Review of Educational Research
Summer 1996, Vol. 66, No. 2, pp. 99–136

Effects of Learning Skills Interventions on Student Learning: A Meta-Analysis

John Hattie
University of North Carolina at Greensboro
John Biggs
University of Hong Kong
Nola Purdie
Queensland University of Technology

The aim of this review is to identify features of study skills interventions that are likely to lead to success. Via a meta-analysis we examine 51 studies in which interventions aimed to enhance student learning by improving student use of either one or a combination of learning or study skills. Such interventions typically focused on task-related skills, self-management of learning, or affective components such as motivation and self-concept. Using the SOLO model (Biggs & Collis, 1982), we categorized the interventions (a) into four hierarchical levels of structural complexity and (b) as either near or far in terms of transfer. The results support the notion of situated cognition, whereby it is recommended that training other than for simple mnemonic performance should be in context, use tasks within the same domain as the target content, and promote a high degree of learner activity and metacognitive awareness.

The present article reviews studies of attempts to improve student learning by interventions outside the normal teaching context. Generically, these can be called *study skills interventions,* although this term has had varied usage to cover a multitude of disparate programs. For present purposes, a normal teaching context is one in which teaching is principally focused on the content to be taught and learned, although secondary aims may be to focus on procedural skills or other cognitive, metacognitive, and affective attributes of the learner. An innovation or other departure from normal teaching becomes an intervention in the sense intended in this review when it (a) is outside what the teacher(s) involved in the study intended to do in the course of teaching; (b) requires, therefore, an outside person (e.g., the experimenter) to design and evaluate the intervention; (c) involves a formal experimental design that includes provision for evaluating the effects of the intervention; and (d) focuses on independent variables that aim to increase various kinds of performances, usually including academic performance but going beyond content learning itself.

These interventions have aimed at enhancing motivation, mnemonic skills, self-regulation, study-related skills such as time management, and even general ability

The research was facilitated by a grant from the Australian Research Grants. Correspondence concerning this article should be addressed to the first author.

itself; creating positive attitudes toward both content and context; and minimizing learning pathologies. Some of these variables are both mediating and true dependent variables; for example, study skill enhancement may be an end in itself or a subgoal whereby enhanced performance is the ultimate criterion by which the success of the intervention is to be judged and the enhancement of study skills is the means by which performance itself is enhanced. A general explanation for these programs is that they are interventions for enhancing learning.

Interventions may broadly be classified as cognitive, metacognitive, and affective in nature. *Cognitive interventions* are those that focus on developing or enhancing particular task-related skills, such as underlining, note taking, and summarizing. Specific skills taught directively are seen as *tactics,* which can be grouped and used purposefully as a *strategy* (Snowman, 1984). Derry and Murphy (1986) described these strategies as "the collection of mental tactics employed by an individual in a particular learning situation to facilitate acquisition of knowledge or skill" (p. 2). *Metacognitive interventions* are those that focus on the self-management of learning, that is, on planning, implementing, and monitoring one's learning efforts, and on the conditional knowledge of when, where, why, and how to use particular tactics and strategies in their appropriate contexts. *Affective interventions* are those that focus on such noncognitive aspects of learning as motivation and self-concept. Attributions for success and failure were regarded here as affective.

Intervention programs may comprise any one or more of these kinds of targets. In fact, whereas in earlier interventions the thrust was in teaching cognitive skills and strategies directly, in recent years the emphasis has shifted to embedding the application of such skills in specific contexts, as is explained in the review below. The aim of this review is to identify features of study skills interventions that are likely to lead to success. Via a meta-analysis, we survey the more recent intervention studies so as to assess the relative effect sizes of different kinds and conditions of intervention and, more generally, to see the extent to which the various theoretical stances may be supported.

Literature Review

There has been an enormous amount of research on study skills. In the ERIC database we located 1,415 separate journal articles, published between 1982 and 1992, reporting research on various aspects of study skills (although only a fraction of that number appear in the present study, for reasons expressed below). There have been reviews of some of this literature (e.g., Hartley, 1986; Pintrich & de Groot, 1990; Tabberer, 1984) and six meta-analyses of particular kinds of interventions. We could find no meta-analyses, however, which attempted to identify the features of a study skills intervention that are likely to lead to its success.

The Nature of the Intervention

The direct teaching of detached study skills has a long history; yet, as relatively late as 1968, Haslam and Brown reported that "published research on the productivity of study skills instruction for high school students appears to be almost nonexistent" (p. 223). In any event, this early work did not consider theory-driven questions like the following: Why should some interventions appear to work while others appear not to? Under what conditions do interventions work best, if they work at all? In more recent years, the discussion has turned to study skills in relation to such factors as learning strategy training, motivation, self-efficacy, self-regulation, transfer, and the context of intervention (A. L. Brown, Bransford, Ferrara, & Campione, 1983; Derry & Murphy, 1986; Garner, 1990; McCombs, 1984; Perkins & Salomon, 1989).

Generally, there seems to be a current consensus that direct teaching of general, all-purpose study skills is not effective (e.g. Garner, 1990; McCombs, 1984; Pintrich & de Groot, 1990; Tabberer, 1984), although Hartley (1986) claimed that at least with tertiary students there were small but consistently positive gains. Kulik, Kulik, and Shwalb (1983) in a meta-analysis of low-ability college students obtained a small average effect size of 0.29. When researchers concentrate on a single aspect of studying, results seem to improve. Henk and Stahl (1985) meta-analyzed 14 studies of note taking and found a slightly larger average effect size of 0.34. In a study of reading and study skills, Sanders (1980) reported a much more impressive effect size of 0.94. This focus on more specific aspects of study skills foreshadows the current position, which states that if strategy training is carried out in a metacognitive, self-regulative context, in connection with specific content rather than generalized skills, and if such training is supported by the teaching context itself, positive results are much more likely (A. L. Brown et al., 1983; Derry & Murphy, 1986; Garner, 1990; McCombs, 1984). Even then, training and test tasks need to be closely related; the further the test task from the training task, the more difficult it becomes to find transfer effects (Perkins & Salomon, 1989).

Kirschenbaum and Perri (1982), reviewing studies conducted with adult participants and published in the period 1974–1978, found 35 studies in which the interventions comprised programs based on applied behavioral analysis, general counseling, self-control techniques, and study skills, either as single-component programs or in multiple-component programs involving certain combinations of these approaches, such as self-control and study skills training. Dependent variables were some aspect of performance, either grade point average or individual subject grades, and sometimes anxiety and/or attitude. Kirschenbaum and Perri found that the proportion of successful to unsuccessful interventions was higher on the affective dependent measures (over 50% were effective) than on performance (33% were effective). As far as performance was concerned, single-component interventions were rather less successful than multiple-component interventions; interventions incorporating study skills, with either behavioral or self-control elements, were most effective. Behavioral interventions on their own were most effective in reducing anxiety. There was some disagreement over the optimum length of a program, but some effective ones were as short as 3 or 8 hours in duration.

The effectiveness of multiple-component over single-component interventions, Kirschenbaum and Perri (1982) argued, was caused by "credibility," or the subjects' expectancy for change, which could be another way of describing a Hawthorn effect. The overall pattern, however, is conceptualized in terms of a three-component model. *Motivation* is enhanced by perceived control and efficacy expectations, which in turn provide the impetus for *study skills development*, while both are supported by *self-regulatory skills development*.

The underlying metacognitive component of self-regulation in some form or another is evident in other reviews (behavioral approaches appear not to be represented in the more recent literature). McCombs (1984), in her review, focused on relationships between metacognitive components, perceptions of personal control that contributed to continuing motivation, and skills training interventions. She defined *skills training* in a very broad sense, however, as anything that may generate processes conducive to learning and that may become subject to intervention. Intervention steps include cognitive and metacognitive strategy training, and within the affective system she includes targets related to eliminating negative and creating positive self-views and making students aware of inappropriate self-cognitions. McCombs's "motivational skills training" program is designed to focus on affective and process variables as outcomes rather than on performance per se; consequently, it is difficult to judge how effective the program is in enhancing learning in the conventional, institutional sense.

Derry and Murphy (1986) explicitly take Bloom's (1984) "2 sigma" criterion; that is, to design whole-class interventions that would meet the level of achievement—two standard deviations above the norm—possible under the ideal instructional condition of one-to-one tutoring. They again use a strong top-down approach, developing a model of intervention from the theories of Gagne (1980), Sternberg (1983), and metacognitive theorists such as Flavell (1979) and A. L. Brown (1978) together with a review of intervention studies. They develop a taxonomy of intervention targets ranging from microcomponents or tactics, which are easily trainable, to executive components, which appear to develop only with much in situ practice in contexts and curricula that evoke and support them. The last position finds elaborated support from Perkins and Salomon (1989), who referred to the "low" and "high" roads to transfer—the former based precisely on specificity and long practice, and the latter on the deliberate and mindful abstraction of principles, and the search for analogies, that might link specific situations with each other.

Haller, Child, and Walberg (1988) meta-analyzed 20 studies of metacognitive intervention in reading skills and found an average effect size of 0.71, which is impressive. Nevertheless, the success of such interventions is not universal, which prompted Garner (1990) to ask why people do not use learning strategies they have been taught to use. She concluded that training tends to remain situated; only exceptionally will students use strategies in contexts other than those in which they are taught. Pintrich and de Groot (1990) emphasized the motivational roots of transfer; students need the "will" as well as the "skill" in learning if they are to continue to use the strategies they have been taught.

Thinking today has come a long way from the simple instruction in "study skills," and there is something of a theoretical consensus about the nature of interventions that might enhance learning. First, the target of intervention is not simply a tactic or microcomponent such as a particular study skill or set of study skills, as would have been the case 30 or 40 years ago, but rather a range of cognitive and metacognitive procedures. The catch is that the more general and more abstract these procedures, the harder it is to achieve measurable results of intervention (Derry & Murphy, 1986; Perkins & Salomon, 1989). Second, the matter is not only cognitive but also affective, involving motivation both as a precursor to effective strategy use (Biggs, 1987; Kirschenbaum & Perri, 1982;

Pintrich & de Groot, 1990) and as a continuing support to the complex of learning-related beliefs and procedures (McCombs, 1984). Third, the teaching context should evoke, support, and maintain the components being targeted by intervention (Biggs, 1993; Derry & Murphy, 1986; Garner, 1990).

Collectively, then, there are several suggested conditions for successful strategy training: (a) high and appropriate motivation, including self-efficacy and appropriate attributions (such as attributing failures to a lack of effort, and setting realistic and attainable goals); (b) the strategic and contextual knowledge for doing the task; and (c) a teaching-learning context that supports and reinforces the strategies being taught.

At the present time, however, attempts at modeling intervention programs for enhanced learning lack broadly based supportive data. Not to put too fine a point on it, theory may have leapt ahead of the evidence. But even within the consensus referred to here, the relative effectiveness of a variety of programs and thrusts needs evaluating for both theoretical and practical reasons.

Classifying the Interventions

A typical way of classifying interventions is on the basis of their supporting theories, but too often such theories are either ambiguous or not mutually exclusive. For example, as already noted, there are many variations on the metacognitive theme, and most theories of intervention now refer to a metacognitive basis. These variations involve self-regulation in some form or another, although some interventions in the recent literature are eclectic or atheoretical.

An examination of the thrust or purpose of an intervention is a fruitful way to identify what parameters that particular intervention aims to change: performance, attributions, self-concept, motivation, attitudes, study skills, and so on. These are examined in the present study. Of course, like supporting theories, they are not mutually exclusive, as many interventions are aimed at changing several dependent variables simultaneously.

It would be desirable to classify interventions in mutually exclusive terms that relate to the nature of each such intervention. In other words, we would like to classify interventions in terms of their independent variables rather than in terms of their effects on dependent variables. Such a classification might refer to the structural complexity of interventions and whether they are intended to achieve near or far transfer. The so-called SOLO taxonomy (Biggs & Collis, 1982), described in the following section, has been used to order the structure of responses. Because this taxonomy is based on structural complexity, it may readily be adapted to suit the present case.

The SOLO Taxonomy: A Hierarchical Model of Learning Outcomes

Biggs and Collis (1982) started from a study of learning outcomes in (mainly) high school content domains and found that students learn quite diverse material in stages of ascending structural complexity that display a similar sequence across tasks. This led to the formulation of the SOLO taxonomy, where "SOLO" is an acronym for "structure of the observed learning outcome." This taxonomy makes it possible, in the course of a student's learning a subject, to identify in broad terms the stage at which the student is currently operating.

The following stages occur.

- The student engages in preliminary preparation, but the task itself is not attacked in an appropriate way (*prestructural*).
- One (*unistructural*) and then several (*multistructural*) aspects of the task are picked up serially, but are not interrelated.
- Several aspects are integrated into a coherent whole (*relational*).
- That coherent whole is generalized to a higher level of abstraction (*extended abstract*).

The SOLO model is readily generalizable, and we use it here to provide a convenient and exclusive system for classifying interventions intended to enhance learning, as is explained and illustrated below.

The present classification begins with the unistructural and not the prestructural stage, as the latter by definition refers to an intervention already expected to be unsatisfactory. An example might be an intervention based on an unacceptable and undeveloped theory base, such as learning in the presence of "good luck" tokens (which may be an interesting question but is not one in which we are interested here).

(1) *Unistructural.* A unistructural intervention is based on one relevant feature or dimension. An example might be an intervention focused on a single point of change, such as coaching on one algorithm, training in underlining, using a mnemonic, or anxiety reduction. The target parameter may be an individual characteristic or a skill or technique. The essential feature is that it alone is the focus, independently of the context or its adaptation to or modification by content.

A typical example of a unistructural intervention is that reported by Scruggs and Mastropieri (1986a), in which a trained experimenter taught students to use a mnemonic strategy for learning information that is not immediately meaningful and which has an abstract, numerical component. In this instance, the material to be learned was the hardness index, from 1 to 10, for each of eight minerals. The content to be learned, however, could just as easily have been drawn from any subject area. There were three experimental conditions involving use of mediating keywords based on imagining pictures linking the numbers indicating hardness (e.g., "one is a bun") with codings of the minerals (e.g., "actor" for the mineral actinolite) in high-, medium-, and low-structure conditions (ranging from supplied to self-generated keywords and pictures), and a control condition. Here the experimental conditions were procedurally simple and direct, involving essentially one technique (mnemonic) aimed at accurate recall.

(2) *Multistructural.* A multistructural intervention involves a range of independent strategies or procedures, but without any integration or orchestration as to individual differences or demands of content or context. Examples include typical study skills packages taught directively, without a metacognitive or conditional framework. An example is provided by Haslam and Brown (1968), who taught the Brown-Holzman *Effective Study Skills Course: High School Level* to high school sophomores in twenty 55-minute class periods. The course involved better time utilization, reading and writing techniques, techniques for preparing for and taking examinations, realistic goal setting, student-to-student tips, and the like. In short, it was a typical study skills course. A basic assumption is that all the "study habits" are detachable, teachable, and usable across the board in many school subjects, resulting in greater increases in grade point average than would be found in a control group. Instrumentation included manuals and workbooks developed

by Brown and Holzman over several years prior to the study in question. It is considered multistructural because it comprises a range of skills taught directively.

(3) *Relational.* All the components in a relational intervention are integrated to suit the individual's self-assessment, are orchestrated to the demands of the particular task and context, and are self-regulated with discretion. Metacognitive interventions, emphasizing self-monitoring and self-regulation, would fit into this category, as would many attribution retraining studies. For example, in Relich, Debus, and Walker's (1986) study, a group of sixth graders identified as "learned helpless" and deficient in arithmetic skills were given attribution retraining followed by manipulated success rates in division exercises, so that the beliefs about success and failure set up by the retraining were directly reinforced by the manipulated performances.

(4) *Extended abstract.* In an extended abstract intervention, the integration achieved in the previous category is generalized to a new domain. Interventions with this thrust would be those aiming for far transfer. In theory, Feuerstein's (1969) Instrumental Enrichment program is an example and was the only one we could find in this category.

Instrumental Enrichment was initially developed to cater to the learning needs of culturally and economically deprived adolescents who were failing at school. Its emphasis is on active student participation, with much independent work and discussion, concentrating on basic cognitive processes, problem solving tactics, and motivational factors. Curriculum content is deliberately excluded; instead, there is an emphasis on teaching thinking about thinking, learning about learning, and cognitive and metacognitive processes. There is a battery of curriculum material with titles such as "organization of dots," "analytic perception," "orientation in space," "family relations," "comparisons," "classification," "numerical progressions," "stencil design," "temporal relations," "transitive relations," and "syllogisms." These exercises are aimed at nurturing learning sets and systematic data-gathering behavior, developing skills in comparative analysis to improve relational insights, and removing attitudinal inhibitions that often operate in low-achieving adolescents. It is claimed that none of the Instrumental Enrichment tasks are designed to "teach to the test."

The Feuerstein packages are classified as extended abstract on the grounds that the intervention aims to produce structural changes in an individual's cognitive functioning to the point where autonomous or independent learning can occur. The Instrumental Enrichment exercises are designed to develop specific cognitive and metacognitive skills necessary not only for success in tests of general ability but also in everyday classroom tasks that require the student to apply abstract principles such as those relating to perception, reasoning, planning, communication, efficiency, elaboration, organization, and relationships.

The interaction of transfer and the SOLO taxonomy. A program may aim to enhance performances that are either closely related or distantly related to the training tasks. The former kind of transfer is called *near,* and the latter kind of transfer is called *far.* Whether a program aims at near or far transfer is independent of its structure in SOLO terms, although the question of near and far transfer interacts with this taxonomic system. Unistructural models may, in theory, aim at near or far transfer, but direct training in a single skill is generally in the context of near transfer. Multistructural and relational models can readily be applied to situations testing near and far transfer. Multistructural models are frequently constructed on the assumption that providing students with a wide range of study procedures would enable them to operate effectively in a wide range of situations, in the typical study skills training format. Relational models are most frequently focused on the context in which they are used, but if the individual acquires strategies and the conditional knowledge of when and where they might work, some degree of far transfer might be expected. Extended abstract models, in being involved with learning how to learn, for example, are essentially concerned with far transfer.

Method

Sample of Studies

We first searched various computer-based information sources using the keywords *study skills, learning strategies, learning processes, cognitive style, study habits, cognitive strategies, cognitive processes, learning style, metacognitive skills,* and *thinking skills.* These keywords were searched for in *Psychological Abstracts* (1983 to 1992) and the database of the Educational Resources Information Center (ERIC) (1983 to 1992). After locating various articles, we searched the references cited in them for further studies. Criteria for including a study in the sample were that (a) it was concerned with learning or study skills, (b) it was possible to calculate an effect size, (c) there was some type of intervention, and (d) the outcome was either performance, study skills, or affect. This yielded the present sample of 51 studies (denoted by asterisks in the reference list). There were some studies with more than one sample, and most had multiple indicators of the variables of interest. As a consequence, there were 270 effect sizes that could be coded. Table 1 presents the summary of information from each study.

Variables Coded From Each Study

The following general information was coded from each study: publication year, publication form (journal article, book chapter, or thesis), and sample size. A number of characteristics of each program were also coded. The *thrust* of the intervention referred to the major intention of the program. There were six levels of thrust: *attribution,* to change the attributions students made for success and/or failure; *motivation,* to change the student's motivation for learning; *study skills,* to diminish use of ineffective study behaviors and train students to use one or a package of targeted skills; *structural aids,* which help the learner interact with content to define structural and high-level meaning (these include concept mapping, certain kinds of note taking and summarizing, and organizers); *Feuerstein programs,* comprising more general ways in which the student can adopt task-appropriate strategies, such as using analogy and relating ideas, elaborative processing, and a "meaning orientation"; and *memory,* where interventions were aimed at improving accuracy of recall for quite specific factual material.

The nature of each intervention was also classified according to the type of outcome for which it aimed, as either *reproductive* or *transformational.* A training program that aimed to develop study skills that are used mainly for the reproduction of content (e.g., memory programs) was classified as reproductive. A program that aimed to help students deal with content at a high cognitive level—that

TABLE 1
Summary of studies included in the meta-analysis

Author	Pub	Age	Ability	Directed	Thrust	Focus	Outcome	Type of outcome	SOLO classification	Near/far	*N*	No. effects	Hedges
Amato, Bernard, D'Amico, & DeBellefeuille	1989	University	High	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Far	131	2	–0.57
Andre & Anderson	1979	Upper sec	Medium	Self	Structural aids	Content	Performance	Reproductive	Multistructural	N ear	71	1	0.61
Armbruster, Anderson, & Ostertag	1987	Primary	Mixed	Teacher	Structural aids	Content	Performance	Transfor-mational	Relational	Far	82	1	1.75
Atkinson & Raugh	1975	University	High	Self	Memori-zation	Other	Performance	Reproductive	Unistructural	Near	52	1	1.11
Barnes, Ginther, & Cochran	1989	Lower sec	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	83	2	0.07
Bean, Singer, Sorter, & Frazee	1986	Upper sec	High	Teacher	Structural aids	Content	Attitude/ performance	Reproductive	Multistructural	Far	72	4	0.60
Billingsley & Wildman	1988	Upper sec	Und-ach	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	54	4	0.85
Bretzing, Kulhavy, & Caterino	1987	Lower sec	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Multistructural	Near	42	1	1.68
Brown & Barclay	1976	Primary	Low	Teacher	Memori-zation	Other	Performance	Reproductive	Unistructural	Near	66	1	0.33
Brown, Campione, & Barclay	1979	Primary	Low	Teacher	Memori-zation	Other	Performance	Reproductive	Unistructural	Near	58	2	0.35
Casey	1990	Primary	Mixed	Self	Study skills	Individual	Performance	Transfor-mational	Relational	Far	68	2	0.79

TABLE 1 *(continued)*

Author	Pub	Age	Ability	Directed	Thrust	Focus	Outcome	Type of outcome	SOLO classification	Near/far	N	No. effects	Hedges
Danner & Taylor	1973	Primary	Medium	Teacher	Memori-zation	Other	Performance	Reproductive	Unistructural	Near	120	2	0.90
Dansereau et al.	1979	University	High	Teacher	Study skills	Individual	Attitude/ study skills/ performance	Reproductive	Relational	Far	87	8	0 .62
Dendato & Diener	1986	University	High	Teacher	Study skills	Individual	Attitude/ performance	Transfor-mational	Relational/ multistructural	Near/far	43	4	0.96
Dwyer	1986	University	High	Teacher	Structural aids	Content	Performance	Reproductive	Unistructural	Near	136	6	0.38
Englert, Raphael, Anderson, Anthony, & Stevens	1991	Primary	Mixed	Teacher	Structural aids	Content	Study skills	Transformational	Relational	Near	174	1	0.88
Feuerstein, Miller, Hoffman, Rand, Mintzker, & Jensen	1981	Adult	Low	Teacher	Feuerstein	Other	Performance	Transformational	Ext abstract	Far	184	1	0.79
Feuerstein, Rand, Hoffman, Hoffman, & Miller	1979	Lower sec	Low	Teacher	Feuerstein	Other	Performance	Transformational	Ext abstract	Far	114	3	0.51
Gadzella, Goldston, & Zimmerman	1977	University	High	Teacher	Study skills	Individual	All	Other	Relational	Far	160	3	0.13
Greiner & Karoly	1976	University	High	Teacher	Study skills	Content	Performance/ study	Transformational	Multistructural	Far	96	12	0.33
Haslam & Brown	1968	Upper sec	Mixed	Teacher	Study skills	Individual	All	Other	Multistructural	Far	118	4	1.26
Judd et al.	1979	Adult	High	Self	Study skills	Individual	Attitude/ performance	Other	Multistructural	Near	160	12	0.23

TABLE 1 *(continued)*

Author	Pub	Age	Ability	Directed	Thrust	Focus	Outcome	Type of outcome	SOLO classification	Near/far	N	No. effects	Hedges
Kiewra & Benton	1987	University	High	Self	Structural aids	Content	Performance	Reproductive	Unistructural	Near	43	1	0.36
Klein & Freitag	1992	University	Medium	Self	Motivation	Individual	Study skills	Transformational	Multistructural	Near	64	2	0.97
Kratzing	1992	University	High		Study skills	Individual	Study skills	Other	Multistructural	Near	140	23	–0.01
Lange, Guttentag, & Nida	1990	Primary	Mixed	Teacher	Memorization	Other	Performance	Reproductive	Unistructural	Near	48	1	0.95
Lodico, Ghatala, Levin, Pressley, & Bell	1983	Primary	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	72	2	0.47
Martin	1984	Upper sec	Mixed	Teacher	Feuerstein	Other	Performance	Transformational	Ext abstract	Far	28	2	1.09
McBride & Dwyer	1985	University	High	Self	Structural aids	Content	Performance	Reproductive	Multistructural	Near	112	1	0.25
McKeachie, Pintrich, & Lin	1985	University	High	Teacher	Study skills	Individual	Performance	Transformational	Relational	Far	419	4	0.29
Morgan	1985	University	High	Teacher	Study skills	Individual	Performance	Other	Unistructural	Near	226	2	0.17
Narrol, Silverman, & Waksman	1982	Upper sec	Low	Teacher	Feuerstein	Other	All	Transformational	Ext abstract	Far	102	25	0.45
Nist & Simpson	1989	University	Medium	Self	Study skills	Individual	Performance	Transformational	Relational	Far	73	1	0.23
Nist, Mealey, Simpson, & Kroc	1990	University	Under ach	Teacher	Study skills	Individual	All	Other	Relational	Far	239	21	0.35
Okebukola & Jegede	1988	University	High	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	145	1	0.07
Purdie	1989	Upper sec	Mixed	Teacher	Motivation	Individual	Study skills	Other	Relational	Far	132	18	0.02
Rand, Mintzker, Miller, Hoffman, & Friedlender	1981	Adult	Low	Teacher	Feuerstein	Other	All	Transformational	Ext abstract	Far	203	1	–0.48

TABLE 1 *(continued)*

Author	Pub	Age	Ability	Directed	Thrust	Focus	Outcome	Type of outcome	SOLO classification	Near/far	*N*	No. effects	Hedges
Rand, Tannenbaum, & Feuerstein	1979	Lower sec	Low	Teacher	Feuerstein	Other	All	Transformational	Ext abstract	Far	114	25	0.18
Relich, Debus, & Walker	1986	Primary	Mixed	Self	Attribution	Individual	All	Other	Relational	Near	14	8	1.42
Schunk & Cox	1986	Lower sec	Medium	Teacher	Structural aids	Content	Attitude/ performance	Reproductive	Unistructural	Near	90	2	0.57
Schunk & Gunn	1986	Primary	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Multistructural	Near	50	2	2.14
Scruggs & Mastropieri	1986	Primary	Medium/ high	Teacher	Memori- zation	Other	Memory	Reproductive	Unistructural	Near	96	6	1.64
Scruggs & Mastropieri	1986	Primary	Low	Teacher	Study skills	Individual	Performance	Reproductive	Multistructural	Far	76	2	0.22
Scruggs, Mastropieri, Levin, McLoone, Gaffney, & Prater	1985	Primary	Under ach	Teacher	Memori- zation	Other	Performance	Reproductive	Unistructural	Near	36	4	0.76
Shayer & Beasley	1987	Lower sec	Low	Teacher	Feuerstein	Other	Performance	Transformational	Ext abstract	Far	12	7	1.03
Simbo	1988	Upper sec	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Unistructural	Near	180	1	1.11
Swing & Peterson	1988	Primary	Mixed	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	121	8	0.12
VanOverwalle & De Metsenaere	1990	University	High	Teacher	Study skills/ attribution	Individual	Performance	Transformational/ reproductive	Multistructural	Near/far	240	10	0.02
Weinstein et al.	1979	University	High	Teacher	Memori- zation	Other	Performance	Reproductive	Unistructural	Near	100	1	1.88
Weisberg & Balajthy	1990	Lower sec	Under ach	Teacher	Structural aids	Content	Performance	Reproductive	Relational	Near	50	10	0.90
Wilson	1986	Lower sec	Medium	Teacher	Study skills	Individual	Performance	Transformational	Multistructural	Far	47	2	0.47

Note. Pub = year of publication; *N* = sample size.

is, to take the content and in some way transform it for a variety of purposes and in different contexts—was classified as transformational.

The nature of the intervention was categorized according to the SOLO taxonomy described above. Interventions were classified as *unistructural, multistructural, relational,* or *extended abstract* and as *near* or *far* in terms of the degree of transfer between training task and outcome measure.

The outcome measure used to assess the effectiveness of an intervention was also classified. Academic performance measures such as subject-based tests and examinations, grade point averages, and tests of general ability were categorized as *performance.* Where the outcome measured change in either one or a range of study behaviors, the category *study skills* was assigned. *Affect* was used when the outcome measure was related to self-efficacy, self-concept, or attitude.

The tests used were coded, and their quality was approximated by coding those that were published and normed as *high,* those for which there was some evidence of psychometric investigation of the instrument as *medium,* and those created for the study with no attempts at psychometric rigor as *low.*

A number of characteristics of the research design were coded. The studies were graded according to quality (coded independently and agreed to by all three authors and classified as low, medium, and high; those that were of patently low quality were not included in the analysis), subject selection (voluntary, intact class groups), theoretical orientation of study (theory based, atheoretical), purpose of study (specifically related to study or learning skills, or study skills was secondary), design of study (control-experimental, pretest-posttest), and direction of program (self-directed or teacher-directed).

Characteristics of the participants in each study were coded according to several categories—for example, age (primary-elementary, junior secondary, secondary, college-university, adults), ability level (low, medium, high, mixed, underachieving), and socioeconomic status (low, middle, upper, mixed).

Computation and Analysis of Effect Sizes

The effect size calculated is *g,* the difference between the means of the intervention group and the control group, or the difference between the pretest and posttest group means, divided by the pooled standard deviation. The sign of the difference was positive when a treatment had a positive effect (thus, those that reduced learning pathologies such as anxiety, surface approaches, and negative attitudes were coded as positive effects). The *g*s were converted to *d*s by correcting them for bias (as the *g*s overestimate the population effect size, particularly in small samples; see Hedges & Olkin, 1985). To determine whether each set of *d*s shared a common effect size (i.e., was consistent across the studies), we calculated a homogeneity statistic Q_W, which has an approximate chi-square distribution with $k - 1$ degrees of freedom, where k is the number of effect sizes (Hedges & Olkin, 1985). Given the large number of effect sizes that are combined into the various categories, and the sensitivity of the chi-square statistic to this number, it is not surprising that nearly all homogeneity statistics are significant. As the most critical comparisons are presented in interaction tables between at least two variables, we are more confident that these means are sufficiently homogeneous to use the means as reasonable estimates of the typical value.

We then used categorical models to determine the relation between the study characteristics and the magnitude of the effect sizes, using the procedures outlined by Hedges and Olkin (1985). These models provide a between-classes effect (analogous to a main effect in an ANOVA design) and a test of homogeneity of the effect sizes within each class. The between-classes effect is estimated by Q_B, which has an approximate chi-square distribution with $p - 1$ degrees of freedom, where p is the number of classes. The statistical significance of this between-classes effect can be used to determine whether the average effect size differs over classes. The tables reporting tests of categorical models also include the mean weighted effect size for each class, calculated with each effect size weighted by the reciprocal of its variance, and the 95% confidence interval of this mean. If this confidence interval does not include zero, then the mean weighted effect size can be considered significantly different from zero.

Results and Discussion

Characteristics of the Studies

Before considering the findings reported in research on the effectiveness of study skills programs, we examined the characteristics of the studies from which conclusions about this research will be drawn.

The first characteristic was the quality of the studies, as we wished to exclude studies of low quality. Quality was assessed on the basis of consensus between the independent ratings agreed to by the three authors. The prime concerns were that the study be based on reasonable sample sizes, have a control (e.g., pretest and posttest, or control and experimental groups), and use reliable tests. The eight low-quality studies (with 14 effect sizes) had a greater mean effect size than the remaining studies. Given typical advice in conducting these analyses, they could not be meaningfully included in the final sample and thus were dropped from all further analyses.

Table 2 shows many of the characteristics of the various effect sizes. As shown by the central tendencies of these characteristics, studies generally were based on reasonably large sample sizes using school age students and were published relatively recently in journals (median = 1986). The programs were implemented by teachers for classes of students, although, as will be shown later, the majority of study skills packages (a) were implemented in universities wherein students self-selected to participate, (b) were conducted for atypical students (the low, high, and underachievers), (c) used a variety of study skills assessments, and (d) included 96 students (range 7 to 226). There were 30 effect sizes that included follow-up evaluations, typically of 108 days, and the effect sizes declined to an average of 0.10.

Overall Summary of the Relative Evaluation of Study Skills Programs

In presenting the findings of our meta-analysis, we first consider the overall effect sizes in the study skills programs and then report a number of models showing that several characteristics of the studies moderated the overall results. The mean weighted effect size was 0.45, with a standard error of 0.03, and the overall homogeneity statistic was 3,246.99 ($df = 269$, $p < .001$), which indicates that the overall mean may not be the most typical value, as there are many moderator variables that mediate this mean. When the study was the unit of

TABLE 2
Summary of effect size characteristics

Variable and class	*N*	Variable and class	*N*
Publication form		Socioeconomic status	
Journal article	189	Low	32
Book chapter	22	Medium	21
Unpublished document & thesis	41	High	18
Purpose of the study		Mixed	199
Specifically study skills	133	Ethnicity	
Study skills are secondary	136	Anglo	55
Quality of article		Mixed	215
Low	14	Academic ability	
Medium	107	Low	67
High	162	Medium	13
Age		High	109
Preschool	2	Underachievers	53
Primary	38	Mixed	23
Lower secondary	54	Type of outcome	
Upper secondary	59	Reproductive	92
University	103	Transformational	122
Adult	14	Other	56
Selection		Direction	
Self	18	Teacher-directed	204
Whole classes	122	Self-directed	29
Other	130	Thrust of program	
Test quality		Attribution	12
Low	7	Motivation	20
Medium	16	Study skills	106
High	68	Structural	50
SOLO classification		Feuerstein	64
Unistructural	29	Memory	18
Multistructural–near	16	Design of study	
Multistructural–far	21	Control-experimental	188
Relational–near	29	Pretest-posttest	47
Relational–far	22	Other	34
Extended abstract	40	Outcome measure	
Theoretical orientation		Affect	44
Theoretical	234	Performance	157
Atheoretical	36	Study skills	69

analysis, the mean weighted effect size was 0.63.

A stem-and-leaf diagram of these effects is presented in Figure 1. As can be seen, there is marked positive skew. A close inspection of the quality of the studies which produced the 26 effect sizes greater than 1.4 did not reveal any pattern. These 26 effects came from 11 different studies, and the mean across all effect sizes within these 11 studies was close to the overall mean, which indicates that the largest effects were not unique to any particular cohort.

A mean of 0.45 can be interpreted with reference to other influences on outcomes in education. Hattie (1987, 1992) outlined a measurement procedure for

–0.9	86
–0.8	10
–0.7	2
–0.6	7
–0.5	774
–0.4	88
–0.3	8732211
–0.2	96422
–0.1	988776654443320
–0.0	9999877764443331
0.0	011111222334455556777779
0.1	001112222223333444555556777889
0.2	1112345557777778999
0.3	0000111223344455556667888999
0.4	1333445667788889
0.5	0001233566667889
0.6	0112445
0.7	0235667779
0.8	01122589
0.9	114445667
1.0	012444557
1.1	0111136799
1.2	12479
1.3	
1.4	009
1.5	0378
1.6	4666788
1.7	4
1.8	25678
1.9	
2.0	45
2.1	6
2.2	35
2.3	
2.4	6

FIGURE 1. *Stem-and-leaf diagram of the effect sizes*

ascertaining the typical effect of most innovations in education. Based on a synthesis of 304 meta-analyses, he ascertained that an effect size of 0.40 was a benchmark from which various innovations could be interpreted (Table 3). That is, across the 304 meta-analyses, based on more than 40,567 studies, the typical effect size in educational interventions was 0.40. Of course, this is a global benchmark, and more refined comparisons can be made to interventions similar to the study skills interventions considered here. Table 3 presents a range of innovations, and it can be seen that the overall effect of study skills programs is close to

TABLE 3
Summary of relationships to achievement

	No. of studies	Overall effect size
School	4,310	0.25
Physical attributes	1,850	–0.05
Finances	658	0.12
Aims & policy	542	0.24
Parent involvement	339	0.46
Class environment	921	0.56
Social	1,124	0.39
Mass media	274	–0.12
Peer	122	0.38
Home	728	0.67
Instructor	5,009	0.44
Style	1,075	0.42
Inservice education	3,912	0.49
Background	22	0.60
Instruction	5,710	0.47
Quantity	80	0.84
Quality	22	1.00
Methods	5,608	0.36
Mathematics	1,713	0.32
Science	1,562	0.36
Reading	2,333	0.50
Others	60	0.28
Pupil	2,249	0.47
Physical	905	0.21
Affective	355	0.24
Disposition to learn	93	0.61
Cognitive	896	1.04
Methods of instruction	21,382	0.29
Team teaching	41	0.06
Individualization	630	0.14
Audio-visual aids	6,060	0.16
Programmed instruction	220	0.18
Ability grouping	3,385	0.18
Learning hierarchies	24	0.19
Calculators	231	0.24
Instructional media	4,421	0.30
Testing	1,817	0.30
Computer-assisted instruction	566	0.31
Simulation & games	111	0.34
Questioning	134	0.41
Homework	110	0.43
Tutoring	125	0.50
Mastery learning	104	0.50
Bilingual programs	285	0.51
Goals	2,703	0.52
Acceleration	162	0.72
Direct instruction	253	0.82
Learning strategies	783	0.61
Behavioral objectives	111	0.12
Advance organizers	387	0.37
Remediation/feedback	146	0.65
Reinforcement	139	1.13
Grand total/mean	40,567	0.40

the typical benchmark figure of 0.40. There were six effects relating to study skills embedded within other meta-analyses. These are listed in Table 4, and three are greater than the typical classroom innovation effect size.

Impact of Moderating Variables on the Relative Evaluation of Study Skills Programs

Table 5 presents the relations between various study characteristics and the categorical models. All the Q_W statistics are significant, which indicates wide variation of the effect sizes within the groupings.

Background variables. It has been noted already that studies classified as low in quality had greater mean effect sizes than the other studies. There were no differences in the mean effect sizes derived from the studies classified as medium ($M = 0.45$, $n = 108$) and high quality ($M = 0.46$, $n = 162$). Further, there were no differences in the means relating to the nature of the research design. The mean effect size from control groups ($M = 0.42$, $n = 189$) was close to the mean from pretest-posttest group designs ($M = 0.48$, $n = 47$) and to the mean from other designs ($M = 0.59$, $n = 34$). Journals report marginally more effective studies than monographs, while dissertations tend to report interventions that are not effective. The last finding could be caused by a greater reliance on tertiary student participants, for whom the effects are least; it should be noted that this cannot be attributed to low-quality work being carried out by graduate students, because poor studies have already been eliminated.

It was not possible to compare the socioeconomic backgrounds of the participants, as most studies either did not comment on this variable or used "mixed" groups. Where there was information on socioeconomic background, the effect sizes were based on too few studies (low $M = 0.23$, $n = 31$; middle $M = 0.61$, $n = 21$; high $M = 0.02$, $n = 18$). When students chose to seek study and learning skills assistance the effect sizes were greater than when intact classes were used.

Structural complexity of the intervention. Table 6 shows the effect sizes for the structural complexity of the interventions as classified by SOLO level, which is our major independent variable. The dependent variables are classified into three domains: performance, study skills, and affect. It can be seen that different interventions have differing effects according to the dependent variable in question; the "total" column for such comparisons is thus not very meaningful in itself. The unistructural near ($M = 0.83$) and relational near ($M = 0.77$) programs have high effect sizes across all outcomes, the latter mean being remarkably close to that reported ($M = 0.71$) by Haller, Child, and Walberg (1988) for the same kind of intervention (metacognitive, contextualized). If there were no moderators, then it would be suggested that study skills programs that can be classified as unistructural or relational are most effective.

Unistructural interventions have the strongest effect on performance. This is not at all unexpected, as most such interventions were simple and taught directly with narrow aims; in this they were highly successful, producing effect sizes approaching one standard deviation (0.84). There is a positive effect on attitudes as reported in one study. The majority of the performance measures were directly related to the instructional material used in the intervention. These interventions were designed to teach students to use such aids to memory as mnemonic devices, graphic organizers, mental imagery, rehearsal, and strategy verbalization in order

TABLE 4

Summary results from other meta-analyses relating to study skills

Topic	Subject	Ability	Age	Authors	Date	No. studies	No. effects	Effect size
Study skills	All	Low	College	Kulik, Kulik, & Shwalb	1983	32	32	.290
Meta-cognitive instruction	Reading	Normal	All	Haller, Child, & Walberg	1988	20	20	.710
Note taking	All	Normal	All	Henk & Stahl	1985	14	25	.340
Textual aids (e.g., underlining, building internal connections)	Science	Normal	All	Horak	1985	40	472	.570
Study programs	Reading	Normal	All	Sanders	1980	28	66	.940
Test anxiety	All	Normal	All	Hembree	1988	562	811	–.260

TABLE 5
Categorical models of the study characteristics

Variable and class	Q_B	*n*	Weighted effect	Standard error	Q_W
Quality of study	0.99				
Medium		108	0.45	.033	1,450.32
High		162	0.46	.070	1,795.67
Design of study	105.02				
Control-experimental		189	0.42	.043	2,365.17
Pretest-posttest		47	0.48	.100	359.44
Other designs		34	0.59	.067	417.36
Publication type	224.12				
Journal		207	0.55	.065	2,549.45
Book		22	0.41	.033	274.64
Thesis		41	0.00	.017	198.78
SOLO classification	165.81				
Unistructural		30	0.83	.031	1,264.15
Multistructural—near		48	0.25	.026	454.01
Multistructural—far		27	0.41	.034	305.73
Relational—near		37	0.77	.083	219.42
Relational—far		64	0.29	.025	435.51
Extended abstract		64	0.42	.112	402.36
Testing conditions	2.41				
Near		115	0.57	.046	2,073.98
Far		91	0.33	.027	768.17
Outcome measure	42.77				
Performance		157	0.57	.041	2,160.83
Study skills		69	0.17	.086	634.11
Affect		44	0.48	.034	409.28
Type of outcome	92.98				
Reproductive		80	0.66	.041	1,692.89
Transformational		99	0.43	.086	699.59
Other		91	0.30	.034	761.53
Thrust of program	107.26				
Attribution		11	1.05	.127	74.08
Motivation		20	0.12	.017	106.81
Study skills		106	0.31	.028	845.06
Structural aids		50	0.58	.043	872.90
Feuerstein		64	0.42	.112	402.38
Memory		18	1.09	.039	838.50
Academic ability	113.75				
Low ability		67	0.39	.107	386.04
Medium ability		13	0.80	.029	283.24
High ability		109	0.33	.029	1,415.88
Mixed		53	0.61	.049	893.87
Underachieving		28	0.64	.058	134.21
Direction	4.01				
Teacher directed		204	0.44	.052	2,675.01
Self-directed		29	0.70	.071	249.68

TABLE 5 *(continued)*

Variable and class	Q_B	*n*	Weighted effect	Standard error	Q_W
Age of subjects	126.24				
Primary		40	0.91	.061	1,014.13
Lower secondary		54	0.51	.061	316.49
Upper secondary		59	0.45	.101	729.61
University		103	0.28	.027	936.50
Adults		14	0.22	.024	124.02
Purpose of article	38.13				
Specifically study		133	0.38	.025	1,999.70
Study secondary		137	0.53	.084	1,209.16
Selection of subjects	130.09				
Self-selected		18	0.63	.030	150.83
Intact classes		122	0.33	.032	1,249.28
Other		130	0.54	.081	1,716.79
Theoretical orientation	110.31				
Theoretical		234	0.45	.060	2,660.63
Atheoretical		36	0.47	.023	476.05

to improve the recall of the factual material that was actually used in the training stage of the intervention. For this meta-analysis, we were not able to locate usable (i.e., those with sufficient detail of intervention procedures or data) studies that investigated whether students were able to transfer such memory strategies to situations where they were required to learn material unrelated to that used in the initial intervention. It seems that it is easier to use unistructural programs to improve memory outcomes where students are not required to use more demanding cognitive procedures such as the unprompted generation of strategy use in different learning contexts and with unfamiliar content.

A study by Atkinson and Raugh (1975) provides a typical illustration of a program classified as unistructural near. In this study, a group of Stanford University students were taught to use the mnemonic keyword method for learning Russian vocabulary. This method divides the study of a vocabulary item into two

TABLE 6
Structural complexity of interventions by outcome measure

Nature of the program	Testing conditions	Performance *n*	Performance *M*	Study skills *n*	Study skills *M*	Affect *n*	Affect *M*	Total *n*	Total *M*
Unistructural	Near	29	0.84			1	0.56	30	0.83
Multistructural	Near	16	0.45	24	0.03	8	0.53	48	0.25
Multistructural	Far	21	0.25	3	1.13	3	0.81	27	0.41
Relational	Near	29	0.62	1	0.88	7	1.40	37	0.77
Relational	Far	22	0.33	34	0.22	8	0.49	64	0.29
Extended abstract		40	0.69	7	–0.16	17	0.02	64	0.42
Total/mean		157	0.57	69	0.16	44	0.48	270	0.45

stages, one requiring a sound association between the spoken foreign word and an English keyword and the other requiring the student to construct a mental image of a physical interaction between the keyword and the English translation. It is not surprising that an effect size of 1.13 was obtained for the experimental group. Where students are taught a single and very specific strategy to help them remember a list of words and are then tested on that same list, a reasonable degree of success is to be expected. Although there was a follow-up test some weeks later on which experimental students outperformed control students, again the test list contained the same words that students had learned previously. To demonstrate far transfer of the mnemonic strategy, a different list of words would have had to be used. Similar results were found in two previous meta-analyses of vocabulary instruction (Klesius & Searls, 1990; Stahl & Fairbanks, 1986), in which the mnemonic keyword method was found to produce positive effect sizes on immediate posttests. Klesius and Searls, however, also found dramatic declines in performance on delayed posttests.

Multistructural interventions are moderately successful in producing near transfer on performance ($M = 0.45$) and positive attitudes to study ($M = 0.53$), but they have no effect on reported use of study skills ($M = 0.03$). When far transfer is tested, effects on performance drop to 0.25 but are massive on study skills ($M = 1.13$) and strong on affect ($M = .81$). However, it must be noted that these means for affect and study skills are each based on only three effect sizes and that all three effect sizes come from one study, Haslam and Brown (1968). They used the Brown-Holzman *Effective Study Skills Course* and assessed the effects of this course using the Brown-Holzman *Survey of Study Habits and Attitudes* (Brown & Holzman, 1967). Although the intent was far transfer, what one is seeing here may be something close to "teaching to the test"; that is, the program addressed content that was keyed to the self-report items in the survey itself. It must also be said, however, that this study, along with others in the same category, did achieve small gains in grade point average.

A demonstration of a successful application of a multistructural intervention with near transfer is that of Schunk and Gunn (1986). One objective of this study was to train children to use task strategies to solve division problems, with a view to improving both performance and self-efficacy. These task strategies were specific to the solving of problems with one to three digits in the divisor and two to five digits in the dividend. A comparison of pretest and posttest scores on tests that required students to solve the same sorts of division problems that were used during the training sessions indicated a substantial improvement. Schunk and Gunn also used path analysis to explore the theoretical relationships between task strategies, attributions (ability, effort, task ease, and luck), self-efficacy, and performance. The largest direct influence on changes in division skills was due to the use of effective task strategies.

Relational near programs were systematically effective over all outcomes. In relational near programs, a range of metacognitive interventions was aimed at teaching students to change their attributional perspectives (Relich, Debus, & Walker, 1986) and to use such strategies as self-questioning (Billingsley & Wildman, 1988), identifying main ideas (Weisberg & Balajthy, 1990), concept mapping (Okebukola & Jegede, 1988), and/or strategy monitoring (Lodico, Ghatala, Levin, Pressley, & Bell, 1983). The degree of success on these and similar relational interventions was assessed using such measures as subject-based tests of comprehension and measures of changes in persistence, self-efficacy, metacognitive knowledge, learned helplessness, and problem-solving ability.

Studies by Billingsley and Wildman (1988) and Dendato and Diener (1986) are examples of effective relational near programs. In the former, learning disabled students who were taught to generate their own questions as a prereading activity were better able than their control counterparts to recognize inconsistencies and embedded errors in a reading passage. A meta-analysis of the effects of teaching students to use self-questioning strategies (Huang, 1992) also found such interventions to be successful (effect size = 0.58).

In Dendato and Diener's (1986) study, test-anxious students were taught deep-muscle relaxation and cognitive strategies to deal with irrational beliefs and practices related to academic performance. When compared with the control group, the treatment group obtained a lower average score on the State-Trait Anxiety Inventory. However, the intervention failed to improve subsequent classroom test scores, thus illustrating the overall finding of this meta-analysis, already noted, that programs are found to be more effective when outcome assessments are closely related to the nature of the intervention rather than less closely related. These results concur only in part with the findings from a meta-analysis by Hembree (1988), in which it was concluded that test anxiety could be effectively reduced by a variety of behavioral and cognitive treatments delivered in a broad assortment of conditions, and that improved test performance and grade point average consistently accompanied test anxiety reduction.

Relational interventions are much less successful, however, when tested in areas far from the taught content (e.g., Amato, Bernard, D'Amico, & DeBellefeuille, 1989; Purdie, 1989). These findings are in close accord with the literature: Metacognitive programs taught in context and orchestrated to suit a particular task are expected to be the most successful, and this would seem to be supported here. It was not possible to trace causal paths, but it does seem likely that the all-around effects achieved here, as opposed to the uneven effects of unistructural and multistructural interventions, are due to common links: The intervention creates effective strategy deployment and monitoring, which in turn produces satisfactory cognitive and affective outcomes.

The extended abstract intervention, Feuerstein's (1969) Instrumental Enrichment program, produced strong effect sizes on performance (0.69), zero effects on affect, and perhaps even negative effects on study skills. Such an uneven pattern must raise questions about the program, particularly as one of its major aims is to enhance motivation. A detailed examination of the training activities, which placed special emphasis on spatial skills, and the criterion test, which was usually Ravens Progressive Matrices test, raises the suspicion that again what we are seeing here is something very akin to "teaching to the test." It may have been more defensible, if more paradoxical, to relabel these programs as *extended abstract near.*

An inspection of the first column of means in Table 7 indicates that interventions for enhanced learning have greater effects on performance outcomes when the programs are based on material closely related to the subsequently assessed material. This is evident in the larger means for the near categories. It appears that the interventions best at enhancing performance of the unistructural or relational

TABLE 7
Structural complexity of interventions by type of outcome

Nature of the program and testing conditions	Reproducing		Transformational	
	n	*M*	*n*	*M*
Unistructural—near	28	0.88		
Multistructural—near	7	1.00	6	0.42
Multistructural—far	8	0.36	15	0.22
Relational—near	27	0.54	2	1.37
Relational—far	10	0.38	12	0.55
Extended abstract—far			64	0.42
Total/mean	80	0.66	99	0.43

type are those focused on near transfer. The lowest effects are for multistructural programs, both near and far. This finding is contrary to that of Kirschenbaum and Perri (1982), who found that multiple-component (i.e., multistructural) interventions were generally more successful than single-component interventions.

Overall, the effects of these interventions are greatest on performance, somewhat lower on affect, and comparatively much lower on study skills. Across all three types of outcome measure, if only the testing conditions are considered, the mean for the near conditions is 0.57 (n = 115), which is greater than the mean of 0.33 (n = 91) for the far conditions.

Except for the extended abstract programs, interventions for enhanced learning also had very positive effects on affect. It is useful to examine more closely the exact nature of this affective outcome as it was measured in the interventions themselves. In general, the positive outcome was derived from measures of attitude change. For example, students reported greater liking for teachers and increased agreement with the goals of education (Gadzella, Goldston, & Zimmerman, 1977) or more positive attitudes towards study and specific subjects (Bean, Singer, Sorter, & Frazee, 1986; Dansereau et al., 1979; Haslam & Brown, 1968; Nist, Mealey, Simpson, & Kroc, 1990). A more positive attitude also was reflected in reduced anxiety (Dansereau et al., 1979; Nist et al., 1990) and increased task persistence (Relich et al., 1986).

The effects on study skills methods appear to be very small for programs aiming at near and far transfer (where there is sufficient sample size). It is very difficult to change the study skills that students have acquired, usually over many years of study, and as will be later shown, older students are more resistant to change.The improvement of student learning via the manipulation of study skills often fails to take account of the interaction between students' intentions and the context of learning. A learning skills intervention with first-year university students not only failed to achieve increases in deep approaches to learning but also led to an increase in surface approaches—the opposite of what was intended (Ramsden, Beswick, & Bowden, 1986). It was suggested that the reason for this failure was linked to the incorrect assumption that the observed behaviors of effective students can be taught to less successful students independently of the teaching and assessment context. Indeed, the less successful students perceived assessment tasks as requiring rote learning, and as long as their perception existed, incorrect though it may have been, students would ignore deep approaches and use self-management skills to rote learn more effectively. Even when students do learn to be more flexible in their use of learning strategies, rigid teaching contexts often prevent the use of some strategies.

Reproductive versus transformational outcomes. If the various outcomes are classified either as requiring students to simply reproduce the content of material learned or as requiring them to express knowledge in different or creative ways, then, as expected, the effect sizes are (a) greatest for the reproductive outcomes when the intentions of study skills programs are towards the lower end of the SOLO taxonomy but (b) reasonably consistent across most levels (Table 6). The transformational effects are greater when the study skills programs are towards the upper end of the SOLO taxonomy. When these were further subdivided into different outcomes, then the effects on the performance outcomes were consistently high. The effects on the study skills and affect outcomes are high only on the reproductive programs ($M = 0.71$, $n = 7$) and much lower on the transformational programs ($M = 0.20$, $n = 32$).

Thrust of the program. Table 8 examines the effects of interventions with different thrusts: attribution, motivation, study skills, structural aids, Feuerstein, and memory. An intervention for enhanced learning is more likely to have a large effect when its thrust is attribution, memory, or structural aids. The lowest effects are associated with motivation and study skills.

When the thrust of the program is to change memory or attribution, the effects on all outcomes are most positive (Table 8). The effects of motivation programs are the lowest, although this result was derived from the findings of one study (Purdie, 1989) in which an achievement motivation training program was found to have mixed effects on the participants' approaches to studying. Although there were positive effects of the program on students' study motives (a reduction in surface motive and an increase in deep motive), these effects were not matched by changes in surface and deep strategies.

There were only 6 effect sizes where attribution retraining was involved, but overall effects were strong on performance ($M = 0.60$) and especially, as would be expected, on affect ($M = 1.32$). Motivation training involved 20 effect sizes, all to do with study skills, but was relatively ineffective ($M = 0.11$). Study skills

TABLE 8
Outcome measures by the thrust of the program

	Performance		Study skills		Affect		Total	
	n	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Attribution	6	0.60			6	1.32	12	0.96
Motivation			20	0.11			20	0.11
Study skills	47	0.26	41	0.23	18	0.63	106	0.31
Structural aids	46	0.58	1	0.88	3	0.53	50	0.58
Feuerstein	40	0.69	7	–0.16	17	0.02	64	0.42
Memory	18	1.09					18	1.09
Total/mean	157	0.57	69	0.16	44	0.48	270	0.45

training, oddly enough, had much stronger effects on affect ($M = 0.63$) than on reported use of study skills ($M = 0.23$). This would suggest that study skills training is more valuable as an anxiety reducer than as an enhancer of learning. Programs using study skills as the major thrust were more effective with reproductive intentions ($M = 0.54$, $n = 10$) than with transformational intentions ($M = 0.37$, $n = 31$).

Structural aids—such as advance organizers, summarizing (Armbruster, Anderson, & Ostertag, 1987); rehearsal (Dwyer, 1986), the selection and use of effective task strategies (Schunk & Gunn, 1986), the construction of graphic organizers, summary writing (Weisberg & Balajthy, 1990) and writing strategies like planning, organizing, writing, editing, and revising (Englert, Raphael, Anderson, Anthony & Stevens, 1991)—appear to be uniformly effective, with an effect size on performance of 0.58. Memory, when separated from other unistructural interventions, is even more powerful in its effect on performance, with an effect size of 1.09.

When classifying by both thrust and SOLO categories, study skills programs are more effective at the more complex end of the SOLO taxonomy (Table 9); training in the use of structural aids is effective over most levels of the taxonomy and for both near and far testing conditions, with the exception of three effect sizes for relational far. Not surprisingly, the memory programs tended to be more unistructural, which highlights the value of such programs in enhancing immediate and lower-order cognitive processes.

When the thrust of a program is to modify students' causal attributions for academic achievement, effects are greatest in relational near contexts. This result is based on eight effect sizes, all from one study (Relich et al., 1986). The other four effect sizes were smaller and came from another study (Van Overwalle & De Metsenaere, 1990) classified as multistructural. Despite the small number of effect sizes, a comparison of the two programs provides some insight into reasons for the greater effectiveness of the intervention reported by Relich et al. Students who had previously been identified as learned helpless and deficient in particular mathematics skills received attributional training in the context of mathematics instruction. They were provided with opportunity over eight training sessions to practice making attributions for success and failure on sets of mathematics problems, and they were given attribution feedback by the instructor. On the other hand, in the intervention reported by Van Overwalle and De Metsenaere, the attributional manipulation lasted only 50 minutes and consisted of a video presentation showing real-life experiences of several students who discussed reasons for their successes and failures in university examinations. Experimental students in this study were provided neither with feedback about their attributions nor with specific opportunity to practice new patterns of attribution. The effects were trivially different from zero.

Attributes of the Students

Ability. The effect sizes are greatest for those in the middle of the academic distribution and those classified as underachieving (see Table 10). It is probable that these are the cohort most likely to seek study skills assistance, and they are most likely to benefit, given their abilities to learn both from the content matter taught and from the study skills applied. It seems that low-ability students are

TABLE 9

Structural complexity of the intervention by thrust of the program

Nature of the program	Testing conditions	Attribution		Motivation		Study skills		Structural aids		Feuerstein		Memory	
		n	*M*	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Unistructural	Near					2	0.17	10	0.49			18	1.09
Multistructural	Near	2	0.09	2	0.97	39	0.08	5	1.36				
Multistructural	Far	2	0.01			21	0.41	4	0.60				
Relational	Near	8	1.42			1	1.85	28	0.55				
Relational	Far			18	0.02	43	0.44	3	–0.17				
Extended abstract	Far									64	0.42		
Total/mean		12	0.96	20	0.11	106	0.31	50	0.58	64	0.42	18	1.09

TABLE 10
Structural complexity of the intervention by academic ability

Nature of the program and testing conditions	Low		Medium		Upper		Under-achieving		Mixed	
	n	*M*	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Unistructural—near	3	0.34	7	0.95	14	0.86	2	1.03	4	0.76
Multistructural—near			3	0.85	42	0.08	3	1.99		
Multistructural—far	2	0.22	2	0.47	19	0.25	4	1.24		
Relational—near					2	0.96	21	0.68	14	0.88
Relational—far			1	0.23	32	0.42	21	0.12	10	0.24
Extended abstract—far	62	0.40					2	1.09		
Total/mean	67	0.39	13	0.80	109	0.33	53	0.61	28	0.64

unable to benefit from interventions of most kinds, with the Feuerstein programs being the exception.

The medium-ability students benefit most from unistructural and multistructural programs, whereas the underachieving students benefit from all programs (Table 10). It is the underachievers and higher-ability students who benefit more from the programs at the relational level, whereas it is the medium-ability and underachieving students who benefit more at the multistructural levels. The higher-ability students benefit from memory ($M = 1.82$, $n = 5$) and affect ($M = 0.63$, $n = 17$) but otherwise not at all.

Age. Interventions may be effective across all age groups, but it is the youngest students who accrue the greatest benefits across all outcomes. University students and adults show much lower effects on their performance outcomes but stronger effects on affect (Table 11). Study skills training is more effective with young students and becomes relatively ineffective at the upper secondary and tertiary levels, which adds further support to the point already made that students' actual study behaviors are developed and maintained to cope with a little-changing teaching context.

Although most programs in which the thrust is study skills use university students, the effects on study skills are minimal. Most affective outcomes for university students related either to improved attitudes towards learning or to the

TABLE 11
Outcome measure moderated by age of students

Age of students	Performance		Study skills		Affect	
	n	*M*	*n*	*M*	*n*	*M*
Preprimary	2	0.79				
Primary	31	0.84	1	0.88	6	1.32
Lower secondary	44	0.58	2	0.44	8	0.09
Upper secondary	231	1.05	25	0.07	13	0.21
University	51	0.27	41	0.19	11	0.68
Adults	6	0.06			6	0.43

reduction of anxiety. One intervention with university students (Gadzella et al., 1977) showed clearly the relative impact of study skills training on performance and affect. The experimental group, after participation in a fairly traditional program dealing with such topics as managing time, improving memory, taking lecture notes, improving concentration, improving scholastic motivation, reading text books, writing reports, and taking examinations, showed no significant improvement in academic performance when compared with the control group (effect size = –0.16). There was, however, a marked improvement for the treatment group in study attitudes (effect size = 0.57). That is, after attending study skills programs, students have more positive attitudes towards their study, but these positive attitudes do not necessarily translate into performance outcomes.

Across the various moderators, then, university- and college-level populations of high ability and high socioeconomic status seem rather more resistant to intervention than younger, middle-ability students. These findings could in part suggest a ceiling effect—it may be more difficult to raise the performance of already high-performing students—but other more complex factors are likely to operate too. Why, for example, should high-performing students see the need to change their study skills, attributions, or other factors moderating their performance?

Other Moderators

In various models of educational productivity (e.g., Hattie, 1992; Walberg, 1981), it has been suggested that the effects of programs on academic performance follow a law of diminishing returns. Programs of shorter duration would have greatest initial impact and a reducing impact over time. The majority of the programs considered in this review were of short duration; 37% were implemented for only 1–2 days, 13% for 3–4 days, 19% for 5–31 days, and 31% for more than 1 month. The correlation between the effect size and the length of a program overall was –.14 (n = 194); although there was a curvilinear trend. The effect size was greatest for the shortest programs. For programs of 1–2 days, the mean effect size was 0.58, n = 55; for programs of 3–4 days, the mean effect size was 0.28, n = 40; for programs of 4–30 days, the mean effect size was 0.76, n = 46. Programs that were shorter than 30 days were positively correlated with effect sizes (r = .14, n = 141), whereas programs longer than 30 days showed diminishing returns (r = –.16, n = 62).

Self-directed programs are more effective across all outcomes (performance, study skills, and affect) than those directed by teachers. These effects are more marked on affect than on performance. Teacher-directed programs are more effective on performance outcomes (M = 0.55, n = 132) than on affect (M = 0.26, n = 8) and study skills (M = 0.22, n = 44).

There are only small differences in the means across the three outcomes when moderated by whether the purpose of a study was specifically to evaluate a study skills program or study skills interventions were only secondary (Table 12).

Conclusions

The present analysis, based on 270 effect sizes from 51 studies, produced an average effect size of 0.45. This figure, however, combines effects on performance, study skills, and affect. The more appropriate summaries are 0.57 for

TABLE 12
Outcome measure moderated by purpose of the study

	Performance		Study skills		Affect	
Purpose	*n*	*M*	*n*	*M*	*n*	*M*
Specifically study	56	0.52	57	0.15	20	0.62
Secondarily study	101	0.61	69	0.17	44	0.48

performance, 0.16 for study skills, and 0.48 for affect. The greatest effect is thus on performance, which yields a figure as high as that for typical innovations in education; ironically, the smallest effect relates to the reported use of study skills on the various outcomes. The performance figure itself breaks down to 1.09 for memory only, 0.69 on reproductive performance in general (i.e., a low cognitive performance level), and 0.53 for transformational performance, which is a high level of cognitive processing. When we look at the nature of the enhanced learning intervention programs that produce these effects, and with whom these interventions are most successful, a clear and comprehensible picture emerges.

Unistructural programs, involving direct teaching of mostly mnemonic devices, are highly effective with virtually all students. Effect sizes greater than 1.0 are typically found for reproductive performances. Much the same is the case for multistructural programs, such as conventional study skills training, being used for near transfer on low-cognitive-level tasks. When multistructural programs are used for high cognitive levels or for far transfer, they are not effective, except in one study (Haslam & Brown, 1968), which found that reported use of study skills and effects were enhanced. Multistructural approaches were most effective, when they worked at all, with younger rather than older students.

When relational programs, which integrate the informed use of strategies to suit particular content, were used for near transfer, they were highly effective in all domains (performance, study skills, and affect) over all ages and ability levels, but were particularly useful with high-ability and older students. This is very reasonable in view of the high cognitive demands metacognitive interventions, based on conditional knowledge, are likely to make.

Given that unistructural methods were highly effective with everybody, for their own limited purposes, groups of different ability levels otherwise showed different degrees of receptiveness to intervention. Mixed-ability students, underachievers, and younger (primary and early secondary) students were relatively receptive to interventions, particularly unistructural and multistructural. Low-ability children were least amenable to intervention, possibly because they were least able to comprehend instructions, but more likely because the programs tended to be too demanding on subjects. At all events, there seems to be a problem in achieving change in the low-ability group that needs addressing in future research.

What might we then conclude from this meta-analysis? Despite, perhaps, the conventional wisdom, most intervention *does* work most of the time. After all, the effect size over all studies was 0.45; and a very respectable 0.57 for performance. Even when we allow for the very clear success of mnemonic-type programs, this figure becomes 0.53 on transformational, or higher-cognitive-order, performance. This is as good as any figure reported for teaching methods elsewhere (Hattie, 1992). When classified according to level of structural complexity, single-component interventions concentrating on near transfer of a specific task-related skill were more effective than multiple-component interventions. Relational interventions, which aimed to change a range of metacognitive behaviors in context, were also systematically effective in near transfer situations; far transfer of skills was less likely to have occurred.

We might ask if these findings take us further in our knowledge of the effects of study skills and strategy training. The general outline is quite compatible with our previous literature review, which suggested that best results came when strategy training was used metacognitively, with appropriate motivational and contextual support. The first point, then, is that we can now live more comfortably with that conclusion; it is clearly supported by the empirical evidence, and we now have clear data about the relative efficacy of different types of interventions. Second, we find that the typical study skills training package is indeed not so effective as metacognitive and contextualized intervention, but it is significantly better than nothing—clearly so in the case of younger students, and only marginally so in the case of college students. The verdict must still be out in the case of more ambitious "learning-to-learn" programs in view of doubts about the suitability of the performance criteria.

Finally, we might conclude that the SOLO taxonomy not only provides a mutually exclusive and practically convenient way of classifying interventions that makes considerable theoretical sense, but also shows the power of the taxonomy for purposes other than classifying performance outcomes themselves. The taxonomy was relatively easy to apply to the interventions, and the major results were easily interpreted relative to the levels of the taxonomy. It could be most useful for future researchers to use the SOLO taxonomy to elaborate on the aims and methods used in their interventions, and we suggest that the nature of the outcomes will be related to the level of the taxonomy.

Implications for Practice

What do these findings mean for the practitioner? Basically, there are three sets of implications for addressing (a) low-level outcomes, (b) high-level outcomes, and (c) other kinds of outcomes.

If the intention is to teach for simple retention of accurate detail, then the use of mnemonics—such as using imagery or linking items to be learned or associated with keywords—is highly effective. Good teachers have long used such methods: ROYGBIV, as an acronym for the colors of the rainbow; HOMES, for the five Great Lakes; or the use of keywords to link associates such as foreign language meanings or technical terms. When students have to remember procedures, formulas, facts, or lists, such highly directive training ("this is the rule, just follow it") is sensible and productive. What this does not do, of course, is to involve the higher-level cognitive processes, and therefore it is suitable only for the quite specific purpose of facilitating accurate recall, independently of understanding.

If, however, the intention is to help students understand content with a view to applying it in a new context, then more complex strategies are indicated. First, one needs to be cautious about the word "new." The question is *how* new. So-called near transfer is very much easier to obtain than far transfer; that is, a strategy suitable for aiding comprehension, such as finding the main idea in a text passage, is more likely to be successful when the strategy is applied to content similar to that in which training in the strategy took place. A very strong implication of this is that study skills training ought to take place in the *teaching* of content rather than in a counseling or remedial center as a general or all-purpose package of portable skills. The major effect of teaching study skills was relatively minor on both performance and reported use of study skills but strong on students' attitudes to their work.

A related point is that strategy training should be taught with understanding of the conditions under which the strategy works. This, of course, is precisely what is absent in mnemonic training, which simply involves drilling in "the rule." If transfer is to take place, the student needs to understand the basis of how the strategy works, when and under what circumstances it is most appropriate, what it requires of the learner; to the extent that this conditional knowledge is properly understood, the strategy may be deployed in contexts "farther" from those in which it was first learned. As Perkins and Salomon (1989) emphasize, we do not get something for nothing; the further the extent of transfer, the more conditional knowledge and the deeper the content knowledge required.

If improved note taking is the target of intervention, for example, teachers of all subjects will use content from their own areas. They will recognize that different tasks will require different approaches to note taking, depending on their curriculum aims. The approach best for taking notes while watching a video about, say, the life cycle of a frog will be different from the approach best for taking notes while studying an art history textbook. The one will focus on speed of recording information and will probably occur at a verbatim level; the other will focus on the ability to select the most important points and to organize them into a meaningful structure. The first is an example of working at the unistructural and/or multistructural levels, whereas in the second example there is opportunity for students to work at the relational level. In both cases students will need to know the purpose of their note taking, that is, the conditions under which they will be required to apply any learning gained from the note taking experience: Are they preparing for a test next week (essay or multiple-choice?), or an end of year exam, or an oral presentation to the class?

As to other kinds of outcomes, oddly enough, directly addressing study skills did not seem particularly fruitful. The desired effect of study skills training—enhanced performance—is better achieved by addressing performance directly, in the relational near manner discussed above.

Affect, on the other hand, is much more amenable to change by intervention; ironically, study skills training is more effective in improving attitudes than in improving study skills themselves. However, the most striking improvements in the affective domain came about with attribution training, in which students are trained to change their attributions for success and failure from maladaptive (success due to effort, failure to lack of ability) to adaptive ones (success due to ability, failure to lack of effort). Again, transfer was limited to the extent that ability is seen as task specific. For example, the reasons attributed to perceived failure in math may not apply to other content areas. While the implications of attribution training for teachers in teacher-student interactions are important, this is not our present concern, which is with *interventions* over and above the context of teaching itself.

When the aim is to change students' attributions for success and failure, teachers should emphasize the importance of systematically using strategies appropriate to the task in hand. The way in which teachers give feedback to students about their use of strategies will probably influence their attributions for success or failure more than will feedback regarding either ability or effort. Two studies in this meta-analysis demonstrated the desirability of providing feedback that explicitly links improved performance with strategy use (Schunk & Cox, 1986; Schunk & Gunn, 1986). Schunk and Cox suggest that the teacher who tells a student, "That's good, you're really working hard" (effort attributional feedback), may not be as effective as the one who links success with appropriate strategy use, as in "That's correct. You got it right because you applied the steps in the right order."

In general, then, the thrust of these findings is quite compatible with the thrust of situated cognition and its implications (J. S. Brown, Collins, & Duguid, 1989; Marton, 1988) and with systems theory (Biggs, 1993). That is, improving learning is less likely to be achieved by targeting the individual in terms of a deficit model, which presupposes that the individual is lacking the right strategies and needs to be taught them or is using the wrong strategies and needs to have them removed. The results of this meta-analysis support the notion of situated cognition, whereby it is recommended that training other than for simple mnemonic performance should (a) be in context, (b) use tasks within the same domain as the target content, (c) and promote a high degree of learner activity and metacognitive awareness. Strategy training should be seen as a balanced system in which the individual's abilities, insights, and sense of responsibility are brought into use, so that the strategies that are appropriate to the task at hand can be used. The student will need to know what those strategies are, of course, and also the conditional knowledge that empowers them: the how, when, where, and why of their use. In other words, effective strategy training becomes embedded in the teaching context itself, a conclusion that has profound implications for future research, development, and application in strategy training.

This analysis, then, returns to the issue of the teaching context itself and points to the central importance of the interface between interventions involving strategy and attribution training and the teaching context. We have not been able in the space available to address that issue adequately, but that is a matter of one thing at a time. We wished in the present article to determine which *interventions* appear to work and under what conditions different kinds of intervention work best. We have addressed that issue, and the results are clear. To fully explore the relationship between the present results and teaching is quite a different exercise and, at this stage, probably not a meta-analytic one.

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Authors

JOHN HATTIE is Professor and Chair, Department of Educational Research and Methodology, 209 Curry, University of North Carolina, Greensboro, NC 27412-5001; hattiej@dewey.uncg.edu. He specializes in measurement, self-concept, and teaching and learning.

JOHN BIGGS is Professor, Department of Education, University of Hong Kong. He specializes in learning and cognition, study processes, and cross-cultural learning theories.

NOLA PURDIE is Lecturer, Queensland University of Technology, Brisbane, Australia. She specializes in cross-cultural learning and study skills.

Received November 16, 1994
Revision received November 28, 1995
Second revision received February 7, 1996
Accepted February 20, 1996