

The Effects of Peer Coaching as Follow-up to Inservice Training on the Frequency of Teacher Initiated Higher Level Questioning

Mary Slade Landrum, Ph.D.
College of William and Mary

Carolyn M. Callahan, Ph.D.
University of Virginia

Two groups of teachers received instruction in strategies for promoting higher cognitive processing in gifted students in regular classrooms (with one of these groups also receiving instruction in peer coaching) while a third group was used as a control. Frequency of teacher-initiated higher level cognitive questioning was significantly greater for both groups of teachers who received training than for the control group. There was also a significantly greater frequency of higher-level cognitive questioning found in the teacher group trained in peer coaching than the other two groups. A study of the impact of the context of teaching (e.g. student ability, subject matter) on questioning performance demonstrated no consistent relationship between the context and subject performance. Teachers trained in peer coaching also reported different perceptions of school organization.

While preservice education programs act to prepare teachers for entry into the profession, inservice training is designed to provide practicing teachers the opportunity to refine and update their knowledge and skills. In this sense inservice teacher training can be considered a regenerative process whereby opportunities are provided for teachers to keep pace with a growing and evolving body of knowledge regarding best classroom practice. Providing the necessary background application of current research on effective new instructional strategies has the potential to enhance classroom instruction (Cochran-Smith & Lytle, 1990).

In designing inservice training, our goal is not only to enable educators to acquire new knowledge and skills but also to aid teachers in the application of their new knowledge and skills to classroom practice. Learning about and being able to implement appropriate instructional activities are both desired outcomes of inservice training. If the outcome of training is skill or knowledge acquisition but does not include the application of skills in the context of individual

classrooms, it has not fully served its purpose (Joyce & Showers, 1988).

Experts in the area of staff development suggest that effective inservice education programs (those leading to actual implementation of new strategies) should provide for follow-up and "on-call assistance" to educators as they use their new skills and understandings in the workplace during and after training (Wood, Thompson, & Russell, 1981). Initial research suggests that the inclusion of some classroom coaching appears necessary for teachers to adapt new ideas and skills as part of follow-up training (Joyce & Showers, 1982; 1987; 1988; McLaughlin & Marsh, 1979; Showers, 1984). The limited research on peer coaching, however, suggests the need to further study the effectiveness of this intervention.

Fullan (1990) further cautions against the widespread implementation of any coaching programs, given the superficial understanding of the relationship between coaching and the organization of school. Which conditions in schools

affect the application of training through coaching? If school administrators are to create environments that facilitate coaching and the application of training, the first step is designing inservice training research that contributes to understanding the influence of frames of references of participants and the influence on teachers of the school organization (Joyce & Showers, 1988).

We need to identify factors conducive to the creation of training environments where the application of training using peer coaching occurs successfully. The study reported here assessed the use of peer coaching as follow-up to inservice training and investigated its relationship to school organization. The reported study is distinguished from earlier studies in its additional focus on the relationship between school organization and peer coaching at the point when the application of training to teachers' classroom performance is expected. If peer coaching is a successful strategy in bringing about application of skills and such factors can be identified, school organization can be modi-

fied so that it facilitates the process.

The first line of investigation for this research study was, thus, to assess the success of peer coaching as a follow-up training strategy in affecting application of skills acquired from inservice training to classroom practice. Then, an exploration of the relationship of school organization to the application of training through the peer coaching model was the basis for generating new hypotheses for further study of the peer coaching process and its success.

Methods

Sample

The sample included 36 regular classroom teachers and three specialists (teachers of the gifted) from two school districts that serve locally identified gifted students in their classrooms. Subjects were randomly assigned in equal numbers to two treatment groups and one control group. Teacher assignments included grades K-12 in elementary,

Table 1
Teacher Demographics

Professional/Personal Attribute	Number of Subjects
Grade Level	
elementary	11
middle	14
high school	14
Teaching Assignment*	
English	4
language arts	13
science	16
mathematics	16
history, social studies	13
health/physical education	7
foreign languages	1
specialty/resource	3
Years Teaching Experience	
1-5 years	7
6-10 years	4
11-15 years	16
16-20 years	8
21-25 years	3
25+ years	1
Age	
20-30 years	4
30-40 years	11
40-50 years	23
50+ years	1
Sex	
males	4
females	35

*Note. A number of subjects were assigned multiple teaching assignments, which reflects secondary teaching schedules and the interdisciplinary nature of elementary education programs.

middle, and high schools. Demographic information was collected on individual subjects on particular personal and professional characteristics including: grade level, teaching assignment, years teaching experience, age, and sex in order to become aware of differences among subjects along these variables (see Table 1).

Design

The study design was a pre-post/post-test control group design. A second post-test measure was used in order to verify the stability of initial post-test findings. The independent variable was the type of inservice training that teachers received: (a) training in questioning strategies, (b) training in questioning strategies followed by peer-coaching experiences, and (c) no training. The dependent variable was the frequency of teacher-initiated higher levels of cognitive questioning as recorded in three separate 30-minute pre-training, post-training, and post-post training observations.

Instrumentation

Measurement of the dependent variable in this study, the frequency of teacher-initiated higher-level cognitive questions, utilized a modified form of The Cognitive Levels of Questioning Record (Shrable & Minnis, 1969). This form of the observation record was field tested during a pilot study. Evidence of instrument validity and reliability was gathered in a pilot study and included: face validity, content validity, inter-observer reliability, and test/retest reliability.

The content validity of the questioning instrument was explored by experts in the fields of gifted education and instrument construction who are presently working and studying in the university setting. Related comments by experts focused on the appropriateness of the instrument for teachers of the gifted and efficient instrument construction.

Independent raters used the questioning form in simulated video-recorded teaching episodes. Reliability on each of three pairs of observers was calculated by Pearson Product-Moment Correlation Coefficients. Mean inter-observer reliability for higher cognitive levels of questioning was calculated among three pairs of observers. Correlations between the pairs of two observers yielded reliability coefficients of .97, .99, and .99 respectively ($p < .01$).

Procedures

The procedures for implementing the study included three phases: pre-training, training, and post-training.

Phase One—Pre-training observations. Pre-training observations occurred one week prior to inservice training. Initial classroom observations were scheduled by mutual agreement between the observer and the teacher. Trained observers made audio-recordings of one 30-minute teaching episode of large group instruction. Additionally, observers recorded the context of teaching in written narratives. Following the pre-training observation, the 39 subjects were randomly assigned to the three groups.

Phase Two—Inservice training observations. Each of the two treatment groups participated in voluntary inservice training involving a one credit-hour course in gifted education focused on higher-order cognitive processing in gifted students. For the convenience of the teachers, the course was

repeated in each school division. Although the course focused on higher-order questioning strategies, the initial course description and outline highlighted the cognitive development of gifted students and their peers. The classes each met for a total of 15 hours in two two-day sessions. All classes were completed within a four-week time period. The course included 15 hours of direct instructional sessions plus approximately 15 hours of practice sessions in the teachers' individual classrooms. The course included recommended procedures for teacher questioning strategies. Instruction included: (a) presentation of theory, (b) demonstrations and modeling, (c) practice, and (e) feedback. Presentation of theory, demonstrations, and feedback made up 12 hours of instructional time (within the 10-15 hours recommended by Showers (1984) as necessary for skill acquisition) and included 15 separate demonstrations of training as recommended by Joyce and Showers (1982). The remaining three hours were spent in instructing training groups in techniques for self-analysis for group one and in peer-coaching for group two, as a precursor for classroom implementation.

Upon completion of the course, the two training groups began the application of training to classroom practice. One of the groups received no follow-up coaching; rather, teachers in this group were urged to take specific steps to implement within their own classrooms the questioning strategies presented during training. The second group engaged in a follow-up coaching activity: peer coaching. Teachers in this group formed peer-coaching pairs, and in one case a triad. Trainees self-selected peer coaches based on common interests and job-related responsibilities among teachers in the group. These teachers participated in peer-coaching experiences for eight to nine weeks, documenting additional coaching sessions as part of the course requirement. Members of the non-coaching group were required to submit logs documenting their attempts to implement questioning strategies in their classrooms. The control group did not receive initial inservice training. This group, however, received related training at the conclusion of the study. All members of the group were invited to participate in the same inservice course offered earlier in the semester.

Phase Three—Post-training observations. Post-training observations occurred six weeks after the conclusion of the inservice course. Trained observers made audio recordings of one 30-minute teaching episode of large-group instruction per subject. Additionally, observers recorded in written narratives the context of teaching.

Phase Four—Post-post-training observations. Post-post observations occurred two to three weeks after initial post-observations. The procedures followed in phase three were repeated.

Phase Five—Interviews. Twelve training participants, six from each research site, were selected to participate in structured interviews. Trainees were selected to participate based on use of higher-level cognitive questioning in the classroom. Individual plots of raw scores for higher-level cognitive questioning during pre-, post-, and post-post training observations of classroom teaching were used to identify

two subjects each who demonstrated minimal, moderate, and greatest gains in frequency of higher-level cognitive questioning in the classroom. In a scatterplot of raw scores, a natural division among scores occurred at three points designated as minimum, moderate, and greatest areas of performance. These categorical points represented: 1-10, 11-20, and more than 20 higher level cognitive questions.

Data Collection

Frequency of Higher Level Questioning

Classroom observations. As the first step in the data collection process, classroom observers audio-recorded 30-minute teaching episodes and concurrently tried to capture the context or nature of individual teaching sessions in written narratives. Upon completion of the last (post-post) classroom observation, an independent group of raters coded data from the three observations (pre-, post-, and post-post). These raters determined the cognitive level of teacher-initiated questions asked during the audio-taped episodes. Raters were uninformed as to the timeframe and treatment group associated with each teaching episode.

Observation record. Measurement of the dependent variable in this study, the frequency of teacher-initiated higher-level cognitive questions, required the development of a new system of measurement. Because the purpose of the research study in part was to determine the degree to which the training contributed to modified behavior, direct observation of behaviors was necessary.

Observation narrative. The frequency of higher-level cognitive questions initiated by a teacher could have been affected by the context in which teaching occurs. Context refers to those circumstances related to the teaching process and includes teacher-pupil ratio, lesson content, lesson objectives, and the like. The effect of individual differences on teacher performance was minimized by random assignment of subjects to treatment and control groups; however, influential contextual variables that could not be controlled may be recognized in descriptions of teaching contexts.

The Relationship of Peer Coaching to School Organization

One purpose of this study was to describe the relationship of peer coaching to school organization during application of training. In order to explore this relationship, trainees were interviewed. A semi-structured interview protocol was developed for use with 12 trainees. Topics included: (a) procedures for implementing training in the classroom, and (b) the relationship between peer coaching and the organization of schools.

Analysis

The Effects of Training and Differences Between Types of Training

The frequency of higher-level teacher-initiated questions was calculated for each subject in the three observations. Mean differences between groups on the dependent measure were tested by using multivariate analysis of variance (MANOVA) techniques in a repeated measures analysis.

Table 2

Group Means and Standard Deviations of Incidence of Higher-Level Cognitive Questioning

Group	pre	post	post-post
Group One (n=13) (training only)			
Mean	7.1	24.3	26.4
SD	8.1	12.8	14.4
range of scores	00-22	04-46	04-49
Group Two (n=13) (training and peer coaching)			
Mean	10.2	27.0	30.5
SD	7.3	6.4	7.8
range of scores	01-25	16-38	16-45
Group Three (n=13) (control group)			
Mean	8.0	8.1	7.5
SD	7.1	7.1	7.5
range of scores	01-24	01-22	02-23

sis of variance. This design indicated main effects of group membership and time, and their interaction. Repeated measures ANOVA and multiple comparison tests as well as plots of group means over time were used to interpret the results of MANOVA.

An analysis of observer narratives was conducted to determine whether systematic differences in contextual variables existed between groups and whether these differences had an impact on teacher questioning.

The Relationship of Peer Coaching to School Organization

In order to investigate the relationship between peer coaching when used for the application of training and factors of school organization influencing the application of training, participant interviews were conducted after the collection of post-training data. These interviews were transcribed and subsequently submitted to content analysis to determine the relationship of school organization to peer coaching.

Results

Mean Group Frequencies for Higher Level Cognitive Questioning

Mean frequency of higher-level questioning was measured by a classroom observation form, The Cognitive Levels of Questioning Record (Shrable & Minnis, 1969). Means and standard deviations of raw scores (incidence of higher-level cognitive questioning) for the two treatment groups (training and training with peer coaching) and the control group are presented in Table 2.

The Effectiveness of Training

The effects for treatment groups and time of measures. An omnibus repeated measures analysis of variance (ANOVA) design was used to determine the significance of group differences on the frequency of higher-level cognitive questions (see Table 3). Multiple analysis of variance (MANOVA) procedures were used to perform a repeated

measures analysis. The analysis indicated the overall main effects for group membership and time, as well as interaction effects. The main effect for within group subjects over time was significant ($F = 34.1, p < .001$) as well as for group membership ($F = 13.3, p < .001$). The interaction of group membership and time was also significant ($F = 7.1, p < .003$).

The effects of time on group mean frequency of higher-level cognitive questioning. Within group differences over time were tested separately for the three groups (see Table 4). Mean frequencies for higher-level cognitive questioning for training group one were significantly different across time ($F = 40.0, p < .001$) as were those for training group two ($F = 42.0, p < .001$). The mean frequencies for higher-level cognitive questioning for the control group over time were not significantly different ($F = .1, n.s.$).

Multiple comparisons tests of within group differences over time illustrated where differences existed. Mean frequencies for training group one (training only) from pre- to post-training measures were significantly different ($t = 6.9, p < .001$), but post- to post-post training frequencies were not significantly different ($t = 1.5, p = .14$). Mean frequencies for higher-level cognitive questioning for training group two (peer coaching) from pre- to post-training measures were significantly different ($t = 7.0, p < .001$), and post- to post-post training frequencies were also significantly different ($t = 2.5, p < .05$).

The Effectiveness of Peer Coaching

Differences between treatment groups. A third repeated measures ANOVA was performed to determine where significant differences existed between training groups and the control group. Analysis included three separate F tests for significance for pre-, post-, and post-post training observations (see Table 5). There were no between group differences in the average number of questions asked during the pre-test observation. However, significant group differences were evident during the post- ($F = 15.9, p < .001$), and post-post observations ($F = 18.5, p < .001$). Ensuing mul-

Table 3
Omnibus Repeated Measures ANOVA for Mean Frequencies of Higher-Level Cognitive Questioning

<i>Source</i>	<i>DF</i>	<i>SS</i>	<i>MS</i>	<i>Error Term</i>	<i>F Ratio</i>	<i>Signif of F</i>
Treatment Groups	2	4703.2	2354.1	176.6	13.3	.001
Time	1	658.2	623.6	18.3	34.1	.001
Treatment * Time	2	259.5	129.8	7.1	10.3	.003

Table 4
Repeated Measures ANOVA by Treatment Group Across Time

<i>Source</i>	<i>DF</i>	<i>SS</i>	<i>MS</i>	<i>Error Term</i>	<i>F Ratio</i>	<i>Signif of F</i>
Group One (Training Only)	2	2920.9	1460.3	36.5	40.0	.001
Group Two (Training with Peer-Coaching)	2	3044.1	1522.0	36.5	41.7	.001
Group Three (Control)	2	5.7	2.9	36.5	.08	.925

Table 5
Multiple Comparisons by Treatment Group Across Time

Treatment Group	Mean Pre-		Mean Post-		Mean Post-Post
Group One (Training)	7.1	$t = -2.2^{**}$	24.3	$t = 2.4^*$	6.4
Group Two (Training and Peer-Coaching)	10.2	$t = 7.0^{***}$	27.0	$t = -2.5^*$	30.5
Group Three (Control)	8.0	$t = .1$	8.1	$t = .6$	7.5

*** $p < .001$

** $p < .01$

* $p < .05$

multiple comparison tests indicated that all three groups were significantly different from one another at both post-training observations. Mean frequencies for training groups one (training only) and two (peer coaching) were significantly different in post-training measures of higher-level cognitive questioning ($t = 2.2, p < .05$). When compared to the control group, mean frequencies were significantly different for training group two on post-training measures ($t = 3.4, p < .01$) and post-post training measures ($t = 4.3, p < .001$). Mean frequency for training group one was also significantly different from the control group at post-training assessment ($t = 4.0, p < .05$) and at the post-post training measure ($t = 2.4, p < .05$).

No consistent patterns of similarities or differences in context variables existed for any comparison of subjects. Therefore, inconsistencies existed in the apparent influences of context variables on performance on the dependent measure across and among groups. For example, there was no pattern of increased incidence of question asking among or between groups given the type of student activity implemented during the observed lessons.

The Relationship Of Peer Coaching to School Organization

Given the effectiveness of peer coaching demonstrated in the statistical analysis of frequency of higher-level cognitive questioning, further investigation was initiated in order to determine the relationship between peer coaching and school organization. Twelve trainees, six each of coached and uncoached teachers, were interviewed after post-post training classroom observations. For coached and uncoached teachers, two respondents each displayed minimal, moderate, and greatest performance in higher-level cognitive questioning on pre- to post-training measures.

The content analysis of interview transcripts addressed the question: "How are peer coaching and school organization factors related?" The unit of analysis was thematic. Three a priori themes were proposed: (a) the effect of school organization on the application of training, (b) the experiences of peer coaches, and (c) teachers' use of higher-level cognitive questioning.

School organization is a dynamic concept incorporating many interrelated variables. Several school organization variables consistently emerged from the content analysis of interview transcripts: (a) school facilities, (b) school administration or leadership, (c) school schedule, (d) curriculum implementation, and (e) collegiality.

The effects of school organization on the application of training. The responses of interviewees indicated a strong relationship between school organization and implementation of peer coaching as a vehicle in application of training. In particular, teachers perceived that school organization variables (e.g., planning time, student grouping, subject matter) shaped and gave direction to teachers' specific implementation of the peer-coaching process.

Experiences related to peer coaching. Teachers acting as peer coaches reported that the application of training was on-going, rather than occurring on separate occasions as reported by uncoached teachers. Further, trainees who

employed peer coaching reported implementing training across subject areas and student ability levels. Teachers in the peer group also reported that they depended on the assistance of their peers in the application of training.

Teachers reported positive influences of certain school organizational factors on peer coaching. In particular, they commented on collegial relationships and school administration. Teachers also talked about the negative influences of school climate on the use of peer coaching. Specifically, their concerns included: school schedules, school facilities, and the curriculum.

Teacher use of higher level cognitive questioning.

School organization was associated with the performance levels of higher-level cognitive questioning for peer coaches. Teachers with minimal, moderate, and greatest changes on the dependent measure from pre- to post-training observations were compared.

Teachers with greatest change in performance reported the predominantly positive influence of school organization on the peer-coaching process. Teachers of moderate performance noted positive influences of school climate as well. For example, interviewees reported the value of the support and assistance of school administration in scheduling peer coaching activities. However, some negative influences were also reported. Those coached and uncoached teachers showing minimal change in performance found the application of training time consuming and demanding. They often cited factors related to school organization as contingency variables. For example, the limitations of the school schedule often interfered with peer-coaching activities.

Conclusions

The Effectiveness of Inservice Training

Most peer-coaching studies have been, in essence, evaluation-oriented studies (Munro & Elliot, 1987; Sparks & Bruder, 1987). The results of most of these studies of peer coaching are often viewed with skepticism because of non-experimental research designs (Licklider, 1986).

In this experimental study of peer coaching, the success of training conditions was assessed by observing the frequency of higher-level cognitive questioning in the classroom across three randomly assigned groups of teachers: one group receiving inservice training only, one group receiving inservice training involving a peer coaching component, and one group receiving no training at all. Prior to treatment, observations indicated equivalence across the three groups. At the time of the first post-treatment observations immediately following treatment, the teachers who received inservice training (both training conditions) asked more higher-level cognitive questions than teachers in the control group. When observations were made two to three weeks later, these two groups still asked significantly greater numbers of higher-level questions than the control group. Teachers who participated in peer coaching asked more questions than those who received only the training. Moreover, the peer-coached teachers showed the greatest increase

over time, supporting the contention that inservice training results in increased frequency of higher-level cognitive questioning and that peer coaching further enhances these effects.

No systematic differences were discerned among the three groups across a wide variety of variables which might be thought to influence the use of the target questioning strategies (referred to as the teaching context). In other words, individual differences among teachers, students, and lessons (e.g., teacher assignment, student ability, and the instructional activity conducted during a lesson) assessed as part of this study were not systematically related to outcomes. There was no evidence, for example, that teachers working with gifted students asked more questions requiring higher-level thinking than teachers working with average students. By analyzing the context of teaching factors that might have affected the application of training, it was possible to rule out competing hypotheses that the variables related to the context of teaching systematically improved teacher performance. Although random assignment of subjects to treatment groups was used to minimize the effects of variables associated with the professional and personal characteristics of individual teachers, this verification adds strength to the conclusion that the success of the peer-coaching process in this study can be attributed to the treatment.

The Relationship of Peer Coaching to School Organization

Data addressing the relationship between peer coaching and school organization were collected during post-training participant interviews with teachers in both training conditions. The perceptions of coached teachers who demonstrated varying levels of change (maximum and minimum) from pre-test to post-test conditions were compared to the perceptions of uncoached teachers representative of teachers exhibiting minimum to greatest amounts of change from pre- to post-training observations on a variety of school organizational factors.

When coached and uncoached teachers with greatest changes in performance were compared, the peer coaching group perceived more positive collegial interactions than uncoached teachers. Coached teachers also perceived that their school administrators were aware of their attempts to implement the strategies which they had learned and in some cases, perceived that their administrators were supportive of these efforts. In contrast to the uncoached teachers, few coached teachers identified difficulties with school curriculum, school facilities, and school schedules as impediments to the application of training and the peer-coaching process.

Uncoached teachers at the highest performance levels perceived limited collegial interactions during the application of training. The uncoached teachers' perceptions of other organizational factors were also more negative. They identified the limited flexibility of curriculum and the constraints of school schedules as detrimental to their efforts to put training to use in their classrooms. Uncoached teachers did not report the same high level of interest and support on the part of administrators in their schools as did coached

teachers, even though they were from the same schools.

When the perceptions of school organization for coached teachers of moderate and minimal performance were compared to those at the highest level of implementation, differences within this group were evident. Coached teachers with moderate changes in performance perceived collegial relationships less sophisticated than did coached teachers of greater performance and found the peer-coaching process more time consuming. Further, these teachers also reported that the demands of the curriculum were debilitating in the application of the training process. Teachers of minimal change performance in the coached group found the peer coaching to be time consuming and demanding because of debilitating organizational factors such as school instructional schedules and limited school facilities.

Further research is needed to determine whether particular organizational factors influence or are influenced by strategies designed to assist teachers in the application of inservice training, in particular the practice of peer coaching. Research that further explores collegial relationships, school administration, and factors related to building management must be undertaken to determine which of these factors are most affected by peer coaching and which are necessary precursors to the effectiveness of peer coaching in the application of training. Future studies should include both pre- and post-training assessment of school organization variables in order to determine existing conditions and their effect upon changes occurring after training. In this way our understanding of the contributions that peer coaching makes to school organization or that school organizational factors make to the success of efforts to implement new instructional strategies may be more well understood. Such research efforts should address not only measures of school organization variables, but also teachers' perceptions of these variables. Analysis of differences in perceptions among teachers from schools characterized by different organizational variables, as well as differences in perceptions among teachers in the same school may also shed light on questions about the relationship between school organizational factors, teacher characteristics and perceptions, and the effectiveness of peer coaching and other training strategies.

In summary, the findings of this study reaffirm the assertion of most staff-development experts that inservice training can change the classroom performance of teachers. Those teachers participating in inservice training demonstrate significantly more change in classroom performance than teachers without training. The greater frequency of higher-level cognitive questioning by coached teachers in post-post training observations suggests that peer coaching further enhances the application of training over time. The effects of peer coaching were not limited to increased frequency of application of training. Secondary benefits of peer coaching as a result of collaborative efforts related to the peer coaching process were also revealed in this study.

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Mary S. Landrum is Assistant Professor of Education in the School of Education, College of William and Mary, Williamsburg, Virginia.

Carolyn M. Callahan is Professor of Education in the School of Education, University of Virginia, Charlottesville, Virginia.