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ABSTRACT

The present study sought to expand upon earlier reviews of research by examining statistically the relative and comparative effects of several common forms of on-campus clinical experience in teacher education. Data were obtained from 60 studies which met a priori criteria for inclusion. Using aggregation techniques suggested by Rosenthal and others and modified Bonferoni techniques for pairwise comparisons, descriptive and inferential statistics were calculated. Among other things, the results suggest that laboratory experiences produce moderate to strongly positive results in terms of teacher affect, knowledge, and instructional behavior. Supporting earlier reviews, the results suggest that laboratory experiences are more powerful for inservice than for preservice teachers. However, in contrast to conclusions drawn in earlier reviews, laboratory experiences appeared to have a strong effect on teacher behavior which did not significantly decrease over time. The results also suggest the relative importance of various element. of laboratory experience. The data are presented in 14 tables. (Contains 83 references.) (Author)

Laboratory Experiences in Teacher Education: A Meta-Analytic Review of Research

by

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Abstract

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The present study sought to expand upon earlier reviews of research by examining statistically the relative and comparative effects of several common forms of on-campus clinical experience in teacher education. Data were obtained from 60 studies which met apriori criteria for inclusion. Using aggregation techniques suggested by Rosenthal and others and modified Bonferoni techniques for pairwise comparisons, descriptive and inferential statistics were calculated. Among other things, the results indicate that laboratory experiences produce moderate to strongly positive results in terms of teacher affect, knowledge, and instructional behavior. Supporting earlier reviews, the results indicate that laboratory experiences are more powerful for inservice than for preservice teachers. However, in contrast, to conclusions drawn in earlier reviews, laboratory experiences most effect teacher behavior, and there appears to be no substantial diminution of effect over time. The results also suggest the relative importance of various elements of laboratory experience.

LABORATORY EXPERIENCES IN TEACHER EDUCATION: A META-ANALYTIC REVIEW OF RESEARCH

Recent social and demographic trends have focused attention on the need to help teachers perform effectively in increasingly complex classroom environments serving more and more diverse student populations. Teachers have been criticized for their inability to understand and empathize with students of diverse backgrounds, to solve classroom problems wisely, to reflect on classroom and school practice, and to apply sufficient pedagogical skill to affect student learning.

Berliner (1985) suggests that these and other criticisms of teaching and related criticisms of teacher education have resulted in noticeable and significant changes in the form and format of teacher education programs. Notably, teacher education has come to include substantially more coursework in the subject areas, with a subsequent reduction in study of pedagogy and a greater number of more extensive field-based experiences, such as early experiences. Underlying these changes are assumptions not only about the quality of the current teaching force, but also about the ways in which teachers best learn to teach. In contrast to other professions wherein preservice education is directly intended to develop thorough understanding of and ability to apply a concrete knowledge base to professional practice, teacher education has come to rely primarily on craft knowledge and apprenticeship models of training (Cruickshank & Metcalf, 1990). Teachers and teacher educators have embraced these assumptions and aggressively promoted teacher education programs which de-emphasize the application of pedagogical principles and, instead, encourage the development of site-specific, field-dependent professional practice.

At least three characteristics of this era of change in teacher education have proven to be problematic. First, substantial evidence indicates that field experiences, especially extended field experiences, do not result in desirable outcomes and may, in fact, negatively effect student teachers' attitudes, knowledge, and classroom practice (e.g., Berliner, 1985; Cruickshank & Metcalf, 1990; Evertson, Hawley, & Zlotnik, 1989; Metcalf, 1991). Further, it appears that the more time preservice teachers spend in field placements, the more negative the effects. Thus, teacher education students are increasingly involved in more field-based experiences of greater duration when the effects of the experiences are at best marginal and, more likely, negative. Second, requirements for more field-based experiences of longer duration have resulted in saturation of field placements (Guyton & McIntyre, 1990). Teacher educators find it increasingly difficult to locate and maintain a sufficient number of desirable field placements for their students. For many preservice teachers this leads to placement in a classroom with one or more other preservice teachers that restricts or precludes anything more than observational activities, and frequently leads to resentment on the part of the cooperating teacher (Feiman-Nemser &

Buchmann, 1983). Sadly, as more classroom teachers feel overburdened with the responsibility for multiple preservice teachers, more of them decline to work with these students and still fewer classroom placements are available. Third, at a time when teacher preparation is expected to increase teachers' experiences with and understanding of diverse student populations, many teacher education institutions cannot effectively provide direct experiences of this type (McCollum, 1990; Metcalf, & Wilson, 1994). Preservice teachers read and hear lectures about diversity, but seldom are they involved in experiences which allow them to observe, experience, or interact professionally with diverse student populations.

For these and other reasons, efforts are currently underway to identify and develop alternative experiences for teacher preparation. Case-based instruction and interactive computer simulations are timely examples. However, many have suggested that laboratory experiences, such as microteaching, minicourses, or protocols also offer promise as alternatives to field-based experiences (Berliner, 1985; Evertson, 1990; Cruickshank & Metcalf, 1990). Many of these experiences were widely used during the 1960s and 1970s, but have come to be less used as field experiences have increased (McIntyre, 1991). Numerous reviews of the research which informs about these experiences are available (e.g., Copeland, 1982; Cruickshank & Metcalf, 1990; MacLeod, 1987). The reviewers have drawn conclusions about the efficacy of various forms of laboratory experience which are, undoubtedly, informative. Among other things, reviewers have concluded that laboratory experiences are effective in producing desirable short-term change in teacher behavior, and that teachers typically feel positively about participation in these experiences, but that changes in teacher behavior produced in laboratory settings seldom are transferred into natural classroom practice.

Though informative, these reviewers have based their conclusions upon what Rosenthal (1991) calls "vote counting" of the statistical significance of the results of the studies they include, assuming that non-significant results indicate a lack of effectiveness. In recent years, this practice has been enhanced through the use of meta-analytic techniques which allow the investigator to aggregate the results of multiple studies in a more objective and powerful way (Hedges & Olkin, 1985; Rosenthal, 1991). The present investigation attempts to expand upon earlier reviews by applying meta-analytic techniques to study and compare the effects of several common forms of laboratory or on-campus experiences which might serve as alternatives to some field-based experiences.

To this end, the present study investigated the following broad research questions and more specific subquestions:

1) Across on-campus experiences and various dependent and independent variables, what is the effectiveness of these experiences?

a. Are there differences in the effect of laboratory experiences between inservice and preservice teacher/participants?

b. Are there differences in the effect of laboratory experiences when the participants work with natural pupils or peers?

c. Is the effect of laboratory experiences influenced by the context in which the dependent variable is evaluated (e.g., on-campus laboratory versus natural classroom)?

d. Are there differences in the effect of laboratory experiences on affect, behavior, and knowledge?

2) Are there differences in effectiveness between and among the laboratory experiences?

a. Are there differences in effect between experiences for inservice and preservice teacher/participants?

b. Are there differences in effect between the experiences when participants work with natural pupils or with peer learners?

c. Are there differences in effect between laboratory experiences related to the dependent variable studied?

d. Are there differences in effect between experiences related to the context in which the dependent variable is evaluated?

Defining Professional Experiences in Teacher Education

Nolan (1983) notes that confusion about professional experiences in teacher education is common and, in large measure, can be attributed to convolution of the terms "clinical", "laboratory", and "field" experiences. Currently, these terms are often used interchangeably to refer to a wide variety of experiences, usually in field settings. However, the terms and the experiences they describe are best viewed as discrete. Thus, it will be useful to define these terms clearly before beginning a detailed description of the present study.

Clinical experiences. Drawing from a psychological rather than a medical model, a clinical experience is one which allows the participant to evaluate the present state of a subject or environment; if a problem exists, to generate and weigh alternative solutions; enact an alternative; and observe and evaluate the results. Thus, both laboratory and field experiences can be clinical if, in either case, the participants are allowed to make clinical decisions. By the same criteria, laboratory and field experiences might neither be clinical if, in a given case, participants are not allowed to engage in the clinical process. For example, if preservice teachers are placed in natural classrooms for three hours each week during which time they observe and record teacher and student behavior, but do not engage in the clinical process either directly or through simulation, the experience is not clinical. If, on the other hand, this three hour experience requires the preservice teachers to identify a student having difficulty, determine the nature and extent of the difficulty, enact some corrective action, and then evaluate the effectiveness of their action, the experience would be clinical. Further, it would appropriately be considered clinical whether the experience occurred in the field or on-campus, and whether it involved application of the clinical approach with a natural or simulated student.

Laboratory experiences. A laboratory experience is a direct or simulated activity which allows experimentation, observation, study, and analysis of educational events or phenomena in a controlled, usually simplified setting. Laboratory experiences can be of varying degrees of reality, control, and complexity. However, the element of control of one or more variables in the environment is requisite. Thus, although field experiences often are considered to be laboratory-like, they seldom afford sufficient control of the environment to classify as such. As indicated by Broudy (1964), "Using a natural classroom as a laboratory experience is analogous to learning chemistry by using a petroleum complex as a laboratory." It should be noted that a laboratory experience can be clinical, but need not be, and is not necessarily.

Field experiences. Field experiences are direct experiences with educational events or phenomena in natural environments. They are not simulated, and seldom control critical variables in the environment. Thus, they cannot generally be considered laboratory experiences. Further, although they can serve as clinical experiences if they allow the participant to engage in clinical activities, they are not clinical by nature. It is also important to point out that shortages of field placement sites, and resultant "saturation" of these sites by multiple preservice teachers, reduce the likelihood that field experiences will allow participants to engage in clinical activities.

Using these definitions, we can begin to discriminate between and among the many and diverse forms of " professional experience" provided students of teaching. The term clinical can be applied appropriately to either laboratory or field experiences if the participant is allowed to engage in the clinical process. However, neither laboratory nor field experiences are clinical by nature. A laboratory experience requires that control be exercised over the environment in which the participant is engaged, but can involve real or simulated, direct or vicarious exposure to educational events or phenomena. Least specific by definition is the field experience which is, in essence, any experience in natural, usually educational settings, wherein participants are to observe or act, but in which critical variables usually cannot or are not controlled.

Procedures

As noted, the present study sought objectively to examine the aggregated results of studies on laboratory experiences in teacher education. A laboratory experience was considered any activity in which preservice or inservice teachers were engaged in the controlled study of educationally significant concepts, practices, or phenomena. The context in which the experience occurred (e.g., on-campus or in natural classrooms) was not considered. However, the experience must have directly allowed the participant to engage in observation, manipulation, and/or practice within a deliberately controlled context which included critical analysis of the activity.

Included in the present study were eight basic forms of laboratory experience organized, for clarity, by degree of systematization into three groups. Laboratory experiences included in the highly systematic group were: (a) microteaching (Allen & Ryan, 1969); (b) minicourses (Borg, 1972, and others); and (c) protocol materials (Smith, Cohen, & Pearl, 1969). Moderately systematic laboratory experiences were: (d) Reflective Teaching (Cruickshank, Kennedy, Williams, Holton, & Fay, 1980), (e) written, media based, and computer-based simulations (e.g., Kersh, 1962); and (f) role playing. Minimally systematic laboratory experiences included: (g) simple peer teaching, and (h) observation of video and audio recordings. Though currently popular and believed to be a promising alternative to field-based experiences, case-based instruction (Shulman, 1992; Sykes & Bird, 1992; and others) was not included in the present study due to a lack of studies of its effectiveness.

<u>Data Collection</u>

Data collection was conducted primarily through the use of established data bases for educational research. Principal sources were the Educational Resources and Information Clearinghouse (ERIC), Education Index, and Psychological Abstracts. In conducting a series of five searches, the following terms or identifiers evolved and were used: microteaching, reflective teaching, minicourses, protocols, simulations, simulators, role playing, peer teaching, laboratory, training, laboratory training, computer-based instruction, recordings, videotape recordings, audio recordings, observation, laboratory experience(s), and laboratory training. In addition, every attempt was made to access studies cited in secondary sources which were <u>not</u> identified in data based searches, but which had been screened by experts in the field (e.g., paper presentations at national conference, large scale technical reports). It was determined that the results of studies for which original reports could not be located would not be included. Citations located by this process were further screened and to include only those which reported the results of controlled study of one or more of the laboratory experiences. This screening provided a pool of 261 studies.

Studies in this pool were examined, and the results of each study were included if the following conditions were met: (a) the report included sufficient numeric data to allow computation of one or more standardized effect sizes; (b) the effect of a given laboratory experience was compared with the effect of some non-laboratory treatment (e.g., didactic instruction-only, field-based treatment, or some combination thereof); and (c) detailed information was provided regarding the sample and sample size, level of the subjects, length of treatment, form of measurement of the dependent variable(s), learners used in the study (when applicable), context of the setting in which the dependent variable(s) was (were) assessed, and time from the end of treatment to time of measurement. The resulting pool consisted of 60 study reports providing 83 pairwise comparisons.

It should be noted that of these 83 comparisons, 15 represent pre-post treatment comparisons for a single group of subjects. Though including these studies presents the potential for problematic interpretation of results, three factors justify their inclusion. First, examination of study effects indicated that few of the dependent variables under study were likely to change without intervention. Non-treatment control groups across studies seldom evidenced any gain in the dependent variables. Second, a large portion of the research of some laboratory methods relied on single group designs (particularly minicourses and protocol materials). In order to allow examination of their effects, it was necessary to utilize single group studies. Third, comparison of mean pooled effect sizes for these studies with between groups studies revealed no substantial difference (between group $\underline{M}$ = .6964, within group $\underline{M}$ = .7121). However, these studies are identified for the reader by asterisks in all tables.

Coding of Study Information

Each pairwise comparison was coded separately using a standardized recording form developed for this study. The form includes a complete bibliographic reference and an assigned study code. Information can be recorded for 32 aspects of the study and specific pairwise comparison. Of primary interest to the present study, the following factors were operationally defined and coded as described below.

Subject level. Studies were coded to examine potential differences in effect between preservice teachers (those who were involved in the experience as a part of their formal professional training prior to certification) and inservice teachers (practicing teachers involved in graduate study or professional development activities after initial certification).

Course type. Each study was coded based upon the type of course or workshop in which the laboratory experience was being applied. Four categorizations were used: (a) general methods, (b) subject area methods, (c) educational psychology, and (d) other (e.g., professional development activity in a school or school district).

Learner type. It was hypothesized from earlier reviews that studies which engaged participants with natural, school-aged pupils would be more effective than those which did not. For example, microteaching or minicourses can and are conducted using peers as learners or school aged children as learners. Learner type was coded into one of three categories: (a) none (e.g., audiotape observation or simulations which did not directly involve participants with learners of any type), (b) peers (e.g., role playing, peer teaching, or microteaching in which participants taught or worked with peers who served as learners), or (c) natural (i.e., studies in which participants worked directly with school-aged pupils in the laboratory experience).

Context of measurement. Based upon earlier reviews of research suggesting that desirable traits of behaviors developed in laboratory experiences do not transfer to use in natural settings, each study was coded based upon the setting or context in which the dependent variable was measured (in spite of the learner type). Studies of affect or knowledge typically utilized written tests or instruments and were coded as written test. Beyond this, four categorizations were used: (a) laboratory-peers included studies in which the dependent variable was measured in a laboratory setting with peers serving as learners or other participants (e.g., parents in role plays); (b) laboratory-pupils included studies in which the dependent variable was measured in a laboratory setting with school-aged pupils serving as learners; (c) field-contrived included studies in which the dependent variable was measured in a field setting with natural pupils, but which was deliberately contrived for the study (e.g., small group rather than whole class lessons were taught bv the participants); and (d) field-natural included studies in which the dependent variable was measured in a natural classroom setting with no simplification or manipulation of the environment (e.g., during student teaching or other field placement).

Dependent variable type. Studies were coded as to the type of dependent variable studied and were categorized into three types: affect, knowledge, or behavior. Included under affect were studies that investigated participant's attitudes (e.g., about students of diversity, teaching as a profession, toward reflection), anxiety about teaching or student teaching, or professional confidence. Knowledge included studies of teachers' ability to analyze or explain educational concepts or phenomena, acquisition of educational, pedagogical, or subject area knowledge, or ability to reflect meaningfully on teaching and learning. Behavior included studies of teachers' pedagogical behavior (e.g., ability to provide desirable and effective instruction).

Time from treatment to measurement. Again, it was hypothesized from earlier reviews that the effects of laboratory experiences would diminish substantially over time. Thus, each study was coded as to the time which elapsed between the end of treatment (e.g., the laboratory experience) and the measurement of the dependent variable. Six levels were used: (a) 1-2 weeks, (b) 2-6 weeks, (c) 6-12 weeks, (d) 12-18 weeks, (e) 18-52 weeks, and (f) more than one year.

Computation of Effect Sizes

Standardized effect sizes were calculated for each pairwise, laboratory to non-laboratory comparison. For example, Winitsky and Arends (1991) compared the effects of both microteaching and videotaped observation with field experience (each of two laboratory methods to a control condition) on preservice teachers' instructional behavior, affect, and knowledge (three dependent variables). Thus, this study yielded six pairwise comparisons of laboratory methods (microteaching or videotape observation with control treatment) across each of the three dependent variables. In addition, several reports provided results of more than one study (e.g., Gliessman & Pugh, 1978). Thus, the number of effect sizes is greater than the number of individual citations.

In several studies it was also necessary to aggregate the results of multiple measures of a single dependent variable using techniques suggested by Rosenthal (1991). For example, Borg (1972) examined the effects of minicourse participation on 10 dimensions of teachers' instructional behavior. Separate tests of difference were computed and reported for each dimension, however, no single, omnibus test result was reported. The results of the 10 separate tests were aggregated by transforming each result to Z using the probability of the result, computing mean of these Zs, establishing the probability associated with this Z, transforming this result to t, and then to g. Thus, when multiple but related measures were reported for a single variable type (behavior, affect, or knowledge), they were aggregated and analyzed as a single pooled effect size.

Mean pooled standardized effect size (gamma) was computed as suggested by Hedges, Shymansky, and Woodworth (1989). Whenever possible, gamma was calculated as:

$$g = (\underline{M}_{treatment} - \underline{M}_{control}) / ((SD_{treatment} * N_{treatment}) + (SD_{control} * N_{control})) / (N_{treatment} + N_{control})$$

In instances where means and standard deviations were not provided, gamma was calculated using t or F values (Hedges & Olkin, 1990). Further, each effect size was adjusted using Hedges' (1982) adjustment factor:

$$J = 1 - 3 / (4 * N - 1)$$

Pooled adjusted effect size (ES), thus was computed as:

$$ES = g * J$$

Three studies reported significant effects and sample size, but did not present either means and standard deviations or the numeric results of inferential statistics (Cruickshank & Broadbent, 1969; Emmer, 1970; & Vlcek, 1966). In these instances, minimum significant values of t were established based upon sample size, and this minimum t-value was transformed to gamma and adjusted. Thus, these effect sizes are likely to be conservatively biased. No studies were found which reported non-significant differences without presenting sufficient numeric data to allow computation of pooled effect size.

In addition, each pooled adjusted effect size was computed as Z using procedures suggested by Rosenthal (1991) to allow determination of statistical significance of the effect and to allow aggregation of effect sizes across studies. The present analysis is primarily descriptive. However, in instances where pairwise comparisons of effect size were possible and useful, the following formula was used and the corresponding probability of the result determined:

$$Z_{diff} = (Z_1 - Z_2) / \text{sqrt } 2$$

Analyses and Results

The procedures described above resulted in a data set consisting of 83 pooled adjusted effect sizes across 60 studies. Effect size data were examined in two principal ways: (a) generally, by aggregating data across laboratory experiences, and (b) by effect size data for each laboratory experience. Mean adjustment factor (J) across the studies was .97. Surprisingly, control and treatment group sizes were highly similar across the studies with the control group being somewhat larger than the treatment group (X_t = 25.97, X_c = 26.64).

Effects of Laboratory Experience Across Laboratory Methods

The results indicate that laboratory experiences are largely and significantly effective in producing desirable effects on teachers' behavior, knowledge acquisition, and affect. Of the 83 effect sizes 75 favored laboratory treatment over a control treatment. Further, the magnitude of these effects is relatively large. Table 1 presents aggregated effect size data. As can be seen mean adjusted pooled effect size (ES) across the studies was moderately strong (ES = .70) and significantly different from zero (Z = 2.03, p = .022). The 95% confidence interval (.51 to .83) suggests that the basic effect of laboratory experiences is at least moderate and, potentially, strong.

Insert Table 1 About Here

Effects by Teacher Level. As might be expected, a majority of the research on laboratory exper nces was conducted with preservice teachers. Only 16 of 83 effect sizes are based upon research in which inservice teachers were participants. The results indicate that laboratory experiences are effective and significant for both inservice and preservice teachers (ES = 1.16 and .59, respectively). However, the effects are significantly stronger for inservice teachers (Z_{diff} = 5.40, $p < .0000$), supporting conclusions drawn in earlier reviews of laboratory experience (Copeland, 1982; Metcalf, 1994). The reviewers speculated that the reason for this may lie in inservice teachers' ability to apply in natural classrooms with school-aged learners the knowledge or behaviors learned in laboratory experiences. If this is true, then laboratory experiences which allow participants to work with natural, school-aged pupils would be expected to be more effective than those using peers, simulated, or no learners.

Effects by Learner Type. Comparisons of effect size by learner (pupil) type reveal effect sizes to be significant for each learner type, but suggest that use of natural, school-aged learners may be valuable. The strongest effect is found in studies employing simulated learners or no learners, in protocols, simulations, or recorded observations, for example (.90, p = .008). Nearly as strong are the effects of laboratory experiences using natural learners (ES = .68, p = .022).

Experiences using peers as learners were least powerful (ES = .50, p = .051), though still significant. Modified Bonferoni procedures were employed to investigate differences in effect size, but revealed no significant differences. Still, it is notable that laboratory experiences employing natural, school-aged pupils tended to be more powerful than those using only peers.

Effects by Context of Measurement. Related to the magnitude of effect sizes due to learner type are differences in effect size that appear due to the context in which the dependent variable is measured. As before, a possible explanation for the greater power of laboratory experiences for inservice than preservice teachers may lie in preservice teachers' greater anxiety and reduced performance in more natural contexts which are less like the laboratory. An examination of effect sizes by context of measurement provides only limited and inconsistent support for this explanation.

Effect sizes in each context were significant. Surprisingly, written tests, used in studies investigating the effects of laboratory experience on teachers' knowledge or affect, provided less powerful effect sizes than any other context (ES = .63, p = .031). The remaining four contexts (laboratory-peers, laboratory-pupils, field-contrived, and field-natural) represent contexts in which teacher behavior was assessed. Though not reported in Table 1, mean effect size for the two laboratory contexts was larger than for field contexts (ES = .80 and .70, respectively). The largest effects were reported when teacher behavior was assessed in laboratory settings with peers as learners, the most controlled, least natural context (ES = .89, p = .005). Interestingly, however, natural field contexts evidenced the next largest effect sizes (ES = .72, p = .012). Nearly as large were effect sizes in contrived field settings (ES = .70) and laboratory settings with natural, school-aged pupils (ES = .69). Follow-up comparisons indicated no significant differences in effect size either across the four contexts or between laboratory and field contexts.

Effects by Time from Treatement to Measurement. A frequent criticism of laboratory experiences, even by those who are advocates has been that their effects do not last for extended periods of time (Copeland, 1982; Cruickshank & Metcalf, 1990. Effect sizes in Table 1, however, suggest that this criticism may be unwarranted. There emerges no clear, substantial pattern of diminution of effect size over time. In fact, the correlation between time of measurement and effect size is quite nearly zero (r = -.02, p=.835). As can be seen, the greatest number of studies measured the dependent variable within 1-2 weeks of the completion of treatment and, for these studies, the effect size is strong and significant (ES = .73, p = .018). Beyond this, no identifiable pattern of effect size over time emerges.

Effects by Dependent Variable Type. Most reviewers of research on laboratory experiences in teacher education have emphasized their effects on teacher behavior, and often have concluded that the experiences are not consistently effective in promoting desirable behavioral change. The results presented in Table 1 indicate that this conclusion is likely to be incorrect. Laboratory experiences appear to influence teacher behavior most positively and significantly (ES = .75), and more strongly than they influence either teacher knowledge (ES = .71) or affect (ES = .53). Laboratory effects on behavior and knowledge acquisition are significant (both p = .015). Effect size for teacher affect is moderate, but not statistically significant (p = .082).

In general, laboratory experiences appear to be effective in promoting desirable and substantial changes in a variety of contexts and diverse conditions. These experiences are significantly more powerful with inservice than with preservice teachers, but highly effective with both. Teacher affect seems least influenced by participation in laboratory experiences, knowledge considerably more so, and behavior most strongly changed in desirable ways. Interestingly, the context of measurement of teacher behavior dces not seem directly to affect the magnitude of effect size, with on-campus contexts providing only slightly larger effect sizes than field contexts. Importantly, including in laboratory activities some experience with natural, school-aged pupils seems to produce a slightly greater result, though this effect is not statistically significant.

Effects by Laboratory Experience

The second principal research question focused on the relative and comparative effects of the various forms of laboratory experience. To address this question, studies of the eight primary laboratory methods were organized around three levels of systematization described earlier. Many of these experiences can be considered similar. For example, minicourses are an extended form of microteaching, and Reflective Teaching a particular and formalized way of conducting peer teaching. In the current analysis, study results were classified according to descriptions and definitions provided by the developers of the laboratory experiences. Thus, microteaching was defined as per Allen & Ryan (1969), minicourses as per Borg (1972), Reflective Teaching as per Cruickshank et al. (1981), and protocol materials as per Smith, Cohen and Pearl (1969). For remaining laboratory methods, less specific operational definitions were applied and are explained in following sections. However, these experiences (simulations, role playing, peer teaching, and recordings) are more easily discriminated from one another and from the more specific laboratory methods described above using developers' definitions.

For most laboratory methods, two tables are provided to display the results of analyses: (a) a chronological listing of studies (i.e., effect sizes) including investigators and date, subject level, sample size (asterisks indicate single group studies), course type, learner type, dependent variable studied, time from treatment to measurement, context of measurement, and adjusted pooled effect size; and (b) a table of aggregated effect sizes by subject level, dependent variable studied, and context of measurement. These tables are intended to provide descriptive information about the effect sizes associated with each laboratory method and various factors of treatment. Relatively small numbers of studies in some categories precluded the application of inferential statistics. However, limited discussion of comparative effect sizes is included, though conclusions drawn from these comparisons should be considered tentative.

Highly Systematic Methods

Microteaching

According to McIntyre (1991), microteaching is reportedly used in 91% of teacher education programs making it second only to field experiences (98%) in the extent of its use in the preparation of teachers. As originally intended, microteaching is a combination of the separate components of controlled practice teaching, videotaped feedback, and directed supervision. However, the term microteaching has come to be used less specifically to refer to any campus-based teaching encounter of short duration which is videotaped.

Microteaching was developed in the early 1960s for use in the Summer Intern program at Stanford University. The primary intent was to promote teachers' use of 18 specific and discrete behaviors thought to contribute to effective teaching (Allen & Ryan, 1969). These included establishing set, asking probing questions, using examples, and achieving closure. Participants read about one of the specific skills, prepared and taught a short lesson (usually 5-minutes) to a small group of school-aged learners which was videotaped and in which they were to demonstrate the skill, and viewed the videotape and received feedback from a university instructor regarding their performance. Then, they either prepared and taught another lesson to further improve their use of the skill, or repeated the process with a different skill. When several individual skills had been mastered in these short lessons, participants prepared and taught a longer lesson (usually 20-minutes) in which the acquired skills were to be demonstrated.

Over the years, the process of microteaching has been adapted and applied to a variety of on-campus teaching experiences. Microteaching has retained the principal components of simplified or shortened teaching, videotape recording, and instructor feedback. However, it seldom is conducted with school-aged learners, more often using peer learners, and is used to allow teachers to develop or practice a variety of instructional behaviors or methods rather than the original and specific 18 skills.

Research on microteaching has been extensive, particularly when compared to that of other aspects of laboratory experience and teacher education. Literally hundreds of studies have been conducted on microteaching and on its various components (MacLeod, 1987). Included in the present analyses are those which provided sufficient, detailed information to allow accurate classification of the study and study characteristics and computation of standardized pooled effect size. Though not included in the present analyses, several studies have found participants, whether preservice or inservice teachers, to report microteaching to be a positive and valuable experience (e.g., Clifford and others, 1977; Gilliom, 1969; VanMondfranz, Smith, Fedlhusen, & Stafford, 1969).

General Effect Size Data. Table 2 presents the characteristics and effect sizes for studies of microteaching. Thirty pooled effect sizes were obtained from 20 studies, most derived from positive if not statistically significant results (26 positive effect sizes). Most studies included microteaching within the framework of a general or special methods course (21 studies) and in the vast majority (24) preservice teachers were participants. Studies in which natural pupils served as learners (n = 17) and those using peer learners (n = 13) were roughly equal in number. However, it is interesting to note that no study after 1978 included school-aged learners. Effects of studies using school-aged learners are slightly but not significantly greater than those in which peers were learners (ES = .62 and .59, respectively). Given the original intent of microteaching, it is not surprising that all but nine studies investigated its effect on teacher behavior. Of the remaining studies, six investigated the effects of microteaching on knowledge and three on affect. Also interesting is that the contexts in which teacher behavior was assessed were equally distributed across laboratory (N = 10) and field (N = 11) settings. In most cases, studies assessed the effects of microteaching within 1-2 weeks of completion of the experience (N = 21). Though it has been widely believed that the effects of microteaching rapidly diminish over time, this effect is not found in these data. The correlation between time from treatment to measurement and effect size is nearly zero (r = .12, p = .522).

Insert Table 2 About Here

Specific Effect Size Data. Table 3 organizes the effect sizes around critical characteristics of the studies. Generally, microteaching produces a moderate effect size (ES = .61, p = .034). However, this effect appears substantially related to the subject level of the participants and, to a lesser extent, to the dependent variable being studied. Microteaching is substantially and significantly powerful in affecting desirable change in both preservice and inservice teachers' instructional behavior (ES = .68, p = .020), and the effects of microteaching are somewhat stronger when measured in laboratory settings than in field settings.

Insert Table 3 About Here

Microteaching is consistently more effective with inservice teachers than with preservice teachers. While microteaching appears highly effective in producing desirable change in inservice teachers' affect, knowledge, and behavior, it produces a significantly powerful effect only on preservice teachers' behavior. As noted above, laboratory settings produced somewhat greater effect sizes than field settings. Though it was expected that inservice teachers' behavior would be less influenced by the context in which they were observed, this was not the case. A pattern of reduced effect size in field settings is highly similar for both subject levels. The most obvious differences in the effectiveness of microteaching between pre and inservice teachers are not, as might be expected, in behavior, but, rather, in producing desirable change in affect and knowledge. Microteaching is substantially more effective in developing inservice teachers' knowledge and positive affect than with preservice teachers ($Z_{diff} = 1.88$, $p = .030$ and $Z_{diff} = 2.35$, $p = .010$, respectively).

Summary of Microteaching Effects. Microteaching was originally intended to help preservice teachers develop desirable instructional behavior and this remains its most common use. The results of this analysis support the use of microteaching for this purpose, indicating that participation in microteaching promotes strong and significant improvement in preservice teachers' instructional performance. Further, this effect is relatively consistent across laboratory and field settings, indicating that the effects of microteaching are transferred to use in natural classroom instruction. Some reviews have suggested that long-term changes in behavior are less likely (Copeland, 1982, Cruickshank & Metcalf, 1990), but this conclusion is not supported by the current study. Effect sizes are not significantly related to the length of time between the conclusion of microteaching and observation of teacher performance. The effects of microteaching on preservice teachers' affect or knowledge seem limited and much less consistent. Perhaps the most important finding is that microteaching is extremely powerful for inservice teachers. For these teachers, microteaching produces substantial effects not only on behavior, but also in affect and knowledge acquisition.

Minicourses

Minicourses are instructional, often self-directed learning modules that attempt to develop teachers' skill in using clusters of related behaviors (e.g., higher-order questioning behaviors). Generally, participants proceed through a series of modules, each intended to help them develop some of the specific skills related to the broader cluster. In each module, participants read detailed descriptions and definitions of the behaviors; view videotape recordings or read transcripts that demonstrate the behaviors; and complete written exercises which require recognition or generation of examples and non-examples. Then, they are involved in preparing and presenting several videotaped lessons, and receive feedback on their ability to use the module behaviors. Participants repeat this sequence for each module, adding new behaviors to those previously mastered.

In many ways, minicourses can be seen as an extension of the microteaching model providing a more intensive experience with somewhat greater emphasis on developing participants' conceptual understanding of the behaviors to be mastered. As in microteaching, changing teacher instructional behavior has been the principal focus. However, in contrast to microteaching, most research of minicourses has been conducted with inservice rather than preservice teachers. A large number of studies have investigated the effects of minicourses (see Borg, Langer, & Wilson, 1975), but only a relatively small number of these studies met the criteria for inclusion.

Overall Effect Size Data. Across variables, minicourses produce a strong, consistent, and significant effect (ES = .89, p = .005). Table 4 presents relevant data for seven studies providing nine effect sizes. All effect sizes are positive and only two are below .80. It should be noted that all studies examined the effect of minicourse participation on teachers' instructional behavior in either contrived or natural field settings rather than laboratory contexts. Further, effect sizes were substantially greater for studies using natural, school-aged learners (ES = .73) than for those using peer learners (ES = .50). Most studies assessed teacher behavior within 1-2 weeks of the completion of the minicourse. However, the two studies examining long-term effects of minicourse participation found strong effects several months after teachers completed the minicourse (ES = 1.05). Several of the reported studies were conducted as inservice education (N = 5) with only a small number integrated into a methods or educational psychology course.

Insert Table 4 About Here

Specific Effect Size Data. As seen in Table 5, minicourses were found to be much more effective with inservice (ES = 1.04) than with preservice teachers (ES = .70), though this difference is not statistically significant based upon the small number of studies (Z_{diff} = 1.18, p = .119). This again supports the notion that laboratory experiences generally are more effective with inservice teachers. Relatedly, all but one study with inservice teachers used school-aged pupils as learners in practice lessons, whereas half of the studies with preservice teachers used peers. Perhaps most surprising is that effect sizes for studies in which teacher behavior was assessed in natural field settings were significantly larger than those assessing behavior in contrived settings. However, this difference may, at least in part, be attributable to the nature of subjects in the studies.

Insert Table 5 About Here

Summary of Minicourse Effects. Minicourses appear to be consistently effective in changing the teaching behavior of both preservice and inservice teachers. However, minicourses are undoubtedly more effective with inservice teachers. For these teachers, the effects of minicourse participation are extremely powerful and appear to be lasting. Limited support is again provided for the benefit of integrating experience with school-aged learners into the laboratory experience. This is particularly true for preservice teachers, and somewhat less so for inservice teachers.

Protocol Materials

Protocol materials, as first suggested by Smith, Cohen, and Pearl (1969), were intended to enhance teachers' understanding of important educational events or phenomena. Protocols would consist of two parts: (a) an audiovisual or written recording of an educational event or phenomena, and (b) aggregated theoretical or empirical knowledge which explained the recorded event or which could help teachers understand the event or phenomena. The initial and primary focus of protocol materials was to further conceptual understanding rather than directly to promote behavior change. In using protocols, teacher-participants view a short recording (10-15 minutes) or read a detailed record of a naturally occurring event, like student cheating. Then they read and discuss the knowledge base that can explain or understand the event. Due largely to program development sponsored by the U.S. Office of Education, however, a second series of protocol materials were developed which tended to focus on changing teacher behavior. Federal funding for the protocol project was short-lived, but nearly 150 sets of protocol materials were developed. However, surprisingly few studies have been conducted on the effects of these materials.

General Effect Size Data. Nine studies report the effects of protocol materials in sufficient detail to allow computation and interpretation of effect size (Table 6). Mean adjusted pooled effect size for protocol materials is quite strong ($ES = 1.38$, $p = .001$), considerably stronger and more consistent than for any other laboratory experience. It is worth noting that half of the studies based effect size estimates on one group, pretest-posttest results. Six studies examined effects on teachers' knowledge, three on teacher behavior. Inservice teachers were subjects in most of the studies, several made use of single group designs, and all examined the effects of the protocol activity within 1-2 weeks of treatment. Still, the overall magnitude of effect is large.

Insert Table 6 About Here

Specific Effect Size Data. As seen in Table 7, protocol materials appear to be quite powerful in promoting knowledge acquisition ($ES = 1.38$, $p = .001$) and desirable behavior ($ES = 1.40$, $p = .001$). Though originally intended to focus upon concept acquisition, the results indicate that protocol materials are at least as effective in promoting change in instructional behavior as knowledge acquisition. The clearest result is that protocol materials were significantly more effective with inservice teachers than with preservice ($ES = 1.77$ and $.62$, respectively, Z_{diff} =

1.73 p = .042). For both behavior and knowledge, inservice teachers gained significantly more from using protocol materials than did preservice teachers. In fact, protocol materials did not produce a statistically significant effect either for preservice teachers' behavior (ES = .66, p = .063) or knowledge acquisition (ES = .62, p = .079). In contrast, inservice teachers evidenced substantial and significant gains in knowledge acquisition (ES = 1.54, p = .003) and, on the basis of only one study, improved instructional behavior (ES = 2.87, p = .000).

Insert Table 7 About Here

Summary of Protocol Materials Effect. Generally, protocol materials seem to offer a highly promising method of developing teachers' acquisition of pedagogical and content related knowledge and desirable instructional behavior. The aggregated effect of protocols is the greatest of any laboratory method included in this analysis. However, this effect is differential for inservice and preservice teachers. Work with protocol materials is extremely powerful for inservice teachers, producing substantial improvement across variables. Based upon a limited number of studies, the effect of protocols with preservice teachers is considerably less certain. Perhaps this may be explained by inservice teachers' greater classroom experience which make the events or concepts depicted in protocol materials more meaningful. Particularly because of the similarity of protocol materials to case-based instruction, further research is warranted.

Moderately Systematic Methods

Reflective Teaching

Reflective Teaching (Cruickshank, Kennedy, Williams, Holton, & Fay, 1980) is an unique hybrid of peer teaching and simulation. Cruickshank and his associates at Ohio State University developed Reflective Teaching to provide students of teaching with opportunities to teach lessons to small groups of learners, receive immediate feedback regarding the extent of their students' learning and satisfaction, and participate with their learners and other peer teachers in guided reflection on the experience (Cruickshank, 1985). Reflective Teaching is distinct from simulations or simple peer teaching in at least three important ways. First, the Reflective Teaching materials are structured to provide experiences in which real teaching and learning can take place. Content of the lessons is unlikely to be known by the teachers or learners prior to the lesson. Thus, teachers need not pretend to teach and learners need not pretend to learn or to be anything other than peer learners. Second, content, length of lesson, evaluation of learning, and even questions to guide reflection are controlled in Reflective Teaching. This control makes Reflective Teaching much more structured than the typical peer teaching experience. Third, the materials which guide the Reflective Teaching experience are more easily adapted to a variety of ends, making Reflective Teaching more versatile than most simulations.

In Reflective Teaching, participants are organized into groups of three to five. One member of each group is designated the teacher, assigned to teach one of approximately 35 lessons, and provided information about the objectives of the lesson and lesson content. In a subsequent class period, designated teachers teach their 10-15 minute lessons to their peer groups, and administer a test of lesson content and satisfaction to their learners. Following this, teachers and their learners participate in guided small group and then whole class discussion of the experience. Promoting analytical thought about teaching and learning are primary intentions of the experience (Cruickshank, 1985).

Unlike microteaching, research of Reflective Teaching is limited. Research of Reflective Teaching has been conducted solely with preservice teachers and has mostly examined its effects on teachers' ability to analyze or reflect on teaching or affect toward teaching as a profession. Preservice participants have reported Reflective Teaching to be a positive experience, valuable to their professional development, more satisfying than other aspects of methods course instruction, and at least as valuable as participation in microteaching (McKee, 1986; Peters, 1980; Peters & Moore, 1980; Williams & Kennedy, 1980). Cruickshank (1985) and other writers have referred to several supportive studies, however, only four investigations were located which met criteria for inclusion in the present analysis, and none of these studies examined the effects of Reflective Teaching on teachers' behavior.

General Effect Size Data. Table 8 presents the results and characteristics of the five analyses. All investigations were conducted following the Reflective Teaching guidelines, using peer learners, controlled content, tests of learner knowledge, and guided discussion. Across affect and knowledge variables, Reflective Teaching seems to produce only a moderate though significant effect ($ES = .38$, $p = .037$). Four of five effect sizes are positive and diverse. It is important to point out that the five effect sizes presented in Table 8 represent the results of only two studies. Two effect sizes, one for affect and one for knowledge (i.e., reflective ability) were provided in a single study by Cruickshank et al. (1980). Holton and Nott (1980), Nott and Williams (1980), and Williams and Kennedy (1980) were related but independent analyses and study reports based upon data from a single experimental investigation. Subjects and experimental control were highly similar across the studies, however, the data in Cruickshank et al. provided somewhat larger effect sizes.

Insert Table 8 About Here

Specific Effect Size Data. Table 9 organizes the data around important variables. The results suggest that Reflective Teaching has a moderate and consistent effect on preservice teachers' affect about teaching and learning (ES = .47, p = .013). Teachers in the studies indicated that they were much more positive about teaching as a profession and confident in their own abilities to student teach as a result of the Reflective Teaching experience. Less consistent are results regarding the development of teachers' reflective ability. Whereas Cruickshank et al. (1980) and Holton and Nott (1980) report moderately strong and positive effects, Nott and Williams (1980) report a slight negative effect. The resulting pooled effect size is relatively small and not statistically significant (ES = .32, p = .063).

Insert Table 9 About Here

Summary of Reflective Teaching Effect Size Data. The cumulative results on the effects of Reflective Teaching are encouraging, though extremely limited. Reflective Teaching appears to produce generally positive effects on preservice teacher affect and, to a lesser extent, knowledge. As with other laboratory experiences, preservice teachers find participation to help them gain confidence in their ability to teach, and knowledge about teaching and learning. And, the experience promotes positive attitudes and greater self confidence. Disappointing are inconsistent effects of Reflective Teaching on teachers' ability to critically analyze teaching. Conclusions about the effects of Reflective Teaching must be viewed as highly tentative due to the small number of studies available.

Simulations

In its broadest sense, a simulation is an instructional alternative wherein participants are presented with recreated elements of real situations to which they must respond. They are typically intended to provide participants with awareness of and opportunity to develop more desirable responses. The experiences classified as simulations or simulators in the present discussion are distinctive in the specific nature of the recreated experience and relative lack of adaptability of the experience or materials. Generally, these simulations: (a) present the participant with information about a hypothetical classroom, school, or pupils; (b) introduce a problem, event, or issue regarding the hypothetical setting; (c) require the participant to generate one or more alternatives for explaining or resolving the event; and (d) provide the participant with feedback on the appropriateness or likely outcome of the suggested alternatives. In practice, these experiences are intended to develop teachers' use of particular pedagogical approaches (e.g., use of probing questions, adaptability) or analysis and problem-solving ability.

Development and use of simulations in teacher education can be organized into two eras. The first era (through the mid-1970s) is characterized by written and media-based simulations, and the second predominated by computer-based simulations. Both eras, however, were influenced by development and availability of technology, such as videotape recordings and, more recently, personal computers.

In the early era, a number of simulations were developed to promote desirable teacher performance in the classroom. These simulators consisted of materials which recreated a classroom or school, and, in varying degrees of detail, provided information about the students, parents, colleagues, and classroom. "Mr. Smith's Sixth Grade" by Kersh (1962) was among the first simulators and was highly detailed in its approach to recreating classroom situations. In this simulation, participants worked in a mock classroom environment complete with chalkboards and student desks. On the back wall of the classroom was a large screen onto which an instructor projected one of several classroom scenes, to which the participant was to react or behave as he or she thought best. On the basis of this reaction, the instructor selected and projected another classroom scene which was believed to be the most likely consequence, and again the participant reacted. This process continued until the behavior of the participant was deemed desirable.

The Kersh simulator was representative of the early period in both design and evaluation. An emphasis of this and the later era is on development rather than evaluation. Though several studies of media-based simulations are reported (e.g., Harvey, 1970; Kidder & Guthrie, 1971; Smith, 1975; and Marsh, 1979), only four studies were found which met the three criteria for inclusion in the present analysis.

The second, current era of simulation development is characterized by computer or computer-based simulations. To an even greater extent than in the earlier era, emphasis has been on development of simulations to the neglect of evaluation of their effects. Thus, although several simulation development efforts are reported, few provide results of evaluation, and fewer still report numeric data of the effects of simulation participation on anything more than participants' attitudes toward the activity. Only one study (Reynolds & Simpson, 1980) was located which met criteria for inclusion in the present analysis. This study is included with written and media-based simulation studies in Table 11. However, it was not included in computation of aggregated simulation effect size.

General Effect Size Data. The four written and/or media-based simulation studies provided nine independent effect sizes (Table 10). Mean adjusted pooled effect size across these studies is statistically significant, though only moderate in magnitude (ES = .50, p = .042). Eight effect sizes are positive, with Ponder and Heath (1972) reporting a very slight, negative result. All studies investigated the effects of simulation with preservice teachers and most included teache.

affect or knowledge acquisition as the dependent variable. Ponder and Heath replaced several weeks of student teaching with simulation experience, whereas all other studies included simulation into general methods course instruction. Data for simulation experiences also indicate that the effects of the experience are reduced over time. A significant correlation is found between effect size and the length of time from treatment to measurement ($r = .68$, $p = .04$).

Insert Table 10 About Here

Specific Effect Size Data. Table 11 presents effect sizes by critical variables. Simulations are found to be most effective in promoting desirable knowledge acquisition and behavior. Particularly strong effects are found for change in knowledge acquisition (ES = .79, $p = .003$) and, at least moderate effects for change in behavior (ES = .52, $p = .027$). Simulations seem to be much less effective in producing change in preservice teacher affect (ES = .38, $p = .106$).

Insert Table 11 About Here

Summary of Simulation Effects. Research on the effects of simulations, particularly computer-based simulations, has largely been neglected. However, simulations appear to engender at least short-term change in preservice teacher behavior and knowledge acquisition. Though participants report participation in the simulations to be positive (Cruickshank & Broadbent, 1969; Marsh, 1979; Smith, 1975), simulations do not produce significant effects on participant affect (e.g., anxiety about teaching). The effect of simulations does not seem to be contingent upon the degree of reality represented in the presentation of the scenario (Kersh, 1965), with no clearly established difference between written or media-based simulations. Kidder and Guthrie (1971) found that a simulation experience was made significantly more effective when participants were guided in reflecting upon the experience and then repeated it. Certainly, simulation and computer technology hold promise for enhancing teacher education, but a dearth of research evidence warrants these experiences be implemented cautiously.

Role Playing

Role playing requires that one or more participants assume the role of specific others in a predetermined, simulated setting and situation. Participants are to behave in what they believe to be realistic or natural ways, and, generally, a post-role play discussion focuses on the experience. For example, three preservice teachers in an educational methods course might be assigned to play the roles of parents and teacher during a parent-teacher conference. Each role player would be informed of the background, attitude, and attributes of the character, and provided an overview of the context in which the scene was taking place. The role players would "act out" the conference, behaving as they believed their character might. Upon conclusion of the role play, the class would discuss the experience in order to analyze it, understand what happened, and generate alternative or likely outcomes of various aspects of the scene.

Role playing is often mentioned but seldom discussed in literature on teacher education. The method would appear to offer promise for allowing teachers to gain experience in understanding and behaving in critical, but infrequent educational or interpersonal situations. Thus, the laboratory method has been included in the present discussion and analysis. However, only four studies report the effects of role playing in sufficient detail for inclusion in the present study (see Table 12) and the results are inconsistent.

General and Specific Effect Size Data. Mean adjusted effect size across the studies is strong, but not statistically significant (ES = .77, p = .111). The high variability of effects is evidenced by Vanderkolk (1975) and Reynolds and Simpson (1980), and makes interpretation of the aggregated results difficult. When the large effect size reported by Vanderkolk is not included, the pooled effect size is nearly zero (ES = .12). No significant effects are found for any set of variables, contexts, or subjects. In sum, the inconsistency of results of research on role playing precludes reasonable conclusions. Though it would appear to offer promise, role playing alone does not appear to affect significant changes in teacher knowledge, affect. or behavior.

Insert Table 12 About Here

Minimally Systematic Methods

Peer Teaching

As a form of laboratory experience, peer teaching can be considered any directed activity which requires a teacher trainee to conduct instruction for one or more learners who are also teacher trainees, and which includes some analysis or reflection on the experience. Frequently, the intent of peer teaching is to provide practice in using particular instructional behaviors, or to allow analysis of the teaching act. In a broad sense, many of the earlier described laboratory activities (e.g., microteaching, Reflective Teaching, role playing) often are more structured forms of peer teaching. For example, microteaching adds the elements of conceptual modelling and videotape review of the teaching episode, Reflective Teaching systematizes content and evaluation of learning, and role playing requires the participants to "pretend" to be something they are not (e.g., when the learners are pretending to be elementary aged students).

As with role playing, peer teaching is often mentioned in teacher education literature, but controlled studies of its effect are extremely rare. Many reported studies either include some form of modelling and videotape recording and, thus, can be considered microteaching (e.g., Smith, 1975) or do not report sufficient data to allow computation of effect size (e.g., Morse, Kysilka, & Davis, 1970). Effect size estimates that are described below are provided merely to help improve our understanding of laboratory experience, but must be interpreted with much caution.

General and Specific Effect Size Data. Four effect sizes were computed for data from two similar studies (Table 13). Both included peer teaching in an Educational Psychology course for preservice teachers and both examined the effects of the experience on teachers' instructional behavior. Overall pooled effect size was surprisingly large (ES = .78, p = .004). Yeany (1978) compared pretest and posttest performance of teachers who completed peer teaching with those who received only instruction and reports a strong effect on teacher behavior in a laboratory context. Emmer (1970) reports that preservice teacher behavior improved significantly from pretesting to each of three brief teaching experiences, but does not report specific numeric data (thus, effect size was estimated). In this study, Emmer compared pretest performance with two peer teaching activities and one small group lesson with high school students. Emmer notes that behavior improved from pretesting to peer teaching, increased again when lessons were taught to school-aged pupils in field settings, and was maintained at a level significantly higher than pretesting when teachers returned to peer teaching settings.

Insert Table 13 About Here

Summary of Peer Teaching Effects. Peer teaching, offers a highly adaptable and inexpensive form of laboratory experience which often serves as the basis for more structured or systematic laboratory activities like microteaching. Research results on the effects of simple peer teaching, that is, peer teaching without recording of lessons or role playing, are extremely scarce. The four available effect sizes suggest that a brief peer teaching experience may be of benefit in producing at least short term changes in preservice teachers' instructional behavior in peer teaching settings. In addition, the results of Emmer (1970) further support the value of including some experience with school-aged learners in preservice teachers' laboratory activities. In spite of strong overall effects reported herein, optimism must be guarded. No evidence is available to indicate the long-term effects of peer teaching or the transfer of learned instructional behavior to teaching in natural classrooms. Peer teaching is probably best be viewed as a valuable component which can enhance the effects of laboratory experience rather than as an independent laboratory activity.

Videotape and Audiotape Observation

Laboratory experiences in teacher education often intend to develop teachers' skill and further their understanding of important educational events or concepts. Audio and video recordings have often been proposed to address or enhance these functions. Recordings are generally incorporated as a component of a larger form of laboratory experience (e.g., protocol materials, minicourses, microteaching). Thus, only a small number of studies have reported the effects of recordings independent from other aspects of laboratory experience. However, because recordings are so frequently used, a brief discussion is included to provide a general review of research and an examination of available effect sizes.

The use of recordings as feedback has accompanied much of the research on microteaching. As a result, the studies have investigated the effectiveness of participant teachers' review of recordings of their performance in developing desirable behavior. Although evidence is minimal, recordings as feedback appear to promote desirable change in teacher behavior and attitude. Lerner (1972) reports no significant difference in preservice teachers' attitudes or instructional behavior between those who received verbal, videotaped, or combined verbal and videotaped feedback. Roush (1969) similarly found no significant difference in teacher behavior between those who received: (a) audio only; (b) video only; (c) audio and video; (d) audio, video, typescript, and supervisory; or (e) no feedback. However, McDonald and Allen (1967) report self viewing of videotaped teaching to contribute significantly to development of desirable teaching behavior. Legge and Asper (1972) found that preservice teachers who viewed and critiqued videotapes of their teaching performance were better able to provide ratings of teaching which agreed with those provided by master teachers. And, Fuller and Manning (1976) found that using videotape recordings to demonstrate desirable behavior and provide feedback significantly enhanced efforts to develop teacher behavior, and aided transfer of the learned behaviors to the first year of teaching. Others have found self viewing to be effective in improving instructional behavior when combined with feedback from peer learners (Orme, McDonald, & Allen, 1966; Pinney & Miltz, 1967).

General Effect Size Data. As noted above, few studies have reported the effectiveness of recordings used for observation independently from other aspects of laboratory experience. However, six studies are available which report 12 effect sizes for either audio or video recordings alone. These studies examined the effects of exposure to recorded models on teachers' instructional behavior, affect, or knowledge acquisition. For clarity, data were aggregated separately for audio and video recordings (Tables 14 and 15). Ten effect sizes were computed for the effects of videotape models. Across studies, the effect of videotape models is not clear. Though nine effect sizes are positive and the single negative effect size extremely small, the overall effect of videotape models is not significant ($ES = .48$, $p = .084$). In contrast, the two reported effects for audiotape models are surprisingly strong ($ES = .75$, $p = .022$). It is also noteworthy that each of the audiotape effects was reported within studies also investigating the effects of videotape recordings. Only one study (Popham, 1966) investigated the effects of recordings after more than 1-2 weeks of treatment.

Insert Tables 14 & 15 About Here

Specific Effect Size Data. Table 16 includes the 12 effect sizes for observation of recordings. Observation of recorded models alone appears to produce no more than moderate improvement across dependent variables. The effect of such observation is significant only for teacher behavior (ES = .59, p = .052). Teacher knowledge acquisition is moderately though not significantly influenced (ES = .5589, p = .058). Recordings do not seem to promote more than small change in teacher affect (ES = .23, p = .236).

Insert Table 16 About Here

Summary of Recording Effects. Observation of audio or videotape recordings appears to produce only moderate effects, and these effects are primarily associated with change in behavior. Nonetheless, such observation is at least as effective as natural classroom observation in promoting desirable outcomes. Winitsky and Arends (1991) found videotape observation to be as effective as viewing live demonstrations in natural classrooms in developing preservice teachers' ability to reflect on and conduct cooperative learning. Though not meeting criteria for inclusion in the meta-analysis, DuBois (1974) and Martin and Fanslow (1980) also report observation of videotaped episodes to be as effective as direct contact with children in helping preservice teachers understand and use desirable instructional practices. These findings suggest that although the effects are not large, audio and videotape recordings can be used in place of natural classroom observation. However, observation alone, via recording or direct classroom exposure, is best used in conjunction with additional clinical experiences.

Conclusions

The above review of research on the most common forms of laboratory experience in teacher education leads to several conclusions about the various experiences, and how best they may be used. Whereas earlier summaries addressed the particular strengths and weaknesses of each laboratory experience, the following discussion turns to conclusions which can be drawn across studies and across the various experiences.

First, and across nearly all forms of laboratory experience, participants believe the experience to be positive, enjoyable, and professionally beneficial. This is among the most consistently reported in research on laboratory experiences. Inservice and preservice teachers appear equally to value the experiences, and, as has been found with field-based experiences, often believe the experience to beneficial in spite of research findings to the contrary.

Second, the evidence suggests that laboratory experiences can be highly effective in the preparation of teachers. Microteaching, minicourses, protocol materials, recordings, and other on-campus experiences are useful in producing substantial improvements in teachers' instructional behavior, knowledge of pedagogy, content, and learners, and, to a lesser extent, affect toward teaching and learning.

Third, some intensive laboratory experiences appear to promote concurrently a variety of desirable outcomes. For example, microteaching, developed for and primarily intended to promote skill acquisition, is found also to promote teachers' ability to reflect on teaching and understanding of desirable instructional principles. To the extent this carryover effect occurs, laboratory experiences are more efficient than generally believed. In contrast to field-based experiences, which we know to promote negative or no changes in teacher behavior, affect, or understanding, some laboratory experiences may promote all three.

Fourth, laboratory experiences are at least as effective and probably more effective with inservice teachers than with preservice teachers. Inservice teachers views of the value of such experiences equal those of preservice teachers and changes in their behavior, knowledge, or affect are as strong or stronger. The reason for this is unclear, but mar result from inservice teachers' ability to apply desirable practices in their own classrooms with natural learners. Laboratory experiences thus offer a promising, though infrequently used method of improving inservice teacher education.

Fifth, and related to the above, the effect of laboratory experiences is enhanced when some work with natural learners is included. However, experience with natural learners need not, and it could be argued should not, be extensive. Further, there is no evidence indicating that a series of laboratory experiences must culminate in natural classroom practice. Rather, work with school-aged learners is likely to be most efficacious when simulated, on-campus experiences precede and follow it.

Sixth, the most effective forms of laboratory experience are characterized by clear outcomes which are made known to the participants, attention to instruction which helps participants understand the outcomes and their purpose, and guided debriefing about the experience. Relatedly, the effectiveness of laboratory experiences in enhanced when they are integrated into a broader, organized pattern of instruction. It seems that laboratory experiences are best viewed not as ends in themselves, but rather as ways of "anchoring" and enhancing didactic instruction. Surprisingly, however, the verisimilitude or degree of reality present generally does not appear critical to the success of laboratory experiences.

Seventh, while recent forms of laboratory experience, such as computer simulation, appear to hold promise, there is to date insufficient evidence of its effect to warrant whole-hearted or widespread adoption of the techniques in the preparation of teachers. Proponents of such experiences press for their inclusion in spite of this lack of evidence and without consideration of earlier findings. Proponents of these experiences must provide additional information regarding their most effective use.

Eighth, and relatedly, recent efforts to produce laboratory experiences have emphasized development and innovation to the neglect of evaluation. Further, developers of laboratory experiences seem mostly to disregard the body of research which could inform their work. The substantial, though incomplete body of research on microteaching, minicourses, media-based simulators, and other forms of laboratory experience, seems not to be considered by those who develop technological simulations. Specifically, and as one example, computer simulations are unlikely to change the ways in which teachers behave or think in natural classroom settings unless they afford at least some direct experience in applying the desirable behaviors or ways of thinking with school-aged learners. Proponents and developers of alternative forms of laboratory experience must provide evidence of each method's effects.

Ninth, and sadly, renewed interest in providing "anchored" instruction for teacher education students often overlooks or rejects earlier methods of laboratory experience on the grounds that they are not effective or are no longer appropriate for contemporary outcomes, such as development of reflective or analytical ability, when, in fact, research suggests that they may produce a variety of desirable and contemporary results. Thus, case-based instruction or computer-based simulations are adopted, about which we know very little, or students are sent into the field with the hope that they will witness, experience, and assimilate desirable concepts, attitudes, and behavior, in spite of growing evidence to the contrary. Or, equally troubling, laboratory experiences, like microteaching, are used without consideration of their efficacy or research which reveals their weaknesses.

Lastly, it is reasonable to believe that on-campus clinical experiences may be more effective when multiple, diverse experiences are provided in an organized series of instruction. A series of experiences which includes microteaching with analysis, Reflective Teaching, videotaped role playing with debriefing, and some experience with school-aged pupils is likely to promote a broader range of desirable outcomes, to develop participant learning which is more resilient, and to make transfer to natural classrooms more likely.

Laboratory experiences hold the potential to provide effective, highly efficient professional experiences in the preparation of teachers. When used appropriately and wisely, the effects of these experiences are superior to extensive and extended field-based experiences currently in vogue. On-campus laboratory experiences can develop teacher behavior, promote desirable cognitive abilities, and develop more positive affect among teacher/participants. It is time to consider what is known about laboratory experiences -- what they can and cannot do, to base their use on this knowledge, and to aggressively seek to extend and expand this body of knowledge in order to use most effectively those forms or combinations of laboratory experience likely to contribute to the preparation of teachers.

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Table 1

Overall Statistics

Mean Adjusted Pooled Effect Size = .70, SD = .76 (N=83)
95% Confidence Interval = .5132 to .8268
Mean Z = 2.03, p = .022
Mean Effect Size Adjustment = .97
Mean Treatment Group N = 25.97
Mean Control Group N = 26.64

By Teacher Level

Preservice	(N=67)	Mean Adjusted Pooled Effect Size = .59, SD = .6489 95% Confidence Interval = .4349 to .7467 Z = 1.72; p = .043
Inservice.	(N=16)	Mean Adjusted Pooled Effect Size = 1.16, SD = .7625 95% Confidence Interval = .4577 to 1.5169 Z = 3.36, p = .001

By Learner Type

None	(N=25)	Mean Adjusted Pooled Effect Size = .90, SD = .8619 95% Confidence Interval = .4135 to 1.1775 Z = 2.43, p = .008
Peers	(N=25)	Mean Adjusted Pooled Effect Size = .50, SD = .4964 95% Confidence Interval = .2963 to .7060 Z = 1.63, p = .051
Natural	(N=33)	Mean Adjusted Pooled Effect Size = .68, SD = .6686 95% Confidence Interval = .4457 to .9198 Z = 2.01, p = .022

Table 1 (cont'd)

By Context of Measurement

Laboratory Peers	(N=12)	Mean Adjusted Pooled Effect Size = .89, SD = .8001 95% Confidence Interval = .3856 to 1.4023 Z = 2.59, p = .005
Laboratory Pupils	(N=9)	Mean Adjusted Pooled Effect Size = .69, SD = .3927 95% Confidence Interval = .3892 to .9929 Z = 2.00, p = .023
Field Contrived	(N=10)	Mean Adjusted Pooled Effect Size = .70, SD = .4488 95% Confidence Interval = .3747 to 1.0168 Z = 1.75, p = .040
Field Natural	(N=15)	Mean Adjusted Pooled Effect Size = .72, SD = .8528 95% Confidence Interval = .2441 to 1.1887 Z = 2.25, p = .012
Written Test	(N=37)	Mean Adjusted Pooled Effect Size = .63, SD = .7386 95% Confidence Interval = .3036 to .8201 Z = 1.86, p = .031

Table 1 (cont'd)

By Time from Treatment to Measurement

1-2 weeks	(N=62)	Mean Adjusted Pooled Effect Size = .73, SD = .6883 95% Confidence Interval = .5587 - .9013 Z = 2.09, p = .018
2-6 weeks	(N=11)	Mean Adjusted Pooled Effect Size = .43, SD = .5542 95% Confidence Interval = .0490 - .8110 Z = 1.55, p = .059
6-12 weeks	(N=1)	Mean Adjusted Pooled Effect Size = .39, SD not calculable 95% Confidence Interval not calculable Z = 1.50, p = .067
12-18 weeks	(N=4)	Mean Adjusted Pooled Effect Size = 1.08, SD = 1.4022 95% Confidence Interval = .4118 - 1.7482 Z = 2.69, p = .004
18 weeks - 1 year	(N=4)	Mean Adjusted Pooled Effect Size = .38, SD = .42 95% Confidence Interval = -.3041 - 1.0641 Z = 1.39, p = .082
More than 1 year	(N=1)	Mean Adjusted Pooled Effect Size = 1.21, SD not calculable 95% Confidence Interval not calculable Z = 3.85, p = .001

Table 1 (cont'd)

By Dependent Variable Type

Affect	(N=15)	Mean Adjusted Pooled Effect Size = .53, SD = .8494 95% Confidence Interval = .0803 to .9855 Z = 1.39, p = .082
Behavior	(N=46)	Mean Adjusted Pooled Effect Size = .75, SD = .6765 95% Confidence Interval = .5524 to .9542 Z = 2.18, p = .015
Knowledge	(N=22)	Mean Adjusted Pooled Effect Size = .71, SD = .6616 95% Confidence Interval = .2461 to .9179 Z = 2.18, p = .015

Table 2

<u>Chronological Listing of Studies on Microteaching (N=30)</u>

Pooled Adjusted Mean Effect Size = .61, SD = .7072
95% Confidence Interval = .3461 to .8743
Z = 1.83, p = .034

Investigators	Subjects	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Adjusted Pooled Effect Size
Fortune, Cooper & Allen (1967)	Preservice	140/140*	Other	Peers	Behavior	1-2	Laboratory Pupils	.3100
Emmer & Millett (1968)	Preservice	27/27	Other	Peers	Behavior	1-2	Laboratory Peers	1.4958
Goldwaite (1968)	Preservice	20/10	Subject Methods	Peers	Behavior	12-18	Field Natural	.7125
Davis & Smoot (1969)	Preservice	85/55	General Methods	Peers	Behavior	1-2	Laboratory Peers	.7389
Kallenbach & Gall (1969)	Preservice	19/18*	Other	Natural	Behavior	1-2	Field Contrived	.0804
Kallenbach & Gall (1969)	Preservice	14/15	Other	Natural	Behavior	12-18	Field Natural	-.1161
Kallenbach & Gall (1969)	Preservice	14/15	Other	Natural	Behavior	18-52	Field Natural	.4883
Morse & Davis (1970)	Preservice	43/43	General Methods	Peers	Behavior	1-2	Laboratory Peers	.3267
Limbacher (1971)	Preservice	25/25	Subject Methods	Natural	Behavior	2-6	Field Natural	1.1300

Legge & Asper (1972)	Preservice	26/88	General Methods	Natural	Behavior	1-2	Field Natural	.5591
Kluecker (1974)	Preservice	9/7	Ed Psych	Natural	Behavior	1-2	Laboratory Pupils	1.0489
Kluecker (1974)	Preservice	9/7	Ed Psych	Natural	Knowledge	1-2	Written Test	.4827
Sparks & McCallan (1974)	Preservice	26/46	Subject Methods	Natural	Knowledge	1-2	Written Test	-.3689
Smith (1975)	Preservice	38/38*	General Methods	Peers	Knowledge	1-2	Written Test	-.0698
Copeland (1977)	Inservice	18/18	General Methods	Natural	Behavior	1-2	Laboratory Pupils	1.0900
Copeland (1977)	Inservice	30/31	General Methods	Natural	Behavior	6-12	Field Natural	.3884
Copeland (1977)	Inservice	15/15	Other	Natural	Behavior	6-12	Field Natural	.7360
Jaus (1977)	Inservice	33/31	Subject Methods	Natural	Knowledge	1-2	Written Test	1.2456
Raymond (1977)	Preservice	10/10	Subject Methods	Natural	Behavior	2-6	Field Contrived	.4202
Raymond (1977)	Preservice	20/20	Subject Methods	Natural	Behavior	2-6	Field Natural	-.9783
Randall & Sutton (1978)	Preservice	25/25	Subject Methods	Natural	Behavior	12-18	Field Natural	3.1100
Stanton (1978)	Inservice	32/32	General Methods	Natural	Knowledge	1-2	Written Test	.5650

Stanton (1978)	Inservice	32/84	General Methods	Natural	Affect	1-2	Written Test	.7177
Klinzing & Klinzing (1984)	Preservice	11/10	General Methods	Peers	Behavior	1-2	Laboratory Peers	.8265
Malone & Strawitz (1985)	Preservice	16/14	Subject Methods	Peers	Behavior	1-2	Laboratory Peers	.6577
Malone & Strawitz (1985)	Preservice	16/14	Subject Methods	Peers	Affect	1-2	Written Test	.8710
Klinzing (1988)	Preservice	25/14	Other	Peers	Behavior	1-2	Laboratory Peers	1.3360
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Behavior	1-2	Laboratory Peers	.0400
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Knowledge	1-2	Written Test	.3259
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Affect	1-2	Written Test	.1351

Table 3

Aggregated Effect Sizes of Studies on Microteaching

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL EFFECT SIZE
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
PRESERVICE	Affect	.5030 (n=2)					.5030 (n=2)
	Behavior		.7745 (n=7)	.6795 (n=2)	.2503 (n=2)	.7008 (n=7)	.6770 (n=18)
	Knowledge	.0925 (n=4)					.0925 (n=4)
	OVERALL	.2203 (n=6)	.7745 (n=7)	.6795 (n=2)	.2503 (n=2)	.7088 (n=7)	.5651 (n=24)
INSERVICE	Affect	.7177 (n=1)					.7177 (n=1)
	Behavior			1.0900 (n=1)		.5622 (n=2)	.7381 (n=3)
	Knowledge	.9053 (n=2)					.9053 (n=2)
	OVERALL	.8428 (n=3)		1.0900 (n=1)		.5622 (n=2)	.7904 (n=6)
TOTAL	Affect						.5746 (n=3)
	Behavior						.6858 (n=21)
	Knowledge						.3634 (n=6)
OVERALL		.4338 (n=9)	.7745 (n=7)	.8163 (n=3)	.2503 (n=2)	.6700 (n=9)	.6102 (n=30)

Table 4

Chronological Listing of Studies on Minicourses (N=9)

Mean Adjusted Pooled Effect Size = .89, SD = .3833
95% Confidence Interval = .5944 to 1.1836
Z = 2.55, p = .005

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Borg (1969)	Inservice	8/8*	Other	Natural	Behavior	1-2	Field Natural	.9266
Borg, Kelly, Langer & Gall (1970)	Inservice	38/38*	Other	Natural	Behavior	18-52	Field Natural	.8855
Hofmeister & Stowikowski (1972)	Inservice	14/14*	Ed Psych	Peers	Behavior	1-2	Field Natural	.8462
Borg (1972)	Inservice	24/24*	Other	Natural	Behavior	More than 1 year	Field Natural	1.2140
Acheson, Tucker & Zigler (1974)	Preservice	16/16	General Methods	Peers	Behavior	1-2	Field Contrived	.8096
Kallenbach & Ward (1974)	Preservice	8/8	Other	Natural	Behavior	1-2	Field Contrived	1.3567
Kallenbach & Ward (1974)	Inservice	8/8*	Other	Natural	Behavior	1-2	Field Contrived	1.3241
Saunders, Gall, Nielson & Smith (1975)	Preservice	15/16*	General Methods	Peers	Behavior	1-2	Field Contrived	.3562

Saunders, Gall, Nielson & Smith (1975)	Preservice	15/16	General Methods	Natural	Behavior	1-2	Field Contrived	.2823

Table 5

Aggregated Effect Sizes of Studies on Minicourses

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect						
	Behavior				.7012 (n=4)		.7012 (n=4)
	Knowledge						
	OVERALL				.7012 (n=4)		.7012 (n=4)
Inservice	Affect						
	Behavior				1.3241 (n=1)	.9681 (n=4)	1.0393 (n=5)
	Knowledge						
	OVERALL				1.3241 (n=1)	.9681 (n=4)	1.0393 (n=5)
OVERALL	Affect						
	Behavior				.8258 (n=5)	.9681 (n=4)	.8840 (n=9)
	Knowledge						
TOTAL					.8258 (n=5)	.9681 (n=4)	.8840 (n=9)

Table 6

<u>Chronological Listing of Studies on Protocol Materials (N=9)</u>

Mean Adjusted Pooled Effect Size = 1.38, SD = .9108
95% Confidence Interval = .0679 to 2.0717
Z = 3.64, p = .0001

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Rector, Hull & Mohan (1972)	Inservice	26/26	Other	None	Behavior	1-2	Laboratory Peers	2.8730
Gliessman, Pugh & Perry (1974)	Inservice	43/43*	Ed Psych	None	Knowledge	1-2	Written Test	1.1700
Kluecker (1974)	Preservice	10/8	Ed Psych	None	Behavior	1-2	Laboratory Pupils	1.0098
Kluecker (1974)	Preservice	10/8	Ed Psych	None	Knowledge	1-2	Written Test	.5389
Borg (1975)	Preservice	25/15	Other	None	Behavior	1-2	Field Natural	.3200
Pugh & Gliessman (1976)	Inservice	41/41*	Ed Psych	None	Knowledge	1-2	Written Test	1.4169
Gliessman & Pugh (1978)	Inservice	30/30*	Ed Psych	None	Knowledge	1-2	Written Test	2.8735
Gliessman & Pugh (1978)	Inservice	20/20*	Ed Psych	None	Knowledge	1-2	Written Test	1.2637
Gliessman & Pugh (1978)	Inservice	20/20*	Ed Psych	None	Knowledge	1-2	Written Test	.9922

Table 6

Chronological Listing of Studies on Protocol Materials (N=9)

Mean Adjusted Pooled Effect Size = 1.38, SD = .9108
95% Confidence Interval = .0679 to 2.0717
Z = 3.64, p = .0001

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Rector, Hull & Mohan (1972)	Inservice	26/26	Other	None	Behavior	1-2	Laboratory Peers	2.8730
Gliessman, Pugh & Perry (1974)	Inservice	43/43*	Ed Psych	None	Knowledge	1-2	Written Test	1.1700
Kluecker (1974)	Preservice	10/8	Ed Psych	None	Behavior	1-2	Laboratory Pupils	1.0098
Kluecker (1974)	Preservice	10/8	Ed Psych	None	Knowledge	1-2	Written Test	.5389
Borg (1975)	Preservice	25/15	Other	None	Behavior	1-2	Field Natural	.3200
Pugh & Gliessman (1976)	Inservice	41/41*	Ed Psych	None	Knowledge	1-2	Written Test	1.4169
Gliessman & Pugh (1978)	Inservice	30/30*	Ed Psych	None	Knowledge	1-2	Written Test	2.8735
Gliessman & Pugh (1978)	Inservice	20/20*	Ed Psych	None	Knowledge	1-2	Written Test	1.2637
Gliessman & Pugh (1978)	Inservice	20/20*	Ed Psych	None	Knowledge	1-2	Written Test	.9922

Table 7

Aggregated Effect Sizes of Studies on Protocol Materials

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect						
	Behavior			1.0098 (n=1)		.3200 (n=1)	.6649 (n=2)
	Knowledge	.5390 (n=1)					.5390 (n=1)
	OVERALL	.5390 (n=1)		1.0098 (n=1)		.3200 (n=1)	.6229 (n=3)
Inservice	Affect						
	Behavior		2.8730 (n=1)				2.8730 (n=1)
	Knowledge	1.5540 (n=5)					1.5440 (n=5)
	OVERALL	1.5440 (n=5)	2.8730 (n=1)				1.7655 (n=6)
OVERALL	Affect						
	Behavior		2.8730 (n=1)	1.0098 (n=1)		.3200 (n=1)	1.4009 (n=3)
	Knowledge	1.3765 (n=6)					1.3765 (n=6)
TOTAL		1.3765 (n=6)	2.8730 (n=1)	1.0098 (n=1)		.3200 (n=1)	1.3846 (N=9)

Saunders, Gall, Nielson & Smith (1975)	Preservice	15/16	General Methods	Natural	Behavior	1-2	Field Contrived	.2823

Table 5

Aggregated Effect Sizes of Studies on Minicourses

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect						
	Behavior				.7012 (n=4)		.7012 (n=4)
	Knowledge						
	OVERALL				.7012 (n=4)		.7012 (n=4)
Inservice	Affect						
	Behavior				1.3241 (n=1)	.9681 (n=4)	1.0393 (n=5)
	Knowledge						
	OVERALL				1.3241 (n=1)	.9681 (n=4)	1.0393 (n=5)
OVERALL	Affect						
	Behavior				.8258 (n=5)	.9681 (n=4)	.8840 (n=9)
	Knowledge						
TOTAL					.8258 (n=5)	.9681 (n=4)	.8840 (n=9)

Table 3

Aggregated Effect Sizes of Studies on Microteaching

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL EFFECT SIZE
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
PRESERVICE	Affect	.5030 (n=2)					.5030 (n=2)
	Behavior		.7745 (n=7)	.6795 (n=2)	.2503 (n=2)	.7008 (n=7)	.6770 (n=18)
	Knowledge	.0925 (n=4)					.0925 (n=4)
	OVERALL	.2203 (n=6)	.7745 (n=7)	.6795 (n=2)	.2503 (n=2)	.7088 (n=7)	.5651 (n=24)
INSERVICE	Affect	.7177 (n=1)					.7177 (n=1)
	Behavior			1.0900 (n=1)		.5622 (n=2)	.7381 (n=3)
	Knowledge	.9053 (n=2)					.9053 (n=2)
	OVERALL	.8428 (n=3)		1.0900 (n=1)		.5622 (n=2)	.7904 (n=6)
TOTAL	Affect						.5746 (n=3)
	Behavior						.6858 (n=21)
	Knowledge						.3634 (n=6)
OVERALL		.4338 (n=9)	.7745 (n=7)	.8163 (n=3)	.2503 (n=2)	.6700 (n=9)	.6102 (n=30)

Legge & Asper (1972)	Preservice	26/88	General Methods	Natural	Behavior	1-2	Field Natural	.5591
Kluecker (1974)	Preservice	9/7	Ed Psych	Natural	Behavior	1-2	Laboratory Pupils	1.0489
Kluecker (1974)	Preservice	9/7	Ed Psych	Natural	Knowledge	1-2	Written Test	.4827
Sparks & McCallan (1974)	Preservice	26/46	Subject Methods	Natural	Knowledge	1-2	Written Test	-.3689
Smith (1975)	Preservice	38/38*	General Methods	Peers	Knowledge	1-2	Written Test	-.0698
Copeland (1977)	Inservice	18/18	General Methods	Natural	Behavior	1-2	Laboratory Pupils	1.0900
Copeland (1977)	Inservice	30/31	General Methods	Natural	Behavior	6-12	Field Natural	.3884
Copeland (1977)	Inservice	15/15	Other	Natural	Behavior	6-12	Field Natural	.7360
Jaus (1977)	Inservice	33/31	Subject Methods	Natural	Knowledge	1-2	Written Test	1.2456
Raymond (1977)	Preservice	10/10	Subject Methods	Natural	Behavior	2-6	Field Contrived	.4202
Raymond (1977)	Preservice	20/20	Subject Methods	Natural	Behavior	2-6	Field Natural	-.9783
Randall & Sutton (1978)	Preservice	25/25	Subject Methods	Natural	Behavior	12-18	Field Natural	3.1100
Stanton (1978)	Inservice	32/32	General Methods	Natural	Knowledge	1-2	Written Test	.5650

Stanton (1978)	Inservice	32/84	General Methods	Natural	Affect	1-2	Written Test	.7177
Klinzing & Klinzing (1984)	Preservice	11/10	General Methods	Peers	Behavior	1-2	Laboratory Peers	.8265
Malone & Strawitz (1985)	Preservice	16/14	Subject Methods	Peers	Behavior	1-2	Laboratory Peers	.6577
Malone & Strawitz (1985)	Preservice	16/14	Subject Methods	Peers	Affect	1-2	Written Test	.8710
Klinzing (1988)	Preservice	25/14	Other	Peers	Behavior	1-2	Laboratory Peers	1.3360
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Behavior	1-2	Laboratory Peers	.0400
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Knowledge	1-2	Written Test	.3259
Winitsky & Arends (1991)	Preservice	18/18	General Methods	Peers	Affect	1-2	Written Test	.1351

Table 4

Chronological Listing of Studies on Minicourses (N=9)

Mean Adjusted Pooled Effect Size = .89, SD = .3833
95% Confidence Interval = .5944 to 1.1836
Z = 2.55, p = .005

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Borg (1969)	Inservice	8/8*	Other	Natural	Behavior	1-2	Field Natural	.9266
Borg, Kelly, Langer & Gall (1970)	Inservice	38/38*	Other	Natural	Behavior	18-52	Field Natural	.8855
Hofmeister & Stowikowski (1972)	Inservice	14/14*	Ed Psych	Peers	Behavior	1-2	Field Natural	.8462
Borg (1972)	Inservice	24/24*	Other	Natural	Behavior	More than 1 year	Field Natural	1.2140
Acheson, Tucker & Zigler (1974)	Preservice	16/16	General Methods	Peers	Behavior	1-2	Field Contrived	.8096
Kallenbach & Ward (1974)	Preservice	8/8	Other	Natural	Behavior	1-2	Field Contrived	1.3567
Kallenbach & Ward (1974)	Inservice	8/8*	Other	Natural	Behavior	1-2	Field Contrived	1.3241
Saunders, Gall, Nielson & Smith (1975)	Preservice	15/16*	General Methods	Peers	Behavior	1-2	Field Contrived	.3562

Table 8

Chronological Listing of Studies on Reflective Teaching (N=5)

Mean Adjusted Pooled Effect Size = .38, SD = .3393
95% Confidence Interval = -.0411 to .8016
Z = 1.78, p = .037

Investigators	Subject Level	Sample Size lab control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Cruickshank, Kennedy, Williams, Holton, & Fay (1980)	Preservice	Not reported	General Methods	Peers	Knowledge	2-6	Written Test	.7070
Cruickshank, Kennedy, Williams, Holton, & Fay (1980)	Preservice	Not reported	General Methods	Peers	Affect	2-6	Written Test	.6560
Holton & Nott (1980)	Preservice	55/46	General Methods	Peers	Knowledge	1-2	Written Test	.3916
Nott & Williams (1980)	Preservice	55/46	General Methods	Peers	Knowledge	1-2	Written Test	-.1379
Williams & Kennedy (1980)	Preservice	55/46	General Methods	Peers	Affect	1-2	Written Test	.2845

Table 9

Aggregated Effect Sizes of Studies on Reflective Teaching

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect	.4703 (n=2)					.4703 (n=2)
	Behavior						
	Knowledge	.3202 (n=3)					.3202 (n=3)
	OVERALL	.3802 (n=5)					.3802 (n=5)

Table 10

Chronological Listing of Studies on Written/Media-based Simulations (N=9)

Mean Adjusted Pooled Effect Size = .50, SD = .2884
95% Confidence Interval = -.2811 to .7245
Z = 1.73, p = .042

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Vlcek (1966)	Preservice	Not reported	General Methods	None	Behavior	1-2	Simulation (Laboratory)	.5238
Vlceck (1966)	Preservice	Not reported	General Methods	None	Behavior	1-2	Field Natural	.5238
Vlcek (1966)	Preservice	Not reported	General Methods	None	Affect	1-2	Written Test	.5238
Cruickshank & Broadbent (1969)	Preservice	40/40	General Methods	None	Affect	2-6	Written Test	.6198
Cruickshank & Broadbent (1969)	Preservice	40/40	General Methods	None	Affect	12-18	Written Test	.6198
Ponder & Heath (1972)	Preservice	25/22	Other	None	Affect	18-52	Written Test	-.1178
Ponder & Heath (1972)	Preservice	25/22	Other	None	Affect	12-18	Written Test	.2561
Anderson (1977)	Preservice	54/18	General Methods	None	Knowledge	1-2	Written Test	.9063

Anderson (1977)	Preservice	54/18	General Methods	None	Knowledge	2-6	Written Test	.6695

Table 11

Aggregated Effect Sizes for Studies of Written/Media-Based Simulations

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect	.3803 (n=5)					.3803 (n=5)
	Behavior		.5238 (n=1)			.5238 (n=1)	.5238 (n=2)
	Knowledge	.7879 (n=2)					.7879 (n=2)
OVERALL		.4968 (n=7)	.5238 (n=1)			.5238 (n=1)	.5028 (n=9)

Table 12

Chronological Listing of Studies on Role Playing (N = 5)

Mean Adjusted Pooled Effect Size = .77, SD = 1.5358
95% Confidence Interval = -1.1324 to 2.6814
Z = 1.22, p = .111

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Harvey (1970)	Inservice	37/37	Subject Methods	Peers	Knowledge	1-2	Written Test	.1128
Henry (1973)	Preservice	4/4	Other	Peers	Behavior	1-2	Laboratory Peers	.3073
Henry (1973)	Preservice	4/4	Other	Peers	Affect	1-2	Written Test	.6105
VanderKolk (1975)	Preservice	14/13	General Methods	Peers	Affect	1-2	Written Test	3.4104
Reynolds & Simpson (1980)	Preservice	12/10	Subject Methods	Peers	Affect	1-2	Written Test	-.5685

Table 13

<u>Chronological Listing of Studies on Peer Teaching (N=4)</u>

Mean Adjusted Pooled Effect Size = .78, SD = .4143
95 % Confidence Interval = .1239 to 1.4425
Z = 2.68, p = .004

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Emmer (1970)	Preservice	44/44*	Ed Psych	Peers	Behavior	1-2	Laboratory Peers	.5760
Emmer (1970)	Preservice	44/44*	Ed Psych	Natural	Behavior	2-4	Laboratory Peers	.5760
Emmer (1970)	Preservice	44/44*	Ed Psych	Peers	Behavior	1-2	Field Contrived	.5760
Yeany (1973)	Preservice	10/10	Ed Psych	Peers	Behavior	1-2	Laboratory Peers	1.4047

Table 14

<u>Chronological Listing of Studies on Videotaped Models (N=10)</u>

Mean Adjusted Pooled Effect Size = .4757, SD = .4104
95% Confidence Interval = .1821 to .7693
Z = 1.38, p = .084

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Popham (1966)	Preservice	41/38	Unknown	None	Knowledge	2-6	Written Test	.2726
Salomon & McDonald (1968)	Preservice	38/38*	Other	None	Affect	1-2	Written Test	.2700
Gall, Dunning, Banks & Galassi (1972)	Preservice	16/16	General Methods	None	Behavior	1-2	Laboratory Pupils	.9219
Santiesteban (1975)	Preservice	16/16	General Methods	None	Behavior	1-2	Laboratory Pupils	.0335
Santiesteban (1975)	Preservice	16/16	General Methods	None	Behavior	1-2	Laboratory Pupils	.9219
Santiesteban (1975)	Preservice	16/16	General Methods	None	Knowledge	1-2	Written Test	.5335
Santiesteban & Koran (1977)	Preservice	16/16	Subject Methods	None	Behavior	1-2	Field Contrived	1.1482
Santiesteban & Koran (1977)	Preservice	16/16	Subject Methods	None	Knowledge	1-2	Written Test	.5335
Winitsky & Arends (1991)	Preservice	12/3	General Methods	None	Behavior	1-2	Laboratory Peers	-.0721

Winitsky & Arends (1991)	Preservice	12/3	General Methods	None	Affect	1-2	Written Test	.1935

Table 15

Chronological Listing of Studies on Audio Models (N = 2)

Mean Adjusted Pooled Effect Size = .75, SD = .1687
95% Confidence Interval = .3794 to 1.2174
Z = 2.01, p = .022

Investigators	Subject Level	Sample Size lab/control	Course Type	Learners	Dependent Variable Type	Time to Measurement (in weeks)	Context of Measurement	Pooled Adjusted Effect Size
Santiesteban (1975)	Preservice	16/16	General Methods	None	Knowledge	1-2	Written Test	.8958
Santiesteban & Koran (1977)	Preservice	16/16	Subject Methods	None	Behavior	1-2	Field Contrived	.6036

Table 16

Aggregated Effect Sizes for Studies on Videotape and Audiotape Models

Subject Level	Dependent Variable Type			Context of Measurement			OVERALL
		Written Test	Laboratory Peers	Laboratory Pupils	Field Contrived	Field Natural	
Preservice	Affect	.2318 (n=2)					.2318 (n=2)
	Behavior		-.0721 (n=1)	.6258 (n=3)	.8759 (n=2)		.5929 (n=6)
	Knowledge	.5589 (n=4)					.5589 (n=4)
OVERALL		.4499 (n=6)	-.0721 (n=1)	.6258 (n=3)	.8759 (n=2)		.5214 (n=12)