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ABSTRACT

This review of research literature about training in the skills of teaching indicates that change in skills can be brought about through different training methods, with different training populations, and in different training settings. This analysis of the literature was designed to assess the comparative contribution of a set of selected variables to gains in teaching skill. The variables were classified under three general categories: training variables, trainee variables, and setting variables. Of central interest in the review was the conceptual-observational instruction method of training. This instruction is based upon well-defined concepts that include the components of concept definition, exemplification, identification, and application. The favored medium was videotape or film. In over half of the studies reviewed, practice was provided in actually using the targeted skills of teaching. Feedback to the trainee on the use of the targeted skills was provided in almost all of the studies. The role of conceptual learning in the development of teaching skills is analyzed, and it is pointed out that training must result in understanding as a prerequisite to change in skill. It is also suggested that consistency of practice conditions is conducive to optimal skill acquisition. (JD)

Conceptual Variables as Predictors of Change in Teaching Skills

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What we know, in the sense of research-based knowledge, about training in the skills of teaching can be summarized at a very general level. We know that teaching skills can be acquired or modified and that this is the case with a variety of skills (Cruickshank and Metcalf, in press; Gliessman, 1981a). The research literature indicates that change in skills can be brought about through different training methods (for example, modeling as well as microteaching), with different training populations (inexperienced as well as experienced teachers) and in different training settings (preservice as well as inservice). There are, of course, limitations on our knowledge as well. Most of the research has addressed relatively noncomplex, generic skills (e.g., asking higher order questions or using praise and approval) assessed on a short-term basis (i.e., immediately following training) using simple criteria, generally incidence or frequency of use (Gliessman, 1981b).

Granting these limitations, the trainer of teachers is justified in acting on the premise that teaching skills are trainable. Beyond this general premise, however, the research presently offers little help. What training components are most closely tied to gains in skill? What are the optimal conditions of training? Are skills of differing complexity differentially responsive to training? These are a few questions concerning the variables of training about which we know far less. It can be argued that the development of training methods that are both optimally effective and efficient depends upon greater knowledge about the effect of these and similar variables on

change in teaching skills.

Knowledge about the comparative effects of different variables can be produced in two ways: by comparing training methods, groups and settings within individual research studies or by comparing the effects of these variables across studies. With respect to the first, few researchers have conducted direct comparisons of different training methods (or their components) and very few have contrasted the effects of training in different settings or for different training groups. The most substantial attempts to contrast different training components have been in studies of microteaching; the components compared have included audio versus video feedback and practice with peers versus practice with school pupils. In a comprehensive early review of microteaching studies, Turney, Clift, Dunkin and Thaill (1973) concluded that the studies reviewed reported generally inconsistent or conflicting evidence on the effects of such variations in training on skill acquisition. In our own review (that will provide the basis for the present paper), we found that a total of thirty-six comparisons of training variables reported in fourteen studies yielded only two significant differences (Gliessman, Pugh, Dowden and Hutchins, 1988). Our tentative conclusion, based upon these two sources, was that the variables compared were perhaps not well chosen in terms of their probable influence on teaching skill (those variables included in our own review, for example, included early versus delayed pretest and self-directed versus instructor led training).

The review by Turney et al. is important from a methodological

viewpoint as well as for its evidence. While they used a traditional study-by-study analysis (as have Cruickshank and Metcalf, in press, in a current review of training studies), Turney and his associates did attempt to "collate" the findings from different studies under specific training categories. These categories included, for example, media used to model teaching skills, pupils used in practice and type of feedback provided. Such collating facilitated the construction of generalizations about the effectiveness of different media or forms of feedback. In a more comprehensive review, Gliessman (1981a; 1981b) classified the training methods used in different studies as based upon concept learning, observational learning, practice and reinforcement and the skills addressed as cognitive, affective, mixed and management. His conclusion was that the use of any of the four training methods, singly or in combination, can result in gains or differences in any of the four skill areas.

What the Turney et. al. and Gliessman reviews lack, however, is a common metric for measuring gains or differences in skill acquisition across studies. This introduces an element of judgment in comparing the effects of different training methods (or of some other training variable) that makes objective comparison extremely difficult. This may help to account for the equivocal results that are so often reported. To avoid this problem, we followed the lead of other researchers in using a meta-analytic measure called "effect size" as a common metric. This made comparisons of training variables across studies a decidedly more direct process.

Variables Influencing Teaching Skill.

Our meta-analysis of the research literature (Gliessman, et. al., 1988) was designed to assess the comparative contribution of a set of selected variables to gains in teaching skill. The variables selected were classified under three general categories: training variables, trainee variables and setting variables. The specific variables included within each category were:

1. Training variables:
   a. General training method--training that included conceptual-observational instruction or training that incorporated conceptual-observational instruction with practice.
   b. General training time--total time (in hours, days or weeks) over which training sessions occurred.
   c. Specific training time--time (in hours) specifically devoted to training.
   d. Amount of practice--number of practice sessions when practice was included in training.
2. Trainee variables:
   a. Experience of trainees--inexperienced or experienced.
   b. Academic level of trainees--undergraduate or graduate.
   c. Certification level--elementary or secondary.
3. Setting variables:
   a. Practice setting--university or college class or laboratory, laboratory within a school, school classroom.

b. Pupils taught when practice was included in training--elementary, secondary or peers.

Because training method was of central interest in our review, and will be of central interest in the present paper, the general methods of training contrasted need to be described. Conceptual-observational instruction refers to instruction that is based upon well-defined concepts that are instantiated in protocols, generally audiotaped or filmed. Ideally, such instruction includes the components of concept definition, exemplification, identification and application. These components reflect some well established principles of concept teaching (Clark, 1971; Stones, 1979; Tennyson and Park, 1980). Thus, a skill such as using praise or approval is first defined, examples of use of the skill are shown, new instances are presented that require identification and finally original examples are to be constructed by the trainee. The anticipated outcome is sufficient grasp of the skill as a concept that actual use of the skill will follow or be increased. This component of training was included in all of the studies that we reviewed although perhaps never in its entirety; all studies, however, included at least concept definition and exemplification. The favored medium was videotape or film although audiotape and print sometimes were used.

In approximately two-thirds of the studies that we analyzed, practice was provided in actually using the targeted skills of teaching. One or more teaching sessions were arranged for the trainee in a laboratory or classroom setting. In the laboratory setting, "pupils" were generally classmates in a college or

university professional education course. When conducted in the schools, in either a small group (i.e., laboratory) setting or classroom setting, the pupils were "real" pupils at the elementary or secondary level. Feedback to the trainee on his or her use of the targeted skills was provided in almost all studies that used practice.

For the purposes of the review, it was decided not to address a broad array of skills but rather to focus on a representative generic skill so that the influence of the variables would be unaffected by differential responsiveness of different skills to teaching (the question of differential responsiveness might well be an informative subject for a further study). The selection of a specific skill was relatively easy because the great majority of training studies address one of two sets of skills: questioning and indirect teaching style. Questioning was selected because it is a cognitive/verbal skill that was judged to be optimally responsive to training. Furthermore, it is a common component of training packages and programs that have been used in teacher education. Specifically, the selection of questioning as a skill translated into asking higher order questions and asking probing questions followed less frequently by analytical questioning and similar skills. The common thread through all questioning skills was that the trainee had to acquire a questioning <u>category</u> such as higher order, probing or analytical.

The criterion for skill acquisition in the studies reviewed was almost uniformly some measure of frequency of use. Quality of questions was very seldom used as a criterion. Assessment of skill

acquisition was uniformly on an immediate basis (i.e., immediately following training). Assessment was always conducted, of course, in an actual teaching setting whether university laboratory, laboratory within a school or school classroom.

What did we learn from this review? We found, first, that although training resulted in significant gains (i.e., the effect size was significantly different from zero) in questioning skills all but one of the variables identified were unrelated to the magnitude of the gains. That is, no single training or trainee variable, and only one setting variable, was associated with the difference between training and control groups. Different amounts of training and different training settings did not affect skill gains while different teacher groups profited equally from training. The single variable related to gains or differences in skill was concerned with pupils taught during practice: trainees who taught peers made significantly smaller gains than those who taught secondary level students. In spite of this single result, however, the differential influence of the variables on skill acquisition was inconsequential.

When we considered the interactions between variables a somewhat different picture emerged. There was evidence, first, of an interaction within setting variables. It was clear that inconsistency across practice setting and criterion teaching setting (i.e., teaching setting in which questioning skill was assessed following training) affected negatively gains in questioning skill. Similarly, inconsistency between the certification level (elementary or secondary) of the trainee and pupils used in practice affected

skill negatively. One "worst scenario" case would be a trainee studying to obtain an elementary certificate who was asked to teach secondary level students in a school classroom setting and whose skill was then assessed while teaching class peers in a university laboratory settir '. Secondly, there was evidence that inexperienced teacher trainees profited significantly more from conceptual/observational instruction <u>alone</u> than did experienced teacher trainees. On the other hand, the two groups did not differ when training included practice.

What do these findings suggest? They suggest that consistency of practice conditions--in teaching certification, pupils taught and physical setting--is conducive to optimal skill acquisition. It is likely that inconsistency in these conditions inhibits or confuses the demonstration of skills. The findings suggest also that inexperienced trainees are likely to benefit more than do experienced teachers from conceptual-observational instruction <u>without</u> the use of accompanying practice. The greatest "pay off" in the training of inexperienced trainees would appear to result from an emphasis on learning the <u>meaning</u>--definitional and applicational--of the teaching skill that is to be acquired. It may be, of course, that our findings are limited by the fact that we were attending to a relatively noncomplex skill assessed in terms of simple criteria on an immediate basis. Certain of the variables considered--especially the training variables associated with the provision of practice and with time devoted to training--might have emerged as significant variables if a more complex skill assessed on a more complex

criterion had been the target of training.

There is an added implication of these results, however, that is suggested by the major finding that training itself clearly produced significant gains in questioning skill. It should be noted again that conceptual-observational instruction was included in all of the training methods both with and without accompanying practice. This suggests the hypothesis that it is the conceptual dimension of training that is the central component in skill acquisition. If practice per se were central to skill development (as it is conventionally assumed to be in teacher education) then its exclusion from training in one-third of the studies reviewed should have resulted in a diminished effect of training. Furthermore, repetition or rehearsal or trial performance is so well established as a condition of skill acquisition, at least in the perceptual or psychomotor realm (Garry and Kingsley, 1970; Stones, 1979), that one would expect an increase in number of practice sessions to be similarly associated with an increased use of the practiced skills. In fact, in the studies reviewed, number of practice sessions was unassociated with level of skill acquisition.

Conceptual Learning as a Central Variable in the Development of Teaching Skills.

The view that conceptual learning is at the heart of acquiring teaching skills is not a new one. Wagner (1973) and Hargie and Maidment (1978) have hypothesized that the process of acquiring teaching skills can be viewed, from a psychological perspective, as a process of acquiring those skills as discriminable concepts. In

brief, both view skill acquisition as a particular case of concept discrimination learning. Wagner's evidence showed that the skills associated with direct and indirect teaching style were modified significantly through instruction directed at discriminating these skills as concepts. MacLeod and McIntyre (1977) along with Griffiths (1977) have taken a somewhat different perspective hypothesizing that cognitive changes accompany experience in teaching; these cognitive changes, in turn, influence the demonstration of teaching skills. Thus, concepts are emergent in teaching, mediating skills as both are shaped and reshaped. A teacher may, for example, "sharpen" her use of analytic questions as she becomes aware of limitations in those she has just asked.

We have, in past writing, attempted to integrate these two perspectives by describing skill development in teaching in terms both of concept acquisition and concept formation (Gliessman and Pugh, 1987). When the trainer is concerned with previously identified skills that can be defined and exemplified, he is justified in treating them as concepts to be acquired. In contrast, some skills result from problem solving by the trainee; for example, he might sense a need to involve students more evenly in a class discussion. To meet this need, the trainee might formulate a strategy to respond to signs of interest that occur prior to (or instead of) hand waving or other signalling on the part of the students. The cognitive activity involved in this kind of skill development might better be viewed as a task in concept formation because the skill has to be conceptualized from identifying its need

to defining and delimiting it. We were able to provide direct evidence that the use of either of these skill development processes was effective as a training strategy.

Further evidence on the role of conceptual learning in skill development. The most definitive evidence on the role of conceptual learning in the development of teaching skills comes from studies in which each of these variables is measured. With a measure of gains or differences in both variables, one is in a position to answer three questions: (1) Are gains or differences in conceptual learning accompanied by gains or differences in skill acquisition? (2) Are mean gain or difference scores in conceptual learning and skill acquisition correlated? (3) Are the concept scores and skill scores of individual trainees correlated? These three questions, in order, reflect progressively more critical tests of the relationship between conceptual learning and skill acquisition. To demonstrate a positive correlation between individual concept and skill scores clearly is more convincing as evidence of the above relationship than to demonstrate that gains in mean concept scores are accompanied by gains in mean skill scores.

In the remainder of this section, we will consider evidence on each of these three questions. It should be understood that the evidence provided is concerned with skill development within a concept acquisition or discrimination model only; similar evidence is not available for skill development within a concept formation model. Thus, our findings are limited in scope if not in consistency. With respect to the first question above, we conducted a selective review

of studies of change in teaching skill several years ago (Gliessman and Pugh, 1981). The five studies that we selected were those in which (1) both mean concept acquisition and skill acquisition scores were reported and (2) the training methods were essentially conceptual-observational in design. The teaching skills addressed in these studies were varied including questioning, informing, accepting and student-centered teaching style.

Since the detailed results of these studies have been reported elsewhere, we will here describe those results at a general level. To quote from our original paper, "The results of these studies uniformly show significant effects on skill acquisition following conceptually-based...training. In all cases, post training skill scores were significantly greater than those achieved by control groups.... In approximately half of the comparisons [between experimental and control groups] significant differences [in concept scores] were found all favoring the experimental groups." (p. 15) Thus, conceptual-observational training uniformly produced significant differences in the teaching skills addressed while these differences were associated with at least one significant difference in concept scores in every study (four of the five studies reported comparisons on three different types of concept score while the remaining study reported one).

To study the second question, "Are mean gains or difference scores in conceptual learning and skill acquisition correlated?", we conducted a search of the ERIC RIE and CIJE databases for the period of 1/66 to 12/88 and carried out a new analysis of the final database

from our previously reported study (Gliessman, et. al., 1988). This new search and new analysis identified studies in which both mean concept learning scores and mean skill acquisition scores were reported. The new search used eight combinations of search descriptors that had been suggested by the descriptors from the previous analysis, descriptors from relevant articles, and a judgment from a review of the ERIC Thesaurus of Descriptors. The eight combinations of search descriptors were performance and teacher education programs, performance and protocol materials, performance and teaching experience, teacher behavior and protocol materials, protocol materials and behavior, protocol materials and laboratory training, protocol materials and microteaching, and protocol materials and teacher behavior.

A total of twelve studies was found in which both mean concept learning scores and mean skill acquisition scores were reported. The search of the ERIC database found nine studies and the new analysis of our previous database produced three studies. These twelve studies provided sufficient information to allow an estimated effect size to be computed for both a concept learning score and a skill acquisition score (the resulting effect sizes are reported by study in Table 1 attached). The judgment was made that an effect size, which is the mean difference between an experimental group and a control group divided by the pooled standard deviation of the two groups, reflected gains or differences for the two variables. Next, these two effect size estimates were then adjusted for small sample bias (Hedges and Olkin, 1985). Finally, the relationship between

these two variables was investigated using a Pearson product-moment correlation coefficient.

The relationship between the concept learning and skill acquisition scores as reflected in effect size estimates was found to be statistically significant. A correlation coefficient of .55 ($df = 10$, $p < .05$, directional) was found between the effect size of concept learning scores and the effect size of skill acquisition scores across the twelve studies. That is, a significant and positive relationship was found between the variables of conceptual learning and skill acquisition.

Evidence relating to the third question, "Are the concept scores and skill scores of individual trainees correlated?", was found in three studies and has been previously reported (Gliessman and Pugh, 1987). Gliessman, Pugh, and Bielat (1979), Biederman (1980), and Koran and Koran (1973) all reported correlation coefficients between concept scores and skill scores of individuals. A previously reported analysis of these three studies revealed a weighted average correlation coefficient between the concept scores and skill scores of .46 which was found to be significantly greater than zero ($p < .01$). A positive relationship was evident between the two variables based on scores from individual trainees.

A Perspective on Training.

In the context of training teachers, what meaning does the above set of findings have? To begin, all three subsets (i.e., change in skills generally associated with gains or differences in concept acquisition, a positive correlation between mean concept scores and

mean skill scores, a positive correlation between individual concept scores and skill scores) are at least consistent with the hypothesis that conceptual learning is instrumental to the acquisition of teaching skills. That hypothesis is strengthened by another observation: To the best of our knowledge, concept learning (as evidenced in concept acquisition scores) is the only variable that has been shown to correlate directly with the use of specified skills in teaching (as evidenced by frequency of use). In our own review, it will be recalled, no other training, trainee or setting variable was associated significantly and directly with skill acquisition.

The conceptual variable entered, too, into one of the two interactions between variables that we found to be associated with change in teaching skill. Inexperienced teachers, it may be recalled, profited significantly more from conceptual/observational instruction in the absence of practice than did experienced teachers. We have reasoned that the former group probably had less initial familiarity with the questioning skills involved and thus had more to gain from instruction. But why did they apparently profit less from conceptual/observational instruction when it was conjoined with practice? It is possible that the instructional component was too abbreviated, less effectively done or not well integrated with the practice component in the case of these studies. In any one of these events, the net effect might well be the same: a less than optimal conceptual base for effective practice. This interpretation is supported by two well designed studies that have experimentally manipulated the practice variable in skill training. Wagner, in her

1973 study, found that essentially uninstructed practice alone led to no change in the teaching style skills that she addressed successfully through conceptual instruction. In a recent study, in contrast, Klinzing, Klinzing-Eurich and Floden (1989) found that a practice component carefully integrated with conceptual instruction resulted in significantly greater use of skills in two of three skill areas (clarity and non-verbal expressiveness but not interest) than did the same treatment in the absence of practice. Thus, practice appears to be effective <u>when</u> it is well integrated with a strong conceptual component.

To put the perspective that we have developed in this paper in other terms, our contention has been that training must result in <u>understanding</u> as a prerequisite for change in skill. This is the kind of statement, however, that is easily enfeebled by taking it too generally. We mean understanding in a more precise sense: understanding a teaching skill as a definable, identifiable, applicable concept or category of behavior. That understanding may be developed in two and perhaps more ways: through the analysis of instances or exemplars of teaching skills, through trial use of those skills with evaluative feedback, or through both of these methods together. In any case, the most important outcome of training is <u>conceptual</u> even though change in skill is what we ultimately want to achieve. To leave the teacher without conceptualization or understanding is to leave him <u>trained</u>, perhaps, but not <u>skilful</u>.

Table 1

Unbiased Effect Size Estimates for Concept and Skill Measures by Study

	Written		Performance	
Study	N	d	N	d
Bass (1972)	55	.285	24	.164
Bean (1974)	14	.211	14	.120
Biederman (1980)	43	-.211	43	-.281
Gliessman, et al. (1979)	20	1.001	20	.744
Holt (1983)	29	.0922	29	.530
Kluecker (1974)	38	1.093	38	1.047
Koran (1969)	121	1.337	121	.970
Koran & Koran (1973)	69	.928	69	.859
Merwin & Schneider (1973)	40	.980	40	1.311
Nisbet (1974)	21	.222	18	1.721
Riley (1978)	40	.556	40	.793
Santiesteban & Koran (1977)	48	.750	48	1.309

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