

**The Effects of Effort Training Over Time  
Using Two Different Training Methods**

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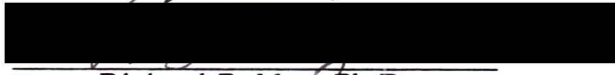
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## ABSTRACT

The relative efficacy of two effort training methods and the effects of multiple training sessions on generalized effort were examined in local Grade 8 students. Each student underwent two effort training sessions. In each session, the problems were arranged in two easily distinguished sets. These sets were the main effort cue in the study. In one session, students were asked to solve a variety of problems involving addition, finding cities on maps and constructing words from target words. Each student received either high effort problems or low effort problems. In the other session, students received both low effort and high effort tangram problems, with each question set associated with either high or low effort. After the second session, generalized effort was measured by asking the subjects for a short written opinion; the opinion sheet came from one question set or the other. Effort was measured both for the quantity and the quality of the opinions produced. It was found that the second session had a greater effect on transferred effort than did the first session, but only for the quality scores. When cues were associated with low effort in both sessions, subjects wrote higher quality opinions than when the opinion cue was consistently associated with high effort. There were no differences found between the effort elicited by the two training methods. Subjects whose opinion cue was associated with contrasting effort levels on the two sessions wrote longer, but not better

quality opinions than those subjects whose cue was associated with a consistent effort history. These results are indicative of the fragility of the effects of effort training. None of the notable trends was shown both for the quantity and the quality scores. In addition, high effort training resulted in reduced effort. The negative results may have been due to either the specific sample used in this study, or to the abstract nature of the effort training tasks. In order to assess the conditions under which effort training will be effective, long-term classroom studies need to be conducted.

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## Chapter 1

### INTRODUCTION

Persistence is defined as the "obstinate continuance in a particular course [of action]" (Oxford English Dictionary); it is manifested by prolonged or increased effort. When attempting a new or difficult task, the persistence that we demonstrate can be a major determinant of eventual success or failure. This is particularly true in academic settings, where new skills and abilities are continually being developed. Students who do not persist in "keeping up" with their school work typically fail to achieve some skills. Further, they likely will not acquire more complex skills that are derived from prerequisite abilities. Understanding the conditions that determine individual differences in persistence and the mechanisms by which expended effort can be maximized is thus an important issue in learning, from both a theoretical and a practical perspective.

Both cognitive and behavioural psychologists have addressed the role of persistence in human learning. From a cognitive perspective, persistence has been attributed to various aspects of perceived competence. For example, Bandura (1977) has proposed a self-efficacy theory, predicting that one's efforts are directly proportional to the strength of expectation that one has the necessary behaviours to complete the task. According to Deci (1980), the more that people feel that their behaviours are self-determined, the more they will be willing to make an effort towards accomplishing a task. In these and other cognitive

theories of competence, researchers (eg. deCharms, 1968; Weiner, 1974) have demonstrated that individual differences in persistence are a function of several organismal factors. However, as Eisenberger & Adornetto (1986) have noted, not all factors affecting persistence are cognitive; relevant behavioural theories can complement the cognitive ones, especially since the former emphasize mechanisms that can be used to maximize the amount of expended effort.

Eisenberger and his colleagues have developed a learned-effort theory (e.g., Eisenberger, Heerdt, Hamdi, Zimet, & Bruckmeir, 1979) to explain and control behavioural persistence. In general terms, persistence on a particular task can be increased by previously exposing individuals to effort training. This training involves doing some tasks that are effortful, yet not so difficult as to result in failure. According to this theory, individuals who are trained to exert a high effort on the training tasks can, under some circumstances, subsequently transfer that effort to a different task.

Effort is defined in the theory as the amount of energy expended per unit of reward. It can be of any nature, either physical or cognitive. When successfully performing a task, individuals learn the amount of effort required for that task (i.e., the energy needed in order to be rewarded). The effort might be low, if the task is easy or if the reward is continuous; or the effort might be higher, as when reward is intermittent or the task is more challenging. This learned effort becomes conditioned to situational stimuli independently of the particular behaviours involved. On subsequent tasks, learned effort is evoked on the basis of the similarity between the two task situations. In other words, it is transferred to the second task situation to a degree dependent on the number of shared cues.

Eisenberger, Heerdt, et al. (1979) call this transferred effort "generalized effort", since effort is transferred across behaviours.

Individuals learn not only the amount of effort required to do a task, but also the kind of effort involved. Through differential reward when performing a task, animals and humans learn which quantitative dimensions of effort are associated with the quantity, quality or rapidity of reward (Logan, 1960). In a spelling bee, for example, effort directed toward increased accuracy is rewarded. For the 100 metre run, in contrast, rewards are available for efforts directed towards greater speed. Effort, according to learned-effort theory, will be transferred along the same dimension as that rewarded previously (Eisenberger, Heerdt, et al., 1979). Again, this does not imply that transfer depends on the behaviours involved; rather, it follows when there are common elements. In most academic tasks, students are likely rewarded for task accuracy. Thus, high effort in a science lab experiment could still be transferred to a later drawing class, as long as there were stimulus similarities between the two class situations.

The effects predicted in learned-effort theory are straightforward in short-term experimental situations. Tasks and cues often have a cumulative history of associated effort, which according to Eisenberger, Heerdt, et al. (1979), may account for some individual differences in persistence. The amount and kind of effort expended in transfer will be a function of both the association of cues with effort during effort training and past associations of effort with cues in the transfer setting. For example, if a teacher wants to make a student more persistent on math word problems, that teacher could conduct some effort training with the student, using a high effort task that rewarded the accuracy of

the student's work. The learned effort from training should, on the basis of stimulus generalization, transfer to later attempts at math word problems. The teacher and the classroom setting would be the shared cues that link training to transfer. However, if the student has had a history of associating low effort with math word problems (and, perhaps, with that teacher), even with the addition of transferred high effort, the resultant expenditure of effort may not increase appreciably. On the other hand, if the past associations were weaker, then the effort training may cause a measurable increase in effort during transfer.

This question of past versus present influences on persistence has not yet been directly tested in the learned-effort literature, even though it has obvious theoretical and practical importance. The first purpose in advancing this thesis was to make a first attempt to address this issue by asking: If effort training is given in two sessions on different days, and if the cues in transfer have been associated with low effort on one day and high effort on the other, what will the transferred effort be? There is no basis in learned-effort theory to predict that there will be any differential effects. In contrast, if the cues in transfer have been consistently associated with the same effort over the two sessions, then the effort expended in transfer should reflect that association. The second purpose in preparing this thesis was to test this prediction.

Eisenberger, in two previous learned-effort experiments, has addressed methods of structuring effort training so as to increase the amount of transferred effort. Eisenberger, Masterson, & McDermitt (1982) found that using high task variety during effort training had this effect. Female college students received either low effort or high effort tasks; these tasks consisted either of a

combination of math, anagram and picture identification problems, or only one of these kinds of tasks. Later, the subjects were asked to write a short essay. The quantity of words and the quality of the essays reflected the effort in training, but only when task variety was high. Eisenberger et al. (1982, p. 500) speculated that high (or low) required effort for a variety of tasks may have led subjects to abstract a rule that high (or low) effort "is required for satisfactory performance, whatever the academic task". From now on, this method will be referred to as "generalized-tasks" training, to avoid repetitious description.

In the second study, Eisenberger, McDermit, Masterson, & Over (1983) demonstrated that generalized effort can come under discriminative control of situational cues. College students were given a set of perceptual problems which required them to identify differences between two drawings. The problems were given alternately by two experimenters; one experimenter required five identifications, while the other required only one. After this training session, the subjects were asked by one of the experimenters to write a short essay. The experimenter who required higher effort on the training tasks elicited essays of greater quantity and quality than did the low effort experimenter. Thus, by discriminating high effort from low effort cues, it may be possible to strengthen the cue/effort association in transfer, thereby increasing the amount of generalized effort. Henceforth in the thesis, this effort training method will be designated as "discriminated-cues" training.

The third purpose proposed in this thesis was to address a practical question: Of the two methods discussed previously for structuring effort training, which one results in a greater amount of generalized effort? The two can be directly

compared by having two effort training sessions; one session with discriminated-cues training, and the other session with generalized-tasks training. This allows the possibility that cues during transfer will be contradictory over the two sessions. The transferred effort will match the stronger method, if one method is stronger than the other. Teachers can then use the better method when trying to increase the persistence of their students on selected tasks.

Although there is no theoretical basis for predicting the relative strengths of the two methods, a cautious prediction can be made based on the results of the two separate studies. In both studies, college students received similar problems and were given the same transfer essay task. In the discriminated-cues study (Eisenberger, McDermit, et al., 1983), subjects in the high effort condition wrote 102 words on average, compared to 75 words for low effort subjects. This separation of scores was larger than for the subjects in the generalized-tasks study (Eisenberger, Masterson, & McDermit, 1982), where high effort subjects wrote 103 words on average and low effort subjects wrote 93 words. The prediction is thus that the discriminated-cues training method will prove to be the stronger of the two methods.

## Chapter 2

### LITERATURE REVIEW

The research tradition in behavioural theories of learning has been to begin with nonhuman animal studies, and to test human applications of the theory later. The study of persistence, including the learned-effort theory, has followed this pattern. In order to trace the development of the behavioural model of persistence, and to put it in a learned-effort perspective, animal and human studies will be addressed in this historical sequence.

#### Persistence Findings in the Animal Literature

Researchers of animal behaviour have shown that a response is more resistant to extinction if it has been learned on a partial reward schedule rather than on a continuous reward schedule. This robust effect, called the partial reward extinction effect (PREE), is the basic experimental finding in the animal persistence literature. Much of the animal research in the 1960's was concerned with testing factors that affected the size of the PREE, such as the number of acquisition trials, the amount of reward, delay of reward, and so on (see Robbins, 1971; Sutherland & Mackintosh, 1971, for reviews).

The generality of the PREE was discovered as a result of the work of Ross (1964). He trained rats to run, jump or climb for food using either partial reward or continuous reward. Next, the rats were trained to run for water using

continuous reward. When the water was removed (extinction), the rats which were trained to run or jump for food showed the PREE, but those which were trained to climb for food did not. He concluded that the PREE was transferrable between two different experimental situations, but only if the behaviours learned under partial reward were compatible with the later-learned behaviours.

The compatibility requirement was challenged by the results of studies showing that the generalized PREE applied to topographically different behaviours. Wenrich, Eckman, Moore, & Houston (1967) demonstrated that partial reward of runway running by rats led to greater resistance to extinction of later-learned lever-pressing. The same results were obtained when runway running was preceded by bar-pressing (Eisenberger, Carson, Guile, & Shapiro, 1979; McCuller, Wong, & Amsel, 1976).

These "different-topography" studies were extended to show that increased persistence was demonstrable in the rewarded performance of transfer behaviours, not only for performance in extinction. Eisenberger, Terborg, & Carlson (1979) found that the rate of lever-pressing was greater following partially rewarded runway shuttling, even when the lever-pressing was previously learned. Increased persistence also resulted during the acquisition of a novel transfer behaviour. When rats were trained to lever-press under partial reward, they later showed a greater number of rewarded runway shuttling responses in acquisition than the rats which lever-pressed under continuous reward (Eisenberger, Carlson, & Frank, 1979).

Training methods other than partial reward were found to increase later persistence in animals. Increasing the force required to be rewarded for a

response also has been shown to have this effect. Lewis (1964) required rats to pull weights of different mass for food. The vigour of later food-rewarded running was related to the heaviness of the weights. In another study, rats which needed to use more force in order to activate a food bar ran faster and rested less between runs on a subsequent runway shuttling task (Eisenberger, Carlson, Guile, & Shapiro, 1979).

Resistance to extinction in rats has been shown to be affected also by the way that they are fed between acquisition of a running response and later extinction of that response (Eisenberger, Masterson, & Over, 1979). Rats which had to gnaw food pellets through the wire mesh of their cages were more resistant to extinction than rats who were fed out of a hopper. The increased persistence was attributed to the greater effort needed to get to the food pellets. According to Eisenberger, Masterson, & Over (1979), this result was consistent with other studies in which it has been shown that transfer of persistence occurred across behaviours. They also concluded that differences in the effort that animals require to feed themselves in the cages may affect the results of ongoing experimental treatments.

### **Human Persistence Findings (from a Behavioural View)**

There have been a number of studies in which it has been confirmed that the PREE applies to human as well as animal subjects. Dweck (1975) showed that, after being trained on a partial reward schedule of success and failure, school children were more persistent when attempting unsolvable arithmetic problems. Similarly, partial reward led to great persistence in school children's reading behaviour (Chapin & Dyck, 1976).

The generalized PREE was also found with depressed psychiatric patients and with learning-disabled children (Eisenberger, Heerdt, et al., 1979). For the depressed patients, verbal praise for doing several custodial tasks later resulted in more time spent and more work completed on a sorting task than if verbal praise followed each custodial task. The learning-disabled children worked harder and completed more work on rewarded math and handwriting tasks if they previously had to read and correctly spell an increased number of words in order to earn rewards.

Nation, Cooney, & Gartrell (1979) have successfully demonstrated the generalized PREE in experiments with college students. Subjects were given either continuous or partial reward on a shuttle-box task. There was increased resistance to extinction in a subsequent button-pressing task if the previous shuttle task was learned with partial reward training.

As in the animal PREE literature, the highly reliable nature of the effect in humans has prompted some research into other factors that may increase or decrease the size of the PREE. For example, resistance to extinction has been shown to be affected by the number of trials of the partial reward training (Nation & Boyagian, 1981) and the relative lengths of partial and continuous reward training, when they are used in combination (Nation & Boyagian, 1980).

There also has been some confirmation in the research on humans of the finding that increased required force in training may increase persistence. Boyagian & Nation (1981) found that requiring high foot pressure on a pedal-pushing task resulted in better responding in the acquisition and extinction of a later-learned shuttle task. The greater force required in pedal training also led to

greater persistence on the acquisition of an anagram task, which seemed to show that transfer was possible between two dissimilar behaviours.

### Learned-Effort Interpretation of Persistence Results

According to the learned-effort theorists (eg. Eisenberger, Heerdt, et al., 1979), the results of all of these persistence studies can be attributed to the effect of learned effort. Any manipulation which adds to the relative effortfulness of a task is assumed to increase behavioural persistence in subsequent related situations. Training that uses either increased force or a partial reward schedule requires additional energy expenditure for reward, and thus is more effortful, than training that uses either low force or a continuous reward schedule.

It is important to note that learned effort requires the occurrence of reward as a consequence of energy expenditure. If effort does not lead to eventual reward, the behaviour ultimately will be extinguished. The negative effects of repeated failure were shown in Eisenberger & Leonard (1980). College students who were trained on unsolvable anagrams were found to be more persistent on a subsequent perceptual task, but only if the later task was solvable. Dweck & Reppucci (1973) also have emphasized the need for success in the context of effort, as this minimizes the risk that the teacher (or other task manipulator) will become a cue associated with failure.

The amount of generalized effort depends on the number of situational cues that are shared by the training and transfer tasks (Eisenberger, Heerdt, et al., 1979). While these details were usually not provided in the articles already

discussed, it seems reasonable to assume that in most, if not all of these experiments, there were a number of shared cues, such as the experimenters, the laboratory, the type of reward given, and so on.

Another prediction in learned-effort theory is that generalized effort will be of the same type learned in training. In the persistence studies that were previously discussed, this prediction could not have been tested, as the experimenters measured transfer performance only on that same dimension (usually speed) as that rewarded in training. However, Eisenberger, Mitchell, McDermitt, & Masterson (1984) did test this prediction, and found that the results confirmed the learned-effort view. Preadolescent learning-disabled students were given a reading task where they were rewarded either for the accuracy or the speed of their reading. When they were later asked to produce some drawings and stories, those students who were rewarded for reading accuracy produced more accurate drawings and stories than the speed reading group or a control group, while those students who were rewarded for the speed of their reading constructed stories more quickly than those in the other groups.

In the previously discussed persistence studies, effort was manipulated either through schedule effects (PREE) or through increased required force. Eisenberger & Leonard (1980) tested the prediction of learned-effort theory that effort could be manipulated in other ways, with the same resultant generalization of effort across behaviours. They gave college students conceptual tasks (anagrams) that were either easy, harder, or unsolvable. The subjects who had the harder anagrams worked longer on a perceptual transfer task, where they had to find differences between two sets of pictures, than did subjects who had the easier

anagrams. Thus, it seemed that effort could be defined by the level of cognitive difficulty. This contention was supported by Eisenberger, Masterson, & McDermitt (1982), who used three cognitive tasks (addition problems, anagrams and identifying differences between pictures) for effort training. Harder versions of these tasks led to greater effort on a later essay transfer task than did easier versions of the tasks. The same picture identification tasks were used in Eisenberger, McDermitt, Masterson, & Over (1983), with the same successful generalization of effort to an essay task.

### **Other Theoretical Interpretations of Persistence Results**

When the reliability of the PREE was established in the animal learning literature, many competing theories were generated to explain it (see Sutherland & Mackintosh, 1971, for a review and discussion of many of the theories). A great number of studies were consequently conducted; none of the theories were consistently supported by all of the findings. Because of this, some of those theories which were more generally supported in the literature have continued to be viable. Two of the current alternative theoretical explanations of persistence are Amsel's (1958, 1972) frustration theory and Wong's (1978, 1979) frustration-exploration hypothesis.

According to Amsel's (1958) original frustration theory, under conditions of partial reward (or any other situation where expected reward for a behaviour is disrupted, like delay of reward), situational cues elicit both anticipated frustration and anticipated reward. Since reward occurs during anticipated frustration, counterconditioning results, and eventually an S-R bond is formed between the

frustration and the learned response. This bond makes the response more persistent after reward conditions have changed (to extinction, for example). When a response is learned under conditions of undisrupted reward, there is no anticipated frustration, hence no counterconditioned bond to drive the behaviour once rewards are removed.

One of the predictions of Amsel's (1958) frustration theory was that frustrative stimuli always elicit the same learned response. This prediction was confirmed by the work of Ross (1964), who found that rats trained to climb using a partial reward schedule later showed climbing behaviour when extinguished on a later-learned runway running behaviour. However, studies that were previously discussed, like Wenrich et al. (1967), showed that persistence was not response-specific.

Amsel (1972) reacted to the disconfirmation of his theory by proposing a general persistence theory. In this new theory, the counterconditioning process was put completely under the control of mediating emotion-produced stimuli, rather than under the control of particular external stimuli. Thus, a strong mediational bond could be evoked in any appropriate situation, regardless of the stimulus and response conditions. This new theory could account for the studies that showed persistence across behaviours.

The second alternative theoretical stance is that of Wong (1978, 1979), who worked with Amsel in the mid-1970's. His frustration-exploration theory is a reinterpretation of Amsel's (1972) theory; it is based on the common observation in the animal persistence literature that intermittent reward results in increased response variability, both during acquisition and extinction of a behaviour

(Sutherland & Mackintosh, 1971). According to Wong (1979), animals show exploratory responses as a result of the frustration due to the uncertainty of noncontinuous reward. They try out different response topographies in order to increase the chances of getting a reward. Eventually, these exploratory behaviours are rewarded (as they would be in partial reward), and thus are conditioned to the frustrative cues. The animal learns to explore different goal-directed behaviours when it is frustrated; in other words, it learns "goal persistence", as opposed to the "response persistence" that continually rewarded animals show. Wong (1979) labelled these exploratory behaviours a "try and vary coping strategy".

The frustration-exploration hypothesis can be used to predict the basic PREE. In extinction, responding shows three distinct stages (Wong, 1978). First, the previous learned response is exhibited, followed by the alternative exploratory responses, and finally, more rewarding non-goal-oriented responses will be exhibited. For animals which have learned a response under conditions of continuous reward, the exploratory behaviours have not been learned, and so the three stages are reduced to two, resulting in less persistence.

The generality of the PREE is predicted by Wong's (1979) theory also. The "try and vary coping strategy" increases goal persistence across situations. Just as in Amsel's (1972) persistence theory, transferred persistence is predicted to occur whenever the new situation elicits frustration. Of course, if the animal is not rewarded in the new situation, the goal-orientation will eventually be extinguished.

### Comparing Learned-Effort with the Frustration Theories

Both Amsel's general persistence theory and Wong's frustration-exploration hypothesis are based upon a behavioural model where frustration is the driving force of persistence. As Sutherland & Mackintosh (1971) have noted, the level of frustration is likely to be related to the amount of effort required per unit of reward, and so the learned-effort interpretation of persistence usually makes the same predictions as do the frustration interpretations. For example, increasing the force required to make an instrumental response led to more persistence, both during extinction of that behaviour (Lewis, 1964) and in performance or extinction of a laterlearned behaviour (Boyagian & Nation, 1981; Eisenberger, Carlson, & Frank, 1979; Eisenberger, Carlson, Guile, & Shapiro, 1979; Eisenberger, Masterson, & Over, 1982). The results of these studies can be attributed either to the increased effort required or to the increased frustration that resulted from having to apply extra force. A similar analysis could be applied to cases where delay of reward was found to increase persistence (Eisenberger & Masterson, 1986; Wong, Traupmann, & Brake, 1974).

There are some experimental results, from both the animal and human learning literature, that are better explained by learned-effort theory than by either of the frustration theories. Eisenberger, Masterson, & Over (1982) found that rats given high effort training during feeding ran faster on the first trial of a runway task than did rats given low effort training during feeding. Amsel's or Wong's theories do not predict any persistence effects until after the subjects have encountered a frustrating situation, which could not have occurred until after the first trial. Along the same lines, the frustration theorists cannot

account for generalized persistence to transfer behaviours that have been continuously rewarded, for these behaviours couldn't have elicited any disruptive emotions (Eisenberger, Masterson, & Over, 1982). Eisenberger's learned-effort theory can account for these results as due to learned effort transferred on the basis of stimulus generalization.

A second, more recent, human learned-effort experiment also disconfirmed the frustration view. Eisenberger & Adornetto (1986) studied two aspects of self-control in young school children: learning to make more of an effort to achieve a larger goal, and learning to delay a reward if the reward is greater after a delay. Both of these aspects of self-control presumably are frustrating. The frustration theorists predict that learning one aspect of self-control will increase the persistence in subsequent situations involving the other aspect of self-control. This follows from the premise that persistence is controlled only by mediating emotion-produced stimuli, and not by situational stimuli. In contrast, the learned-effort view is that transfer will be in the direction of previously rewarded types of effort (Eisenberger, Mitchell, McDermitt, & Masterson, 1984). The results of the Eisenberger & Adornetto (1986) study were consistent with the learned-effort view. Rewarded higher self-control on one aspect of self-control led to greater self-control on that aspect but not on the other.

With regard to the research questions posed in this study, the learned-effort view and the frustration theories do not make different predictions. For example, Wong's frustration-exploration theory can account for the greater persistence that resulted from both generalized-tasks training and discriminated-cues training. Subjects who were trained with a variety of high effort tasks, as in Eisenberger,

Masterson, & McDermitt (1982), were learning to make variable responses in a frustrating situation, according to Wong's (1979) theory. This "try" strategy was rewarded, and so the subjects were more persistent on the later essay-writing task. In the discriminated-cues study (Eisenberger, McDermitt, Masterson, & Over, 1983), the experimenter who required more identifications for each reward could have become a cue for uncertain frustration. This might have caused the subjects to associate a "try" strategy with that cue, leading to greater performance on the transfer essay task. In similar fashion to the learned-effort view, the frustration-exploration hypothesis provides no theoretical basis for predicting the relative strengths of the methods if the two are directly compared.

The predictions made by Amsel and Wong regarding the relative influence of past versus present learning on persistence are the same as in learned-effort theory. When a cue has been consistently paired with rewarded high effort, the resultant increased persistence in the presence of that cue is attributed to greater counterconditioning of anticipated frustration to the cue. When cues have a history of mixed associated effort or frustration, each of these theorists would predict that the influence of past or present learning would depend on the relative amount of each.

### **Practical Uses for Persistence Training**

There are a number of obvious target populations which would benefit from current knowledge about persistence. For example, school children who put out little effort towards one or more school subjects could benefit from persistence-enhancing techniques. This has already been demonstrated in the classroom

setting, for both reading behaviours (Chapin & Dyck, 1975) and for mathematics (Dweck, 1975). Nation & Woods (1980) have proposed that established psychotherapeutic techniques could be improved by using "persistence training" during therapy. In essence, this involves the use of partial reward during the acquisition of appropriate behaviours, with nonrewards similar to those that the clients would encounter in the real world. There is evidence that depressed people might have longer-lasting psychotherapeutic benefits if their therapy incorporated the persistence training method (Nation & Massad, 1978).

In a more quasi-experimental setting, Eisenberger & Masterson (1983) attempted to discover if effort training could stimulate moral or other socially-prized behaviours. They found that college students who received high effort training on a perceptual task claimed to have solved fewer unsolvable anagrams than did low effort-trained students. The reduction in cheating behaviour was attributed to a greater effort at trying to solve the anagrams. They speculated that effort training may be useful in trying to increase the honesty of students in school. Eisenberger, Mitchell, & Masterson (1985) also tested whether humans could be trained to choose more valued, but higher effort goals over more easily-attained, lesser goals; in other words, to increase their self-control. They asked second grade and third grade students to do either high effort tasks (object counting, picture memory, and shape matching) or the same tasks at a lower effort level. Those who had the higher effort training tasks made more self-control choices on a later copying task. Again, the authors speculated that effort training may help people develop the habit of exercising better self-control.

In order to maximize the potential use of effort training in increasing persistence, or possibly developing socially-prized behaviours, it is necessary to address two critical questions. The first is how to structure effort training so as to maximize the apparent benefits. High task variety has been shown to increase generalized effort (Eisenberger, Masterson, & McDermitt, 1982). This increase may be due to the formation of a general rule that high effort is necessary, regardless of the task. Putting learned-effort under the discriminative control of situational cues (Eisenberger, McDermitt, Masterson, & Over, 1983) is another training method that has been shown to increase the amount of effort on a later task. Such use of discriminative control may result in the strengthening of the association between learned effort and the situational cues. There are no studies that have compared the two methods, even though this would be of practical importance in the development of an effective effort training program.

The second critical unanswered question about effort training is the effect of accumulated experience on effort transfer. Eisenberger, Masterson, & McDermitt (1982) explicitly pointed to this deficiency; subjects in most of the Eisenberger studies received only one relatively short effort training session, with the transfer task following immediately afterward. Eisenberger et al. (1982) also provided direct evidence that prior experience with a transfer task can inhibit effort transfer. When subjects were pretested for verbosity by writing a short essay (the same kind of essay as in the later transfer task), and when they were trained on only one type of task, the usual generalized effort was not found. Those subjects who had low effort training wrote 97 words on the transfer essay task, compared to 98 words for the high effort-trained group. When the same experimental

procedures were conducted again, but without the initial essay-writing pretest, the generalized effort effect was restored (85 words for the low effort subjects versus 110 words for the high effort subjects). These results may suggest that the amount of effort transferred to a target task could be a function of both current effort training, and past effort experiences involving that task.

Eisenberger & Shank (1985) provided the only learned-effort study in which the effect of subjects' past effort experiences on current learned effort was directly addressed. Subjects were assigned to two groups on the basis of their scores on a work ethic scale. Similarly to results by Eisenberger & Masterson (1983), subjects' resistance to cheating on an unsolvable anagram task was measured, after one of these conditions: no effort training (control), low effort training, or high effort training. As expected, the low work ethic control group resisted cheating only about half as long as did the high work ethic control group. For the two experimental groups, however, there were no significant differences in transfer between the low work ethic and high work ethic subjects. This may suggest that, in this instance, effort transfer was a function of current effort training only; initial differences in work ethic apparently had no effect on the subjects' cheating behaviour on the transfer task.

The seeming lack of influence of prior effort orientation found in Eisenberger & Shank (1985) seems to contradict the learned-effort theory, in which it is stated that generalized effort will be related to both past and current effort training. One possible explanation is that there may have been no relevant stimulus cues that were common to both the subjects' past experiences and the current experimental set-up. Without stimulus generalization, effort transfer may not

have been possible. The study was done in an experimental setting that may have seemed completely novel to the subjects. In contrast, in the design of this thesis study, past and current effort training were made directly comparable by making key stimulus cues constant in both effort training sessions.

There is a large body of research, both animal and human, that bolsters the prediction in learned-effort theory that both past and present learning affect transfer behaviour. Alloy & Tabachnik (1984) reviewed the literature on covariation assessment, and found that the behaviour of animals and humans was a function of both past experience and current situational contingencies. When the two sources on information are contradictory, but of about equal strength, as was the case in this thesis experiment, neither of the two would be expected to predominate over the other. However, when strong prior expectations have been formed, they often have been shown to predominate over salient current information. An example of this is a study by Lepper, Ross, & Lau (1986), where students persisted in attributing their scores on a logic task to their abilities, even when the scores were demonstrated in graphic fashion to have been due only to the quality of the initial instruction.

### **Summary**

Persistence, both in the form of resistance to extinction of a learned response, and in the form of generalized responding across behaviours, has been demonstrated in the animal and human learning literature. Increased persistence has been shown as a consequence of partial reward training, force training, and in the case of humans, training on cognitively or perceptually demanding tasks.

Learned-effort theorists have interpreted these findings as evidence that effort can be conditioned to the relevant situational cues. Other theorists have put forth explanations of persistence based on the concept of frustrative drive. Of the few studies (all by the learned-effort theorists) that have been done which have contrasted the predictions of the two theories, the learned-effort account has been supported. In the persistence literature, attention has been given lately to practical uses of the theoretical knowledge of persistence. This thesis has been proposed in order to advance this research direction. Two unanswered research questions, both with practical implications, have been addressed in this study: the relative efficacy of two effort training methods, and the effects of multiple training sessions on generalized persistence.

## Chapter 3

### METHOD

#### Design

Subjects each had two sessions with the experimenter. The first session was dedicated either to generalized-tasks training or discriminated-cues training. In the second session, held the next day, the subjects were given the type of training not used in the first session. As soon as the second training session was complete, subjects did the transfer task.

During generalized-tasks training, subjects received mathematical problems, map reading problems and word search problems. The order of presentation of these problems was counterbalanced across subjects. During discriminated-cues training, subjects received tangram problems only. For the transfer task, subjects were asked to write their opinion as to which factors affect students' effort levels in school. The number of words written in the opinions and the conceptual quality of the opinions constituted the two dependent variables in the study.

In both training sessions, the experimental materials were divided into two question sets. The sets were easily distinguishable; they constituted the main cue in the study. Each set contained half of the questions of each problem type attempted during that session. If the session was one of generalized-tasks training, then the sets each contained math, map and word questions, all of the same effort level (either high or low). If the session was one of discriminated-

cues training, then both sets contained only tangram questions, but one set had only the high effort tasks, while the other set had only the low effort tasks. Effort level was counterbalanced across the two sets. For the transfer task, the sheet of paper came from either one set or the other.

Subject's English teachers were asked to provide a rating from 1 (low) to 10 (high) on the typical quantity and quality of their written work. These ratings were meant to reflect the subjects' output relative to that of all of the Grade 8 students that the teacher had ever taught. As such, the ratings were used as covariates in the statistical analyses.

In summary, the study was designed as a  $2 \times 2 \times 2$  multivariate analysis of covariance (MANCOVA) with two dependent variables and two covariates. The three factors were:

Factor 1. Type of Training Method in First Session.

Level 1. Generalized-tasks.

Level 2. Discriminated-cues.

Factor 2. Effort Level in Generalized-Tasks Training.

Level 1. Low.

Level 2. High.

Factor 3. Consistency of Cued Effort in Transfer.

Level 1. Consistent (either low or high in both sessions).

Level 2. Inconsistent (low in one session, high in the other).

The eight experimental cells resulting from this factorial design are outlined in Table 1.

Table 1

Outline of Experimental Design

Cell	Session 1	Session 2	Transfer
G <sub>L</sub> -D-C	G <sub>L</sub>	D	C
G <sub>L</sub> -D-I	G <sub>L</sub>	D	I
G <sub>H</sub> -D-I	G <sub>H</sub>	D	I
G <sub>H</sub> -D-C	G <sub>H</sub>	D	C
D-G <sub>L</sub> -C	D	G <sub>L</sub>	C
D-G <sub>L</sub> -I	D	G <sub>L</sub>	I
D-G <sub>H</sub> -I	D	G <sub>H</sub>	I
D-G <sub>H</sub> -C	D	G <sub>H</sub>	C

Note.

G<sub>L</sub>= generalized-tasks training at the low effort level.

G<sub>H</sub>= generalized-tasks training at the high effort level.

D= discriminated-cues training.

C= cue was consistently associated with same effort level.

I= cue was associated with inconsistent effort levels.

## **Subjects**

Subjects were 96 Grade 8 students from three local middle schools. There were 55 male and 41 female subjects. At one school, all Grade 8 students were given permission forms, while random samples of students were given these forms at the other two schools. Given that permission to participate in the study was required of the students' parents, the sample was not selected at random. However, assignment to the eight experimental conditions was done randomly.

## **Materials**

### **Generalized-Tasks Training.**

The mathematics task consisted of four laminated 8 X 11 inch sheets, each of which had two numbers to be summed (see Appendix C). In the low effort condition, two digit numbers were selected, while in the high effort condition, six digit numbers were chosen. The task was designed to be attempted without the aid of paper and pencil, and given that many of the sums involved regrouping, the high effort task required some short-term memory storage, and therefore was designed to be more effortful. This task was essentially identical to that of Eisenberger, Masterson, & McDermitt (1982), with the exception that their high effort addition task used seven-digit numbers. The reduction of digit size to six in this study was intended as an allowance for the lesser addition experience that Grade 8 students have had relative to college students. Pretesting indicated that this reduction retained the desired high required effort along with the desired modest error rate. Subjects in the pretest made an average of 1.25 incorrect responses on each of the high effort math problems.

The map reading task consisted of four laminated maps of various countries, each map coming with a list of cities on a separate laminated sheet (see Appendix D). In the low effort condition, the list consisted of only one city from the corresponding map, while the list consisted of five cities in the high effort condition. Subjects were asked to locate the listed cities on the map, and to indicate the location by pointing to that city on the map. This perceptual task was similar to the identification task used in Eisenberger et al. (1982).

In the word search task, subjects were presented with six laminated sheets with one seven-letter word listed on each sheet (see Appendix E). In the low effort condition, the task was to find one three-letter word that could be formed from the letters of each test word. In the high effort condition, the requirement was to find four three-letter words for each test word.

### **Discriminated-Cues Training.**

Tangram problems were used in the discriminated-cues training. A tangram is a Chinese puzzle which consists of seven pieces of various geometric shapes; these pieces can be combined two-dimensionally to form larger shapes. Subjects were given a set of five rubber tangram pieces corresponding to the five smallest pieces of the seven piece standard set. Twelve tangram problems were given during the discriminated-cues training, six each of low and high effort, administered one at a time in a fixed order. Each problem consisted of a piece of laminated paper on which was printed a closed polygon (see Appendices F and G). The task for the subjects was to fill this polygon exactly using some or all of the five tangram pieces. The low effort problems could be solved using a combination of three pieces, while all five pieces were required in order to solve the high effort

problems. Pilot studies on this task have resulted in solution times for the low effort problems in the range from 5 sec to 15 sec, while the high effort problems required solution times from 70 sec to 90 sec.

### **Transfer Task.**

For the transfer opinion task, students were given a pen, a piece of lined paper, and a page containing the opinion question. The question was, "How can teachers get their students to work harder in school?" (see Appendix H).

### **Procedure**

Subjects were tested individually. They entered a quiet room, one that was normally reserved for counselling or small meetings, and were seated across the table from the experimenter. In front of the subject was a black binder labelled "Student Questions", while the experimenter had a white folder entitled "Examiner Questions" in front of him. The folders contained the materials to be used for that particular session and experimental condition of the study.

If the subject was doing Session 1 of the study, the experimenter first introduced himself as a graduate student at the University of Victoria, and briefly explained that the study is an exploration of the factors that affect learning in school. The subjects were then told that the experiment involved solving some problems, both that day and again on the next day, for a few minutes each day. The experimenter asked if the subject probably would be present for the next day's session. Subjects who knew in advance that they had a prior commitment and would be absent the next day were politely excused from participating in the study. The remaining subjects were reassured that the whole procedure was

anonymous, confidential, voluntary and completely unconnected with any school evaluation. If the subject had no questions, the experimental procedure was begun.

Before any questions were attempted, the experimenter explained the general procedure. He pointed to the black binder in front of the subject and the white folder in front of the experimenter and said, "Notice that there are two sets of problems in front of us: your 'student questions' in the black binder, and my 'examiner questions' in the white folder. You will be attempting all of the questions from both of these sets today. Since there are two sets, we will alternate one question from one set, then the next question from the other until you have attempted all of the questions in both sets. In order to start, we have to know which set to begin with. I will flip a coin. You call heads or tails, and the winner chooses which set goes first." After the coin toss, the starting set was determined and recorded by the experimenter. At this point, the time was also recorded, and the experiment begun.

For the generalized-tasks training, subjects received verbal instructions just before they attempted each new kind of task (math, map reading, or word search). Subjects heard this set of directions for the mathematics task: "The next few questions have to do with addition. On each problem sheet, you will see two numbers. I want you to add the numbers in your head, and tell me the answer." If subjects gave the correct answer, the experimenter said, "correct." If subjects gave the wrong answer, they were told to "try again." If after five tries at a certain problem a subject still didn't have the correct answer, the experimenter said, "Let's try the next problem." These directions are essentially those of

Eisenberger et al. (1982). The task was designed to be easy enough that five consecutive incorrect responses would be quite a rare event.

The instructions for the map reading task were: "The next few problems involve finding cities on maps. You will see a sheet with a map of a country. On the sheet next to it, you will see a list of cities. Show me the location of all of these cities on the map by pointing to them." If the subject misidentified a city, the experimenter said, "that's not correct, try again." After each list was completed successfully, the experimenter indicated satisfactory performance by saying "good" and moving on to the next problem.

For the word search task, the instructions were: "In the next few problems you will see a word on a sheet of paper. I want you to tell me some three-letter words that can be spelled from the letters of that word. I will tell you if you give a wrong answer, and also when you have found enough three-letter words." After the subject found the required number of three-letter words, the experimenter said "good" and the experiment continued with the next problem. If subject stated that they could not find any more words, then the experimenter said, "let's try another word", and the next problem was presented.

Subjects received verbal instructions before they attempted the tangram tasks in the discriminated-cues training session. The experimenter showed the five rubber tangram pieces to the subject, and said: "Here are five rubber geometric shapes. They can be put together to make other, larger shapes. After these instructions are finished, I will give you some problems where you will have to fit some pieces into the shape that is on the paper. Your task is to find a way to make your pieces fit exactly to the shape on the paper. I will tell you if your

solution is right or not." For each of the harder tangrams, the experimenter gave the subject all five pieces and said, "you will need to use all five pieces to solve this problem". For each easier tangram, the experimenter gave the subject the three pieces necessary to solve it, and said, "you only need these three pieces to solve this problem". After satisfactory completion of each tangram problem, the experimenter said, "correct"; if the solution was not right, the experimenter said, "wrong, try again". If the subjects said that they couldn't solve a particular tangram problem, the experimenter said, "let's go on to the next problem".

For the generalized-tasks training session, questions were arranged randomly in the folders before the subject arrived, so that order effects were minimized. However, the tangram questions (discriminated-cues training) were always arranged in the same order in each question set. This order was established as a consequence of pretesting these questions. From the pretest results, the harder (five piece) tangram problems and the easier (three piece) could be ranked as to mean solution time. Using these ranks, the harder tangrams were ordered so that the hardest problems came first and last in the set. Similarly, the easier tangrams were ordered so that the easiest problems came at the beginning and end of the set. Through this technique, it was hoped that the difference in difficulty between the easier and harder sets would be emphasized for the subjects.

At the end of Session 1, the experimenter arranged with the subject to come back the next day for another session.

When the subject returned for Session 2 of the experiment, the experimenter asked, "Are you ready to go on with some more problems? These will be different from the ones we did yesterday." After the subject assented, the experimenter

asked, "Do you remember which question set we started with yesterday?" The answer was recorded, and the study continued with the kind of training not conducted in the previous session, beginning with the opposite question set. At the end of this new training session, the experimenter told the subject, "You have finished all of the problems that I have for you to do. Before we are through, however, I would like you to write an opinion about something for me." Depending upon the experimental condition, the experimenter either took the opinion question sheet and a piece of lined paper out of his white folder and gave it to the subject, or he told the subject that the opinion question was in the back of the subject's black binder. The subject was then asked to read the opinion question, and to indicate that it was understood. If the subject had any questions about the requested opinion, the experimenter clarified. The subjects then wrote their opinion on the lined paper supplied. After the subject finished writing, and the paper was collected, the experimenter asked, "Had you given much thought to this question before?" and "Did you notice any difference in the shape questions between those in my question set and those in yours?" After recording their responses to these questions, the experimenter then told the subjects that the study was finished and thanked the subjects for their time. Finally, he promised to return to the school to inform them of the results of the study after the data were analyzed.

## Hypotheses

All of these hypotheses are phrased in directional hypothesis form (wherever a difference between means is predicted).

1. Subjects attempting high effort math problems will make more errors than those attempting low effort math problems.

2. Subjects attempting high effort map problems will make more errors than those attempting low effort map problems.

3. Subjects in the high effort word search condition will have more unfound words than those in the low effort word search condition.

4. Subjects will solve fewer high effort tangrams than low effort tangrams.

5. Subjects whose transfer task cue was for low effort in both sessions will write fewer words on the transfer opinion task than subjects whose transfer task cue was for high effort in both sessions.

6. Subjects whose transfer task cue was for low effort in both sessions will write an opinion of poorer conceptual quality on the transfer task than subjects whose transfer task cue was for high effort in both sessions.

7. When the transfer task cue was associated with low effort in one session and high effort in the other, the number of words written by subjects in transfer will be consistent with the effort associated with the cue during discriminated-cues training, not with cue/effort association during generalized-tasks training.

8. When the transfer task cue was associated with low effort in one session and high effort in the other, the quality of the opinion written by subjects in transfer will be consistent with the effort associated with the cue during discriminated-cues training, not with cue/effort association during generalized-tasks training.

9. When the transfer task cue was associated with low effort in one session and high effort in the other, the number of words written by subjects in transfer will be consistent with neither the effort associated with the cue in the first session, nor the cue/effort association in the second session.

10. When the transfer task cue was associated with low effort in one session and high effort in the other, the quality of the opinion written by subjects in transfer will be consistent with neither the effort associated with the cue in the first session, nor the cue/effort association in the second session.

11. There will be no difference in the number of words written on the opinion transfer task between those subjects whose cue in transfer was associated with high effort in one session and low effort in the other, and those subjects whose cue in transfer was always associated with the same level of effort.

12. There will be no difference in the quality of the opinions on the transfer task between those subjects whose cue in transfer was associated with high effort in one session and low effort in the other, and those subjects whose cue in transfer was always associated with the same level of effort.

## Chapter 4

### RESULTS

#### Summary of Major Findings

Subjects underwent two effort training sessions and then wrote an opinion. In using two sessions, two purposes were served. The first was to allow the transfer cue to have been either consistently associated with the same effort, or associated with contrasting effort levels. The second purpose was to compare the generalized-tasks and the discriminated-cues methods for training subjects to associate cues with a particular effort level.

The major results were as follows. None of the hypothesized trends were statistically significant for both the quantity and quality scores. However, some notable trends were found for either one of these dependent variables or the other. There were two interesting, but nonsignificant effects for the quality scores on the transfer opinion task. First, the latter training session had a greater effect on opinion quality than did the initial session. In other words, when the transfer cue was associated with contrasting effort levels, the quality of the opinions was more closely related to the effort learned in the second session. Second, when the transfer cue had a consistent history of associated effort, the high effort cue elicited lower quality opinions than did the low effort cue.

There was only one statistically significant trend for the quantity scores on the opinions. The number of words written in transfer was greater when the cue

was associated with contrasting levels of effort over the two sessions than when the associated effort was consistent.

No reliable differences were found on either the quantity or quality scores between the discriminated-cues method and the generalized-tasks method of effort training. It was possible to compare these two methods when the transfer cue was inconsistent over time. In such cases, subjects learned to associate the cue with one effort level using one method, and the opposite effort level using the other method.

### **Data Analysis Procedures**

The data analysis can be divided into four distinct sections. In the first section, tests are conducted to determine whether the training tasks and the subjects were manipulated as intended in the experimental design. The tasks were designed to be either more or less effortful, while the subjects were intended to be randomly distributed into the eight experimental conditions. In the next section of the data analysis, the procedures for scoring the quantity and quality of the opinions are discussed. The testing of the hypothesized effects on these dependent variables constitutes the third section of the analysis. Finally, other factors that might have affected the results, like gender differences, or the physical setup of the experiment, are examined.

All of the statistical tests were conducted using the SPSS-X computer package (Norusis, 1985). The particular SPSS-X procedures employed at each stage are discussed when the results are presented.

### Effort Manipulation and Randomization Check

Each training task was designed to require either low effort or high effort. For each subject, the number of math errors, map errors, unsolved words and unsolved tangrams were recorded in order to assess the effectiveness of the effort manipulation. Using the SPSS-X MANOVA procedure, high effort generalized-tasks problems were found to result in more errors than low effort generalized-tasks problems,  $F(3,92)=18.01$ ,  $p < 0.001$ . Subjects who did the high effort math problems made significantly more errors on average (4.69) than did those who did the low effort math problems (0.71),  $F(1,94)=38.65$ ,  $p < 0.001$ . Map reading errors, in similar fashion, were more frequent for those subjects looking for five cities ( $M=0.17$ ) than for those with only one city to find ( $M=0.02$ ),  $F(1,94)=6.28$ ,  $p=0.014$ . The average number of missed words by subjects in the high effort word search task was 0.42, compared to 0.08 for those in the low effort condition; this was statistically significant also,  $F(1,94)=4.53$ ,  $p=0.036$ . The frequency of missed solutions for each of these generalization tasks at low and high effort is shown in Tables 2 to 4.

Unlike the three generalization tasks, each subject attempted both the low effort and high effort tangrams. Again using the SPSS-X T-TEST procedure, but this time for paired scores, 0.41 unsolved five-piece tangrams were found on average, higher than the average of 0.02 unsolved three-piece tangrams,  $t(95)=4.80$ ,  $p < 0.001$ . The frequency of unsolved tangrams is shown in Table 5.

Another indication of the effectiveness of the effort manipulation was the time needed by subjects to solve the generalization tasks. In the low effort condition, subjects needed an average of 8.25 minutes to complete all twelve

Table 2

Crosstabulation of Number of Math Errors  
by Effort Condition

Errors	Effort	
	Low	High
0	27	4
1	12	6
2	6	8
3	2	3
4	1	5
5	0	9
6-10	0	9
11-15	0	1
16-20	0	3
	48	48

Table 3

Crosstabulation of Number of Map Reading Errors  
by Effort Condition

---

Errors	Effort	
	Low	High
0	47	40
1	1	8
	<hr/> 48	<hr/> 48

---

Table 4

Crosstabulation of Number of Unsolved Words  
by Effort Condition

Number Unsolved	Effort	
	Low	High
0	47	35
1	0	10
2	0	1
3	0	1
4	1	0
5	0	1
	48	48

Table 5

Crosstabulation of Unsolved Tangrams by Effort Condition

---

Number Unsolved	Effort	
	Low	High
0	94	72
1	2	14
2	0	6
3	0	3
4	0	1
	<hr/>	<hr/>
	96	96

---

problems, while high effort subjects required 22.71 minutes. A corresponding comparison could be undertaken for the discrimination tasks, as each subject did both low and high effort problems; the time needed to solve individual problems was not recorded as a precaution against possible reactive effects.

The next step in the data analysis was a check on the effectiveness of the randomization procedures used in the study. As previously stated, selection of subjects from the population of local Grade 8 students could not be made randomly due to the requirement of written parental permission. The usual procedure of assigning subjects to conditions at random was also not possible, as subjects were not all available at the outset of the study. Instead, the experimental conditions were assigned to the subjects randomly. This was the only available method of random assignment under the circumstances.

Teachers' ratings of the subjects' quantity and quality of written work were treated as covariates. Using the MANOVA procedure in the SPSS-X statistical package, a multivariate analysis of variance was conducted to test the experimental hypotheses with these covariates as dependent variables. None of the hypotheses should be related to either of the covariates, as any significant relationship between a hypothesis and a covariate would indicate poor random assignment. Wilk's lambda was the statistic used both in this test and all of the following multivariate tests of significance. No significant effects were found, either on the multivariate tests (all  $p$ 's > 0.3), or on the univariate tests (all  $p$ 's > 0.25). There is no evidence, then, that the subjects were not randomly assigned to the experimental groups.

### **Scoring the Dependent Variables**

Subjects were given a quantity and a quality score for the opinions that they produced on the transfer task. The quantity score was defined as the number of words written in the opinion. Two judges, working independently, counted the number of words. Perfect agreement was found between their two scores. The quality of the opinion task was measured using a procedure modified from that used by Eisenberger, Masterson, & McDermitt (1982), who themselves modified another procedure by Taylor, Berry, & Block (1958). Both judges, again working independently throughout, read all of the 96 opinions and made a list of all of the distinct concepts that they could find therein. Each judge then classified the concepts into content categories. Within each category, each concept was given an integer rating from 1 to 7 for the effectiveness of that suggestion in making students work harder in school (1=very ineffective; 7=very effective). Finally, the judges re-read the opinions, and by rating each concept, they assigned a total quality score for each opinion. The two scores were highly correlated (Pearson's  $r=0.95$ ), and so each subject was given a quality score that was the average of the two judge's scores.

### **Testing the Experimental Hypotheses**

The distributions for the two dependent variables were each positively skewed, as shown in Figures 1 and 2. To minimize this skewness, the scores in each measure could have been transformed into the corresponding base 10 logarithm scores, which then could have been used in the tests of the hypotheses instead of the raw scores. This was not done, as the skewness was not anticipated

Figure 1

Frequency Distribution of Quantity Scores

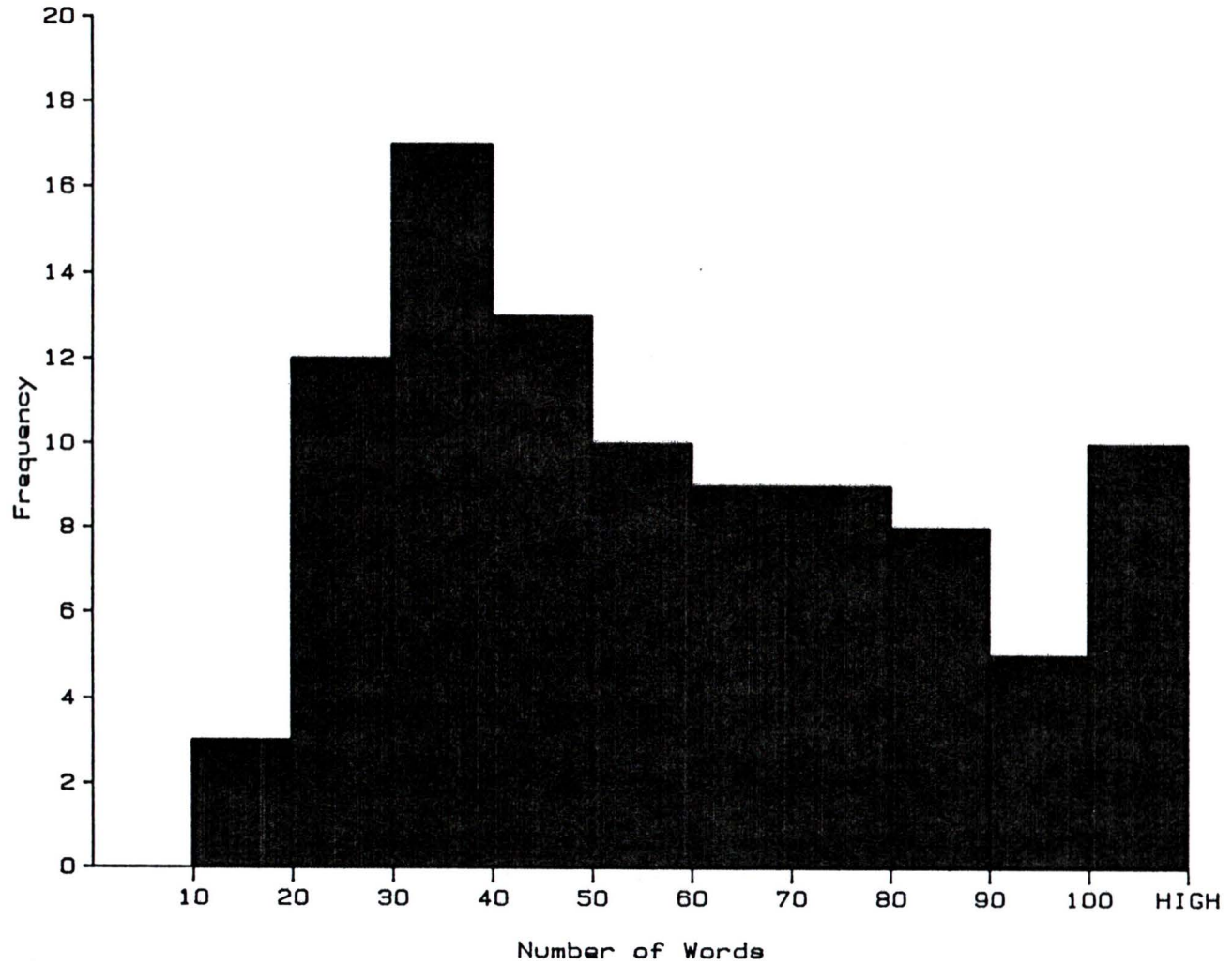
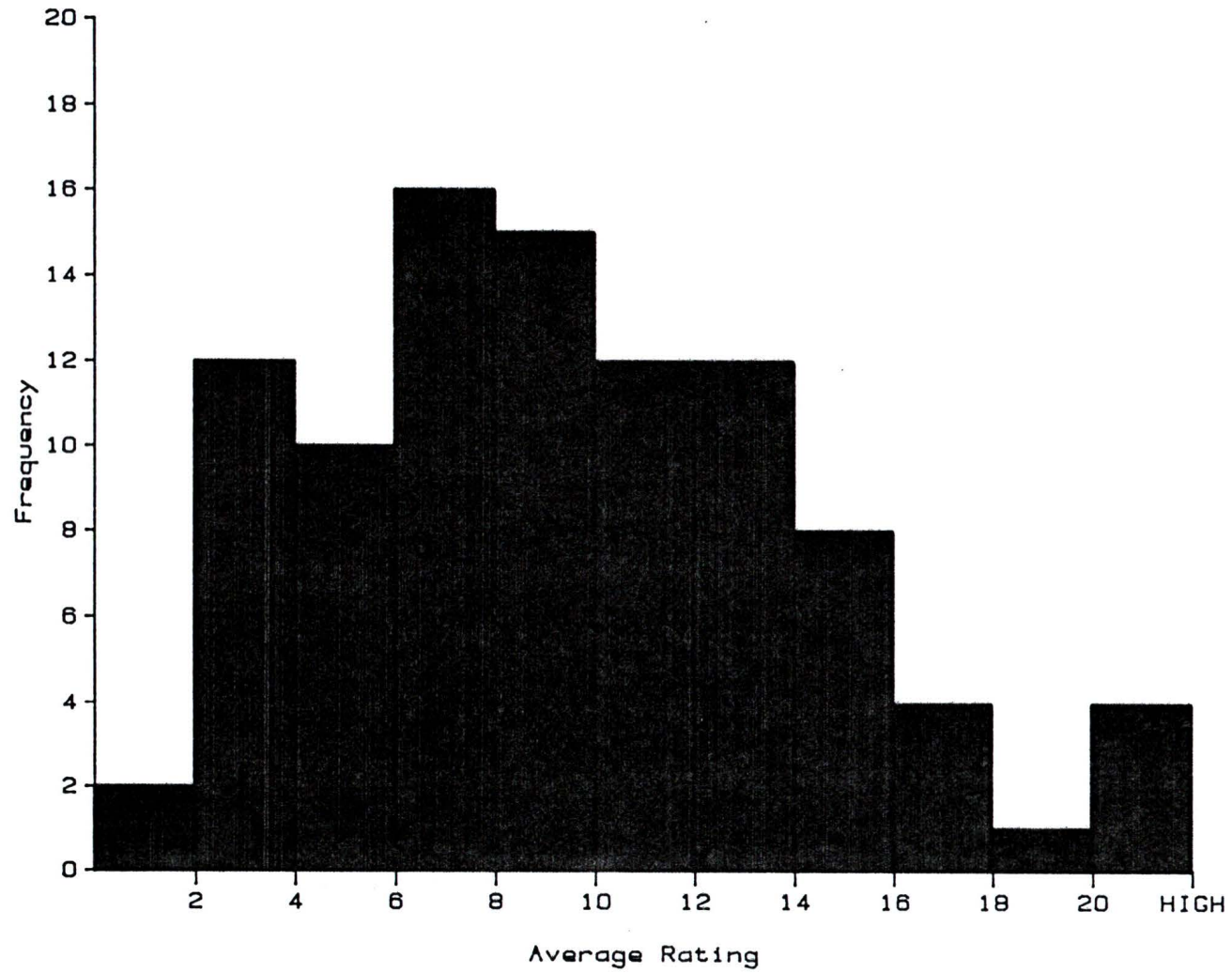


Figure 2

Frequency Distribution of Quality Scores



prior to the the experiment, and because the interpretation of such scores is not as straightforward as that of raw scores.

When scores are skewed, the assumptions of homogeneity of variance and normality are sometimes not met. Using the Bartlett-Box F test in the SPSS-X procedure MANOVA, neither the quantity nor the quality scores in this study met the assumption of homogeneous variances (quantity scores,  $F(7,7679)=4.82$ ,  $p < 0.001$ ; quality scores,  $F(7,7679)=5.25$ ,  $p < 0.001$ ). In Table 6, the means and standard deviations for each experimental condition are shown. As is demonstrated in this table, the standard deviation for cell D-G<sub>H</sub>-C was very high for both the quantity and quality scores. It was over four times higher than the lowest standard deviation for the quantity scores, and more than three times higher than the lowest standard deviation for the quality scores. In spite of violating the homogeneity of variance assumption, the potential effect on the Type I error rate was judged to be minimal, due to the nearly equal number of subjects in each cell (Glass, Peckham, & Sanders, 1972). (The slight differences in cell size were due to errors in recording the proper experimental condition on the scoring sheets.) Therefore, the analysis of the hypothesized effects proceeded as originally planned.

The SPSS-X MANOVA procedure was used to test the main experimental hypotheses. The design was a three-way multivariate analysis of covariance. The number of words written on the opinions and the averaged quality score for the opinions were the two dependent variables in the analysis, while the teachers' ratings of the typical quantity and quality of subjects' written work were the covariates. Three factors were included in the MANOVA: (a) whether

Table 6

Mean Quantity and Quality Scores

Cell	n	Quantity		Quality	
		<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
G <sub>L</sub> -D-C	13	53.2	32.7	9.8	4.5
G <sub>L</sub> -D-I	11	73.7	36.5	11.6	5.8
G <sub>H</sub> -D-I	12	66.3	49.7	9.5	4.3
G <sub>H</sub> -D-C	12	59.2	28.9	7.6	3.9
D-G <sub>L</sub> -C	13	65.9	35.0	12.0	3.8
D-G <sub>L</sub> -I	11	72.2	28.8	9.4	4.6
D-G <sub>H</sub> -I	12	84.3	84.7	13.8	13.0
D-G <sub>H</sub> -C	12	40.9	19.5	8.1	4.1

Note. Cells defined as in Table 1.

generalized-tasks training or discriminated-cues training was used in Session 1; (b) whether subjects underwent low effort or high effort generalized-tasks training; and (c) whether the cue presented in transfer was associated with either the same effort level in both sessions, or contrasting effort levels (see Table 1). In accordance with the hypotheses, planned orthogonal contrasts were constructed from these three factors. The resulting contrast matrix is shown in Table 7.

There are two assumptions that need to be met for an analysis of covariance. The requirement that the covariates be unrelated to the hypotheses was not violated, as previously demonstrated in the randomization check. However, the covariates did not meet the second requirement, which is that the covariates be significantly related to the dependent variables. The multivariate test, in which the combined dependent variables were compared to the combined covariates, was not significant,  $F(4,170)=2.05$ ,  $p=0.089$ . Therefore, the covariates were excluded, as the power of the MANOVA analysis may have been reduced by their inclusion. Nonsignificant covariates might have decreased the power of the tests by accounting for little of the variance in the dependent variables while simultaneously reducing the degrees of freedom.

Before the hypotheses concerning individual dependent measures were tested, multivariate tests were conducted. Effects must be significant at both the multivariate and univariate levels in order to protect the experiment-wise Type I error rate (Hummel & Sligo, 1971). None of the hypotheses passed the multivariate stage (see Table 8), and therefore, the conclusion must be made that there were no statistically significant effects in this study.

Table 7

Contrast Matrix for Hypothesized Effects

Cell	H5,H6	H7,H8	H9,H10	H11,H12
G <sub>L</sub> -D-C	1	0	0	1
G <sub>L</sub> -D-I	0	1	1	-1
G <sub>H</sub> -D-I	0	-1	-1	-1
G <sub>H</sub> -D-C	-1	0	0	1
D-G <sub>L</sub> -C	1	0	0	1
D-G <sub>L</sub> -I	0	1	-1	-1
D-G <sub>H</sub> -I	0	-1	1	-1
D-G <sub>H</sub> -C	-1	0	0	1

Note. Cells defined as in Table 1. Each contrast is for two hypotheses, since there were two dependent variables.

H5,H6=Effort when transfer cue was consistently low in both sessions (1) versus when transfer cue was consistently high in both sessions (-1)

H7,H8=Effort when transfer cue was inconsistent between discriminated-cues training (1) and generalized-tasks training (-1)

H9,H10=Effort when transfer cue was inconsistent between Session 1 training (1) and Session 2 training (-1)

H11,H12=Effort when transfer cue was inconsistent over the two sessions (1) versus when the transfer cue was consistent over the two sessions

Table 8

MANOVA Results for the Hypothesized Effects

Hypotheses	Multivariate $F(2, 87)$	Univariate $F(1, 88)$	
		Quantity	Quality
H5, H6	2.34	0.60	3.09*
H7, H8	0.22	0.03	0.41
H9, H10	1.59	0.58	3.17*
H11, H12	2.34	4.68**	1.77

Note. Hypotheses defined as in Table 7.

\*  $p < 0.10$ ; \*\*  $p < 0.05$

From a purely statistical standpoint, the analysis had to be terminated before the univariate results could be examined. However, some of these trends were of sufficient interest to merit mention. There were three such results. The quantity of words written was higher when the transfer cue was associated with contradictory effort levels over the two sessions than when the effort levels were consistent over time ( $F(1,88)=4.68$ ,  $p=0.033$ ). This trend can be seen in Figure 3. The quality scores for this effect were not significant ( $F(1,88)=1.77$ ,  $p=0.187$ ), although the trend was in the same direction (Figure 4).

There were two nonsignificant univariate trends for the quality scores that were of interest to the hypotheses. When the transfer cue had an inconsistent effort association over the two sessions, the quality scores elicited in transfer reflected the association during the latter session ( $F(1,88)=3.17$ ,  $p=0.078$ ). For example, if the transfer cue was associated with high effort during Session 1, and low effort during Session 2, the quality scores were low. The quality scores were high for the opposite experimental situation. This trend is illustrated in the right side of Figure 4. There was a second notable effect on quality, this time when the transfer cue had the same effort association over both sessions. As is shown in the left side of Figure 4, subject's quality scores were higher when low effort was cued in transfer than when high effort was cued in transfer ( $F(1,88)=3.09$ ,  $p=0.082$ ).

No other univariate effects came close to significance (all  $p$ 's  $> 0.2$ ). Thus, no differences were found in the amount of generalized effort elicited by the generalized-tasks method versus the discriminated-cues method. However, for each of the three effects just discussed, both dependent variables followed the

**Figure 3**  
**Quantity Scores by Experimental Condition**

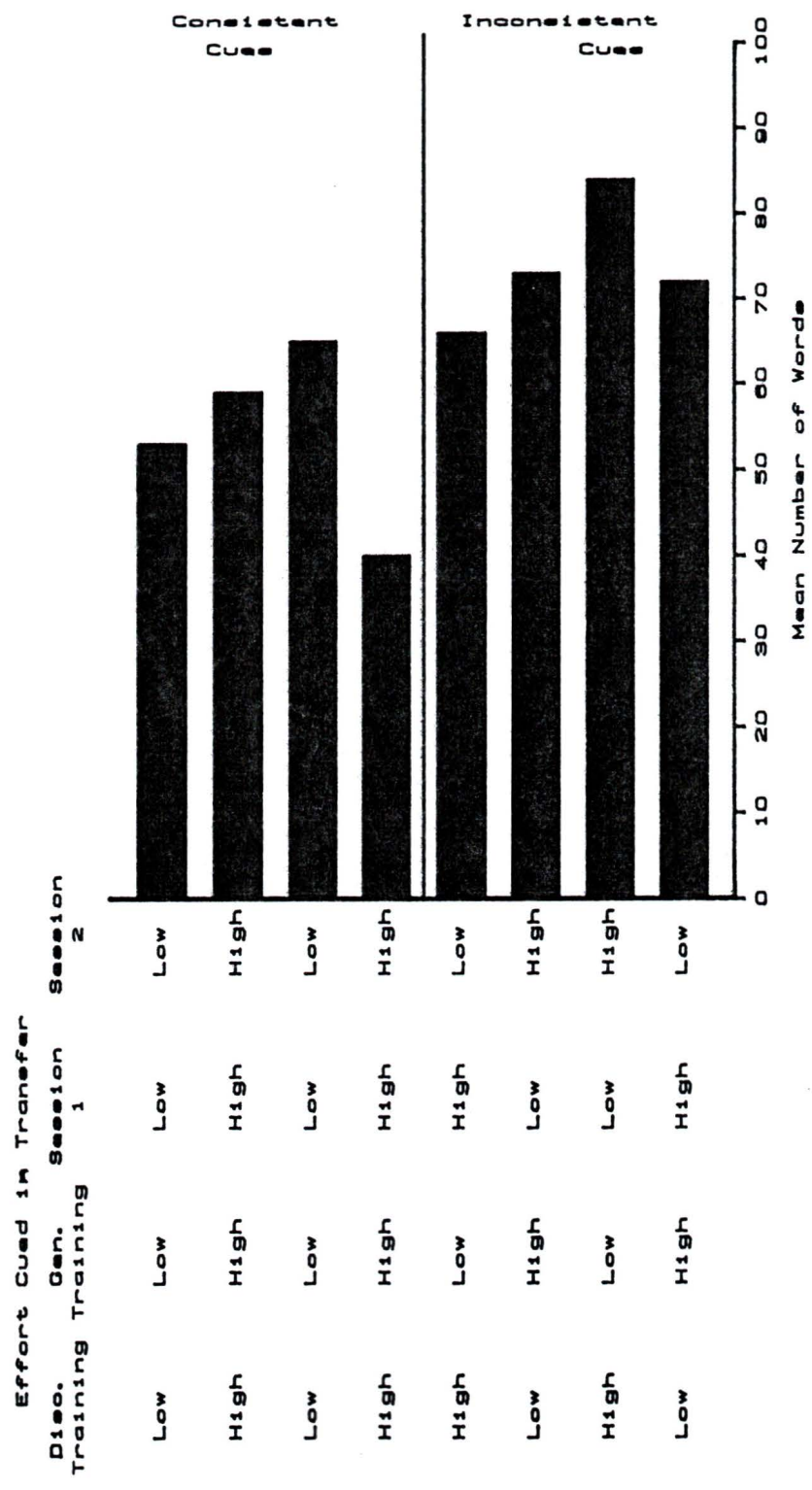
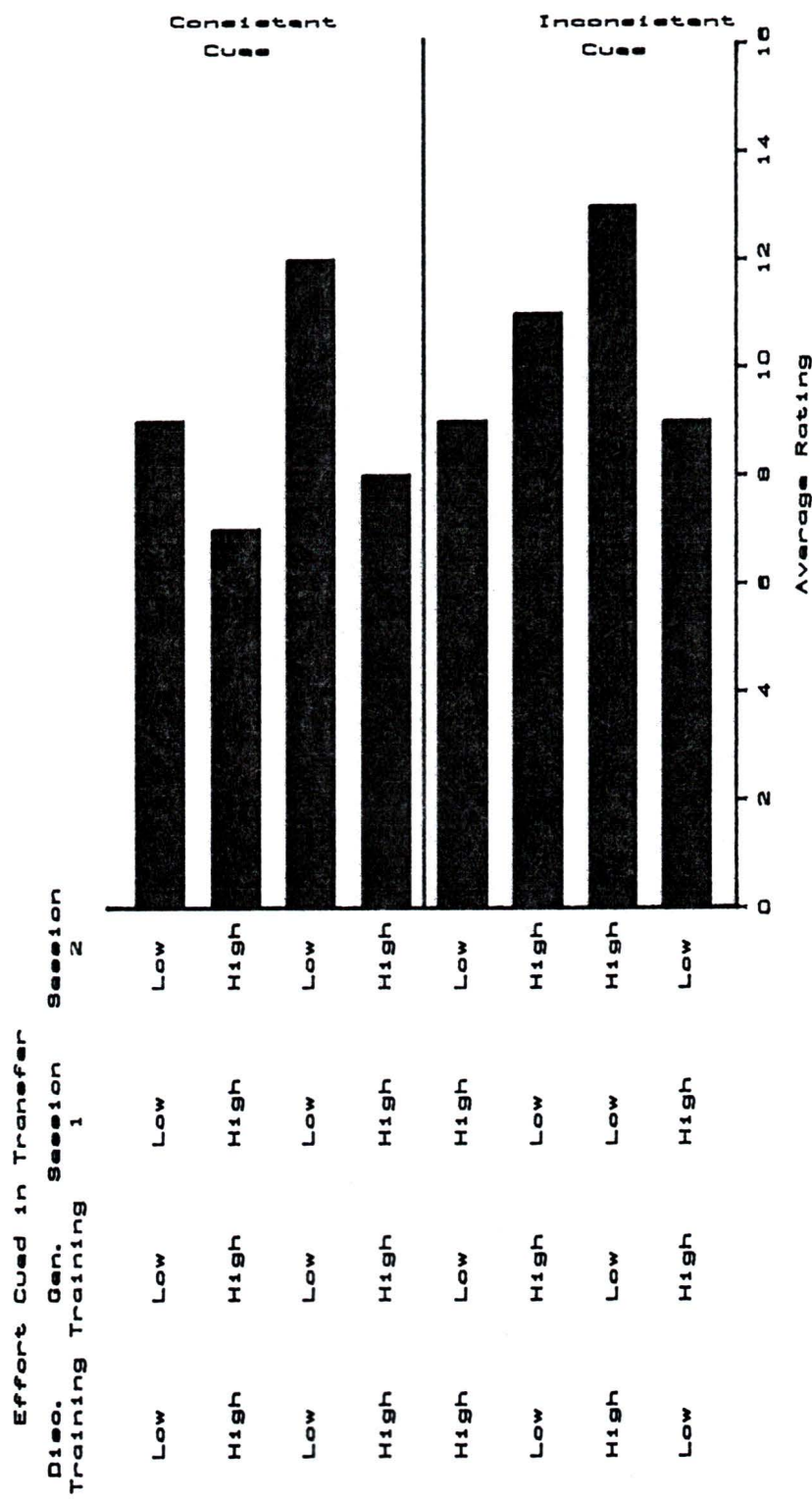


Figure 4  
Quality Scores by Experimental Condition



same general trend (see Figures 3 and 4). This consistency of trend was due to the sizeable relationship between the quantity and quality scores (Pearson's  $r=0.536$ ). It is not surprising that the two dependent variables were so closely related, as both were totals; of words in the former, and of concepts in the latter.

### Other Potentially Important Factors

The quantity and the quality scores were found to be negatively correlated with the number of math problem errors that subjects made in the generalized-tasks session (Pearson's  $r=-0.26$ ,  $p=0.011$ , two-tailed, for quantity; Pearson's  $r=-0.20$ ,  $p=0.048$ , two-tailed, for for quality). This correlation was even stronger (for the quantity scores) for those subjects who had the high effort generalized-tasks session (Pearson's  $r=-0.31$ ,  $p=0.034$ , two-tailed). There were no other significant relationships between the dependent variables and any of the other problems.

One possible extraneous factor in the experimental procedure was the arrangement of the two question sets. Each set was associated not only with a certain effort level, but also with its location in front of either the examiner or the subject. The location could have been a factor if subjects had (mistakenly) related the location of the questions with the required effort. For example, subjects may have believed that "examiner questions" were harder than "student questions". However, using the SPSS-X T-Test procedure, neither the quantity scores ( $t(94)=1.44$ ,  $p=0.153$ ) nor the quality scores ( $t(94)=0.50$ ,  $p=0.615$ ) were found to be correlated with problem set location.

The scores on the dependent variables might also have been affected by subjects' prior consideration of the opinion question before the study. Those who indicated at the end of the study that they had thought about the question before may have had longer and better quality opinions than those for whom the question was novel. Such was not the case, as there were no significant differences for either quantity ( $t(64)=0.58$ ,  $p=0.566$ ) or quality ( $t(64)=0.59$ ,  $p=0.555$ ).

Another factor that may have influenced the results was the time of day when the subjects wrote their opinions. Perhaps subjects who did the transfer task in the afternoon wrote shorter, poorer opinions because they were getting tired after a day of school work. Alternatively, by the afternoon, the students could have "warmed up" to writing, which may have led to increased quantity and quality of their opinions. Neither trend was evident in the data. Those who wrote their opinions in the morning wrote an average of 64.0 words, compared to 64.5 words for those who had the transfer task in the afternoon ( $t(94)=0.05$ ,  $p=0.96$ ). There also was no difference in the quality scores ( $M=10.5$ , morning;  $M=9.8$ , afternoon;  $t(94)=0.65$ ,  $p=0.52$ ).

The experiment was designed so that the subjects would notice the black binder/white folder cue, and come to associate each cue with a certain effort level during the session. Two measures were taken to address the success of the manipulation. First, subjects were asked at the beginning of the second session if they remembered the starting question set from the day before. Almost all of the subjects (95.5%) were able to identify the correct question set. Second, subjects were asked at the end of the second session if they noticed any difference between the tangrams in one question set versus the other. Overall, 72.2%

mentioned the difference in difficulty or effort required. The subjects who did notice were comprised of 88.2% of those who had just had the tangrams during that session, compared to 56.3% of those who had done the tangrams on the previous day. This apparent decrease in recall over time was statistically significant,  $\chi^2(1)=6.97$ ,  $p=0.008$ .

It was possible that the stronger effects found in the MANOVA were associated only with those subjects who consciously noticed the effort cues. This relationship could not be addressed reliably in this study, given the combination of highly variable scores and the smaller sample sizes involved in such tests. Unfortunately, the "notice" question was only asked of 66 of the 96 subjects, and so the results of such a test would not have been reliable.

Subjects were selected as they became available, rather than all at once before the onset of the experiment. As a result, gender could not be used as a blocking factor. Gender effects might have been taken into account by using gender as a covariate, but an SPSS-X MANOVA analysis using quantity, quality and gender as covariates showed that gender was significantly related to the Session 1 versus Session 2 learning effect,  $F(1,88)=6.03$ ,  $p=0.016$ . Covariates must not be related to the hypothesized effects, and so gender was rejected as a possible covariate.

A breakdown of the covariate scores indicated that teachers rated female subjects higher than the males on both the quantity and quality of their written work. The average quantity rating was 6.9 for males, 7.9 for females,  $t(94)=2.42$ ,  $p=0.017$ . For quality ratings, the average was 6.5 for males, 7.7 for females,  $t(94)=3.23$ ,  $p=0.002$ . In contrast to the teacher's ratings, sex differences in the

actual quantity and quality scores produced by the students did not reach significance. Males wrote an average of 66.8 words, compared to 60.6 by the female subjects ( $t(94)=0.71$ ,  $p=0.478$ ), while the mean quality scores were 9.4 for males, 11.5 for females ( $t(94)=1.63$ ,  $p=0.106$ ). These particular results must be looked upon with suspicion, given that the subjects were not randomly assigned by sex to the experimental conditions; this assignment did not break down very evenly, as shown in Table 9.

There were no gender differences with regard to whether subjects had previously thought about the opinion question, or whether they remembered the identity of the initial question set, or whether they noticed the different cued effort in the tangram problems (all  $\chi^2(1)=0.00$ ,  $p=1.0$ ).

Table 9

Crosstabulation of Experimental Condition by Gender

Cell	Male	Female
G <sub>L</sub> -D-C	7	6
G <sub>L</sub> -D-I	8	3
G <sub>H</sub> -D-I	4	8
G <sub>H</sub> -D-C	11	1
D-G <sub>L</sub> -C	6	7
D-G <sub>L</sub> -I	4	7
D-G <sub>H</sub> -I	8	4
D-G <sub>H</sub> -C	7	5
	55	41

Note. Experimental condition for each cell in Table 1.

## Chapter 5

### DISCUSSION

In order to address the contribution of this study to current and future theories of persistence, the discussion is organized into three parts. In the first part, the findings of the study will be reviewed both in terms of the stated hypotheses and in terms of the concordance or discordance with current theories. In the second part, the possible shortcomings in the design and implementation of the study will be examined. In the third part, practical educational ramifications of the findings, and suggestions for possible future research on persistence in academic settings will be discussed.

#### Interpretation of the Results

##### Effort Manipulation.

The success of the effort manipulation is a prerequisite for any later discussion of the major hypotheses in this study. If subjects did not find the high effort questions to be harder than the low effort ones, then the whole intent in the experiment of associating different cues with various effort levels would be defeated. However, the a priori hypotheses concerning effort manipulation were confirmed. In each of the four types of training tasks (addition, map reading, word search and tangrams), the average number of missed solutions was

significantly greater for the high effort questions than for the low effort questions.

The particular tasks used in this study were chosen to closely resemble the tasks that are found in some of the learned-effort literature. In the original generalized-tasks study (Eisenberger, Masterson, & McDermitt, 1982), the training tasks used were addition problems, anagrams and picture identification questions. In this study, addition problems, word searches, tangrams, and map reading were used. The word search and tangram questions were intended to resemble Eisenberger's anagrams, as all three tasks require subjects to organize information into a coherent whole. Similarly, both map reading and picture identification are perceptual tasks. Given the substantial comparability of the two sets of tasks, the generalized effort effect found in the learned-effort research was expected in the current study.

It must be noted, however, that the subjects in Eisenberger et al. (1982) were college students, not Grade 8 students. It is possible, though not predicted by learned-effort theory, that the effects of effort training may be different for the two populations. The learned-effort effect has been demonstrated both for preadolescent children (Eisenberger & Adornetto, 1986; Eisenberger, Heerdt, et al., 1979; Eisenberger, Mitchell, & Masterson, 1985; Eisenberger, Mitchell, McDermitt, & Masterson, 1984) and for adults (Eisenberger, Heerdt, et al., 1979; Eisenberger & Masterson, 1983; Eisenberger, Masterson, & McDermitt, 1982; Eisenberger, McDermitt, Masterson, & Over, 1982; Eisenberger & Shank, 1985), but not for adolescents.

### Past versus Present Learning.

No difference was found on the quantity scores for the relative influence of Session 1 versus Session 2 learning. For the quality scores, there was a fairly strong, but statistically unreliable trend towards the greater influence of the latter training session. Thus, the hypotheses of no difference between past versus present learning were generally confirmed.

One possible explanation for the nonsignificant trend is that some subjects may have forgotten the Session 1 training by the time that they wrote the transfer opinion task, and therefore were more influenced by the training in the second session. This conjecture is supported by the finding that subjects who did the discriminated-cues training on the second day noticed the discrimination significantly more often than those who did that training on the day before. This difference could be explained either by the fading of Session 1 learned-effort with time, or by the active replacement of Session 1 learned-effort by the training in Session 2. There is no evidence in favour of either alternative.

The learned-effort theorists, like the other persistence theorists already discussed, have not made strong predictions about the interactions of past and present influences on persistence. Perhaps, as is suggested by the results of this study, this is because the relative contribution of past effort training may be difficult to quantify. As Alloy & Tabachnik (1984) have noted, the influence of prior experiences on current behaviours may be affected by the recall of the experiences. This recall, in turn, may have been hampered by the artificiality of the cues used in the current study. Eisenberger, McDermitt, Masterson, & Over (1983) used two experimenters to act as a discriminative cue. This cue probably

was more concrete to students that the colour, binding and labelling of a problem set. Of course, many different classroom stimuli besides the identity of a teacher can function and probably do function as discriminative cues. Two examples of such stimuli might be the subject matter and the arrangement of the desks.

### **High Effort versus Low Effort Training.**

It was hypothesized that generalized effort would be low if the transfer cue was associated with low effort throughout both training sessions, and generalized effort would be high if the association was consistently high in both sessions. This hypothesis was not confirmed, either for the quantity or the quality scores. In fact, for the latter, there was a moderate trend in the opposite direction; low generalized effort resulted from a transfer cue that was consistently associated with high effort, and higher generalized effort resulted from a transfer cue that was consistently associated with low effort.

These findings clearly are inconsistent with the predictions of the persistence theories. Perhaps the number of errors that the subjects made during training in the current study accounts for these results. There was a small, but significant negative correlation between the number of math errors on the generalized-tasks problems, and the quantity and quality scores. Although the error rate per problem on the math questions was not much higher than in Eisenberger, Masterson, & McDermitt (1982) (1.17 versus 0.72), the positive relationship between effort training and effort in transfer found there was reversed in this study.

Another possible explanation is that the subjects who worked longer on the training tasks got tired or frustrated, and consequently put less effort into their

opinions. This possibility was not supported by the results. The time spent on the training tasks was not related to either opinion quantity or quality.

The negative relationship found between the math training problems and the scores on the dependent variables may be interpreted as evidence that the learned-effort phenomenon is manifested only under a small subset of possible learning conditions. For example, Eisenberger, Masterson, & McDermit (1982) found that there was no generalized effort effect if subjects were given a pretest and then trained using only one type of task. The effect was restored either by increasing the variety of the tasks or by not using a pretest. In Eisenberger & Adornetto (1986), generalized self-control involving delay of reward was found for low effort training, but not for high effort training. It may be the case the the younger subjects in this study were more affected by their errors than were the college students in the learned-effort literature.

#### **Discriminated-Cues vs. Generalized-tasks Training.**

It was hypothesized that the discriminated-cues training procedure would be superior to the generalized-tasks training procedure. This was not confirmed by the results. There were no significant differences, for either the quantity or the quality scores, in the generalized effort elicited by the two procedures.

This research question has practical implications, since different effort training structures are required for each method. As no differences in effectiveness were found, and considering the lack of replication in this study of the basic findings of the learned-effort theory, no practical suggestions are offered for increasing the persistence of students in the classroom setting.

### **Consistent versus Inconsistent Cues.**

According to the learned-effort theorists, cues which have been consistently associated with a certain (low or high) effort level will elicit the same effort level in transfer. In contrast, cues with an equal history of low and high effort associations should lead to an intermediate level of generalized effort. This hypothesized relationship was not supported in this research. The presence of an inconsistent cue in transfer resulted in more words written than did the presence of a consistently low or high transfer cue. A similar, but much weaker trend was found for the quality of the written opinion.

As in the previously discussed instance where the results did not match the persistence theories, one can only speculate cautiously about the mechanisms involved. One possibility is that the inconsistency in the transfer cue caused the subjects to react; it may have been that this reactive energy was channelled towards increased opinion quantity. For the subjects whose transfer cue was consistent over the sessions, there was no opportunity to react, and therefore less energy available to be put towards the opinion task. The learned-effort theorists have not addressed this possibility, as transfer cues were always consistent in their training sessions.

### **Shortcomings of Design and Implementation**

The cues which were used in the study were not as salient as those found in the typical classroom. Although the subjects were aware of the two different cues, and nearly all of them were able to remember the cue of the first training session problem, they did not make the strong associations between cue and effort

that were intended in the study. For a seemingly small effect like that of learned-effort, the cues must be more concrete and affectively involving.

The choice of covariates was poor. Teachers' ratings, rather than a sample of the students' writing, were used as the measures of preexperimental individual differences because it has been demonstrated that prior familiarity with the transfer task can reduce or eliminate the learned-effort effect. In the study by Eisenberger, Masterson, & McDermitt (1982), such a negative result occurred when the subjects wrote a preeffort training essay that was similar to the transfer essay. The reliability of these teachers' ratings can be questioned, as several different teachers were involved. Each of them were asked to base their ratings on the general population of Grade 8 students, rather than those in a particular class or cohort, but it is still likely that there was some variability between the teachers on their internal rating scales. The teachers' ratings might also have been affected by the nonspecific language in the rating request (see Appendix B). Foster & Salvia (1977) found that teachers' ratings of children's learning disabilities were related to the specificity of the instructions. In addition, the covariate scores were measured on a scale of 1 to 10. This range was not broad enough, given the highly variable quantity and quality scores in the study.

It is possible that the opinion question was too familiar to the subjects to be affected very much by the effort training sessions. Almost half of the subjects claimed to have given prior thought to the opinion question. Subjects also may have told their friends about the details of the study, including the topic of the opinion question. This could have exacerbated the possible familiarity problem.

The study took place in schools during school hours. As a result, the implementation of the study sometimes was affected by conflicts with school functions. For example, it often was not possible to schedule a subject for two sessions exactly 24 hours apart. Some subjects had tests or other important school work at that time, or the teacher involved did not wish to let the subject leave the class. As a result, intersession durations ranged from 18 to 30 hours. In some instances, the room used for the experiment was temporarily unavailable, and so some subjects had their sessions in two different rooms. Finally, some subjects may have reacted to the bell that signalled the end of one period and the beginning of the other. They also may have been distracted by the noise in the hallway if one of their training sessions took place over two school periods.

#### **Educational Implications and Future Research Directions**

The lack of basic replication of the predictions of the learned-effort theory and other persistence theories makes it difficult to make any suggestions as to how to use the theory to improve educational practices. If anything, the results have indicated that the apparently beneficial effects of learned-effort found in the literature may not generalize to Grade 8 students.

However, the real advantages or disadvantages of effort training can be determined only by testing the theory in the classroom setting over a much longer time. In order to control for individual differences in effort orientation before effort training begins, it will be necessary to study learned-effort in young school-age children. Some longitudinal studies on learned-effort would help to clarify the crucial question of how people develop persistence.

Some basic experimental work also could be done to determine, for different tasks and for students of various ages, the function between the amount of effort required in training and the amount of effort transferred.

### Conclusion

Although this study did not confirm the predictions of learned-effort theory, the theory has not necessarily been falsified. In this experiment, the abstract cues and the distracting background school setting may have combined to eliminate any possible effects of effort training. The learned-effort effect seems to be fragile. However, since increased effort in students is a universal goal for teachers, future studies should be conducted to determine the conditions under which effort training is effective. Then, new teaching strategies could be devised to help all students, but especially those who could benefit most from the effort habit.

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**APPENDIX A**  
**LETTER TO PARENTS**

Dear Parent or Guardian,

I am a graduate student at the University of Victoria. I am conducting research on factors that affect the amount of effort that Grade 8 students exert on school-related tasks. I would like you permission to conduct the following study with your child:

1. Presenting a short series of simple addition problems, map reading problems, and word construction problems for you child to solve (15 min.).
2. Presenting a short series of simple shape manipulation problems for your child to solve (15 min.).
3. Asking your child to write a paragraph giving an opinion on effort (5-10 min.).

The study will take place in two sessions, held on consecutive days. Participation in this study is purely voluntary. If for any reason you do not wish your child to participate in this study, or if he/she does not wish to continue in it, this will in no way affect his/her school grades.

If you have any questions, I am available to discuss the study with you. You can phone me at 479-7216 after 6:00 p.m.

Thank you for your consideration.

Sincerely yours,

Barry Forer, B.Sc.

-----detach-----detach-----

I give permission for my son/daughter \_\_\_\_\_ to participate in the generalized effort study, as described in the letter of February 27, 1987.

\_\_\_\_\_

Parent/Guardian Signature

**APPENDIX B**  
**TEACHERS' COVARIATE RATING FORM**

Dear Teacher,

In order to complete by study, I would like you to provide me with two ratings concerning your students' written work. The first rating is the typical quantity of each students' written work (i.e. how many words that student writes on average). The second rating is for the typical quality of each students' written work (i.e. the strength of the ideas expressed in the work). Please confine your ratings to a whole number from 1 to 10, where 1 is the lowest rating based on all of the Grade 8 students that you have ever taught, and 10 is the highest rating, again on the same basis. Thank you.

<u>Student Name</u>	<u>Quantity Score</u>	<u>Quality Score</u>
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**APPENDIX C**  
**MATH PROBLEMS**

23

98

84

76

63

49

87

59

256089

395384

471528

268905

619378

275893

627754

184695

**APPENDIX D**  
**MAP READING PROBLEMS**

Arequipa

Cajamarca

Ayacucho

Chimbote

Arequipa

Chiclayo

PERU



Zacapa

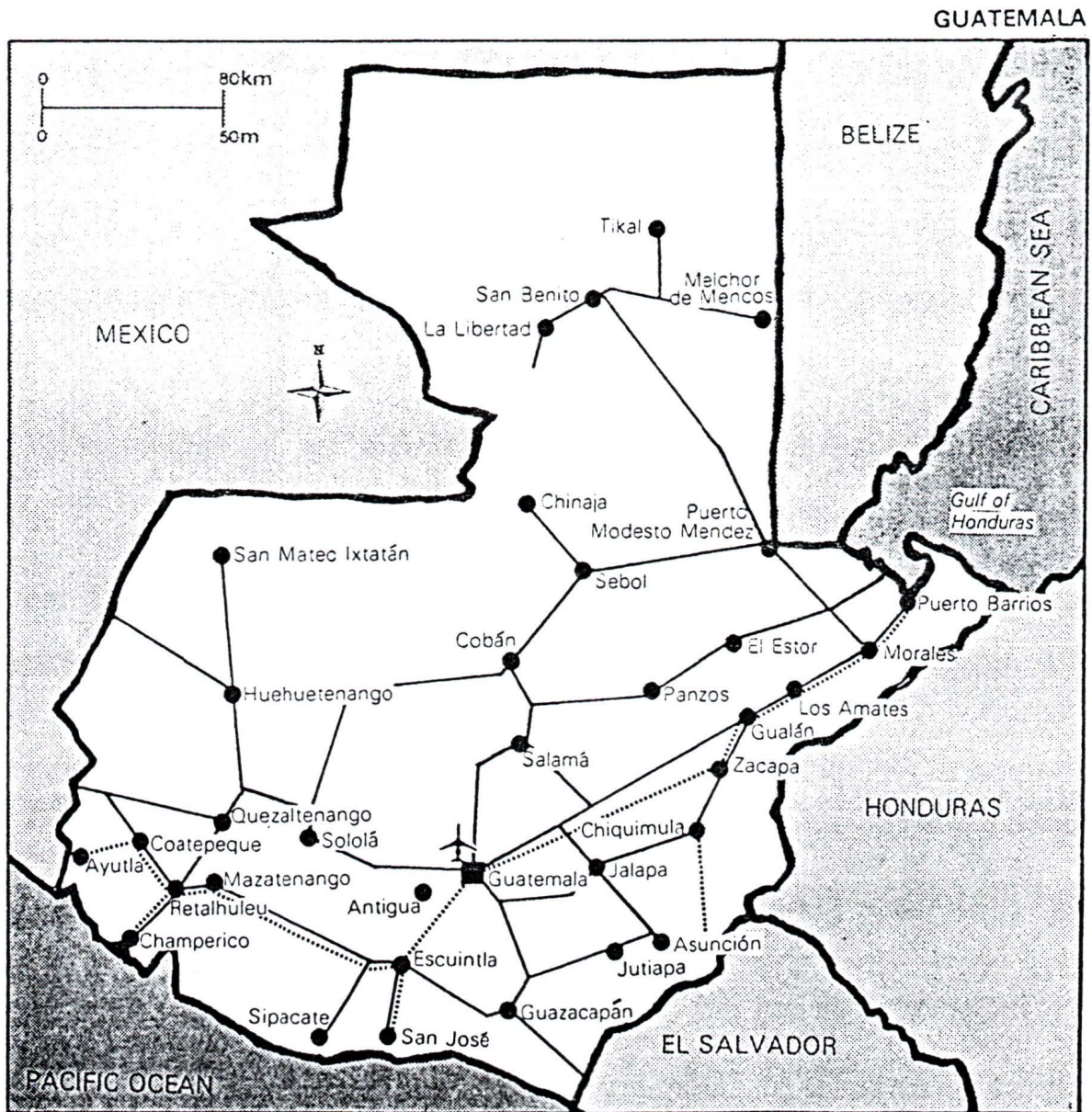
Coatepeque

Jalapa

San Benito

Zacapa

Sipacate



Machala

Esmeraldas

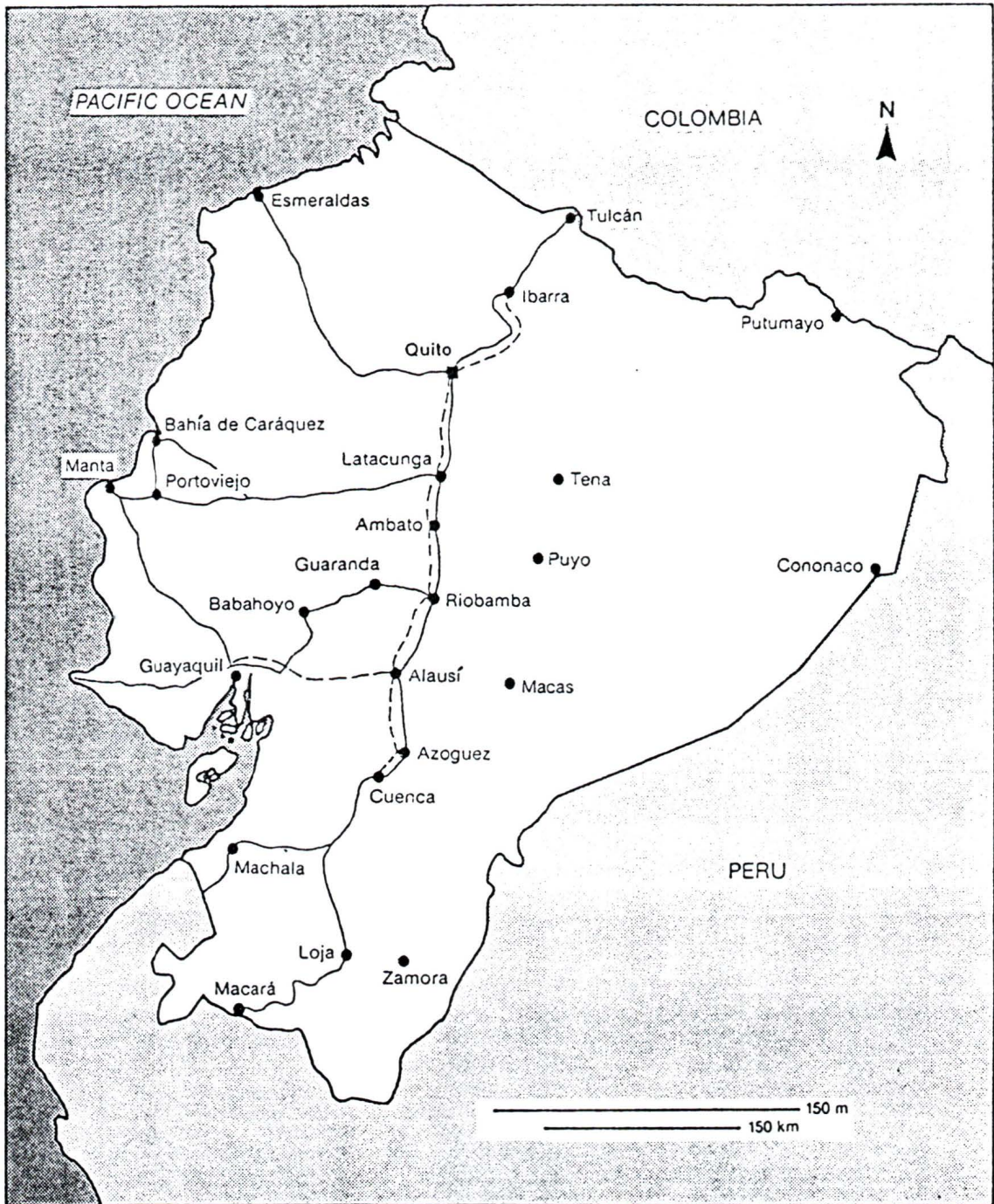
Azoguez

Manta

Machala

Puyo

ECUADOR



Garzón

Cartágena

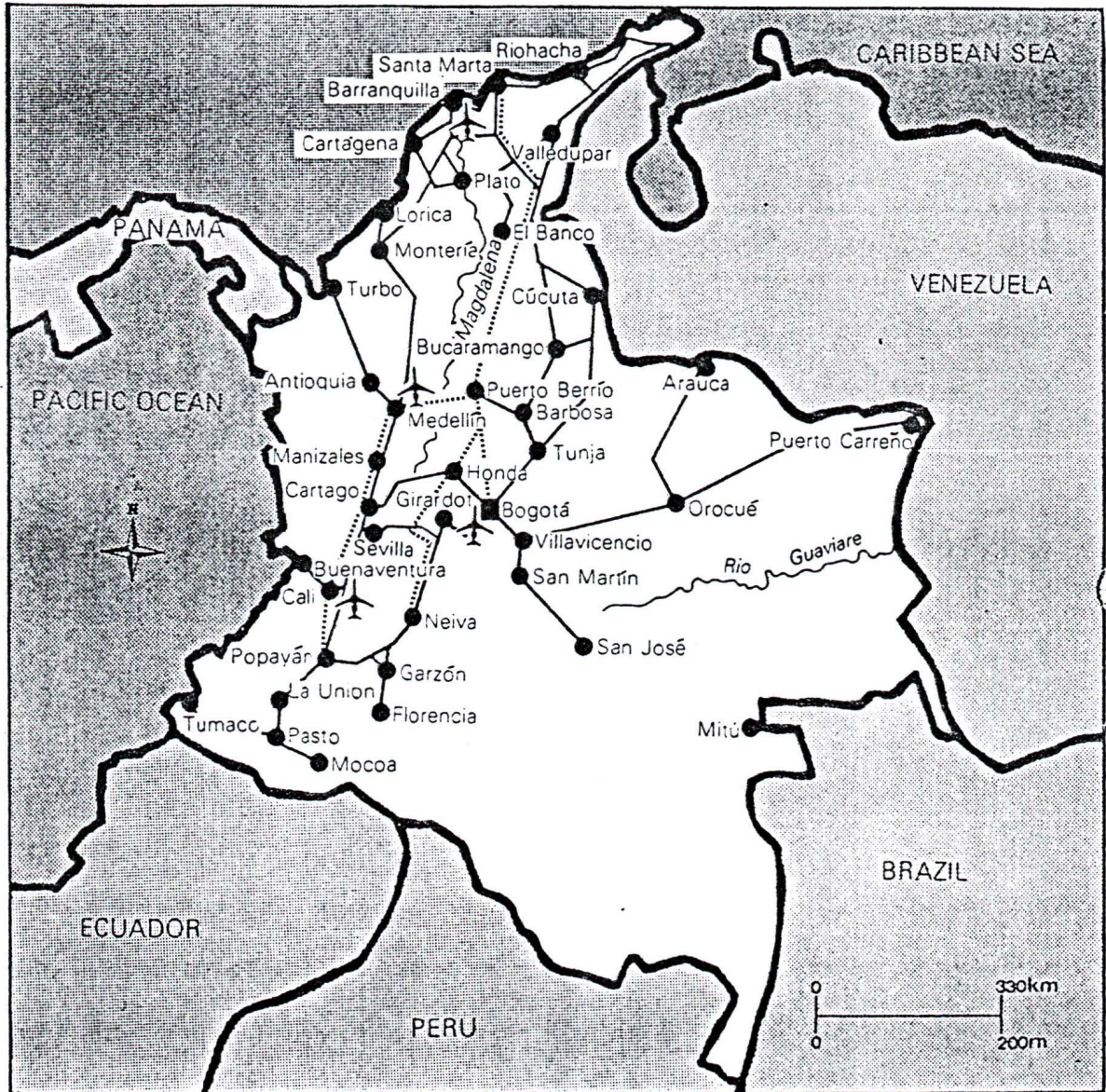
San Martín

Arauca

Garzón

Cartago

COLOMBIA



**APPENDIX E**  
**WORD SEARCH PROBLEMS**

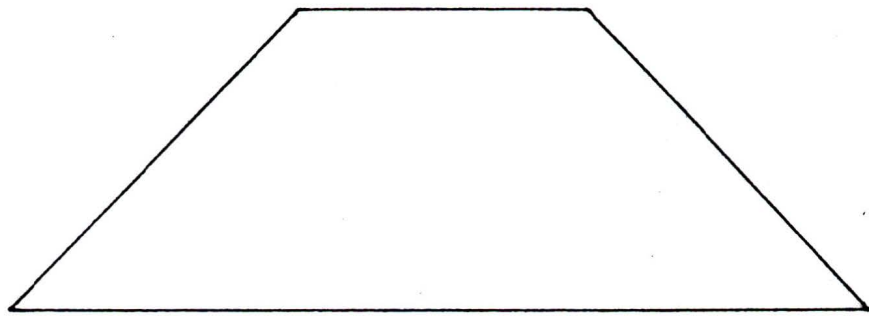
**MAUDLIN**

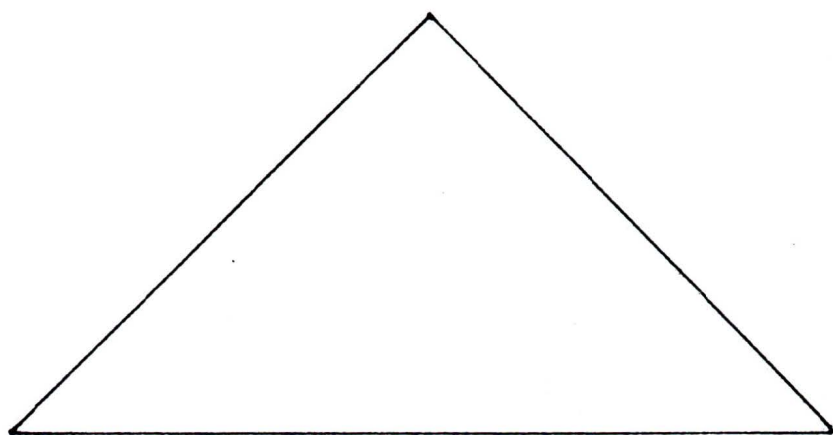
***REBOUND***

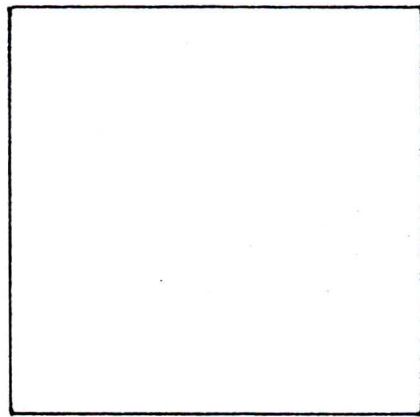
***DURABLE***

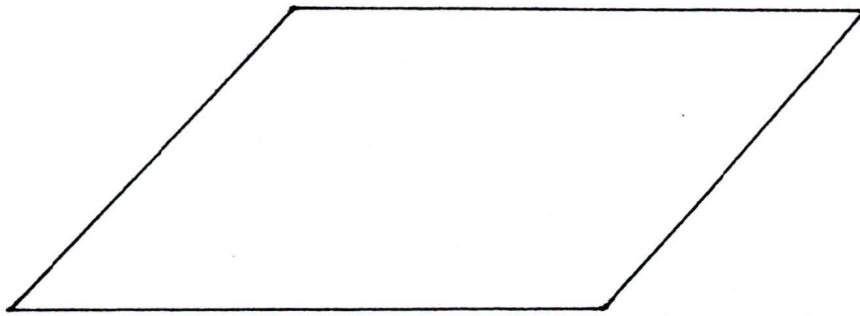
# *HOSPICE*

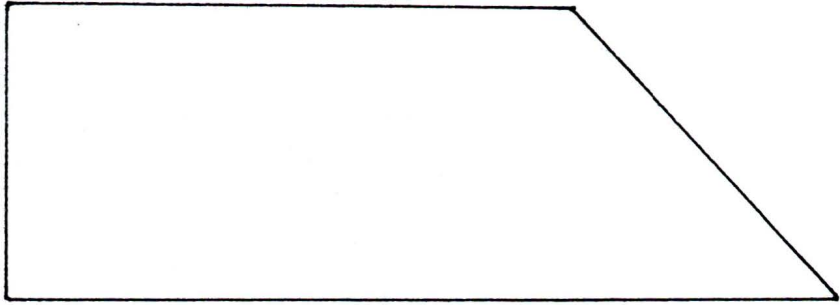
**APPENDIX F**  
**LOW EFFORT TANGRAM PROBLEMS**

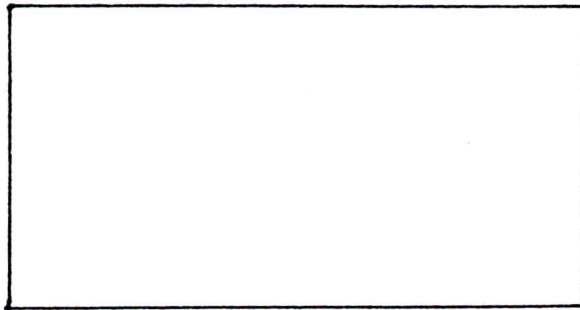




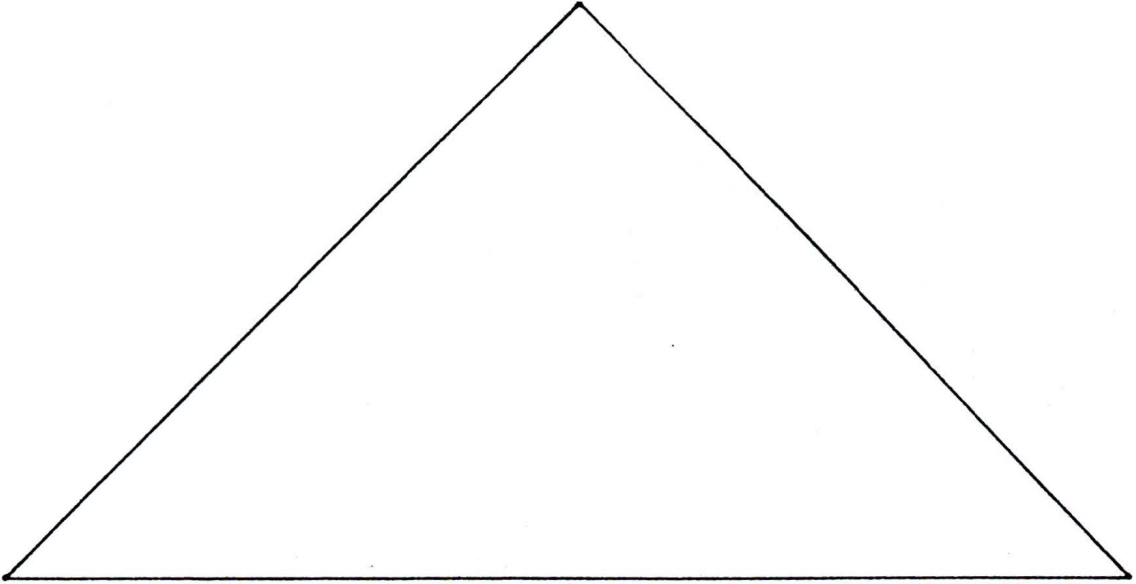


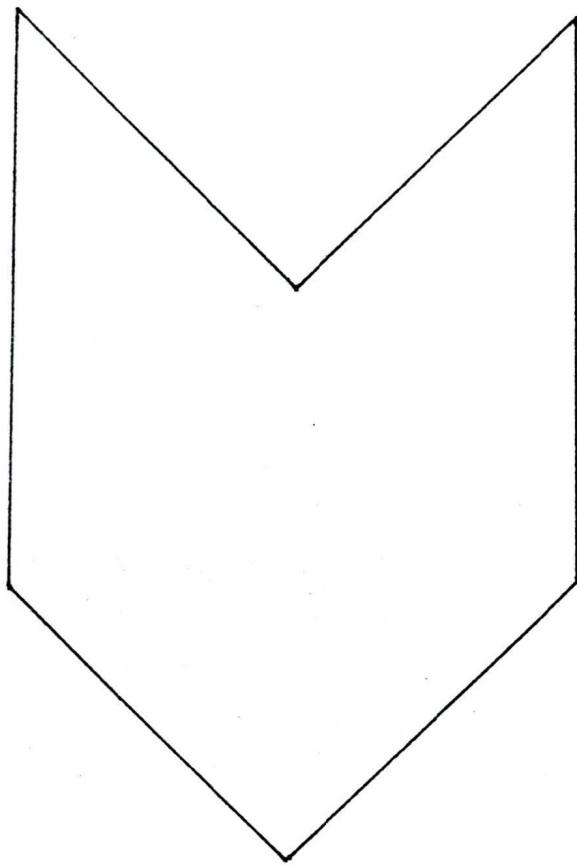


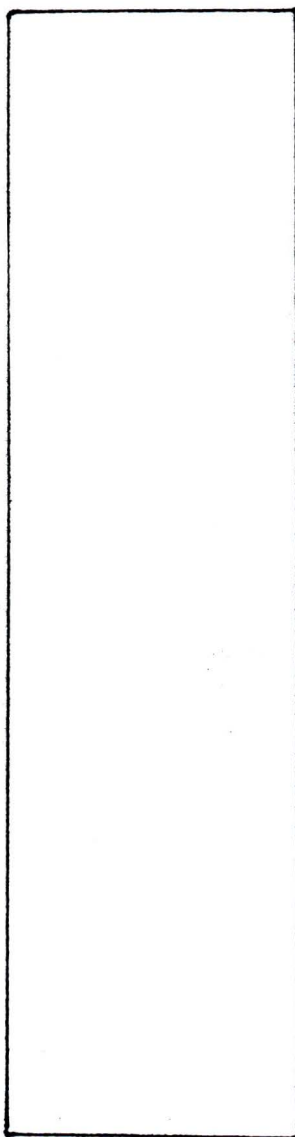


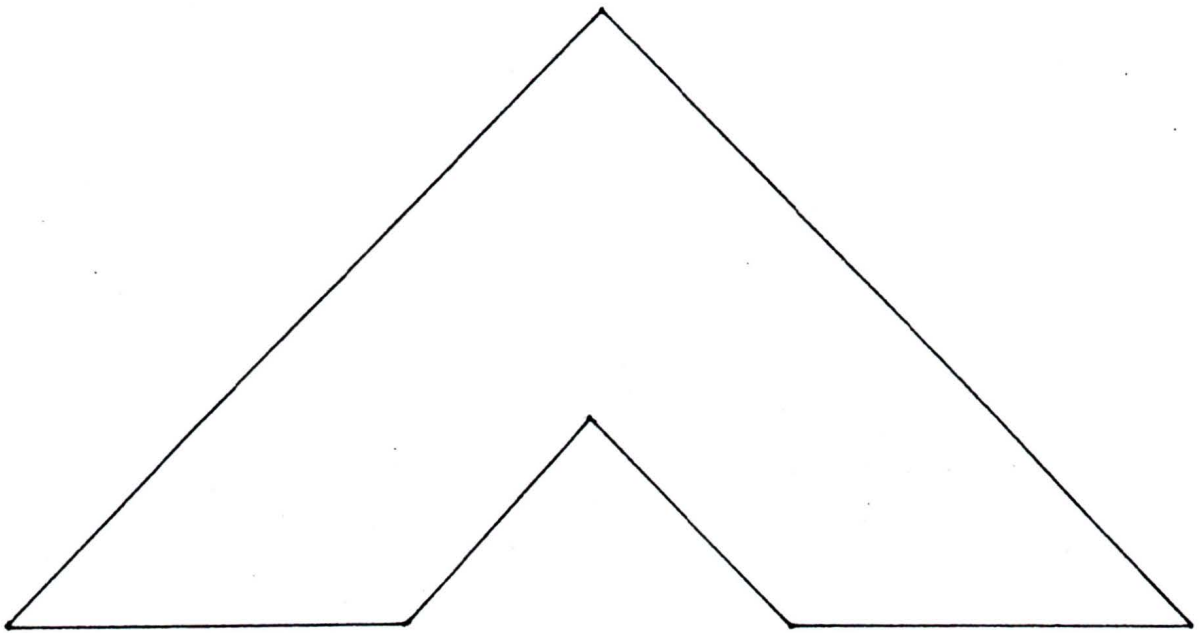


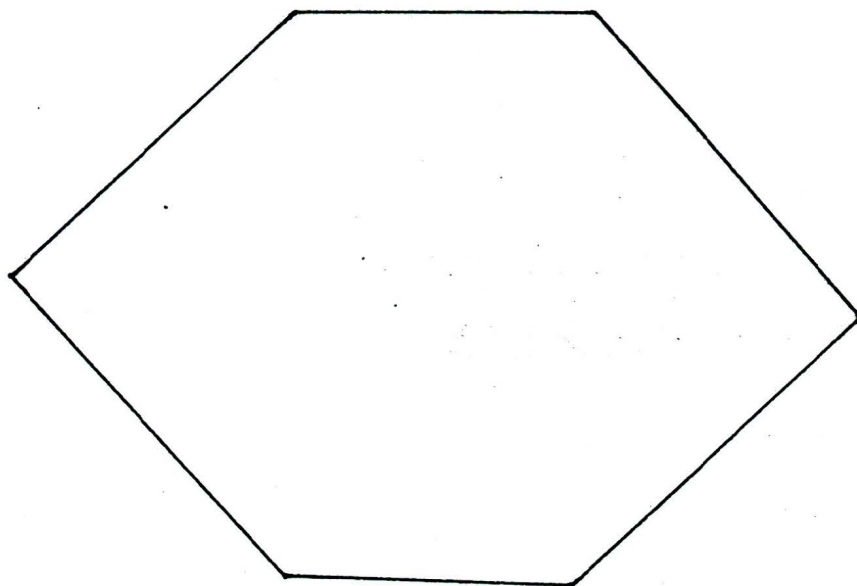
**APPENDIX G**  
**HIGH EFFORT TANGRAM PROBLEMS**

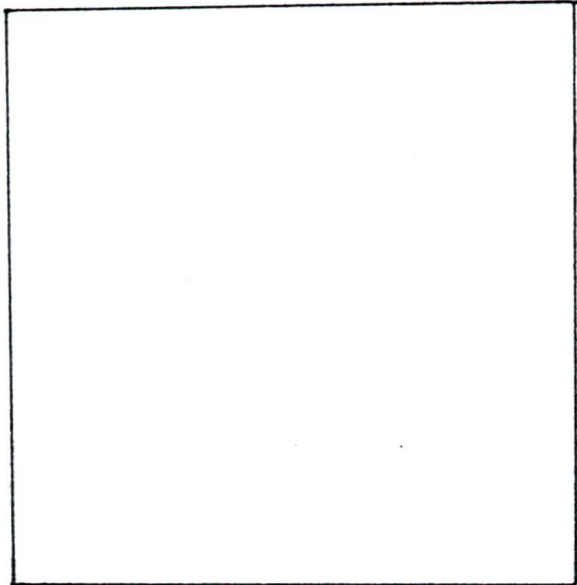












**APPENDIX H**  
**TRANSFER OPINION QUESTION**

Please write one paragraph given your opinion on the following question:

How can teachers get their students to work harder in school?

VITA

Surname: Forer Given Names: Barry Allan

Place of Birth: Toronto, Ontario Date of Birth: June 2, 1955

Educational Institutions Attended, with Dates of Entering and Leaving:

UNIVERSITY OF TORONTO, ONTARIO	1973 to 1979
UNIVERSITY OF VICTORIA, B.C.	1979 to 1980
UNIVERSITY OF VICTORIA, B.C.	1982 to 1987

Degrees, Diplomas, Etc., Awarded, with Dates and Names of Institutions:

B.Sc.	1979	University of Toronto, Ontario
Diploma (Teaching)	1980	University of Victoria, B.C.
M.A.	1987	University of Victoria, B.C.

Honors and Awards:

None

Publications:

None

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The Effects of Effort Training Over Time Using Two Different Training Methods

Author



BARRY FORER

August 31, 1987