* 49.1 (1979): 131-150.

The conclusion: "... the overwhelmingly negative evidence reviewed here for a causal connection between self concept and academic achievement should create caution among both educators and theorists who have heretofore assumed that enhancing a person's feelings about himself would lead to academic achievement." Highly recommended!

Stallings, Jane A. *Implications From the Research on Teaching for Teacher Preparation.* Washington: National Institute for Education, ERIC ED 246030, 1984.

After surveying the research, Stallings states that effective teachers in language and mathematics: make efficient use of time, use homogenous groups, structure the learning experiences, proceed rapidly in small steps, give detailed instructions, maintain high frequency of questions and practice, provide feedback and correctives, have a success rate of at least 80% from initial learning, manage seatwork in small segments with frequent monitoring, provide continued student practice (overlearning) for 90-100% mastery, and emphasize problem solving.

Stevenson, Harold W. "Learning from Asian Schools." *Scientific American* Dec. 1992: 70-76.

The cross-cultural studies will be of interest to the science community.

Stevenson, Harold W., Chen Chuansheng, and Shin-Ying Lee. "Mathematics Achievement of Chinese, Japanese, and American Children: Ten Years Later." *Science* 259 (1993): 53-58.

Stevenson, Harold W., and James W. Stigler. *The Learning Gap: Why Our Schools Are Failing and What We Can Learn From Japanese and Chinese Education.* New York: Summit Books, 1992.

Of great significance. Based on well over a decade's research by a large team of investigators, this landmark book destroys many myths about Asian education at the elementary level. Highly recommended!

Stevenson, Harold W., and Shin-Ying Lee. *The Polished Stones: Mathematics Achievement Among Chinese and Japanese Elementary School Students.* Ann Arbor: University of Michigan, 1989. VHS, 34 min.

This 34-minute VHS videotape shows what Asian elementary schools and classrooms are like and how they produce the world's best mathematics students. The video may be ordered by sending check or money order (U.S. funds) for $35.00 payable to the University of Michigan to: Catherine A. Smith, 300 North Ingalls, 10th Floor, University of Michigan, Ann Arbor, Michigan, 48109. Highly recommended!

U.S. Department of Education. *What Works: Research About Teaching and Learning.* Washington, 1986.

This summary of research about teaching and learning may be obtained by writing to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Highly recommended!

Vellutino, Frank R. "Introduction to Three Studies on Reading Acquisition: Convergent Findings on Theoretical Foundations of Code-Oriented Versus Whole-language Approaches to Reading Instruction" *Journal of Educational Psychology* 83.4 (1991): 437-443.

Critical reading on the very foundation of the two basic approaches. The list of generalizations (p. 442) supported by the research is devastating. Highly recommended!

Walberg, Herbert J. "Improving the Productivity of America's Schools." *Educational Leadership* 41.8 (1984): 19-30.

This is a fine synthesis of many thousands of research studies.

Effective Schools

Chubb, John E., and Terry M. Moe. *Politics, Markets and America's Schools.* Washington: The Brookings Institute, 1990.

Based on a massive analysis of 20,000 students, teachers, and principals in 500 schools, this widely referenced book zeros in on the serious flaws in America's system of governing its schools. Private schools outperform public schools, and there is a reason. Highly recommended!

Coleman, James S., and Thomas Hoffer. *Public and Private High Schools.* New York: Basic Books, 1987.

This is a landmark piece of research. Coleman's earlier large scale studies had deservedly received major criticism. This research refutes his critics. Again, private schools are shown to produce higher levels of achievement than public schools. His "functional community" argument cuts right to the heart of Canada's lowest common denominator problem in school achievement and behavior. Highly recommended!

Hanushek, Erik A. "The Impact of Differential Expenditures on School Performance." *Educational Researcher* May 1989: 45-51.

This work is very important for Canada's educational debate. A review of 187 separate scholarly studies on (often expensive) input factors (e.g. pupil-teacher ratios, the quality of buildings, the nature of administration, etc.) show very weak correlations with student achievement. This means that money is not the problem and throwing more money at the problem won't help.

Hill, Paul T., Gail E. Foster, and Tamar Gendler. *High Schools with Character.* Santa Monica, California: The RAND Corporation (R-3944-RC), 1990.

This analysis is very powerful. Using the high schools of New York City as a base, the short (82 pages) book analyzes why the private parochial schools have better student outcomes than do the public schools. It explains the difference between "zoned" and "focus" schools, notes the vastly different expenditure for administration, and reviews the effective schools' literature. The outcomes for 350 "partnership students" (all at risk of dropping out) are stunning. They were simply given a chance to attend an effective school. Highly recommended!

McDill, Edward L., and Leo C. Rigsby. *Structure and Process in Secondary Schools: The Academic Impact of Educational Climate.* Baltimore: John Hopkins University Press, 1973.

Purkey, S., and M. Smith. "Effective Schools: A Review." *Elementary School Journal* 83.1 (1983): 427-452.

Probably the most widely quoted summary of the research, it led to the frequent repetition of lists of correlates of effective schools: strong

leadership; pleasant, orderly climate; instructional emphasis; academic climate; regular monitoring of achievement; strong parent/school relations.

Rutter, Michael, Barbara Maughan, Peter Mortimore, and Janet Ouston. *Fifteen Thousand Hours: Secondary Schools and Their Effects on Children.* London: Open Books, 1979.

Perhaps the most famous piece of effective school literature. Based on a sample of somewhat similar schools in a poor part of London, Rutter et al. found that some schools were much more effective than others, with strong independent effects on academic success, attendance, and behavior.

U.S. Department of Education. *Parental Involvement in Education.* Policy Perspective Series. Washington: Dept. of Education, 1991.

James S. Coleman introduces "social capital" in this short but important booklet. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

Educational Policy and Evaluation

Alberta Chamber of Resources. *International Comparisons in Education: Curriculum, Values and Lessons.* Edmonton: Alberta Education, 1992.

This study, instigated by Dr. Joe Freedman, compares Alberta's mathematics, physics, and chemistry curricula with those of Germany, Japan, and Hungary, topic-by-topic and in depth. Earlier topic introduction and greater depth of treatment are striking in the comparison countries. This is very sobering because Alberta students are arguably the strongest in Canada (together with those from British Columbia) and, therefore, in North America. The differences found are not surprising as the subsequent discussion of educational philosophies discloses.

Bishop, John. "Incentives for Learning: Why American High School Students Compare So Poorly to Their Counterparts Overseas." *Research in Labor Economics* 11 (1989): 17-51.

"Motivating Students to Study: Expectations, Rewards, Achievements." Paper #634. Ithaca: ILR Press, n.d.

"Is The Test Score Decline Responsible for the Productivity Growth Decline?" Paper #640. Ithaca: ILR Press, n.d.

"The Productivity Consequences of What is Learned in High School." Paper #643. Ithaca: ILR Press, n.d.

"Why the Apathy in American High Schools?" Paper #645. Ithaca: ILR Press, n.d.

A series of papers that may be ordered from ILR Press, School of Industrial and Labor Relations, Cornell University, Ithaca, New York, 14851-0952. They may also be ordered by telephone: (607) 255-2264. These American concerns apply to the Canadian situation as well. In a global economy, there are economic consequences to under-performing schools.

Canada Communication Group. *Education and Training in Canada.* Ottawa: Canada Communication Group, 1992.

This is the companion piece to *A Lot to Learn* published by the Economic Council of Canada in April, 1992 (see below). This report provides the details of the research. It is highly recommended for those in leadership positions in Canada's education system as well as business leaders, public policy officials, and those in the media who report on education. It may be obtained from the Canada Communication Group–Publishing, Ottawa, Ontario, K1A 0S9, or from your local bookseller. The DSS catalogue number is EC22-188/1992E.

Canadian Gallup Poll. Gallup Survey. *Let's Talk About Schools.* Victoria: Ministry of Education, 1985.

In British Columbia, 67% of the public thought that education was better in independent schools, 5% that it was better in public schools. Sixty-nine percent of the public thought that standardized evaluation of students was very important compared with 3% of educators. In contrast, 40% of educators thought it not at all important, compared with 2% of the public.

Conference Board of Canada. *Prosperity Through Innovation: The Task Force on Challenges in Science, Technology and Related Skills—A Summary Report.* Ottawa: Conference Board of Canada, 1992.

This is the report of a national task force on science and technology undertaken as part of the recent Prosperity Initiative. The education recommendations in this official public document are the boldest and most proactive of any such report yet. Specific mechanisms are proposed to pressure the Canadian system of education toward international levels of performance. Copies of the summary report and the associated background report are available from the Prosperity Secretariat, 235 Queen Street, 2nd Floor, Ottawa, Ontario, K1A 0H5. Highly recommended!

Coons, John E., and Stephen D. Sugarman. *Education by Choice: The Case for Family Control.* Berkeley: University of California Press, 1978.

The classic argument for free choice of school.

Corporate-Higher Education Forum. *To Be Our Best: Learning for the Future.* Montreal: Corporate-Higher Education Forum, 1990.

A thorough discussion of the issues underlying Canada's educational debate. The document reflects the concern of two communities, a large group of the leaders of Canada's largest firms and the presidents of her universities. The report may be ordered by writing the Corporate-Higher Education Forum, 1155 René-Lévesque Blvd. West, Suite 2501, Montreal, Quebec, H3B 2K4. Highly recommended!

Dischер, Michael. *Fiscal Accountability in Milwaukee's Public Elementary Schools: "Where Does the Money Go?"* Milwaukee: Wisconsin Policy Research Institute, 1990.

This institute report (Vol. 3, No. 4, Sept., 1990) looked closely at a district's spending and found that only 26% of per-pupil cost reaches the classroom. Even allowing for differences in structure, there are lessons for Canadians. For a copy write to the Wisconsin Policy Research Institute, 3107 North Shepard Avenue, Milwaukee, Wisconsin, 53211, or phone (414) 963-0600.

Economic Council of Canada. *A Lot to Learn: Education and Training in Canada.* Ottawa: Economic Council of Canada, 1992.

Simply the finest report available on the status of Canadian education and the legitimate concern for Canada's prosperity in a global economy. Canada's teachers and as many parents as possible should be reading this short report. It may be ordered from the Canada Communication Group–Publishing, Ottawa, Ontario, K1A 0S9, or from your local bookseller. The DSS catalogue number is EC22-182/1992E. Highly recommended!

Holmes, Mark. *Educational Policy for the Pluralist Democracy: The Common School, Choice and Diversity.* London: Falmer Press (in press).

A study of the fundamental problem of providing education in a multi-faith, multicultural society. The theme is that there must be some common elements in education to preserve the values of a free, democratic society, but beyond that framework, parents should have the greater say in the education of their children.

The Future of the Public School in Canada, in Reform and Relevance in Schooling: Dropouts, Destreaming and the Common Curriculum. Eds. Derek Allison and Jerry Paquette. Toronto: OISE Press, 1991. 92-109.

Crucial reading on the theme that the public school will be strengthened if it adopts a consensual policy reflecting the public will with respect to direct instruction emphasis on achievement and a high doctrine of traditional values. Highly recommended!

Holmes, Mark, Kenneth A. Leithwood, and Donald F. Musella. *Policy for Effective Schools.* Toronto: OISE Press, 1989.

Holmes' chapter on the history of the effective school movement, that of La Rocque and Coleman on district accountability in British Columbia, that of McLean on the lessons to be learned from the Japanese in teaching mathematics, and, finally, that of Wynne on traditional values in our schools, are especially noteworthy.

International Association for the Evaluation of Educational Achievement (IEA). *The Underachieving Curriculum: Assessing U.S. School Mathematics From an International Perspective.* Champaign: Stipes Publishing Company, 1989.

This national report on the poor performance of U.S. students in the Second International

Mathematics Study has lessons for Canada. In particular, the spiral mathematics curriculum is indicted with considerable force. For a copy, write: Stipes Publishing Company, 10-12 Chester Street, Champaign, Illinois, 61820. Highly recommended!

Science Education in Seventeen Countries: A Preliminary Report. Oxford: Pergamon Press, 1988.

Macek, J.J. *Towards a Better Education: A Brief.* Winnipeg: J.J. Macek, 1991.

This brief is a thoughtful analysis of how Canadian schools might be improved, with an emphasis on curricular reform. It includes a devastating curricular comparison between Manitoba and the former Czechoslovakia. For a copy, write to Dr. Macek at 79 Petriw Bay, Winnipeg, Manitoba, R2R 1K2.

National Endowment for the Humanities. *National Tests: What Other Countries Expect Their Students to Know.* Washington: National Endowment for the Humanities, 1991.

The title says it all. These samples of international expectations in the humanities are revealing. As well, that there are national achievement examinations in the sampled countries makes a strong statement for Canadians and their fiefdomlike ministries. For a copy, write the above endowment, Washington, D.C., 20506.

Nelson Canada. *Canadian Tests of Basic Skills: Forms 5 and 7 Equating Study, 1980-87.* Toronto: Report to the Economic Council of Canada, 1991.

This data is the only good longitudinal data about overall Canadian student achievement in the basic skills from 1966 through 1991. All the trend lines are down, particularly in language skills, the area employers complain about most vigorously.

Ontario Ministry of Education. *Ontario Study of the Relevance of Education and the Issue of Dropouts.* Toronto: Publications Ontario, 1987.

Better known as the Radwanski Report, this stunning outsider indictment of Ontario's educational malaise is about to resurface as newly discovered wisdom. It very much bears rereading.

Ontario Premier's Council. *People and Skills in the New Global Economy.* Toronto: Queens Printer for Ontario, 1990.

The first 51 pages deal with primary and secondary schooling. The concern for manufacturing Ontario and her young people is palpable. Highly recommended!

Raphael, Dennis. *Accountability and Educational Philosophy: Paradigms and Conflict in Ontario Education.* Toronto: Dennis Raphael, 1992.

A sophisticated analysis of the deep philosophical uncertainty of Ontario's Ministry of Education. For a copy, write to Dr. Dennis Raphael, 62 First Avenue, Toronto, Ontario, M4W 1W8.

Educational Evaluation and the Quality of Agenda in Canada. Toronto: Dennis Raphael, 1992.

A good review of recent developments in provincial educational policies and practices in relation to the issue of educational quality. For a copy, see the above entry.

Schweitzer, Thomas T. *International and Interprovincial Comparisons of Student Cognitive Achievement.* Ottawa: Economic Council of Canada, 1992.

Sobering analysis of Canadian student prowess in an international context. Ideally, all Canadian educators should be personally aware of this data.

Schooling and the Statistics Canada Survey of Literacy Skills Used in Daily Activities. Ottawa: Economic Council of Canada, 1992.

Further sobering analysis of the general levels of functional literacy and numeracy in Canada. They are "... significantly, disconcertingly, low. These considerations more than justify concern about the quality of education in Canada." Again, all Canadian educators should be aware of this data.

Singal, Daniel J. "The Other Crisis in American Education." *The Atlantic Monthly* Nov. 1991: 59-74.

Singal presents data suggesting that the United States has suffered particularly from increasing mediocrity among its brightest students. Could this be happening in Canada? There is

no way to know because Canada's educators have not established a mechanism to provide such a data base. Surely Canadians should have one if we wish to remain successful in a global economy.

Southam Press. *Literacy in Canada: A Research Report.* Toronto: Southam Press, 1987.

This series of six articles by Peter Calamai was published in the Vancouver Sun (Sept. 14-19), Toronto Star (Sept. 12-17), and Ottawa Gazette (Sept. 12-17). It examined basic literacy in Canada using test material very similar to tests already used in the United States. Literacy was defined as basic skills normally found in a child in grade 4 or 5. The report found that 8% of university graduates and 13% of high school graduates were illiterate. The most shocking finding for Canadians was that in the 20-25 year age range, Canadians were more often illiterate and read more poorly than Americans.

Statistics Canada. *The Survey of Literacy Skills Used in Daily Activities.* Ottawa: Statistics Canada, 1990.

This consists of a series of surveys of skills in reading writing, and numeracy conducted for the National Literacy Secretariat. The results confirmed the disturbing findings in the Southam Press report on literacy. This time, it was found that 30% of Canada's high school graduates could not meet most everyday reading demands and 36% could not meet everyday mathematics requirements.

Stevenson, Harold W. et al. *Contexts of Achievement: A Study of American, Chinese and Japanese Children.* Monographs of the Society for Research in Child Development, Serial No. 221, Vol. 55, No. 1-2, 1990.

This landmark study compares the mathematics performance of middle class American students with those in China and Japan. The results are shocking. The monograph then closely examines all the factors that led to the strongly superior Asian performance. Highly recommended!

Union Carbide Corporation. *Undereducated Uncompetitive USA.* Danbury: Union Carbide Corporation, 1989.

This Corporate Task Force on Education report gives an overview of the U.S. national crisis in education as well as the implications for the country and the Union Carbide firm. It reeks with fear! It argues that catalysts for change will have to come from outside the system and that educational insiders have advised against tinkering but rather to aim for major structural reforms. A copy may be obtained by writing: Union Carbide Corporation, 39 Old Ridgebury Road, C-2193, Danbury, CT, 06817-0001. Highly recommended!

Walberg, Herbert J. *U.S. Educational Productivity: Urgent Needs and New Remedies.* Oak Park: Herbert J. Walberg, n.d.

This analysis is short, urgent, and compelling. Dr. Walberg is the Research Professor of Education, University of Illinois. This paper is available by writing the author at the University of Illinois, 522 North Euclid Avenue, Oak Park, Illinois, 60302.

I wish to fully acknowledge the kind and capable assistance of Professor Mark Holmes in compiling this bibliography. A number of the items listed are from his own annotated bibliography on school reform. I strongly recommend it to the interested reader. It may be purchased from: Administrative Officer, Educational Administration, Ontario Institute for Studies in Education, 252 Bloor Street West, Toronto, Ontario, M5S 1V6 Canada. Please enclose a check or money order made payable to OISE in the amount of $10.00 (Canadian). No purchase orders please.

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February, 1993

Phases of Meaningful Learning

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Excerpted from Review of Educational Research, *Winter 1990, Vol. 60, No. 4, pp. 531-547, with permission.*

ABSTRACT: *The research literature is examined for evidence suggesting that in complex, meaningful learning the learner passes through a series of stages or phases during which the learning process and the variables influencing it change systematically. After discussing various conceptual and methodological issues, phase theories in more meaningful forms of learning are reviewed. Finally, the initial, intermediate, and terminal phases of learning are discussed. It is suggested that during the initial phase of learning the individual typically acquires isolated facts that are interpreted in terms of preexisting schemata and added to existing knowledge structures. Gradually, the learner begins to assemble these pieces into new schemata that provide him or her with more conceptual power until a level of automaticity is achieved.*

Learning is a much more complex and drawn out process than generally acknowledged. The type of complex, meaningful learning that occurs in school and throughout the life span occurs over a period of weeks, months, and years, and there is good reason to believe that the nature of the learning process changes as the task of mastering a complex body of knowledge unfolds. For example, there is good evidence that experts and novices in a field respond to tasks in fundamentally different ways (e.g., Chi, Glaser, & Rees, 1982). As one progresses from the initial encounter with a complex body of knowledge to the point where the expert is able to demonstrate understanding of that knowledge in ways that are more-or-less automatic, a task that once constituted a problem for the new learner (and elicited various problem-solving strategies) becomes little more than a simple recall task for the more experienced and sophisticated learner.

This article will explore the notion that distinct stages or phases can be identified along the journey from knowing virtually nothing about a complex body of knowledge to the demonstration of a highly proficient mastery of that knowledge. After a discussion of several issues related to a phase theory of learning, research relevant to phases in meaningful learning will be presented. Finally, implications of these reviews will be discussed with regard to both theories of learning and educational practices.

The idea of stages is certainly not new to psychology. There are the developmental stages of Piaget and Bruner and a long-standing concern for stages in problem solving (Andre, 1986; Mayer, 1983). Over the years, a variety of stage theories have been suggested for various types of learning (e.g., Anderson, 1982; Fleishman & Hempel, 1954, 1955; McGuire, 1961; Underwood, Runquist, & Schulz, 1959), and Brainerd (1985; Brainerd, Howe, & Desrochers, 1982) has developed a sophisticated mathematical two-stage model of learning. A concern for stages is clearly evident, at least implicitly, in the current literature on cognitive learning—for example, the growing body of literature on expert-novice differences (e.g., Chi, Glaser, & Rees, 1982).

A number of factors have contributed to this concern for stages, or phases, in meaningful, cognitive learning. Current theories of learning, for instance, emphasize that learning is an active, constructive, cumulative, and goal-oriented process that involves problem solving (e.g., Shuell, 1986a, 1990). This view of learning as a complex, drawn-out process (e.g., Norman, 1978) that depends on factors from many sources suggests that learning may change as it progresses. This possibility, coupled with evidence that performance is strongly influenced by one's prior knowledge (e.g., Bransford & Johnson, 1972; Chiesi, Spilich, & Voss, 1979), makes a concern for phases in meaningful learning an appropriate and timely pursuit.

Although many cognitive theorists seem to accept the notion of phases in meaningful learning, there have been few systematic attempts to explore the issue in depth. Most of the empirical evidence on stages of learning deals with simpler forms of learning. Although the evidence of phases in long-term meaningful learning is not as convincing at present as one would like, there is good reason to postulate their presence. The following review combines

evidence from empirical studies and theoretical discussions of both simple and meaningful forms of learning in order to evaluate this possibility.

An Overview of the Problem

Imagine yourself about to embark on a long journey, a journey that involves learning a complex body of knowledge with which you currently are unfamiliar. At first, the new terrain appears strange, although certain similarities with familiar territory can be identified. During the first leg of this journey you find yourself primarily memorizing isolated facts (i.e., landmarks), for you do not yet possess a schema for interpreting and integrating the various pieces of information that are encountered. Initially, for example, you may find that mnemonics are helpful in remembering these more-or-less isolated facts. As learning progresses, however, and you begin to group and organize the facts and integrate them into higher order structures, you may find that mnemonics play a less beneficial role. In their place, various types of organizational aids (e.g., developing hierarchies and matrices) that were of little help initially may begin to play a more important role.

The type of complex, meaningful learning that occurs in school and throughout the life span occurs over a period of weeks, months, and years, and there is good reason to believe that the nature of the learning process changes as the task of mastering a complex body of knowledge unfolds.

But the nature of the learning process is not the only thing that changes as learning progresses; the learning process also becomes more diverse. Initially, the learner must rely on experiences associated with a particular course or on a few books selected for self-study. As the learner becomes more familiar with the territory through which he or she is traveling, the learner is likely to encounter a variety of relevant books, to attend lectures, to discuss issues with other students (at the same and/or more advanced levels), to use his or her knowledge to interpret various situations (e.g., a play, a movie, the failure of something to work in the way it is supposed to, the behavior of other people), and so forth. In short, meaningful learning in any field is a much more complex process than often realized; different types of learning are involved, and—as this article will address—various phases or stages occur during which the nature of the learning process changes in systematic ways.

What is a Phase of Learning?

Because special connotations are usually associated with the use of the term *stage* within psychology, it seems advisable to address at the onset the way in which *phase* will be used in this article.

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Generally speaking, the term *stage* is used to refer to distinct time periods. Each period is characterized by psychological functioning that is qualitatively different from that which occurs during other periods. The most notable examples, of course, are developmental stages such as those of Jean Piaget. Developmental stages of this type are structural in nature and apply across all domains. For example, most developmental stage theories consider it impossible for a child to be in the formal-operations stage in mathematics and in the concrete-operations stage in social studies, and thus developmental stages are considered to be independent of specific content domains.

There is a growing body of literature, however, that challenges the validity of developmental stages conceived in this way (e.g., Keil, 1986). There is increasing evidence that the qualitative changes that occur with age are the result of knowledge-based competencies within a particular content domain, although the possibility of general competencies arising from similarities among the various domains is not ruled out. An example of such knowledge-based competencies is demonstrated in a study by

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Chi (1978). There is a great deal of evidence, reviewed by Chi that *memory span* (the number of items that can be recalled after a single presentation) increases in a linear manner with age, with adults

remembering up to twice as much as children five- to seven-years old. Chi's study involved children in the third through eighth grade (mean age was 10.5 years) who were experts at playing chess and adults who were only novice chess players. The typical finding of adult superiority in memory span was obtained when the subjects were asked to remember digits (6.1 vs. 7.8). However, when the subjects were asked to remember the placement of pieces on a chess board, the performance of the 10-year-old experts far surpassed that of the adults (9.3 vs. 5.9). This finding is often cited as evidence that knowledge differences may explain many of the developmental differences (and perhaps developmental stages as well) typically found in the literature.

There is a growing body of literature, however, that challenges the validity of developmental stages conceived in [Piaget's] way.

Karmiloff-Smith (1984, 1986) makes a useful distinction among *stage, phase,* and *level. Stage* is used to refer to periods of time that differ qualitatively from both the preceding and succeeding stages. These stages, by definition, cover performance in a variety of content domains, and, once a person achieves a particular stage, he or she cannot return to a preceding one. Although a *phase* may include behavior across several domains, phases are recurrent in that individuals can pass through the various phases in each of many different content domains. Phases are based on:

> ... the hypothesis that children (and adults, for that matter) attack any new problem by going through the same three phases, both within the various parts of particular domains and across different domains. The phase concept is focused on underlying *similarity of process* [italics added], whereas the stage concept usually refers to similarity of structure. (Karmiloff-Smith, 1984, p. 41)

Level refers to qualitative changes within a particular domain (e.g., the proper use of modifiers such as adjectives and adverbs) and accounts for specific changes within that domain. "Like stages, and unlike phases, levels are not recurrent. Once a child is at, say, level 3 in a specific domain, she does not return to level 1" (Karmiloff-Smith, 1984, pp. 41-42). Within this type of conceptual framework, it makes most sense to think in terms of learning phases rather than learning stages, and, consequently, that term is used in this article.

The qualitative changes that occur with age are the result of knowledge-based competencies within a particular content domain.

Do Phases Add Anything Worthwhile to Our Understanding of Human Learning?

If learning is a continuous process—and most of us would agree that it is—then one might reasonably ask what the notion of phases adds to our understanding of complex, meaningful learning. Both theoretical and practical implications exist if in fact the nature of the learning process changes in fundamental ways as learning progresses. Theoretically, it means that learning is a much more complex process than we had imagined. Not only must the type of learning be considered when conducting research but factors related to the length of time that the learning has been taking place must be considered, and prior knowledge will need to be considered in a much more explicit manner than is typically the case. In addition, concern for boundary conditions of various learning principles will need to include factors related to the phase of learning in which the learner is working.

Learning is a much more complex process than we had imagined. Not only must the type of learning be considered when conducting research but factors related to the length of time that the learning has been taking place must be considered, and prior knowledge will need to be considered in a much more explicit manner than is typically the case.

On the more practical side, there are also implications for teaching. Just as one should not teach in the same way when different types of outcomes are sought (e.g., the acquisition of concepts vs. the acquisition of facts), one should teach differently when different phases of learning are involved. The teaching methods employed, as well as the content, should be appropriate for the phase of learning in which the

students are engaged. For example, one would teach differently if a new topical area is just being introduced than if the students had already gained some proficiency in the domain. Thus, introductory courses should be taught differently from more advanced courses—at least in part—but, in more instances than not, introductory and advance courses in a particular content area are taught in basically the same way.

Phase Theories in Meaningful Learning

Although there is considerable agreement among various investigators on the viability of phases in long-term meaningful learning, the empirical evidence to support their presence is not overwhelming at present. Thus, the following review of the literature is based more on theoretical arguments than on empirical evidence, although the latter will be discussed whenever possible.

The teaching methods employed, as well as the content, should be appropriate for the phase of learning in which the students are engaged.

Perhaps the earliest discussion of stages in meaningful learning was Wallas' (1926) suggestion that problem solving involves four stages: preparation, incubation, illumination, and verification. Unfortunately, Wallas' stages, as well as similar ones suggested by other investigators, are based more on introspection than on sound scientific investigations of any kind. A good critique of this literature is contained in Mayer (1983).

Within the context of a schema-based theory of long-term memory, Rumelhart and Norman (1978) have suggested three qualitatively different types of learning: (a) *accretion*, or the encoding of new information in terms of existing schemata; (b) *tuning*, or schema evolution, the slow modification and refinement of a schema as a result of using it in different situations; and (c) *restructuring*, or schema creation, the process by which new schemata are created. Rumelhart and Norman imply that these three kinds of learning occur sequentially, but whereas there is consistency in listing accretion as the first phase, they interchange the order of tuning and restructuring in their discussion.

Spiro, Coulson, Feltovich, and Anderson's (1988) cognitive flexibility theory focuses on advanced knowledge acquisition. This phase of learning occurs between one's initial attempt to study a subject area and the high levels of expertise that come with massive amounts of experience. According to Spiro et al.:

> This often neglected intermediate stage is important because the aims and means of advanced knowledge acquisition are different from those of introductory learning. In introductory learning the goal is often mere exposure to content and the establishment of a general orientation to a field; objectives of assessment are likewise confined to the simple effects of exposure (e.g., recognition and recall). At some point in learning about a knowledge domain the goal must change; at some point students must 'get it right.' This is the stage of advanced knowledge acquisition. (p.1)

Although the phase aspect of the Spiro et al. theory is based more on their experience than on sound empirical evidence that the various phases actually exist, it does provide an example of current thinking among cognitive psychologists on the topic. Probably the best developed and most empirically based phase theory of meaningful learning is Karmiloff-Smith's (1984, 1986) theory of cognitive development, discussed in the following section. The subsequent section will explore implications of research on expert-novice differences (and the corresponding concern for the development of competence) for a phase theory of learning.

Developmental Learning

Based on evidence from several studies, Karmiloff-Smith (1984, 1986) has developed a knowledge-based theory of cognitive development. She believes that the theory is relevant to individuals of all ages who are learning a new content area. Phases and levels are distinguished from stages (as described earlier in this article), and she postulates the involvement of three phases/levels referred to as: (a) procedural; (b) metaprocedural; and (c) conceptual.

During the procedural phase/level, the individual's responses are generated primarily by data-driven processes generated by the individual's adapting to external stimuli. The person's behavior is controlled predominantly by the environment. During this initial phase/level, one observes behavioral change with no attempt to develop an overall organization capable of linking the isolated behavioral units into a consistent whole.

During the second (or metaprocedural) phase, the individual begins to work in a "top-down" manner on the mental representations formed during the first phase—that is, the person begins to reflect

or think about these representations as entities in their own right. During this phase, external stimuli become secondary to an internal representation that the person imposes on the environment. The person's external behavior may actually deteriorate somewhat from what was observed during the preceding phase, for external stimuli are ignored as he or she experiments with the internal representation.

The third (or conceptual) phase is governed by a subtle control mechanism that modulates the interaction between the data-driven processes characteristic of the first phase and the top-down processes characteristic of the second phase. The person is now in control of both environmental stimuli and the internal representations that guide his or her behavior. During this phase, the individual is able to consider environmental feedback without jeopardizing the structure of the internal representations.

Expert-Novice Differences

Research on expert-novice differences grew out of a concern for the nature of intellectual competence and the way it develops. Because experts and novices are presumed to differ primarily, if not exclusively, in terms of the experience they have had in a particular subject-matter domain, we are dealing once again with a knowledge-based approach to learning. Although there is general agreement that a continuum exists as the individual moves from novice to expert in a particular field, most of the research to date has been concerned with describing differences in the way the two groups solve problems. It should be noted that in this research *novice* typically refers to someone who has had limited experience with the field of material being investigated, not someone with no experience. For example, in research on physics problem solving, a novice might have had one undergraduate course in physics, whereas an expert might be a professor of physics or someone with comparable experience. Such minimal experience for the novice is necessary in order to have a reasonable basis for comparison, for data on how novices solve a problem could not be obtained if the subjects could not solve the problem at all.

A number of qualitative differences between experts and novices have been identified (for a brief review, see Glaser & Chi, 1988; Shuell, 1986b). For example, in solving physics problems, experts tend to perform a qualitative analysis of the problem prior to deciding which equations to use, whereas novices tend to focus on equations from the onset and engage in a direct syntactic translation (e.g., identifying variables and then plugging them into an equation) rather than generating a physical representation of the problem situation. Likewise, novices tend to focus on literal objects and/or key terms explicitly mentioned in the problem, whereas experts tend to identify features that reflect the states and conditions of the physical situation described in the problem (Chi et al., 1982). Thus, novices might respond to (identify or classify) a problem in terms of "friction" or "gravity," whereas experts might refer to it in terms of "given initial conditions" or "no external force" (p. 64).

As these relationships become better developed, they are formed into higher order structures and networks.

Few attempts have been made to identify stages or phases that might exist between the two states, although Voss, Greene, Post, and Penner (1983) discuss differences among undergraduates (novices), graduate students, and experts. Chi (1978) distinguishes among novice, advanced novice, and expert. Champagne, Klopfer, and Gunstone (1982) differentiate between uninstructed, or preinstructional students (i.e., those who have no experience studying the topic); novice (those with minimal experience in the field—i.e., the typical novice in expert-novice studies); and experts in their discussion of research relevant to the teaching of physics.

Not only do Champagne et al. (1982) provide a detailed description of differences between the schemata of students in these three phases of learning based on their analysis of various empirical studies, they also discuss ways in which these differences are related to teaching students in each phase. Uninstructed students, for example, use principles that are little more than generalized rules derived from their everyday experiences. Consequently, these principles tend to be imprecise due to the students' vague understanding of concepts, errors of magnitude, and inappropriate formulations of general rules. For novices, however, principles involve relationships between physical variables in the form of equations or rules. Although the major laws of physics are expressed in equation form, there is no indication that these equations serve an organizing function (e.g., as schemata). For experts, principles represent major laws of physics in a highly abstract form that expresses relationships with great generality. Each principle includes the conditions under which the principle applies and has an associated schema that serves to organize the relevant material.

Conclusions

Meaningful cognitive learning is an active, constructive, and cumulative process that occurs gradu-

ally over a period of time (Shuell, 1986a). It is a goal oriented process best characterized in terms of problem solving (Anderson, 1987; Bereiter, 1989; Shuell, 1990). Learning is not merely an additive process. Qualitative, as well as quantitative, changes occur, and qualitative differences are evident in both the substance of what is being learned and in the learning processes most appropriate for acquiring additional knowledge.

There is reasonable agreement that a learner passes through phases as his or her knowledge evolves. Merely postulating their existence is not enough. It may prove useful to describe what the various phases might be like.

Initial Phase

During the initial phase of learning, the individual encounters a large array of facts and pieces of information that are more-or-less isolated conceptually. Merely because someone familiar with the topic (teacher, expert, etc.) may see an organizing structure with many interrelationships among the various facts does not mean that the novice learner can make sense out of them. Initially, there appears to be little more than a wasteland with few landmarks to guide the traveler on his or her journey toward understanding and mastery.

Initially...the learner does the only thing that is reasonable: memorizes facts and uses preexisting schemata to interpret the isolated pieces of data.

Under the circumstances, the learner does the only thing that is reasonable: memorizes facts and uses preexisting schemata to interpret the isolated pieces of data. Some of this new information is added to existing knowledge structures—for example, Rumelhart and Norman's (1978) notion of accretion—and these preexisting knowledge structures are used for interpreting the new information and giving it meaning. If no meaning can be found, the information remains as isolated facts.

The information acquired during this initial phase is concrete rather than abstract and bound to the specific context in which it occurs.

Because the learner has little specific knowledge of the domain, the initial processing is global in nature (Sternberg, 1984). The learner must rely on general, domain-independent problem solving strategies and knowledge from other domains to interpret the new information, to make comparisons and contrasts, and to find analogies that appear relevant to the learner (Anderson, 1987; Brown, Bransford, Ferrara, & Campione, 1983). The information acquired during this initial phase is concrete rather than abstract and bound to the specific context in which it occurs (Bransford & Franks, 1976). Thus, the encounter with a new domain of knowledge involves the rote learning of more-or-less isolated facts (we memorize new terms or what appear to be key facts—if we are learning a structured body of knowledge such as history, literature, or psychology—or we identify and try to remember key landmarks if we are learning to navigate around a large city. Too frequently, rote learning and meaningful learning are pitted against one another in a good/bad or either/or manner. In reality, both play an important role in learning from instruction, for at times it is intelligent to memorize something by rote, especially in the present content where rote learning is a means to an end rather than necessarily being an Gradually, the learner begins to form an overview of what the new domain is all about. In pursuing this task, our prior knowledge provides some help (or in certain cases hindrance) by suggesting initial possibilities and by establishing boundary constraints that assist in identifying both the sameness and the uniqueness of the new information (Bransford & Franks, 1976). Analogies from other domains may be used to represent the new domain, although these initial analogies must be modified as learning progresses (Anderson, 1987). The sophisticated learner may make assumptions, based on previous learning experiences, such as (a) "The knowledge [I am learning] has a structure that is more complex than [presently evident]," (b) "[I am] going to have trouble judging the importance of information and [it is] better to err on the side of overestimating importance," and (c)"familiar words may have special meanings in the [new] domain" (Bereiter, 1989, p. 4). The fog that has shrouded the terrain is beginning to lift, but it is still difficult to see things clearly.

During the initial phase, relatively simple forms of learning (e.g., operant conditioning, verbal learning) account for a large part of the learning that occurs. Classical conditioning may also be relevant with regard to establishing an emotional/affective predisposition to learning within that domain. Early stages of concept learning (e.g., grouping) may also occur, but the learner has acquired insufficient information for more complex forms of propositional

and procedural learning to occur—such as Rumelhart and Norman's (1978) tuning and restructuring. Thus, one might reasonably expect *mnemonic strategies* (a form of elaborative encoding) to have a greater affect on learning than *chunking* (a form of reductive encoding).

Intermediate Phase

Gradually, the learner begins to see similarities and relationships among these conceptually isolated pieces of information. The fog continues to lift but still has not burnt off completely. As these relationships become better developed, they are formed into higher order structures and networks. New schemata that provide the learner with more conceptual power are formed, but these new structures and schemata do not yet allow the learner to function on a fully autonomous, or automatic, basis.

Does learning automatically progress to this intermediate phase? Not necessarily.

More meaningful forms of propositional and procedural learning predominate—what Spiro et al. (1988) refer to as *advanced knowledge acquisition*—and the student must now "'get it right' ... attain a deeper understanding of content material, reason with it, and apply it flexibly in diverse contents" (Spiro et al., 1988, p. 1). We extend our knowledge by applying it to new situations and by learning by doing—that is, the information acquired during the initial phase is now applied to the solution of various problems that the learner encounters, including understanding and explaining various situations such as might be involved in answering an essay question.

An important advantage of this phase is that we can try out new knowledge in various ways and receive feedback on its appropriateness without its having autonomous control over our behavior (Anderson, 1982). Thus, there is the opportunity for reflection. As our knowledge becomes more abstract and more capable of being generalized to a variety of situations, it becomes less dependent on the specific context in which it was originally acquired (Karmiloff-Smith, 1984, 1986). During this phase, there may be a temporary deterioration in performance as all of these competing factors are sorted out (Karmiloff-Smith, 1984, 1986; Lesgold et al., 1988).

Does learning automatically progress to this intermediate phase? Not necessarily. To insure that the transition occurs from the initial to the intermediate phase, certain things need to occur. Unfortunately, these things often are missing from an educational system that emphasizes the accumulation of end in itself.

An important advantage of this intermediate phase is that we can try out new knowledge in various ways and receive feedback on its appropriateness without its having autonomous control over our behavior.

more and more factual information—that is, an additive model of learning. In order for information to become more abstract, or decontextualized, Bransford and Franks (1976) suggest that concepts and knowledge should be used to clarify different situations, and they stress the importance of encountering relevant examples, a recommendation that is similar to Spiro et al.'s (1988) emphasis on learning by cases. The teacher and/or the learner can additionally employ various organizational strategies such as outlining and cognitive mapping (that can help the learner to identify and develop higher order relationships in the information being learned) and use the information to solve problems of various types (learning by doing). Variables such as mnemonics, for example, that had substantial affects on learning during the initial phase may have little, if any, affect on learning during the intermediate phase.

Terminal Phase

During the last phase of learning, the knowledge structures and schemata formed during the intermediate phase become better integrated and function more autonomously. In most situations, performance will be automatic, unconscious, and effortless, because relevant knowledge structures now

The ability to perform a task that is accomplished in a straightforward automatic manner involves neither learning nor problem solving.

control behavior in a more direct manner (Anderson, 1982). The individual relies heavily, if not exclusively, on domain-specific strategies for solving problems, answering questions and so forth. The emphasis in this phase is on performance rather than learning, because any change in performance is most likely the result of different task requirements

rather than changes in one's cognitive structure or potential for performing in a particular manner.

The realization that phases most likely exist in the learning of complex and potentially meaningful knowledge provides useful insights into the learning process (including a basis for explaining why certain variables affect learning in some situations but not in others).

In fact, performance (e.g., solving a mathematics problem) that may have involved learning during an earlier phase may involve little, if any, learning during the terminal phase. The ability to perform a task (including answering certain questions about a complex body of knowledge) that is accomplished

During the last phase of learning...performance will be automatic, unconscious, and effortless, because relevant knowledge structures now control behavior in a more direct manner.

in a straightforward automatic manner (i.e., one merely utilizes preexisting procedures) involves neither learning nor problem solving. The learning that does occur during this phase most likely consists of either: (a) the addition of new facts to preexisting schemata (i.e., accretion), or (b) increasingly higher levels of interrelationships (e.g., where the schemata consist of other schemata rather than facts). In one sense, learning in a particular domain never ends, but a point is reached when the expert (not necessarily defined in the traditional sense) functions autonomously on automatic pilot, giving little thought and/or exerting little mental effort to the control of what he or she is doing.

Transition Between Phases

The most problematic part of any phase theory concerns the transition between phases. What, for example, is the nature of the change that occurs as one moves from one phase to the next? And what factors lead to the changes that are purported to occur? To many people, phases suggest the presence of separate and distinct entities with clear-cut boundaries between adjoining stages. But it seems unlikely that such is the case. It probably is best to think of learning as a continuous process; the boundaries between phases are most likely fuzzy, and the transitions between phases gradual rather than dichotomous.

In closing, there appears to be sufficient rationale to support the notion that learning a complex body of knowledge–whether it be the type we learn in school, the compilation of life experience, or the mastering of skills inherent in a craft, trade, or profession–involves a series of phases during which the learning process in fundamentally different. However, it must be cautioned that, although a phase analysis of learning is appealing in many ways, much more evidence is needed if the existence of phases is to be established in a scientifically valid manner. Some of the methodological concerns have been discussed in this article, but delineation of the phases (with regard to both the number of phases that might be involved and the characteristics of each phase) must await future research. In the meantime, the realization that phases most likely exist in the learning of complex and potentially meaningful knowledge provides useful insights into the learning process (including a basis for explaining why certain variables affect learning in some situations but not in others). In teaching such knowledge, it also suggests that we should pay attention to the way the teaching/learning process changes as learning progresses.

References

Anderson, J.R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*, 369-401.

Anderson, J.R. (1987). Skill acquisition: Compilation of weak-method problem solutions. *Psychological Review, 94*, 192-210.

Andre, T. (1986). Problem solving and education. In G.D. Phye and T. Andre (Eds.), *Cognitive classroom learning: Understanding, thinking, and problem solving* (pp. 169-204). Orlando, FL: Academic Press.

Bereiter, C. (1989, March). The role of an educational learning theory: Explaining difficult learning. In W.J. McKeachie (Chair), *Toward a unified approach to learning as a multi-source phenomenon.* Symposium conducted at the meeting of the American Educational Research Association, San Francisco.

Brainerd, C.J. (1985). Model-based approaches to storage and retrieval development. In C. Brainerd and M. Pressley (Eds.), *Basic processes in memory development: Progress in cognitive development research* (pp. 143-207). New York: Springer-Verlag.

Brainerd, C.J., Howe, M.L., & Desrochers, A. (1982). The general theory of two-stage learning: A mathematical review with illustrations from memory development. *Psychological Bulletin, 91,* 634-665.

Bransford, J.D., & Franks, J.J. (1976). Toward a framework for understanding learning. In G.H. Bower (Ed.), *Psychology of learning and motivation* (Vol. 10, pp. 93-127). New York: Academic Press.

Bransford, J.D., & Johnson, M.K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior, 11,* 717-726.

Brown, A.L., Bransford, J.D., Ferrara, R.A., & Campione, J.C. (1983). Learning, remembering, and understanding. In P.H. Mussen (Ed.), *Handbook of child psychology, Vol. III. Cognitive development* (J.H. Flavell & E.M. Markman, Vol. Eds.) (4th ed., pp. 77-166). New York: John Wiley & Sons.

Champagne, A.B., Klopfer, l.E., & Gunstone, R.F. (1982). Cognitive research and the design of science instruction. *Educational Psychologist, 17,* 31-53.

Chi, M.T.H. (1978). Knowledge structures and memory development. In R.S. Siegler (Ed.), *Children's thinking: What develops?* (pp. 73-96). Hillsdale, NJ: Lawrence Erlbaum Associates.

Chi, M.T.H., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 1, pp. 7-75). Hillsdale, NJ: Lawrence Erlbaum Associates.

Chiesi, H.L., Spilich, G.J., & Voss, J.F. (1979). Acquisition of domain-related information in relation to high and low domain knowledge. *Journal of Verbal Learning and Verbal Behavior, 18,* 257-273.

Fleishman, E.A., & Hempel, W.E., Jr. (1954). Changes in factor structure of a complex psychomotor test as a function of practice. *Psychometrika, 19,* 239-252.

Fleishman, E.A., & Hempel, W.E., Jr. (1955). The relation between abilities and improvement with practice in a visual discrimination reaction task. *Journal of Experimental Psychology, 49,* 301-310.

Glaser, R., & Chi, M.T.H. (1988). Overview. In M.T.H. Chi, R. Glaser, and M.J. Farr (Eds.), *The nature of expertise* (pp. xv-xxviii). Hillsdale, NJ: Lawrence Erlbaum Associates.

Karmiloff-Smith, A. (1984). Children's problem solving. In M.E. Lamb, A.L. Brown, and B. Rogoff (Eds.), *Advances in developmental psychology* (Vol. 3, pp. 39-90). Hillsdale, NJ: Lawrence Erlbaum Associates.

Karmiloff-Smith, A. (1986). Stage/structure versus phase/process in modelling linguistic and cognitive development. In I. Levin (Ed.), *Stage and structure: Reopening the debate* (pp. 164-190). Norwood, NJ: Ablex.

Keil, F.C. (1986). On the structure-dependent nature of stages of cognitive development. In I. Levin (Ed.), *Stage and structure: Reopening the debate* (pp. 144-163). Norwood, NJ: Ablex.

Lesgold, A., Rubinson, H., Feltovich, P., Glaser, R., Klopfer, D., & Wang, Y. (1988). Expertise in a complex skill: Diagnosing x-ray pictures. In M.T.H. Chi, R. Glaser, & M.J. Farr (Eds.), *The nature of expertise* (pp. 311-342). Hillsdale, NJ: Lawrence Erlbaum Associates.

Mayer, R.E. (1983). *Thinking, problem solving, cognition.* New York: W.H. Freeman.

McGuire, W.J. (1961). A multiprocess model for paired-associate learning. *Journal of Experimental Psychology, 62,* 335-347.

Norman, D.A. (1978). Notes toward a theory of complex learning. In A.M. Lesgold, J.W. Pellegrino, S.D. Fokkema, and R. Glaser (Eds.), *Cognitive psychology and instruction* (pp. 39-48). New York: Plenum Press.

Rumelhart, D.E., & Norman, D.A. (1978). Accretion, tuning, and restructuring: Three modes of learning. In J. W. Cotton and R.L. Klatzky (Eds.), *Semantic factors in cognition* (pp. 37-53). Hillsdale, NJ: Lawrence Erlbaum Associates.

Shuell, T.J. (1986a). Cognitive conceptions of learning. *Review of Educational Research, 56,* 411-436.

Shuell, T.J. (1986b). Individual differences: Changing concepts in research and practice. *American Journal of Education, 94,* 356-377.

Shuell, T.J. (1990). Teaching and learning as problem solving. *Theory into Practice, 29,* 102-108.

Spiro, R.J., Coulson, R.L., Feltovich, P.J., & Anderson, D.K. (1988). *Cognitive flexibility theory: Advanced knowledge acquisition in ill-structured domains* (Tech. Rep. No. 5). Springfield, IL: Southern Illinois University School of Medicine, Conceptual Knowledge Research Project.

Sternberg, R.J. (1984). *Mechanisms of cognitive development* (pp. 163-186). New York: W.H. Freeman.

Underwood, B.J., Runquist, W.N., & Schulz, R.W. (1959). Response learning in paired associated lists as a function of intralist similarity. *Journal of Experimental Psychology, 58,* 70-78.

Voss, J.F., Greene, T.R., Post, T.A., & Penner, B.C. (1983). Problem-solving skill in the social sciences. In G.H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 17, pp. 165-213). New York: Academic Press.

Wallas, G. (1926). *The art of thought.* New York: Harcourt Brace Jovanovich.

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A New Direction in the Fight Against Educational Discrimination

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Executive Summary

In the past 20 years, success in school has become an increasingly important determinant of an individual's future economic well being. Thus any type of educational discrimination in the present is economic discrimination for the future. The overriding question concerning children of poverty is whether they can, in spite of all their hardships, succeed in school, achieving at a level commensurate with their more advantaged peers. The answer to this question is a resounding *yes*. In theory, only one demonstration would be needed to prove that success is within reach. In fact, there have been many instances in which children of poverty have performed extremely well (e.g., the work of Jaimie Escalante in California, Marva Collins in Chicago, and Thaddeus Lott in Houston).

The question then becomes that, if success is possible, why in fact are the vast majority of students in programs which lead them to academic failure? There are many reasons. This article focuses on just one reason, a little recognized but powerful form of discrimination in education—the discriminatory use of educational tools, such as textbooks, software, specific teaching practices, etc. The discrimination typically comes in one of two forms. First, educational tools based on current popular trends are mandated for all students, despite the lack of evidence of their effectiveness with children of poverty and strong evidence that suggests the use of these materials is resulting in an unacceptably high failure rate for children of poverty. Second, programs which are not currently popular, but have proven to be effective with children of poverty, are not allowed to be used.

Within the education community, efforts to determine whether educational tools are safe and effective are being abandoned in leading states such as California and Florida. Approaches that have failed in the past are updated and again imposed on children of poverty.

Rhetoric is increasingly being used to justify lower expectations for children of poverty. In subtle and not so subtle ways, too many educators are saying that because of social and cognitive deprivation, children of poverty cannot be expected to succeed in school.

It is time to shift the blame from the children to the schools. Community organizations and child advocacy groups can and must play an important role in combating educational discrimination. Here are some specific actions that can be taken:

(1) Demand that educators emulate the successes that other educators have produced with students of similar background to those students in your community. Go to your school. Tell the administrators, "We want the success that we know is possible." Tell them, "No more excuses."

(2) Demand that school board members focus their attention on student learning. School board involvement in a quality control system based on student learning has the potential to set up structures that will significantly improve student learning and guarantee success for all children.

(3) Support legislation on a national level that will provide educators information on what educational approaches are effective with children of poverty.

Students deserve protection from untried practices and tools. The American public should no longer tolerate the unintended but still discriminatory educational practices suffered by children of poverty.

Discrimination typically comes in one of two forms. First, educational tools based on current popular trends are mandated for all students [and]... second, programs which are not currently popular, but have proven to be effective with children of poverty, are not allowed to be used.

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A New Direction in the Fight Against Educational Discrimination

Education and income are becoming more and more tightly linked. For heads of households under age 25, income (in 1990 dollars) of a high school dropout dropped from $15,188 in 1972 to $9,965 in 1990. In contrast, the college graduate saw a rise from $23,643 to $25,835. Not providing students with effective education now is likely to deprive them of a decent living in the future.

Too many educators are saying that because of social and cognitive deprivation, children of poverty cannot be expected to succeed in school.

During the 1980's, a new form of subtle discrimination has evolved and become a powerful factor in denying children of poverty access to an effective education. This form of discrimination involves education bureaucrats mandating the same teaching tools and methods for all students, in spite of evidence that using the same approaches with all students results in high failure rates for children of poverty. Education bureaucrats claim that educating all students in the same way represents equality. The bureaucrats ignore the high failure rate for children of poverty. Equal access to an education should not simply entail using the same tools with all children; the goal is to use tools that are effective. There are three ways in which educational tools are used in a discriminatory manner:

Use of Educational Tools not Designed for Children of Poverty

Most teaching that takes place in school is organized around certain educational tools—textbooks, activity guides, computer programs, films, etc. These tools are used in a range of settings—lectures, cooperative learning, independent projects, etc. According to one estimate, such tools are used during more than 90% of the 30 billion hours in which America's 40 million students are in school (Komoski, 1992).

For the most part, the same tools are used in schools for advantaged and disadvantaged students. An educational tool developed to be acceptable to upper-middle class parents, the most vocal educational consumers, is claimed to fit the needs of all students, including children of poverty. Various educational critics have referred to this as a "one-size-fits-all" mentality.

An example of the one-size-fits-all mentality can be found in the claims of national curriculum organizations. The National Council of Teachers of Mathematics (NCTM, 1991) states that its progressive teaching method applies to all students. According to this widely distributed document, which is likely to be the prime source influencing math education in the next decade, these are the students who should be taught with the same method:

- "Students who have been denied access in any way to educational opportunities as well as those who have not.
- "Students who are African American, Hispanic, American Indian, and other minorities as well as those who are considered to be a part of the majority.
- "Students who are female as well as those who are male.
- "Students who have not been successful in school and in mathematics as well as those who have been successful" (p. 4).

Is it reasonable to assume that a single method is going to best meet the needs of all the diverse types of students in the U.S.? Many educators seem to think so. For example, in Texas, California, Illinois, and Florida, a survey of a rich school district with high expenditures and a poor school district with low expenditures was conducted. The results showed the programs published by Silver Burdett and Harcourt Brace Jovanovich were the most frequently used, both in rich districts and poor districts.

Mandating use of ineffective tools for children of poverty has not gone unnoticed. The disillusionment felt by Blacks about mandated "progressive"

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methods is captured by Delpit, in her *Harvard Education Review* article (1988, reprinted in *Effective School Practices*, Spring, 1993):

> Several Black teachers have said to me recently that as much as they'd like to believe otherwise, they cannot help but conclude that many of the "progressive" educational strategies imposed by liberals upon Black and poor children could only be based on a desire to ensure that the liberals' children get sole access to the dwindling pool of American jobs. Some have added that the liberal educators believe themselves to be operating with good intentions, but that these good intentions are only conscious delusions about their unconscious true motives (p. 285).

If children of poverty are to succeed in school, teachers need instructional practices and tools designed to meet the needs of those students. Some people might argue that using different tools for children of poverty is discriminatory; certainly it is no less discriminatory than using the same tools with all students and having large numbers of disadvantaged students fail.

An example of the one-size-fits-all mentality can be found in the claims of national curriculum organizations. The National Council of Teachers of Mathematics (1991) states that its progressive teaching method applies to all students.

Educational Use of Tools Not Tested for Effectiveness with Children of Poverty

The tools of professions other than education have been extensively tested—prescription drugs, computer-aided design programs, electronic magnetic imaging machines, and so forth. In contrast, educational tools and practices themselves are almost never systematically tested for effectiveness. Most educational material for the elementary grades is not even written by educators and is not thoroughly field-tested and then revised.

An educational tool developed to be acceptable to upper-middle class parents, the most vocal educational consumers, is claimed to fit the needs of all students, including children of poverty.

At the state level, where responsibility for education lies, efforts to determine the effectiveness of educational tools are losing ground. Two of the largest states, California and Florida, had learner-verification legislation, which required that educational tools be tried out with students and then be revised before they were adopted. California passed its learner-verification legislation in 1976, Florida in 1974. Florida defined learner verification in this way, "...data gathering and analysis by which a publisher of curriculum material has improved the instructional effectiveness of that product before it reaches the market and then continues to gather data from learners in order to improve the quality and reliability of that material during its full market life."

In 1988, the California State Board of Education issued a document spelling out a list of "progressive" techniques mandated for teaching language arts. In making this mandate, the California State Board of Education explicitly refused to comply with the 1976 learner-verification law, stating that the law "... is not to be considered as part of the criteria for recommending materials to the State Board of Education" (California State Department of Education, 1988, p. 15). The "research" for the mandated "best method" for language arts was primarily testimonial rather than empirical research dealing with student learning. A review of scientific research related to this mandated method for teaching beginning reading in first grade found overall no research support for the mandate (Stahl & Miller, 1989). In fact, many of the characteristics of these progressive methods have proved unsuccessful with children of poverty. Yet schools that dared to refuse to comply with the mandate were led to believe they might lose state funding.

For explicitly ignoring the 1976 law and other reasons, a judge ruled that the State Board's procedure allowing untested curricular methods to be adopted was illegal (Long, James L., Judge of the

Superior Court, 1989). In December of 1991, in a 39-page ruling, the California Court of Appeals upheld every aspect of the initial ruling; subsequently the California Supreme Court agreed with the Appeals Court. How did the California Department of Education respond? It gathered the support of the educational establishment and sponsored Senate Bill 1859, which passed on May 14, 1992. The bill essentially voided the Court ruling. Florida has also repealed its learner-verification legislation.

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There are no formal agencies to protect children of poverty from untested tools. Near the beginning of the document prepared by the National Council of Teachers of Mathematics (1989), the authors stated they were protecting the American public from shoddy practices, just as the Food and Drug Administration does. The document included provisions that mandated the methods for instruction. Were these mandates based on scientific research in which the method was tried out with students? This statement from the same document answers that question: It "suggested the establishment of some pilot school mathematics program based on these standards to demonstrate that all students—including women and under-served minorities—can reach a satisfactory level of mathematics achievement" (NCTM, 1989, p. 253). Can you imagine the Food and Drug Administration approving a drug and mentioning that it would be a good idea to try it out at some later time to show how wonderful it is? Yet these recommendations for math education are now being implemented in many school districts across the country.

Were these mandates based on scientific research in which the method was tried out with students? This statement from the same document answers that question: It "suggested the establishment of some pilot school mathematics program based on these standards to demonstrate that all students—including women and under-served minorities—can reach a satisfactory level of mathematics achievement" (NCTM, 1989, p. 253).

Another example of the education establishment's "one-size-fits-all" orientation involves the NCTM's insistence on manipulatives. A videodisc fractions program that the U.S. Department of Education's Program Effectiveness Panel had certified as being exemplary in its effects on students' learning did not feature manipulatives, because it was video-based. A mathematics curriculum specialist working from the NCTM standards responded in this way to a teacher's request to pilot the program: "... No mention is made of hands-on manipulatives which are so important to the mathematics program, in particular to the areas of algebra and ratios ... For the above reasons, it is my opinion that a pilot of this program through the Curriculum Department would not be in keeping with the instructional direction we are undertaking at this time" The fact that it was an effective teaching tool was irrelevant.

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The need for consumer protection is made clear in the Spring '92 issue of the *Social Studies Review*, which describes how educational tools are developed and marketed. The article was prompted by the inaccuracies found in several U.S. history textbooks:

> Social studies textbooks are developed by teams who have little or no experience in the subject, and who are far more agitated by problems of schedule, design, permission, and scope and sequence than of style or narrative. Quality control is missing. Editors roam the country, jangling the tambourines on behalf of their latest product in sales caravans and at educational conferences. The actual writers of textbooks are almost never the stated authors on the spine of the book. Such "names" are usually consultants,

and the actual work is done by anonymous writers, too often of modest talent. . . .

Murray Giles, the editorial director for social studies and health at Glencoe, the high school imprint of Macmillan/McGraw-Hill, blamed time pressures. "We usually have less than two years from the proclamation date to produce a manuscript that routinely runs at least a thousand pages," Giles said in *Publishers Weekly*. "In that time we have to conduct market research, find an author, get the manuscript written and reviewed by experts, do the art work and photo-editing, and finally print the book . . ." (p. 12).

The chronology of the development process, described above by Murray Giles from Glencoe, does not even mention trying out educational tools. The publishers are not solely at fault. Publishers face a marketplace in which the most important attributes seem to be attractiveness and progressiveness. In a recent survey, instructional effectiveness was considered important to the marketplace by only a sixth of the publishers interviewed. Educators do not demand educational tools that have been tested. The textbook adoption process is severely flawed. When the noted physicist, Richard Feynman (1985), served on the California State Board of Education Textbook Commission to select the best math textbooks, one with all blank pages was sent by accident to the commission members. Six of the ten members gave the book a rating of "above average," even though all the pages were blank!

The "one-size-fits-all" mentality is resulting in children of poverty being subjected to educational tools quite similar to those that have been tested and found to be ineffective. Many currently popular progressive approaches are updates of tools that were shown to be ineffective 20 years ago. The Follow Through study, the largest educational experiment ever conducted, added an average of more than 1500 inflation-adjusted dollars every year for every student in every classroom to cover additional teachers, materials, staff development, liaison with parents, and so forth. For a classroom of 25 students in kindergarten through third grade, that's $150,000 in additional support. At the end of third grade, with all the additional money and services, the students in what Delpit calls "progressive" approaches scored worse overall than control students, on both academic and affective measures (Watkins, 1988).

The lack of appropriate and validated tools undermines teachers. The tools that are being given to our front-line soldiers—teachers—are more often than not, ineffective.

The lack of appropriate and validated tools undermines teachers. The tools that are being given to our front-line soldiers—teachers—are more often than not, ineffective. Teachers are the ones failing on the front lines, but making teachers scapegoats is unfair. Teachers and principals often have little to say about the educational tools teachers are required to use. When these tools turn out to be inept or only marginally effective, teachers are blamed—for doing what they were required to do.

The Follow Through study added $150,000 in additional support. At the end of third grade, with all the additional money and services, the students in what Delpit calls "progressive" approaches scored worse overall than control students, on both academic and affective measures.

Excuses to Justify Lower Expectations for Children of Poverty

The education community fosters discrimination against children of poverty by displacing the cause of student failure. The most common explanation for student failure involves blaming the families of poverty. Of course, children of poverty usually have more difficulty in school and many lack support for what they do in school. Nevertheless, states should not imply that poverty justifies school failure, as does California's criterion for effective English-language arts programs, which includes the following description of effective and ineffective home environments.

Table 1. *Effective and Ineffective Features of Home Environments on Language Arts Achievement.*

Effective Feature	Ineffective Feature
A home environment where parent model effective listening, speaking, reading, and writing and offer appropriate help with their children's homework.	A home environment where parents play a passive role as their children are learning the language arts.

The document sets the stage for shifting responsibility for student failure away from the ineffective methods used in school and placing it on the students' home environment.

Educational bureaucrats have always taken credit for their successes and looked for excuses outside the quality of instruction for their failures. When untested innovations fail, the advocates of the innovation displace the responsibility. Recent trends being promoted by educators have the potential to be highly discriminatory against children of poverty. Several of these trends come from questionable interpretations of developmental psychology: (1) delaying academic instruction in favor of non-academic developmentally appropriate activities, (2) eliminating assessments as being incompatible with developmentally appropriate activities, and (3) making reports about students' progress based on developmental expectations.

1. *Delaying academic work in favor of non-academic activities.* A new phase of the "displace the blame for failure" mentality is what educators refer to as "developmentally appropriate practices." The basic theme is that children fail because instruction is presented before the student is developmentally ready. One major recommendation being proposed by "progressive" educators involves delaying formal academic instruction. Delaying academic work until children are 6-1/2 or 7, however, can be highly discriminatory for children of poverty. These children typically have been taught far less by their home environment than their more-advantaged peers. (Although it is possible to view this difference as a difference in the "learning capacity" of the individuals, the only consistent position from the standpoint of instruction—and not "development"—is that for whatever reasons, the environment of the more-advantaged student has been more effective in teaching academically relevant content than the environment of the less-advantaged student.) For the less-advantaged students to catch up, they need a learning environment that effectively compensates for their deficiency in academically related content. If the school's academic environment lacks an effective academic focus, the more-advantaged students are able to compensate through what is learned at home, while the less-advantaged students typically do not have this opportunity. This condition will widen the gap between advantaged children and children of poverty.

If reading is scheduled for a "developmental age" of 6-1/2, many less-advantaged students would not be put in formal reading instruction when they are 6-1/2. They may be 8 before their developmental age is 6-1/2. If academic work is delayed until this time, these students would lose valuable time and have a small chance of achieving world-class standards.

2. *Eliminating assessments needed for accountability.* Another current movement calls for the elimination of achievement tests. Eliminating testing is dangerous. Without performance markers, the school district is provided with no information at all about the performance of children at different levels. To eliminate testing is to permit uncontrolled experimentation with children. There are problems with current standardized tests. Many tests include items that do not test important skills. Many are biased towards more advantaged students. The answer lies in preparing better tests, tests based on standards that are regarded as being both desirable *and* measurable. There are serious academic performance problems. The solution must rely on documentation. The documentation must be timely enough to suggest remedies if students are falling behind.

Several [discriminatory] trends come from questionable interpretations of developmental psychology: (1) delaying academic instruction in favor of non-academic developmentally appropriate activities, (2) eliminating assessments as being incompatible with developmentally appropriate activities, and (3) making reports about students' progress based on developmental expectations.

3. *Reporting results that do not reflect actual student performance.* A third form of excuse-making explains the difficulty of children of poverty in the early grades as a developmental problem that will be alleviated as students mature. Unsubstantiated interpretations of student performance are unacceptable. Early-childhood educators have been known to tell parents that although children are not reading in the second grade, they will catch up by the fourth grade because they are in developmentally appropriate programs. There is no data to suggest that falling behind academically by the second grade predicts anything but highly serious retardation in the later grades. Performance by the end of first grade is a reliable predictor of later achievement (Juel, Griffith, & Gough, 1986; Juel, 1988). In fact, a poor reader at the end of the first grade has about a 90% chance of being a poor reader at the end of fourth grade (Juel, 1988). Poor student

performance at the fourth grade is reflected in poor achievement much later in school (Stanovich, 1986).

Protect the Children

Community groups and child advocacy groups can and must play an important role in combating educational discrimination. Here are some specific actions that can be taken by these organizations.

1. Demand that educators in your community emulate the successes that other educators have produced with students of similar backgrounds. Communicate with educators in your community who make decisions about which instructional programs will be used to teach basic skills in the primary grades. Request that the educators show evidence that the materials they are using or plan to use have a high probability of being tools that will assist teachers in helping all students succeed.

The evidence submitted by the educators should not be the opinion of so-called experts, but should be the performance of students in schools where the program has been used. The proof should be a clear statement showing that educators have made an extensive search of schools similar to theirs and have found the program that has been proven to be the most successful. If research studies are referred to, explanations of the research should be detailed enough so a layman can understand.

The evidence submitted by the educators should not be the opinion of so-called experts, but should be the performance of students in schools where the program has been used.

In education, unlike other professions, there seem to be few functional standards for credible research. When reading about educational research, one must be aware of the following tendencies:

- **Improperly conducted studies.** A research study should be carefully controlled. If two methods are being tested, the students in each group should be comparable in background and skills. The time spent in each program should be kept equal. Both methods should have been implemented in a fair manner. Measurements of student progress should be objective, not subjective. Unfortunately, education journals have varying standards. While some journals are very strict about the quality of the research reported in the journal, others are not. Always ask to see more information about research studies.
- **Faulty conclusions.** When writing a research report, authors will often use global names to describe an instructional technique (e.g., wholistic, activity-based, structured, child-centered, integrated approach, etc.). Unfortunately, there may be a great deal of difference between two programs given the same name. For example, two programs may be called phonics programs. One program may be very structured with the teacher presenting individual sounds and step-by-step teaching of the sounding-out process, while the other program does not teach sounding-out or isolated sounds. Even though the two programs are very different, educators will often make a conclusion about both programs based on research about just one of the programs that is, in fact, significantly different. There are many types of phonics programs. If somebody compared one type of phonics program against a non-phonics program, the conclusion could only tell about that phonics program, not all phonics programs.

We recommend focusing on kindergarten through third grade, because these years are the most important years of a student's educational career. An intensive, carefully designed program during the early years appears to be capable of enabling children of poverty to make significant gains. However, to significantly increase the likelihood that children of poverty will complete high school, intensive and effective instruction must continue at least through grades 6 or 7.

2. Request that educators establish a system to monitor student performance. Nearly every teacher has a story about a problem a student had that wasn't spotted until halfway through the school year and was not remediated until virtually the end of the school year. An unacceptably high number of students are falling through the cracks of our system. Every school should have an instructional management system that assesses student performance at least once every four to six weeks and promptly modifies instruction for any student not progressing at an acceptable rate or for any student who is not performing successfully.

The assessment should be simple. It should be a test of the content taught during the last four to six weeks. Groups of teachers can prepare the tests and set up reasonable criteria for performance.

The system should not be used as a means of "getting" teachers, but should set up a system that guarantees that teachers will receive the assistance needed to ensure that all students are learning at an optimal rate.

Every school should have an

quality assurance system to ensure that all students are learning at a satisfactory level.

4. **Support legislation on a national level.** The industry functions in many ways like a boys" network. Some programs will ıise as being highly effective, but it's rare out any program being criticized as an tool with which to teach children. An ıl version of the Food and Drug Adminis- ıld operate within current budget limits ınly a slight change in the legislation for

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Every school should have an instructional management system that assesses student performance at least once every four to six weeks and promptly modifies instruction for any student not progressing at an acceptable rate or for any student who is not performing successfully.

3. Tell school board members to focus on student learning. School boards function like the board of directors of a corporation. Unfortunately, most school boards do not spend a great deal of time dealing with student performance. School board involvement in a quality-control system based on student learning has the potential to set up structures that will significantly improve student performance.

A quality control system has been instituted by a school board in Michigan. The school district improved student performance significantly within the constraints of a modest funding base. The leadership and policies of the school board were the driving force in creating this highly successful school system.

School board involvement in a quality-control system based on student learning has the potential to set up structures that will significantly improve student performance.

Most school systems have no structure in place to ensure that all students receive a quality education at every step. Systemic change in a school district is very difficult to accomplish without leadership coming from the school board. School boards have traditionally deferred to the superintendent for issues concerning student learning. The widespread dissatisfaction in North America with the levels of student performance indicates that it is time for dramatic shifts in how schools conduct themselves. School boards can and should help ensure that those shifts are responsive to the needs of students and respectful of the talents and commitment of the teachers and administration.

On the school level, parents and community members can seek to focus the parents' organization on student learning, demanding the establishment of a quality assurance system to ensure that all students are learning at a satisfactory level.

4. Support legislation on a national level. The education industry functions in many ways like a "good old boys" network. Some programs will receive praise as being highly effective, but it's rare to hear about any program being criticized as an ineffective tool with which to teach children. An educational version of the Food and Drug Administration could operate within current budget limits and with only a slight change in the legislation for the ten regional educational laboratories sponsored by the federal government. An educational version of the Food and Drug Administration could identify what does not work as well as what does work. Until a mechanism is in place to test the tools upon which the professionalism of most teachers depends, other aspects of reform will fall short.

Systemic change in a school district is very difficult to accomplish without leadership coming from the school board.

An educational version of a Food and Drug Administration could be established as part of the scope of work for the ten regional laboratories. The laboratories would collaborate with school districts to identify popular practices in their early stages and assist in conducting longitudinal research to determine whether the approach works, under what conditions, and so forth. Then the effects of a method could be considered **before** schools mandated its use with millions of students.

Currently, the U.S. Department of Education actively promotes practices deemed effective by its Program Effectiveness Panel. During the 1989-90 school year, the last year for which data are available, inservice meetings on effective programs had an attendance of about 90,000. However, total attendance at public school inservice meetings probably exceeded 6,000,000. In short, for every nine participants at meetings on validated approaches, there are about 591 participants at meetings on approaches of unknown validity. Think back to the Food and Drug Administration (FDA) analogy: 90,000 administrations of a validated treatment is good; 5,910,000 administrations of treatments of unknown effects is inexcusable.

It's important to note that the FDA does far more than validate exemplary practices. It also secures essential information about nonvalidated practices. In education, nonvalidated practices are promoted as if they are exemplary. Educational decision-

makers have no way of knowing about the claims made by these nonvalidated practices. In short, there is no information to educational decision-makers available about what does **not** work, an important responsibility of the FDA. The federal research apparatus is doing little to support evaluations of the major educational approaches that are sweeping the country. Revised legislation for the ten regional educational labs, involving collaboration with districts to longitudinally evaluate emerging practices, would help make accountability feasible.

Until a mechanism is in place to test the tools upon which the professionalism of most teachers depends, other aspects of reform will fall short.

Educational tools not only lack the screening that the FDA requires for medical practices, but also the labeling the FDA requires for food products. Not only does the spotted owl, through environmental impact studies, receive more protection than our students, a grocery shopper can find out more from a label on a box of cereal than an educator can from a set of textbooks that cost millions of dollars to develop and market. "Truth in labeling" for educational tools would require information about their effects and how they should be used to obtain those effects. (Just as insulin's benefits depend on appropriate use, educational tools' benefits also depend on appropriate use). National Education Association (NEA) members of the Center to Improve the Tools of Educators are helping the Oregon Education Association draft legislation that would require "truth in labeling" for educational tools. The Oregon Education Association is also considering working to make this issue part of NEA's national agenda. Advocacy groups might support this type of legislation, particularly when combined with evaluation research conducted by relatively impartial agencies, such as the federally-funded regional educational laboratories.

Conclusion

The U.S. has more lawyers than the rest of the world combined—we fight for what we believe in. Not only do we hire lawyers to help in those fights, we also give millions of dollars to special interest groups. While many special interest groups are self-serving, other groups take on more altruistic goals, for example, the many groups that work to protect the environment.

In education, nonvalidated practices are promoted as if they are exemplary. Educational decision-makers have no way of knowing about the claims made by these nonvalidated practices.

At the heart of these struggles is the desire to make a difference, such as saving endangered species from extinction. Through lobbying efforts and popular support, the law now requires that proposed major environmental activities be analyzed to see what the effect will be on endangered species. These environmental impact studies offer very real and controversial safeguards for animals such as the spotted owl.

While wildlife protection can be controversial, other safeguards are more widely accepted. For example, the Food and Drug Administration has to evaluate the effects of drugs and new medical procedures before they can be made available to the public.

Degrading the minds of thousands of children of poverty is at least as abhorrent as polluting the environment and engaging in quackery in medicine. Children deserve protection from untried practices and tools. The American public should no longer tolerate the unintended but still discriminatory educational practices suffered by children of poverty.

References

California State Department of Education (1988). *California basic instructional materials English-language arts: Recommendations of the Curriculum Development and Supplemental Materials Commission* (available from Bureau of Publications, P.O. Box 271, Sacramento, CA 95802-0271).

Delpit, L. D. (1988). The silenced dialogue: Power and pedagogy in educating other people's children. *Harvard Education Review, 58*, 280-298.

Feynman, R. P. (1985). *Surely you're joking, Mr. Feynman.* NY: W. W. Norton.

Juel, C. (1988, April). *Learning to read and write: A longitudinal study of fifty-four children from first through fourth grade.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans.

Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78*(4), 243-255.

Long, James L., Judge of the Superior Court. Statement of Decision, No. 361906, Dept. 14, in the Superior Court of the State of California, in

and for the County of Sacramento, November 14, 1989.

National Council of Teachers of Mathematics, Commission on Standards for School Mathematics (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics (1991). *Professional standards for teaching mathematics.* Reston: Author.

Stahl, S. A., & Miller, P. D. (1989). Whole language and language experience approach for beginning reading: A quantitative research synthesis. *Review of Educational Research, 59,* 87-116.

Stanovich, K. E. (1986). Matthew's effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360-407.

Watkins, Cathy L. (1988). Project Follow Through: A story of the identification and neglect of effective instruction. *Youth Policy,* Education section, July, pp. 7-11.

Charter Schools Offer Another Choice

Laurel Shaper Walters
Staff Writer for *The Christian Science Monitor*

Reprinted from The Christian Science Monitor, *June 8, 1993 with permission.*

Impatience with the slow pace of school reform is causing states across the country to legislate new options.

"Charter schools" are the latest vehicle for change. Minnesota pioneered the idea in 1991 with a law allowing licensed teachers to operate publicly funded schools under contract or charter with a school board.

In the past two years, five states have passed charter-school laws: California, Colorado, New Mexico, Minnesota, and Georgia. Governor Roy Romer (D) of Colorado signed charter-school legislation. And more than a dozen states have introduced charter bills in the past year. Those states are: Alaska, Oregon, Idaho, Wyoming, Arizona, Michigan, Wisconsin, Pennsylvania, New Jersey, Connecticut, Massachusetts, Vermont, Tennessee, Louisiana, and Florida.

Charter schools are given wide latitude as long as their students meet performance goals established in the contract. "Their continuation depends on their students' performance," says Ted Kolderie of the Center for Policy Studies in St. Paul, Minnesota.

Under the Minnesota law, charter schools cannot screen students, charge tuition, discriminate, or have a religious affiliation, but all other state regulations are waived. If students fail to meet performance goals outlined in the contract, the school's charter can be revoked.

State and local aid follows students if they leave a regular public school and enroll at a charter school.

Although most school boards and teachers unions are opposed to charter schools, President Clinton and Education Secretary Richard Riley have endorsed the concept. A bill that would provide start-up aid to charter schools is pending in Congress.

The specifics differ from state to state, but the common goals are to foster innovation, increase student options, free teachers and schools from regulation, and introduce more accountability into the public-school system.

The charter concept expands the idea of public-school choice but does not go as far as vouchers, which would allow parents to use taxpayer dollars to send their children to any public or private school.

"I view charter schools as a way to reform the whole system," says Governor Romer. "Quite often the institutional form is so rigid that we need to break that form in order to have the opportunity to try some things differently."

Romer considers the new legislation in Colorado to be a research-and-development project. "It's a controlled experiment," he says. "And that's very much needed."

Charter-school laws could lead to a redefinition of public education, some experts say.

"The idea that the state will say it's OK for more than one public organization to be offering public education in the same community has big implications," Kolderie says. "People don't know where that's going to lead, but it could create a lot of dynamics in the system."

Minnesota's experience is already offering lessons. The state has approved eight charter schools since 1991. Two schools are already open; the other six expect to begin classes in the fall.

Charter schools are given wide latitude as long as their students meet performance goals established in the contract.

Most of the charter schools approved so far target students who are not being served well by the current system. A school for deaf students will open next fall, for example.

The first charter school in the nation—City Academy in St. Paul, Minn.—opened last fall and held graduation ceremonies for 16 students last week. The school operates year-round and enrolls students who have dropped out of traditional high schools.

Milo Cutter, one of the teachers who founded the school, saw the need for a small program that could tailor coursework to the needs of individual students.

"When the legislation for charter schools came out," Ms. Cutter says, "it seemed to suit exactly what we wanted to do."

"City Academy works primarily with kids who were not attending school," says Peggy Hunter, who administers the charter-school program for Minnesota's Department of Education. "They are certainly showing some success in being able to both draw these kids back off the streets and getting them to graduate."

Under the Minnesota law, charter schools cannot screen students, charge tuition, discriminate, or have a religious affiliation, but all other state regulations are waived. If students fail to meet performance goals outlined in the contract, the school's charter can be revoked.

A more controversial charter went to Bluffview Montessori School in Winona, Minnesota. It was operating as a private school before applying for a charter last year.

Critics say the school simply wanted to solve its financial problems, but a school board approved the charter. Bluffview became a charter school in March and a handful of new students left public schools to attend. Next year, Bluffview's enrollment is expected to double.

At this point, charter schools in Minnesota are expanding the current system rather than competing with it.

"What we're seeing so far is that school boards would rather not bring in new and innovative programs," Kolderie says. "Proposed schools that would take mainline, regular kids are the ones that seem to get the maximum resistance from boards and superintendents."

Joan Riedl has experienced that resistance. As a teacher at North Elementary School in Princeton, Minnesota, Ms. Riedl has structured her class to offer small-group learning and an increased emphasis on technology.

"When I heard about the charter schools, it made sense to me," she says. So Riedl proposed a new school based on the ideas she is already using successfully at North Elementary.

But the school board wouldn't approve the proposal. "What we heard so much was: 'We don't have enough information; we can't make a decision,'" Riedl says.

"They were blocking her, as districts often do," says Ms. Hunter of the state education department. "It's those kinds of blocks that really hamper creative teachers from being able to do something new and innovative."

The debate about charter schools has raised "some very important questions about the role of the school board and who it represents," Kolderie says.

Thomas Shannon, executive director of the National School Boards Association in Alexandria, Virginia, says the association is not opposed to charter schools.

"But once government gives a right," he says, "it's very difficult to take it away. School boards are much better advised to be very tough on the front end. In the final analysis, it's all going to be back in their lap if the charter school doesn't work."

In the midst of the debate, some school districts in Minnesota are making changes without actually chartering schools.

"What we're finding is that the charter-school proposals are a catalyst for getting districts to start paying attention and listening to what the learners are needing and the parents are requesting," Hunter says.

In one case, a group of parents requested a Montessori alternative school for the district but were turned down several years in a row. So they worked up a charter-school proposal and took it to the local school board.

"The board was about to approve it when the administration decided to have another look at the situation," Hunter says.

Within two weeks, the district administrators created a district-run Montessori option. "When push comes to shove, there are ways in which it can be accomplished," Hunter says.

Several weeks ago, Minnesota passed new legislation that allows applicants whose proposals are denied by a local board to appeal the decision to the state board of education.

"That may force local school boards to respond a little differently than they did before," Hunter says.

It's too early to determine the effect of charter schools on the public-school system in Minnesota, but the debate is focusing attention on parents' concerns and interests.

"It's caused a policy debate that's way out of proportion at this point to the number of kids and the number of schools involved," Kolderie says. "People clearly feel there is something much bigger at stake."

Appraising Reforms: Working for Better Tools for Better Teaching

Douglas Carnine
National Center to Improve the Tools of Educators

Teachers know that the right tool or technique at the right time can make the difference between "feel good" innovation and true reform which yields higher student achievement.

A 1990 National Teacher Survey by the Carnegie Foundation for the Advancement of Teaching found that more than two-thirds of the nation's teachers said that improved instructional materials and supplies were essential for improving the quality of education in the United States. They rated quality materials as more valuable than career ladders, mentor teachers, and merit pay programs. In fact, studies have shown these materials (books, software, manipulatives) consume only 1.5 percent of the school's budget yet influence around 75 to 90 percent of what goes on in the classroom. Anyone who has seen a battered textbook at the end of the school year knows the use students received from it.

However, at present there is no system for evaluating the performance of these materials. Schools searching for solutions must buy and use the book, pay for training the teacher in a technique, and only after years of use can they evaluate its effectiveness.

No business would consider making a major purchase without evaluating the benefits. Yet schools adopt new initiatives without knowing their specific effects. Promoters of reform often promise radical change, but all change is not necessarily an improvement. Innovations that make broad claims without research to support their goals actually hurt accountability. When schools do not know exactly what the innovation was supposed to do, they cannot evaluate its effectiveness. Educational fads recirculate, under new names, as schools try to show their diligence in finding a solution to educational problems. As a result, schools and teachers are overwhelmed by often meaningless changes.

The solution is not a new approach or a new reform, but a new way at looking at all innovation: Appraising reforms before they are used to influence children. The appraisal process would focus on the classroom level to determine the connection between a given innovation and improved learning. The appraisal process asks about these components of a reform:

- a clear definition of its approach and expected outcomes;
- research to substantiate its claims;
- a focus on the classroom and student learning;
- an accountability system and back-up plan;
- a sustainable approach with realistic demands;
- equitable methods that meet the different needs of diverse learners;
- a reasonable cost.

The National Center to Improve the Tools of Educators believes that an appraisal process will enable educators to find the best ways to increase student learning. An appraisal process can empower teachers to succeed and protect them from trying ineffective approaches. The process reduces the cost of reform while encouraging more schools to try reforms since they will know the specific benefits of the change in advance of its execution.

Such a process enables educators to focus on student achievement rather than the mechanisms of each new innovation. They are able to distinguish between innovations that require further testing before being used on a large scale from reforms that have already been tested and found effective.

An appraisal process also helps professionalize education, since most professions have ways to measure the results of changes. It helps teachers who are becoming bewildered with the huge number of suggested innovations. Most of all it helps students, particularly diverse learners, through quality-assured tools and proven ways of teaching.

While the benefits of an appraisal process are numerous, it is far from simple. The challenge is not simply adopting an appraisal process but helping create the conditions that make such a process viable. For example, the limitations of educational research constrain the appraisal process. Relatively little longitudinal research is conducted on educational tools and approaches. While efforts are made to solve this and other shortcomings in educational research, educators can only be honest with themselves and the public about the basis for innovations that are promoted. This does not mean that innovations should be stifled, but rather that we are careful to evaluate what is happening to children as a consequence of the innovation. Similarly, the appraisal process does not prescribe what a teacher can and cannot do. The process is a way of systematically

organizing information to support the art of teaching. Clearly, the appraisal process has as many implications for teachers and other educational leaders as it does for teachers. But genuine reform can come only through a genuine partnership between educational leaders and teachers. Recognizing the need for and obstacles to an appraisal process is an excellent starting point for such a partnership.

The National Center to Improve the Tools of Educators' mission is to work with individuals and organizations on creating the context for an appraisal system by working with teachers, researchers, policymakers, and interested non-educators. For more information, write:

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Using the Scientific Method in a Japanese Elementary Classroom

Yuji Anjo
Mizumoto Elementary School, Tokyo, Japan

EDITOR'S COMMENT: We commend our Japanese colleague for his conscientious implementation of data-based procedures in the classroom. He observed a problem, hypothesized a solution to the problem, tried the solution, and used concrete data to evaluate the effect of that solution. Using these procedures, this beginning teacher can only grow in his understanding of the effect of specific teaching variables on behavior and learning. Mr. Anjo has expressed an interest in studying Direct Instruction at the University of Oregon. He may eventually become one of those needed persons he describes, who can teach others in Japan about effective teaching practices.

ABSTRACT: *The effect of using the scientific method to modify mathematics instruction was evaluated in a Japanese elementary classroom. Forty-one children participated in the study. Their on-task behavior and the test scores were recorded. Experimental conditions added components of the Direct Instruction Model. The A condition included teaching strategies with rules and guided practice but without independent practice. In the B condition, a daily mastery test (independent practice) and reinforcement for attending behaviors were added to the A condition. In the C condition, reinforcement for on-task behavior during seatwork was added. The results suggest that the Direct Instruction Model with reinforcement for attending to the teacher and on-task behavior during seatwork improved test scores and brought on-task behavior to a high level. A more desirable experimental design for this study and the dissemination of effective teaching methods were discussed.*

I came to Mizumoto elementary school in Japan on January 8th in 1991. At that time, children in my classroom were silent during my lessons and I thought that they were listening carefully to my instruction. But, when I asked the children some questions, they often did not answer, or answered incorrectly. I became aware that many of them looked down while I instructed and I realized they might not be listening to my instruction. Thus, off-task behavior might explain their poor academic achievement.

Teaching strategies which have enhanced academic achievement to a very high level are incorporated in the Direct Instruction Model (Gersten, Carnine, & White, 1984; Rosenshine 1985). Direct Instruction has been studied by staff of the University of Oregon and Rosenshine in University of Illinois and found to result in greatly improved academic achievement in elementary school.

The purpose of this study was to investigate effects of the Direct Instruction Model on the mathematics academic achievement of Japanese elementary school children.

Method

Subjects

Forty-one children (twenty-one boys and twenty girls) in fifth grade (ages 10 or 11) of a public elementary school, Tokyo, Japan, served as subjects.

Teacher

The author served as teacher. The author (age 24) had worked at the school as a classroom teacher from January to March, 1991. He had had only about four months teaching experience in elementary school at the time of the study.

Setting

This study was conducted during math instruction. A camera was set up in the corner of the room. Data was recorded for nine students who were visible in the camera. The term of this study was about one month from February 8th to March 6th in 1991.

Procedures and Design

Three units of math were taught: Unit 1, 'Circle'; Unit 2, 'Letter (e.g., X or Y) and Formula'; and Unit 3, 'Rate and Graph'. Number of lessons in Unit 1 included fifteen lessons; Unit 2, nine; and Unit 3, thirteen. Each lesson was about 42 minutes in length.

The lessons included a review lesson and a summative test lesson at the end of each unit. The review lesson consisted of independent practice. The summative test lesson evaluated student mastery of each unit.

Unit 1 (Circle): Direct Instruction Model without independent practice. In the first unit, independent practice was not included, either because the teacher was unskillful, or found it impossible to include in the 45 minute lesson.

(1) *Daily review of a last lesson.* At the beginning of each lesson, the teacher reviewed the last lesson. At this time, children were asked to look at the teacher.

(2) *Posting performance objectives for the lesson.* After review, the teacher posted the objectives of the current lesson on the front chalkboard. Goals of the lesson in traditional schools are often indefinitely stated, such as "Understand a way of calculation" or "See a hero's feeling." But in this study, the lesson objectives defined expected performance behavior, such as "Draw a regular polygon using a circle," "Solve one of the problems on page XX," or "Express rate as a fraction, a decimal and a percentage."
(3) *Teaching strategies and rules.* The teacher taught strategies for solving problems. Students were again asked to pay attention.
(4) *Guided Practice.* The teacher then presented problems for the children to solve. While the children worked, the teacher walked around the classroom and checked their answers. If their answers were correct, the teacher wrote reinforcing comments on the paper. If they were incorrect, the teacher gave assistance.

Unit 2 (Letter and Formula): Direct Instruction Model with reinforcement for attending to the teacher. In the first unit, the children's on-task behavior had decreased gradually (no data on that). Therefore, in Unit 2, the following procedures were added to those described in Unit 1: (1) *Reinforcement for attending to the teacher.* Six or seven children were assigned to a team. Whenever the teacher judged that children were noisy or were not attending to him, he said, "Look ahead!" and reinforced teams that were attending to the teacher by pasting a reinforcing symbol beside the team's name on the front chalkboard. (2) *Daily mastery test (Independent practice).* A daily mastery test was used to assess whether each child had achieved the lesson objective. The mastery test represents the independent practice of the Direct Instruction Model, and included from 2 to 10 problems.

Unit 3 (Rate and Graph): Direct Instruction Model with reinforcement for on-task behavior during seatwork. The teacher found it difficult to reinforce on-task behavior during seatwork in Unit 2. Therefore, in Unit 3, the same procedures used in Unit 2 were continued with the addition of one more procedure: *Reinforcement for on-task behavior during seatwork.* After the daily mastery test, the teacher awarded three reinforcing symbols to teams who had maintained on-task behaviors throughout the lesson. Table 1 summarizes the reinforcement procedures in Unit 2 and Unit 3.

Measurement

Children's on-task behavior during the lessons, and percent correct on the daily mastery and summative unit tests were assessed. Children's behavior during Units 2 and 3 were videotaped. Because many of the children could not be clearly seen, on-task behavior was calculated for only nine children. On-task behavior was measured by internal time sampling every 20 seconds. Interobserver reliability was calculated for about 24% of the lessons. Reliability was calculated by dividing the the total number of observations by the number of agreements and multiplying by 100. Agreement on the occurrence of on-task behavior was 97% (range 91% to 99%), and on non-occurence, 80% (range 46% to 94%).

Results

The mean test score for the whole class was 60% in Unit 1. In Unit 2, the mean test score increased to 91% (range 87-98). In Unit 3, the mean test score was maintained at 89% (range 74-97).

Table 1. *Reinforcement Procedures in Units 2 and 3.*

	Reinforcement Procedures		Reinforcement Procedures	
PROCEDURE	**BEHAVIOR**	**REINFORCER**	**BEHAVIOR**	**REINFORCER**
Review	Attending	A piece of seal for attending.	Attending	A piece of seal for attending.
Posting goals				
Teaching strategies				
Guided practice	Problem-solving mainly	None	Problem-solving mainly	None
Achievement test				
Reinforcement of on-task behavior	Not applied		Attending	Three pieces of seal for on-task behavior (including attending and problem-solving

Discussion

In Unit 1, the Direct Instruction Model without independent practice produced mean score of 60% on the unit test. In Unit 2, test scores of all children from C1 to C9 and the whole class increased dramatically with the addition of independent practice (daily mastery tests) and reinforcement. And in Unit 3, their test scores for the most part maintained with the addition of reinforcement during seatwork. The on-task behavior of all children reached a high level in Unit 2 that was maintained in Unit 3.

Parents comments were also more favorable after I introduced Direct Instruction. I heard such comments as, "My child was changed. He (She) studies at home every night," "When my child caught a cold, I said she would have to miss school. But she replied 'I shall go to school. If I do not, I cannot understand the lessons,' " or "My child became more active and kinder." Obviously these changes were produced by the changes in the operating environment in the classroom.

Was the improvement in test scores and high level of on-task behavior in Units 2 and 3 due to the experimental variables? The placement of the camera in the room may have affected the students' behavior. Each experimental condition in Unit 1, 2, and 3 was varied, but the contents of each unit were also varied. To find the effect of each experimental variable, the change in experimental condition should be introduced in the same unit. Different treatments could also be assigned to different classrooms or children.

In Unit 1 independent practice, a component of the Direct Instruction Model, was not included and the teacher felt the children's off-task behavior was increasing. Therefore, in Unit 2 reinforcement for on-task behaviors was introduced. However, another teaching variable might also be important to evaluate. Carnine (1976) indicated that a faster presentation pace might decrease off-task behavior and increase correct answering and participation. In this study, the teacher's slow presentation might have caused the initial lack of time for independent practice and the failure to reinforce on-task behavior.

Who, in Japan, will train teachers in effective teaching methods like Direct Instruction and Behavior Analysis? Only a few university teachers or educators understand them. I think that disseminating knowledge about effective teaching methods to education is one of the biggest needs for the happiness of human beings. I suppose a rough task analysis of that dissemination would be (1) to understand Direct Instruction and Behavior Analysis, (2) to investigate the effects in all subject areas (language, math, science, social studies, art, music, physical education and so on), (3) to establish methods for teaching them, and (4) to set up environments that maintain effective teaching methods.

References

Carnine, D.W. (1976). Effects of two teacher-presentation rates on off-task behaviors, answering correctly, and participation. *Journal of Applied Behavior Analysis, 9,* 199-206.

Gersten, R., Carnine, D.W., & White, W.A. (1984). The pursuit of clarity: Direct Instruction and applied behavior analysis. In L.W. Hewerd, T.E. Heron, D.S. Hills, & Trap-Porter (Eds.), *Focus on behavior analysis in education* (pp. 38-57). Merrill.

Rosenshine, B.V. (1985). Direct Instruction. In N.L. Gage (Ed.) *The psychology of teaching method.* Chicago: University of Chicago Press.

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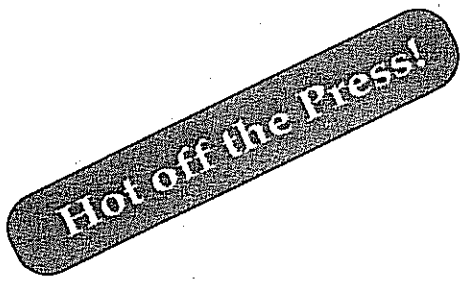

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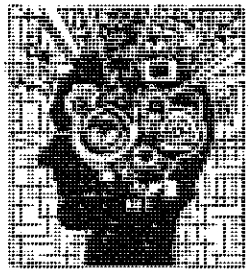

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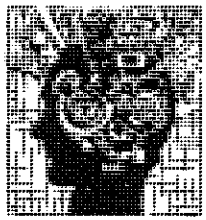

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