



Deliberate practice in teaching: what teachers do for self-improvement

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Abstract

Two studies investigated teacher activities that may lead to the development of competence, if not expertise. In Study I, 136 teachers indicated in a questionnaire that evaluation and planning activities (informal and formal) best parallel deliberate practice activities that Ericsson and colleagues report as accounting for expertise in other domains. In Study II, log data and interviews from eight experienced teachers indicated that these activities provide opportunities for self-improvement even though that may not have been why teachers did them. The frequent and mindful engagement in these activities, prompting cycles of teaching – evaluation – revision, may be what accounts for expertise. © 1999 Elsevier Science Ltd. All rights reserved.

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Research in the field of expertise has suggested that a number of characteristics distinguish expert performers from novices in a domain. Among these characteristics are differences in pattern recognition, time required to complete tasks, accuracy in representing and solving problems, as well as differences in short- and long-term memory capabilities (Glaser & Chi, 1988). Additional research indicates that experience, an integral factor in the acquisition of expertise, is a necessary but insufficient condition. Experience alone does not guarantee high

levels of competence. The findings of these studies, however, which contrast experts and novices in a domain, do not say anything about how the superior knowledge displayed by experts came to be, or how it is possible for performers who have equivalent amounts of experience to differ in the amount of knowledge they possess (Bereiter & Scardamalia, 1993, p. 42). If experience in a field does not necessarily result in high levels of performance, what other factors account for it?

Several authors have addressed this question. Bereiter and Scardamalia (1993) suggest that expertise is a process rather than a state of being characterized by capabilities that people have. They suggest that there is something that experts

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do over and above ordinary learning that accounts for the fact that they become and remain experts. According to these authors, available mental resources are continually reinvested back into solving additional problems at higher levels of complexity. The process builds on normal learning because it is through normal learning and proceduralization that mental resources are freed and made available for reinvestment (p. 120). Experts continue to look for and tackle the complexities of a domain, rather than reduce problems to situations that can be handled with routine procedures. Bereiter and Scardamalia suggest that although it may take years for socially recognized expert performance to develop, the process of expertise could begin very early.

Another approach to understanding the development of high levels of competence in the professions has been offered by Schön (1983, 1987). Challenging the notion that practice is guided by theory and applied principles, Schön sees practitioners as more than mere problem solvers who apply theory and principles. Rather, he suggests that the role of the practitioner is critical. Individuals are thought to display an ability to see problems in ways that facilitate solution in the particular context which Schön has called “reflection-in-action.” The effective professional is characterized by an ability to recognize and explore puzzling, problematic events and situations as they occur. A less than effective professional will resort to routine responses and repetitive behavior, regardless of how well these actions resolve the current situation. The notion of reflection-in-action is somewhat elusive. Schön (1983, 1987) differentiates this type of reflection from “reflection-on-action” which is a deliberate, retrospective analysis of action. Reflection-in-action is more a process of experimenting with interpretations and possible solutions until an appropriate combination is found. According to Schön, professional knowledge, and the potential for more effective, improved performance, arise from direct interaction between the practitioner and the action.

Another model to explain the acquisition of expertise has been developed by Ericsson, Krampe and Tesch-Romer (1993). It is this model that serves as a basis for the studies and discussion presented

in this paper. These authors suggest a framework that explains expert performance as the result of individuals’ prolonged efforts to improve. Individuals are thought to acquire new knowledge, methods, and skills which allow them to restructure their current performance. This is not done as an automatic response to experience in the field, but rather it is a consequence of structured learning and effortful adaptation. Performance is improved when individuals participate in domain specific activities that provide optimal opportunities for learning.

Ericsson et al. (1993) have described deliberate practice as those activities which are highly relevant to improving performance and require significant personal effort to initiate and maintain. Performance of the activities is thought to be motivated by a goal of performance improvement rather than enjoyment inherent in the activities themselves. Deliberate practice activities are performed frequently, and the amount of practice is thought to relate directly to the level of performance. Many individuals may cease “practicing” once they reach an acceptable level of competence in their field. The expert, however, continues to regularly engage in “practice” activities which contribute to continued improvement in performance. Ericsson et al. (1993) have identified a monotonic benefits function between deliberate practice and expertise. Higher levels of engagement in deliberate practice are associated with higher levels of performance.

In their investigations of deliberate practice, Ericsson et al. (1993) report data regarding musicians’ perceptions of activities most relevant to improving performance. Practicing alone was the activity rated most relevant. In addition, they found that expert musicians spend more time engaged in practice activities than average or good musicians. For the domain of music, it was clear what activities constituted practice. These activities did not include actual performances and did not include playing for fun and enjoyment. Practice activities were deliberate efforts to improve, hence the term “deliberate practice.”

In subsequent work, Ericsson and Charness (1994) argue that it is possible to study and analyze the factors which mediate expert performance in any domain. Many of the domains considered so

far, however, are in the areas of music and sports. These domains can be considered somewhat well-structured in the sense that practice leading to improvement can be recognized and observed. In addition, improved performance in these domains is defined and can be assessed by comparison to some standard. Not all performance domains, however, are well-structured. When performing in ill-structured domains, there is difficulty in defining goals and subgoals that constitute improved performance. The problems that performers in these domains need to overcome in order to improve are not clearly defined.

The studies reported here represent an attempt to explore an ill-structured domain, classroom teaching, from the perspective of deliberate practice. Several general questions have guided this work: Does the framework of deliberate practice provide a useful approach to understanding the development of expertise in the ill-structured domain of teaching? Does considering the domain of teaching from this perspective provide insight into the factors that may mediate the development of expertise in teaching?

Over the last few decades considerable research and development efforts were carried out with the intent of identifying, and creating conditions for, the development of high levels of teacher competence. In this regard, Competency Based Teacher Education (e.g., see Hall & Jones, 1976) and process-product research (e.g., see Gage, 1985) stand out. While much was learned from these efforts their promise was certainly not fulfilled. Still quite elusive is a clear definition of effective teaching and how to evaluate it (Dunn, 1980, 1994; Shulman, 1986).

These difficulties notwithstanding, research on teachers and teaching has indicated that highly competent teachers exhibit performance characteristics similar to those associated with expert performers in other domains (e.g., Berliner, 1986; Borko & Livingston, 1989; Swanson, O'Connor & Cooney, 1990; Sabers, Cushing & Berliner, 1991; Clarridge & Berliner, 1991). Although the domain of teaching is ill-structured and specific performance criteria needed to identify "expert" performers are elusive, real differences in performance have been observed. As in other domains, differ-

ences in levels of competence imply differences in the knowledge that has been acquired by the performer, and experience alone does not account for these differences.

1. Deliberate practice activity for teachers

The activities of teaching are quite varied. However, among these activities "practice," in the sense that it occurs in the lives of musicians and athletes, is not one that occurs frequently for teachers. The concept of deliberate practice, however, captures a mechanism that may be manifest in activity that does not resemble what we commonly think of as training activity. In many professions, performers "practice" by engaging in repetitive activity designed to improve specific aspects of performance. These performers frequently practice under the direction of an experienced coach or trainer who helps them monitor progress and provides immediate feedback. At the foundation of the notion of deliberate practice, however, is the fact that deliberate practice refers to activity that provides optimal opportunity for learning and skill acquisition (Ericsson & Charness, 1994). It is possible that activities may look very different across domains yet serve this same purpose. For example, Forbes (1992) notes that advanced chess players spend many hours each day studying previously played, published games of grand masters. As they study these games, these advanced players try to predict the master's moves and if a prediction is wrong, try to understand the move at a deeper level and the master's reasons for it. For the domain of science, Ericsson et al. (1993), noting the relationship between eminent achievement and published manuscripts, have suggested that it is through the process of writing that scientists develop and refine their ideas. The written manuscripts that present arguments in support of the scientists' new theory or idea are revised many times in response to comments and criticisms. Scientists improve their arguments as they deliberately revise and restructure their written presentations of them.

The following two studies consider the activities of teachers from the perspective of deliberate practice. Assuming that the development of expertise

over years of experience is supported by engagement in specific activities that provide optimal opportunity for learning and skill acquisition, these studies try to identify these activities for teachers.

2. Study I

In order to be considered deliberate practice activities for teachers, behaviors should satisfy the conditions proposed for such activity by Ericsson et al. (1993): (a) teachers should perceive the behaviors as highly relevant to improving teaching effectiveness; (b) they should acknowledge that considerable effort is required to initiate and maintain the behaviors over time; (c) they should perform these behaviors frequently; and (d) they need not find the behaviors highly enjoyable in themselves. It should be reasonable that teachers can learn from engaging in these behaviors, and that they can adapt and restructure their performance as a result of them. This study involved an investigation of teachers' beliefs about activities related to teaching in primary, middle grade, and junior high classrooms. The major question concerned identifying activities simultaneously rated high in relevance, effort and frequency by classroom teachers. An activity that meets these criteria may be considered as a possible "deliberate practice" activity if it reasonably provides teachers with optimal opportunities for active learning.

2.1. Method

Data for this study were collected using a questionnaire designed specifically for the purpose of gathering information regarding teachers' perceptions of activities related to teaching. The specific items on the questionnaire included activities thought to support or complement a teacher's classroom performance and to potentially increase effectiveness. The questionnaire presented 15 activities generated through discussions with experienced classroom teachers as well as individuals involved with the training of new teachers. During development of the questionnaire, classroom teachers were asked to read and respond to potential items. Revisions were made as needed to clarify

and refine the items. Some of the items were thought to present specific activities likely to be interpreted by respondents in similar ways. For example, "Attending workshops or in-service meetings," "Serving on school or district committees," and "Observing others teach or interact with children," were items thought to represent similar activities for all individuals. Circumstances would be different, but the activities themselves similar.

Other activities related to teaching, however, were thought to be interpreted in unique ways based on an individual's approach to teaching and existing behavior patterns. For example, items presenting "evaluation" and "planning and preparation for instruction" would be subject to various interpretations since individuals have developed unique ways to do these things. In these cases, the items were elaborated in an attempt to make them have similar meaning for respondents. The activity of evaluating student performance was eventually represented by four separate items on the questionnaire:

- (1) evaluating student performance and understanding through the use of graded written work and projects,
- (2) evaluating student performance and understanding through the use of tests you develop yourself,
- (3) evaluating student performance and understanding through the use of tests provided by publishers, and
- (4) evaluating student performance and understanding through informal observations of students' behavior and non-graded performance.

The final questionnaire included items describing activities a teacher would engage in independently (e.g., writing lesson plans, mental planning, or professional reading), and those which involve other school personnel (e.g., discussions with other teachers or administrators). Some activities could be performed in the context of the school day (e.g., informal observations of student behavior), and others could not (e.g., attending workshops, committee work). The final form contained 15 items which referenced specific activities involved in teacher planning and preparation, evaluation of

students, interaction with other teachers and professionals, as well as opportunities for continued education (see Appendix A).

The general term “teaching” is not listed among the 15 items. This is consistent with Ericsson et al. (1993) in that deliberate practice is distinct from actual job performance. It is very likely that teachers would consider the general activity of teaching, that is, time spent engaged with students and the delivery of instruction, as quite relevant to improvement, effortful, and frequent. While most teachers would no doubt rate actual teaching high on all three characteristics, these results would not provide potentially discriminating evidence of more specific activity that may lead to expertise. Two activities that can co-occur with the delivery of instruction are included – mental planning (#10) and informal evaluation (#15).

The 15 activities were rated on four separate but parallel rating scales. Each rating scale assessed teachers’ perceptions of one of the characteristics of deliberate practice suggested by Ericsson et al. (1993), that is, relevance to improving teaching effectiveness, effort required to initiate and maintain performance, enjoyment inherent in the activity, and frequency of performance. Questionnaires were distributed to classroom teachers in 14 private elementary schools in northwest Ohio and southeast Michigan. The schools included those located in low-income, inner-city neighborhoods as well as middle class neighborhoods. The number of teachers per school varied. Enrollment ranged from 300 to over 700 students, and all schools consisted of kindergarten through eighth grade classes. A total of 201 questionnaires was distributed and 142, or 70%, were completed and returned. Several had to be eliminated, and the final number of usable responses was 136. Respondents were distributed across grade level, years of experience, and level of education.

Ratings were made on a nine-point scale for relevance, effort and enjoyment (1 = the minimum rating and 9 = the maximum rating). Ratings for frequency were made on a 5-point scale (1 = seldom, 5 = daily). Mean ratings were calculated for each item on the four rating scales. Respondents’ ratings were also tabulated using a three-dimensional array, relevance by effort, controlling for

frequency. Activities were rank ordered according to the number of teachers who assigned a high rating to the activity on the scales regarding perceptions of relevance, effort, and frequency.

2.2. Results

The analyses of ratings for the separate dimensions of relevance, effort, enjoyment, and frequency produced a number of interesting trends. As shown in Table 1, mean ratings suggest that all activities were perceived as at least somewhat relevant to improving teaching effectiveness.

Teachers considered activities involving planning and evaluation, as well as discussions with other teaching professionals, as more relevant than other activities presented. These activities are closely connected to instruction and a teacher’s classroom performance.

The results concerning perceptions of effort suggest that while teachers find activities involving other people (with the exception of committee work) to require the least effort, they consider activities involved in planning, preparation and evaluation to require greater effort. In general, teachers also perceived activities involving other people as more enjoyable, and regarded activities which involve “paperwork” as the least enjoyable.

The main purpose of Study I was to investigate activities related to teaching from the theoretical perspective of deliberate practice. Of primary interest were activities simultaneously rated as highly relevant to improving performance, thought to require considerable effort, and performed frequently. The nine-point scales were collapsed into three categories and responses were recoded as low, moderate, and high. For the scales reflecting perceptions of relevance and effort responses of 7, 8 or 9 were considered high. For the ratings of frequency, reports of 4 (2 or 3 times a week) or 5 (daily), were recoded as high frequency. Ratings regarding inherent enjoyment were not considered in this analysis since deliberate practice activities may or may not be perceived as enjoyable. The activities were rank ordered according to the number of teachers who rated them high on all three scales. Table 2 displays these results.

Table 1
Mean ratings of all 15 activities related to teaching

Questionnaire item	Mean ratings			
	Relevance	Effort	Enjoyment	Frequency
Professional reading	6.76	5.28	5.71	2.56
Attending workshops	7.15	5.79	5.90	1.99
Committee work	5.16	7.08	3.98	1.90
Discussions—teachers	7.87	3.30	7.51	4.08
Discussions—resource pers.	6.75	4.15	6.45	2.16
Discussions—administrators	6.97	4.09	6.55	2.48
Observing others teach	7.49	4.88	7.33	2.49
Discussions—teaching prof.	7.68	4.20	7.50	2.30
Written planning	7.46	5.87	4.36	3.70
Mental planning	8.04	5.58	6.48	4.45
Preparing materials	8.22	6.43	5.65	4.65
Evaluation—written work	7.35	6.31	4.79	4.26
Informal evaluation	7.56	5.35	6.60	4.21
Evaluation—self-made tests	7.41	6.69	5.15	2.93
Evaluation—prepared tests	6.08	4.50	4.10	2.60

Table 2
Number of teachers responding with high ratings for relevance, effort, and frequency

Questionnaire item	Number of teachers
Preparing materials	71
Mental planning	47
Evaluation—written work	46
Informal evaluation	35
Written planning	23
Evaluation—self-made tests	11
Discussions—teachers	7
Observing others teach	4
Evaluation—prepared tests	4
Discussions—teaching prof	2
Discussions—administrators	1
Professional reading	1
Attending workshops	0
Discussions—resource pers	0
Committee work	0

Based on this ranking procedure, the first six activities listed in Table 2 best reflect characteristics of deliberate practice. They are:

1. preparing materials needed for instructional activities,

2. mentally planning instructional strategies and activities,
3. evaluating student progress using graded, written work, and projects,
4. informally evaluating students through observations and non-graded performances,
5. written planning,
6. evaluating student progress using teacher-made tests.

While teachers reported that they engage in these activities frequently, they did not report them as highly enjoyable. It follows that some goal other than enjoyment may support the performance of these activities. The other activities were seldom rated simultaneously high on the scales reflecting characteristics of deliberate practice.

2.3. Discussion

The framework for deliberate practice proposes that participation in such activities will be relevant to improving competence (Ericsson et al., 1993). Engaging in deliberate practice provides opportunities to generate knowledge of current performance levels that can be used to determine improvement goals. Practice allows for repeated

experiences in which individuals can pay attention to particular aspects of their performance, usually with the help of a teacher, and gradually improve by incorporating knowledge of results and feedback into their current performance patterns. The environment of teaching is considerably different, of course, with no generally accepted practice activities and relatively rare opportunities for help. After student teaching, there is often little guidance, limited opportunities to work closely with experienced teachers, and a lack of internship programs in which well-respected teachers serve as mentors for beginning teachers.

The planning, preparation, and evaluation activities which elementary classroom teachers perform frequently, and which surfaced as possible deliberate practice activities in this study, represent a broad spectrum of such activities, both formal and informal. These are not unusual activities and all teachers perform them to a certain extent. However, their common nature may belie their importance. The issue here is if they can provide motivated performers with opportunities for improvement.

While we cannot say for certain that planning and evaluation activities will lead to the development of teacher expertise there are others whose recommendations for improved teaching propose actions and activities purported to improve teaching that are similar. Certainly we see the evaluation/planning emphasis in Shulman's (1987) cyclical Model of Pedagogical Reasoning and Action involving Comprehension – Transformation – Instruction – Evaluation – Reflection – New Comprehensions. In addition, advocates of teacher reflection (see, e.g., Zeichner & Liston, 1987; Calderhead, 1989) emphasize the cycle of changing and improving what you do based on careful consideration of its impact on students. Instructional Systems Designers encourage similar efforts when developing curricula and instructional materials. This is especially the case in the various tryout, process evaluation, and revision cycles so pervasive in formative evaluation of instruction (Dick & Carey, 1990). Evaluation has often been assigned the role of being a part of the process of both curriculum development and teacher self-improvement (Scriven, 1967).

The teacher activities involved in preparation, planning, and evaluation can also be related to expertise as it is discussed by Bereiter and Scardamalia (1993). Considering expertise as a process rather than an acquired state, they suggest that the process of expertise is, in part, the process of tackling problems at higher levels. As initial problems become manageable and routines are developed for dealing with them, experts redefine problems to consider more variables, establish a higher standard of results or meet a larger, more subtle range of requirements. For classroom teachers, where the problems are centered around developing and implementing appropriate teaching and management strategies, this process of progressive problem solving could be occurring as they plan, prepare, evaluate, and revise their strategies for the unique situations they encounter and choose to address.

The teachers' perceptions reported in Study I and the work of the authors referenced above provide some support for the importance of planning and evaluation activities in teaching. However, as stated previously, these activities are performed by all teachers, yet all teachers do not reach high levels of teaching competence, and even fewer become expert. A second study was developed to explore how engaging in these relatively common teaching activities could facilitate the development of high levels of teaching competence over years of teaching experience.

3. Study II

The activities identified in Study I as at least having potential to serve the function of deliberate practice, are not generally considered to be practice. In other domains where practice activities are more readily identified, their value for the development of expertise is also more readily understood. While most teachers, at least on some level, understand the value of planning and evaluation activities in teaching, they may not understand their value for self-improvement. The purpose of the second study was to further explore these activities as mechanisms supporting the development of teacher knowledge leading to teacher expertise. Specifically, we investigated the potential effects of

these activities on teaching as well as their frequency. The specific research questions were: What more can we learn about the nature and dimensions of these activities that may support their identification as deliberate practice for teachers? and How much time do teachers invest in these activities and what are the perceived outcomes?

3.1. Method

One important issue that was considered in the selection of teachers for Study II was that novice teachers are often involved in planning and evaluation activities for survival (e.g., see Huberman, 1989). The frequency, nature, and usefulness of these activities for novice teachers would likely be different than it would be for more experienced teachers. We were interested in investigating these activities for teachers who were past survival and perhaps had had enough experience to develop high levels of competence. We decided to limit our investigation to teachers with at least 10 years of experience. These teachers have passed the stabilization period (Huberman, 1989), probably have made a professional commitment to a teaching career, have had enough time to develop routines, and perhaps even expertise. However, this is not a study about teacher expertise, but rather an investigation of teacher activities that may influence the development of higher levels of competence for teachers who have already developed at least adequate levels of competence.

To identify teachers for this study we asked several administrators and experienced teachers in a middle class suburban school district to recommend names of primary or middle grade teachers in self-contained classrooms who were considered to be good teachers, had at least 10 yrs of experience, and did not have a student teacher during the quarter in which the study was to be carried out. Although working with student teachers is a common activity for experienced teachers, in this study we wanted to study primarily teaching and teaching-related activities as opposed to supervisory activities. From a total of 19 teachers identified, eight volunteered to participate. The eight participants averaged 18 yrs of teaching experience (one 1st grade, two 2nd grade, three 4th grade, one 5th

grade, and one 6th grade). There were no obvious differences between the teachers who volunteered to participate and those who did not.

Data were collected using integrated methods: activity logs for keeping a diary of daily activities, and qualitative interviews for elaborating on activities and the perceived effects of activities on teaching. Using activity logs served two purposes. It provided information regarding the frequency of activities of interest as they exist in their natural context and also served as a stimulus for elaborative interviews. Using qualitative interviews allowed for exploration of relationships between reported activity, knowledge of teaching, and the development of competence. The interviews provided an opportunity for participants to elaborate on their activities and the perceived outcomes of these activities on teaching.

Each teacher kept a diary of activities for the same 14 days, 10 days when school was in session and two weekends. Teachers recorded their activities in 15-min increments for each 24-hour period. They coded their recorded activities on a daily basis using a coding scheme which was provided for them and coding booklets especially prepared for that purpose. The coding scheme had been developed through pilot work and listed codes representing 24 categories of possible activity. Categories included activities related to classroom teaching, planning for instruction, evaluation, support for teaching or instruction, and everyday activities involving family, recreation, and personal interests (see Appendix B).

In Study I there were four evaluation activities that teachers rated. In Study II there were only two evaluation categories for coding purposes: C4, which combined formal evaluations of written work, projects and tests (both teacher made and already prepared); and C3, informal evaluation. Using only two categories for coding evaluation activities simplified the process for teachers.

In addition to within school, we asked teachers to log everyday activities outside of school so that we could capture teaching-related activities that occurred in those settings. A sample page from the coding booklet with actual data is included in Appendix C. We knew before running the study, and this was confirmed from pilot data, that we could

not expect teachers to code every 15 min throughout the day and evening. This would be an obvious problem for some categories like sleeping, but also for actual teaching. During an initial visit with each teacher we encouraged completing the information after each interval if they could, but at least several times in the morning and in the afternoon. The coding booklets were designed to be very transportable (3 in × 6 in) and the teachers were encouraged to keep this booklet with them throughout the day and in an obvious place in the home. We strongly discouraged the strategy of waiting until some free time at the end of the day to go back and code all intervals for that day. To encourage the timely collection of data teachers were instructed to send log data to one of the experimenters every other day in a pre-addressed/stamped envelope.

For each 15-min increment, the recorded activity could be assigned one, two, or three category codes. This is similar to the log procedures that Ericsson et al. (1993) used. It allowed participants to more accurately represent time when they were doing more than one thing. Total minutes were calculated for each activity category. If an interval was assigned multiple codes, the number of minutes in the interval was divided across the categories reported. For example, if a teacher reported grading papers (C4) and watching TV (E7) during the same 15-min interval, each of these categories was credited with 7.5 min.

Follow-up interviews consisted of a series of open-ended questions and explored the participants' interpretation of the following activities: C4—Evaluating students by grading written work, projects, and tests; C3—Evaluating students by informally observing their behavior and non-graded performance; and P2—Mentally planning and developing instructional strategies and activities. We selected these three categories for more intensive study for two reasons. First, of the activities identified in Study I as likely deliberate practice candidates, these three would provide the most information regarding how teachers responded to student behaviors and the results of their own (i.e., the teacher's) behavior. In particular, inquiring about evaluation activities (C4 & C3) would provide insight as to how teachers dealt with in-

formation they had collected and/or observed about student behavior. Did they tend to be mindful and change what they did based on this information? Perkins has referred to this mindfulness as reflective intelligence and that reflectiveness is essentially what determines the value of our experiences for subsequent learning and transfer (1995, p. 109). Second, the covert nature of C3—informal evaluation, and P2—mental planning, convinced us that we needed to know how teachers interpreted these activities.

The questioning for each of these three categories (C4, C3, P2) followed a similar pattern starting first with asking what this category meant to the teachers, how often they did it, how it affected their teaching, and what advice they received regarding how to carry out this activity. Interviews were recorded, transcribed, and examined for evidence of activity that participants reported as contributing to teaching knowledge or effectiveness.

3.2. Results

Total time in minutes was determined for all log categories over the two-week period for each teacher. Means and ranges for all these activities are included in Appendix D. We will restrict the more detailed presentation of results to the planning and evaluation activities identified in Study I as having deliberate practice characteristics, although in general, there was great variability among teachers in the amount of time they allocated to both teaching and non-teaching activities. The means and ranges for these activities of interest are displayed in Table 3. The ranges for these activities are also quite broad, and individual teachers did not report consistent amounts of engagement in these activities from day to day.

In general, teachers invest almost an additional two hours each day beyond the time when school is in session on activities related to teaching, and almost one hour each weekend day. This includes time spent planning, preparing materials, and grading. The total time reported for activities which were directly related to instruction, including actual teaching time (C1), was 3.4 hours per day. These results are consistent with those of studies which focused on how teachers use their time

Table 3
Means and ranges in minutes for selected evaluation and planning activities

	Weekdays		Weekends
	In school	Out of school	
C3. Evaluating informally by observation	29 (0–158)	4 (0–73)	0
C4. Grading written work, projects, tests	24 (0–88)	33 (0–135)	34 (0–135)
P1. Completing written lesson plans	12 (0–65)	16 (0–135)	17 (0–225)
P2. Mental planning	4 (0–90)	18 (0–98)	3 (0–45)
P3. Preparing/organizing material	16 (0–90)	43 (0–150)	5 (0–90)
Total instruction-centered activity	3.4 (0–5.7) ^a		

^aThis activity reported in hours per day.

Table 4
Selected teacher comments regarding C4—evaluating students by grading written work, projects, and tests

Support for grades and report cards required by school	<p>We have certain forced methods of evaluation that are required through the district and of course, we have to meet those ... writing portfolios that need to be maintained ... reading and math skill cards have to be kept in the child's file.</p> <p>I do more written evaluation because it's required for report cards and you need something objective to put in the grade book.</p>
Evidence of student understanding or lack of understanding	<p>I view homework as a learning experience, so even though I evaluate it, I don't usually count it in as part of their grade, because that's for me to find out what they don't know and what they do know. I consider that a kind of practice for them and evaluation of 'Do they understand or do they not'.</p>
Direction for instruction and necessary intervention	<p>Hopefully that helps me to determine where we need to go from there. The evaluation helps me to know if we need to back up, do I need to find an alternative method of teaching it, or, if the children have mastered it, we can move on.</p> <p>When I see what they don't know ... when somebody does something incorrectly, I work one-on-one with them, cause I want to know if they did it out of carelessness, if they misread it, or they can't read it and they don't understand it. So I've never sent anything home until I have worked with that child on that particular concept.</p> <p>(Using evaluation) I was able to intervene for those that needed help and enrich those that were more able.</p>
Opportunities for self-evaluation	<p>I think that (written work) evaluates me and to a large extent, how well I taught the material. I use it as my own tool as well as something that is used with the children.</p>

(Chissom, 1987; Roney, Delong, Bloomer & Lindsey, 1990; National Center for Education Statistics, 1994).

The interview data provided information regarding how several codes for categories of activity were interpreted by participants, how the activities related to and affected teaching, and how they may have provided deliberate practice opportunities for acquisition of teacher knowledge. As indicated previously, the focus of these interviews was on three specific activities: C4—evaluating students by grading written work, projects, and tests; C3

—evaluating students informally by observing their behavior and non-graded performances; and P2—mentally planning and developing instructional strategies and activities. Each of the authors read the transcribed interviews independently looking for patterns or themes of responses and compared the findings. The patterns or themes identified by both authors were essentially identical although some discussion was necessary to decide on the number of, and specific titles for, the functions or dimensions for these activities as presented in Tables 4–6.

Table 5
Selected teacher comments for C3—informal evaluation through observation

Assessment of the whole child	At the end of the year, you can write a book on each kid. You know them. If there is a child in your room who is troubled, whether it is academic, emotionally, or anything else, I find that if there is a component in his life that's not working, its going to affect everything else. If something is wrong at home, I am not going to make much headway with him in the classroom. So I (need to) look at the whole package.
Information regarding specific behaviors and behavior patterns	I'm observing them all the time. Who's on task, who's focused ... who is paying attention, who isn't. I keep a register, and so do my teammates. What we do is we try to watch for behavior patterns You are evaluating behavior as you go along.
Opportunities for assessment of instruction and teaching strategies	(While I am instructing) I can see that blank (look), 'I don't get this at all.' I can see that immediately ... those kinds of clues ... I change my strategy then. I might repeat myself in a different way, or I might pull a child in. Call on him, include him, ask him a question. Because it's constant (observation of students). I find while I am teaching a lesson, I am refining, I'm making changes. I'm deciding, Is there a better way?

Table 6
Selected teacher comments for P2—mental planning

Organization	Intentionally, I go through the day before I get to school. Well, am I forgetting anything? That was the time, in the morning, and I was walking and I would go over my day. When you get to school you are organizing your desk, you are organizing the work that you are going to give them for the day. That is when you do a lot of mental planning.
Creativity/Spontaneity	Hopefully I will be more organized and more creative. I think if you are always thinking about what you are going to do, then you are constantly getting new insights into what you want to do or how you are going to do it. You are better prepared. It used to be when I'd walk our dog, he's passed away since, I'd have all these ideas, 'cause there was extra time that I could spend in the morning going over what I was going to do during the day, and oftentimes I'd get to school and change what I was going to do, from walking the dog. But ideas come to me at the craziest times, like my driving. "Oh, it would be great to do that!"
Problem solving concerning students or presentation of content	I plan out units and that sort of thing. I think of projects to do, and things the kids would enjoy doing, and ways I can really get the information across to them. I wake up at 3:00 in the morning and I'm thinking, "All right, what am I going to work on," whatever, "Synonyms. What would be a fun way to do that? ... What is a way I could teach a certain skill that would be fun and mean something to the kids?" Sometimes, because (my driving to school takes) a good half hour, (I) don't turn on the radio and I need to think about a student and what's happening in the classroom with that student, and why it may be happening, and try to look at all the factors. So sometimes, yes, I use time specifically for mental planning. Evaluating your own lessons. What went wrong here? You sit back and focus. And then backtrack-ing. OK, how can I change? Because its usually yourself ... you have to change yourself to get the class listening to you or whatever the problem might be.

Responses regarding the evaluation of students' written work (C4) suggested that this activity has several dimensions and serves several functions for teachers: (a) support for grades and report cards required by school districts, (b) evidence of student understanding or lack of understanding, (c) direc-

tion for instruction and necessary intervention, and (d) opportunities for self-evaluation. Sample comments for these C4 dimensions are included in Table 4.

These dimensions and functions are not unusual. Most teachers understand the value of evaluation

activities for grades and evidence of what students understand. It is also not uncommon for teachers to use this information for subsequent interventions and for self-evaluation. It is these latter two functions that are of primary interest in this study as they represent activities which provide opportunities for new learning. While all teachers carry out formal evaluation activities, some may learn more from these efforts than others. It would seem reasonable to look toward such activities as indicators of processes leading to improvement. The procedures and analyses in this study were not designed to differentiate between those teachers who actually changed what they did based on the results of evaluation and those who tended to persist at what they have been doing even if data suggest that change may be necessary. However, it would seem a reasonable conclusion that teachers who frequently carry out formal evaluation activities will at least have more opportunities for self-improvement than those who do so less frequently.

Two of the reasons to have teachers log C3—informal evaluation, were (a) to investigate how teachers might carry out more subtle forms of evaluation, and (b) to determine if these informal attempts might indicate a pervasive disposition or orientation towards improving instruction and self-improvement. Somewhat unanticipated was the frequency of informal evaluation. All eight teachers reported during interviews that this type of evaluation is ongoing. The following quotes from two of the teachers make this point clearly:

It's almost like a second sense. It's like radar. The minute the kid comes in the room in the morning, it starts. I feel like I have got my little scanners going all the time, picking up signals. It's part of being on the job. It's constant. When you are teaching, you are teaching, but there are also other things going on, like I'm doing constant evaluation during that time, you know, I'm organizing things, there is so much going on.

Analysis of the responses indicated that C3—informal evaluation has several dimensions and functions: (a) assessment of the whole child, (b) information regarding specific behaviors and behavior patterns, and (c) opportunities for assess-

ment of instruction and teaching strategies. Sample comments for C3—informal evaluation, are included in Table 5.

Very important for this study was whether informal evaluation would present opportunities for self-improvement, as was the case for more formal evaluation. All teachers reported such opportunities. In this regard, we anticipated that teachers would describe instances of observing student behavior during teaching and making changes based on these observations. Such was the case, but interestingly, their comments included not only opportunities for improving teaching/instruction but also a major emphasis on getting to know the “whole” child, and the child’s behavior patterns that would influence learning and classroom behavior over the entire school year.

Based on pilot data, discussions with other teachers, and even personal experience, we expected that much of informal evaluation would take place during teaching. As anticipated, several teachers consistently combined the codes for teaching and informally observing students (C1 and C3) when they completed the activity logs. During the interviews, they elaborated on this combination of activities and were able to describe their integration. These teachers were aware that they were constantly watching students and responding by changing what they were doing to fit the immediate needs of their students. However, other teachers described the same kind of ongoing student observation with similar responses but their activity logs did not reflect it. They discussed how they coded their teaching time with only a single code (C1) though other things were occurring during that time.

Similar to the discussion of informal evaluation by observation (C3), the responses to questions concerning mental planning (P2) indicated that teachers engage in more mental planning than was reported in the logs. Analysis of mental planning (P2) responses for these experienced teachers indicated that they did this activity for several different reasons. Essentially, mental planning was thought to provide: (a) organization, (b) creative, spontaneous ideas, and (c) opportunities for solving problems concerning students or presentation of content. Examples of these different forms and

functions of mental planning are depicted in Table 6.

While there are differences between informal evaluation and mental planning, we did recognize that there may be instances when informal evaluation during teaching would co-occur with, or be immediately followed by, mental planning, and that this might be difficult to code. In all likelihood teachers probably continued coding these instances as informal evaluation (C3). Log data support this conclusion since most of the mental planning time was reported to have taken place at times other than teaching (see Table 3).

To summarize, some of the major findings from the analyses were:

- (a) While all teachers engage in these behaviors, their value for teachers would vary based on factors related to mindfulness and effort.
- (b) Evaluation activities, whether formal or informal, provide learning opportunities for teachers in that they can become aware of the impact of their teaching and take steps to change it.
- (c) Informal evaluation included both an awareness of “how things were going” during teaching, and also ongoing assessment of students over the school year.
- (d) According to interview data, informal evaluation was continuous in nature. However, some teachers did not indicate this in their logs.
- (e) Teachers could report when they did mental planning. The clearest examples occurred during non-teaching activities. Mental planning that occurred with informal evaluation was most likely coded as informal evaluation.

3.3. Discussion

Teachers reported that the process of keeping a daily activity log was difficult although, over time, experience with the coding scheme made it somewhat easier. Teachers also found the size of the coding booklets to be very helpful. Teachers further indicated that the ten school days, within the fourteen days during which they logged their activities, were typical school days for them with the exception that one teacher attended a day long in-service meeting during this two-week period. We feel confi-

dent that the data provide a reasonably accurate account of how teachers spent their time.

As mentioned previously, multiple coding for informal evaluation (C3) and teaching (C1) caused problems for some teachers in that they coded little or no informal evaluation while teaching, but during the interview reported that informal evaluation was an on-going activity. We believe there are two reasons for this discrepancy. First, actual teaching (C1) was relatively easy to code. Teachers knew when they were doing it, and indeed it occurred at predictable times each day. Teachers did not stop their teaching at the end of a 15-min interval to code this activity. Instead they would code several 15-min intervals when they had the opportunity during a break. At these opportunities they could readily recall that they were teaching and if there was any ambiguity about how to code, and/or there was any time pressure, it was easier to use the singular code for teaching. A second, and related explanation is that some teachers were more metacognitively aware than others. That is, using the C3 code for informal evaluation necessitated that teachers, at that moment, were aware of the activity. Although all the categories were explained to teachers in a preliminary meeting, we suspect that for some teachers and some categories (especially informal evaluation and mental planning) the actual logging experience and subsequent interview were instrumental in the development of metacognitive awareness for these activities. The C3 category of informal evaluation is similar to what Schön (1987, p. 26) calls reflection-in-action in the sense that teachers would be reflecting on their actions, and the impact of these actions on students, while they are teaching. The fact that some teachers did not or could not register this reflection activity in the logs might reduce the value of this activity insofar as it may lead to teaching improvements in the future.

In general, low values were reported in the logs for all the activities categorized as supporting instruction, such as reading educational literature (S1) and discussions with other teachers (S4). During the interviews, however, teachers referenced the value of interaction with other teachers. Having discussions with other teachers was considered a source of ideas, feedback, and information

regarding students and teaching strategies. It was very common for teachers to refer to the value of other grade level colleagues and how much they learn from each other, including ideas about planning, grading, evaluation, and actual teaching. In Study I we found that teachers perceived discussions with other teachers as highly relevant to improving their teaching effectiveness. However, these discussions did not require effort and therefore did not fit the definition of deliberate practice. Even though these interactions may not be that effortful they apparently provide opportunities for the acquisition of new knowledge of teaching.

3.4. General discussion

Both Studies I and II dealt with potential deliberate practice activities in teaching. In Study I we investigated teachers' perceptions of activities that might qualify as deliberate practice based on the framework presented by Ericsson et al. (1993). In Study II we wanted to further explore these activities and attempt to understand their potential to support the development of effective and competent teaching over years of teaching experience.

Teaching activities that involve aspects of planning and evaluation do not automatically qualify as deliberate practice. They are activities that all teachers do. They are a routine part of the job. However, as indicated in Study II, these activities can serve different functions and teachers use them in different ways. The purpose for engaging in these activities can vary, and consequently, so can the results. Each of the specific activities explored (C4, C3, P2) contained a dimension that suggested the activity has the potential to *provide a teacher with opportunities to acquire new knowledge of teaching*. Learning from these activities is possible but not automatic. What would make these planning and evaluation activities deliberate practice for teachers is continued frequency and that they would be carried out when it is not absolutely necessary to do so.

Consider the first years of teaching. During these years, extensive planning, evaluation and revision are quite common. As time goes by, teachers get better. They develop routines and events are more predictable. Yet some teachers will still not settle for relatively effective teaching. They will deliber-

ately and frequently engage in activities to improve their teaching. Ostensibly, the increased effectiveness should come about as a consequence of the application of new knowledge resulting from deliberate practice activities.

It is apparent that planning and evaluation activities require effort, for some teachers they occur often, and at least theoretically, they are believed to help teachers become more effective. These activities are not inherently enjoyable and, in addition, we can see how for some teachers, they are carried out even when a relatively acceptable level of competence already exists. From this perspective they would fit the description of deliberate practice (Ericsson et al., 1993). As part of an iterative process involving instruction and revision, these activities provide motivated teachers with unlimited opportunities to acquire new knowledge of teaching and to incorporate this knowledge into their unique repertoire of teaching strategies.

Given the apparent cognitive nature of activities that contribute to increases in teaching effectiveness, it is more difficult to capture and assess deliberate practice for teachers than for performers in a number of other domains. Comparing the contexts and results of this study with other deliberate practice studies (Ericsson, et al., 1993; Ericsson & Charness, 1994; Ericsson & Lehmann, 1996), it becomes increasingly clear that the factors which affect the development of competence in teaching are quite different from the factors in other areas where this framework for explaining the acquisition of expertise has been applied. These differences may influence our ability to recognize and assess deliberate practice as it is applied to the development of expertise in teaching. At the same time, however, examining these differences may help us understand certain aspects of the domain that may either support or impede the development of competent performance. We turn now to a discussion of a number of these factors.

3.4.1. Goals

Studies of deliberate practice were carried out primarily in the areas of music and sports (Ericsson et al., 1993). In these areas of human activity the goals for practice are clearly self-improvement. For example, major league baseball players, already

operating at world caliber performance levels, often spend considerable time trying to improve their hitting. Tony Gwynn, an outfielder with the San Diego Padres, is well known for his efforts at improving his hitting. With seven batting championships and a lifetime batting average over 0.330, he is considered by many to be the best hitter among active players. However, Tony Gwynn works hard at improving his hitting. He video tapes his own hitting, spends hours analyzing his swing, practices hitting to various parts of the field, etc. This is above and beyond team scheduled batting practice. He does not necessarily enjoy doing this. It is not inherently fun. It requires effort. His goal here is clearly self-improvement.

How often are teachers' planning and evaluation activities, considered to be deliberate practice, driven by the goal of self-improvement? The teachers we interviewed clearly wanted improvement in their students' learning and that seemed to be the primary overall goal, as opposed to self-improvement. Surely there is a relationship here in that, at least logically, what helps students do better should be related to improvements in teaching. There would be a major difference, however, in the information that is used to judge whether or not a goal has been attained.

3.4.2. *Feedback*

The musician has various sources of feedback that provide information as to goal attainment of self-improvement. For example, a violinist may know that she has improved her performance based on (a) her "feeling" that the fingering was correct, (b) how the performance sounded, (c) feedback from a teacher who is watching her, (d) the impact of the performance on an audience, and (e) comments from a music critic. Most of these sources of feedback, with the exception of the fifth, are somewhat immediate. In addition, although this could be argued in some contexts, musicians rely more on the first three sources for feedback as to self-improvement.

The situation in teaching, of course, is quite different. Ultimately, we have to look for changes in student behavior to judge the effectiveness of teaching, and these relationships, the major focus of process/product research, have not been easy to verify (see Shulman, 1986). In addition, the more

immediate feedback, that is, student behavior in the classroom *during instruction*, may not be a valid source of information regarding student learning. Typically, feedback regarding student learning is less immediate (tests, assignments, projects, etc.). Of course the quality of feedback depends on the predictability of knowledge that exists within a domain.

3.4.3. *Teaching is an ill-structured knowledge domain*

Part of the value of feedback, of course, depends on specificity. In some domains, and notably those that focus on motor skills, feedback can be very specific, in addition to being immediate. Teaching is notoriously ill-structured in that predictable relationships are not strong enough so that we can take reasonably complex subject matter and teach it to a group of diverse learners and expect success for all students. Other professions, particularly those dealing with human behavior, deal with similar problems of uncertainty. Schön has described these problems as indicative of the "indeterminate zones of practice" (1987, p. 11). This uncertainty dramatically affects how one learns to practice in the professions. In teaching, for example, clear standards for highly competent performance do not exist. Therefore, one is never quite sure when these high levels have been attained, nor is it totally clear what one can do to improve teaching, thus affecting deliberate practice. These comments are not meant to present a bleak picture of teacher education but rather to point out some inherent difficulties in that endeavor. There have been some attempts to reduce the ambiguity of what makes teaching effective and define these as competencies. Competency Based Teacher Education (CBTE) was a very popular movement in the 1970s and into the 1980s. Part of the problem with CBTE was the inability to be precise regarding what it is that competent teachers do (see Dunn, 1980; Dunn, 1994).

3.4.4. *Teaching/coaching*

Most professions have a period of time when a novice is introduced to the world of practice with the help of a more experienced professional who acts as a teacher, mentor or coach. This is the case in medicine where preceptors work with residents and interns, and certainly in education where

cooperating teachers work with student teachers. The introductory period in medicine lasts for several years, whereas student teaching lasts for a few months. Consequently, after student teaching, opportunities for teachers to receive detailed feedback and advice about all dimensions of their teaching are rare. The effect here is very substantial. Not only will teachers be limited in their sources of feedback about their teaching, but without it they may not choose to improve their teaching at all, or at least less often, thereby reducing the time spent in deliberate practice.

Even more dramatic differences are evident when comparing fields such as music and sports with teaching. In both music and sports there is a history and tradition of experienced teachers or coaches who can guide the individual through deliberate practice and provide important sources of feedback. These coaches and teachers continue to have impact on their “students” throughout the active lives of professionals. The world’s best pianists and violinists still practice under the guidance of teachers who would have a great influence on their deliberate practice. There are batting coaches and pitching coaches at the major league level who serve in similar capacities for major league players.

3.4.5. *Environments that promote deliberate practice*

Some environments expect and value efforts that will result in increasing levels of expertise. These environments will not have the same impact on all individuals, but for some, the dynamic environment will influence many to strive for improvement even though their skill and performance levels were already considerable. Professional sports serve as such an environment. For example, major league baseball players may have excelled in college and/or the minor leagues, but the level of competition at the major leagues is dramatically different. For many players to survive or progress, they need to engage in deliberate self-improvement. Bereiter and Scardamalia (1993, p. 104) describe these environments as expert subcultures, or second-order environments, that embody the ideals and goals that direct the progress of expert development. The subculture provides models of successful professionals and recognition within the subculture. Surely we can see this in music and sports where

subcultures provide “highly sophisticated mutual admiration” (p. 105).

The novice physician’s environment is similar in that the subculture provides models of highly successful professionals while offering the potential for much recognition from peers and professional organizations. The implication is that in order to adhere to the subculture’s expectations one has to engage in continuing efforts to improve. Academic environments in higher education are similar in that there is a distinct culture of searching for and disseminating knowledge through research and publication that definitely requires continuing efforts to improve and expand one’s knowledge. In addition, the discussion of such knowledge with students and peers is a frequent and expected activity.

There are good models to follow in teaching. There are also professional organizations that promote teacher growth and offer recognition for outstanding teachers. However, this subculture is by no means as pronounced and influential as it is in sports, arts, music, the theater and other professions. As a consequence, the activities that would lead young teachers in the direction of advanced standing in the profession are unclear.

In addition to these factors the teaching profession is not as independent as other professions. In music, sports, art, medicine, law, dentistry, etc., the individuals within these professions, for the most part, decide on what constitutes standards for appropriate practice. There is also the long standing tradition of academic freedom in higher education. Teachers, on the other hand, are subject to various pressures which affect how they teach. While we may not always be pleased with what our doctor recommends, we are more likely to go along with his or her recommendations than go to some higher authority to exert pressure to change these recommendations. On the other hand parents often go above a teacher to attempt to change a teacher’s recommendations. The general public is more likely to believe that these other professions require specialized knowledge and skills that they do not have, and is less likely to feel that way about teaching. Berliner (1991) expressed this very well:

Pedagogical knowledge is not seen as sophisticated knowledge because it overlaps with

knowledge of childcare, is possessed mostly by woman, held by members whose social-class standing is not high, and it is a form of knowledge thought to resemble common sense so closely that anyone can acquire it rapidly (p. 146).

In sum, examining the domain of teaching from the perspective of deliberate practice has drawn our attention to a number of factors that are present in the domain that may influence the ease with which we can use this framework to explain the development of teaching expertise. Teaching is a classic ill-structured knowledge domain in which clear standards of high level performance are lacking. In addition, there is no standard expectation or role for coaches or mentors beyond student teaching. These conditions affect both the quantity, source, and quality of feedback that teachers could use for self-improvement. Furthermore, teachers do not “practice” teaching in order to improve but instead engage in patterns of planning, evaluation and revision so that students improve. While it certainly makes sense to look to student behavior for evidence of teaching effectiveness, establishing reliable and replicable “process/product” relationships has been problematic (Shulman, 1986). Finally, the environments in which teachers work provide varying degrees of support, recognition, and encouragement for improvement. All these factors influence the teaching profession and certainly the conditions that would help teachers advance within it.

4. Conclusions

The intent of this paper was to explore the model of deliberate practice as an explanation for the development of expertise in the domain of teaching. Does the framework of deliberate practice provide a useful approach for understanding the development of teaching expertise, and does it provide insight into factors that may mediate such development? Based on the results of the studies described here, we believe it does.

Several common and routine aspects of teaching emerged as ones displaying the characteristics of deliberate practice as it is described by Ericsson et al. (1993). Teaching activities that involve planning

and evaluation were described by teachers as providing frequent opportunities to assess the effectiveness of their teaching strategies, to revise, and to restructure them. We do not normally think of teachers as engaging in “practice” to improve their teaching skills. For most of us, the word “practice” elicits images of repeated performances aimed at refining and perfecting some skill, usually a motor skill. Teachers do not practice, they “teach.” Perhaps deliberate practice for teachers is approaching the normal activities of teaching in a “deliberate” way. It may be doing more of the normal activities of teaching—more planning, more thorough evaluation of students and, of equal importance, evaluation of self. It may be being fully mindful during these activities—mindful of what was effective, what was not, of changes that may lead to improvement. It may be choosing to be effortful—making changes when teaching seems to be going well, trying to find an even better way, trying to reach a particular child, trying to solve a particular problem. Perhaps it is this approach to activities inherent in teaching that, when exemplified on a regular basis over many years, both leads to and maintains teaching expertise.

The framework of deliberate practice recognizes the complexity of becoming “expert.” It acknowledges the motivation of performers to choose to improve, to learn through their experience, and to integrate new knowledge into future performances. The framework further addresses the importance of goals, feedback, and the role of coaches and mentors in this process. A supportive environment is critical if performers are to maintain their improvement efforts over time, long enough to develop beyond competent performance toward levels of expert performance. Further consideration of these factors may help teacher educators understand not only how expertise in teaching develops but how both pre-service and in-service teachers can be supported and encouraged to advance within their profession.

With these points in mind, several recommendations for future research emerge. First, how are teachers who engage in these activities for the purpose of acquiring new knowledge of their own teaching different than those who do so less often? Are they motivated by different goals? Are they

considered to be better teachers? Results from Study II indicate that teachers seemed to be motivated to engage in evaluation and planning activities in order to improve instruction and help students. Less common was a goal of self-improvement. Would a goal of self-improvement result in different activity than a goal of improving instruction? Is this a worthwhile discrimination to make?

In addition to motivation, further exploration of the environmental factors thought to support the development of expertise is suggested. What can we learn about the impact of these factors on teacher

development? Furthermore, can teacher educators and administrators enhance the role of goals, feedback, mentoring, and coaching for novice as well as experienced teachers?

Research in the field of expertise has demonstrated that “experienced” does not equal “expert.” Whatever can be learned about the aspects of teaching experience that support the development of competence has the potential to lead to improvements in our programs for teacher education and professional development. Considered from this perspective, such work has much to offer.

Appendix A. Sample questionnaire page

The following list contains activities related to teaching and education. Teachers are known to engage in some or all of these activities which may complement or support classroom performance. Please rate each of the following activities according to how much it has helped you become a more effective teacher. “Effective” should be thought of as your ability to implement instructional activities which result in the student outcomes you desire, that is, your students learn what you set out to teach. If you do not engage in an activity, leave the line blank.

	Not helpful	Somewhat helpful	Very helpful
1. Reading educational literature and books	1 2 3	4 5 6	7 8 9
2. Attending workshops or inservice meetings	1 2 3	4 5 6	7 8 9
3. Serving on school or district committees	1 2 3	4 5 6	7 8 9
4. Professional discussions with other teachers	1 2 3	4 5 6	7 8 9
5. Professional discussions with resource personnel such as a counselor	1 2 3	4 5 6	7 8 9
6. Professional discussions with administrators	1 2 3	4 5 6	7 8 9
7. Observing others teach or interact with children	1 2 3	4 5 6	7 8 9
8. Discussing your teaching with an experienced professional with the intention of improving your teaching	1 2 3	4 5 6	7 8 9
9. Completing written lesson plans to guide daily activities	1 2 3	4 5 6	7 8 9
10. Mentally planning and developing instructional strategies and activities	1 2 3	4 5 6	7 8 9
11. Organizing and preparing teaching materials	1 2 3	4 5 6	7 8 9
12. Evaluating student performance and understanding through the use of graded written work and projects	1 2 3	4 5 6	7 8 9
13. Evaluating student performance and understanding through the use of tests you develop yourself	1 2 3	4 5 6	7 8 9
14. Evaluating student performance and understanding through the use of tests provided by publishers	1 2 3	4 5 6	7 8 9
15. Evaluating student performance and understanding through informal observations of student behaviors and non-graded performances	1 2 3	4 5 6	7 8 9

Appendix B. Codes used to categorize logged activities

Planning and preparation activities

- P1. Completing or revising written lesson plans
- P2. Mentally planning and developing instructional strategies and activities
- P3. Organizing and preparing materials for instruction

Classroom activities

- C1. Teaching, directing learning activities, working with students to meet instructional goals
- C2. Interacting with students when instruction is not the main focus
- C3. Evaluating students by informally observing their behavior and non-graded performance
- C4. Evaluating students by grading written work, projects, and tests
- C5. Completing school-related tasks not directly related to students or instruction

Everyday activities unrelated to teaching

- E1. Completing household chores
- E2. Driving
- E3. Shopping
- E4. Performing activities related to the care of dependent children
- E5. Engaging in activities related to body care and health
- E6. Sleeping
- E7. Engaging in leisure activities centered around relaxation or enjoyment
- E8. Participating in physical activities including sports and exercise
- E9. Communicating with others – having discussions or telephone conversations not related to teaching

Activities supporting instruction

- S1. Reading educational literature
- S2. Attending workshops, inservice meetings, or classes related to education

- S3. Observing others teach and interact with children
- S4. Having discussions with other teachers concerning students, the content you teach, or teaching strategies
- S5. Having discussions with school administrators concerning students
- S6. Having discussions with school resource personnel concerning students
- S7. Having discussions with parents concerning their child
- S8. Having discussions with others about your teaching

Appendix C. A sample page of actual data from a 4th grade teacher's coding booklet

Time	Activites	Activity codes	
6:00 a	Workout	E8	E7
6:15 a	” ”	”	”
6:30 a	” ”	”	”
6:45 a	Shower-dress	E5	
7:00 a	” ”	”	
7:15 a	Chores-break-lunch	E1	E5
7:30 a	Drive	E2	P2
7:45 a	Prep.	P3	C5
8:00 a	Assignments	P1	P3
8:15 a	”	”	”
8:30 a	Coffee	”	” E9
8:45 a	Opening	C5	
9:00 a	Kids	C2	C5
9:15 a	Sharing-stapling	C2	P3
9:30 a	Organizing room	C2	C5
9:45 a	Health	C1	C3
10:00 a	”	”	”
10:15 a	”	”	”
10:30 a	”	”	”
10:45 a	Plans-Chris	C3	
11:00 a	Media	”	S1
11:15 a	Heading	S4	
11:30 a	”	”	
11:45 a	Recess	C2	

Appendix D. Means and ranges in minutes for all coded activities

	Weekdays		Weekends
	In school ^a	Out of school	
C1. Teaching, directing learning activities	177 (0–345) ^b	< 1 (0–15)	0
C2. Interacting with students, non-instruction	45 (0–180)	6 (0–30)	0
C3. Evaluating informally by observation	29 (0–158)	4 (0–73)	0
C4. Grading written work, projects, tests	24 (0–88)	33 (0–135)	34 (0–135)
C5. Completing other school related tasks	10 (0–120)	14 (0–90)	10 (0–120)
P1. Completing written lesson plans	12 (0–65)	16 (0–135)	17 (0–225)
P2. Mental planning	4 (0–90)	18 (0–98)	3 (0–45)
P3. Preparing/organizing materials	16 (0–90)	43 (0–150)	5 (0–90)
E1. Completing household chores	< 1 (0–7.5)	66 (0–375)	164 (0–435)
E2. Driving	2 (0–38)	53 (0–270)	53 (0–210)
E3. Shopping	1 (0–45)	15 (0–120)	44 (0–165)
E4. Caring for dependent children	1 (0–30)	47 (0–210)	45 (0–360)
E5. Caring for body and health	21 (0–75)	95 (30–220)	122 (23–278)
E6. Sleeping	0	425 (300–555)	521 (420–743)
E7. Engaging in leisure activities	3 (0–38)	93 (0–255)	257 (0–435)
E8. Participating in physical activities	1 (0–45)	33 (0–165)	26 (0–105)
E9. Communicating with others	7 (0–63)	55 (0–225)	121 (0–405)
S1. Reading educational literature	2 (0–30)	4 (0–60)	8 (0–85)
S2. Attending workshops, inservice	10 (0–300)	7 (0–148)	0
S3. Observing others interact with children	9 (0–113)	< 1 (0–15)	0
S4. Discussions with other teachers	9 (0–90)	14 (0–120)	6 (0–143)
S5. Discussions with school administrators	1 (0–23)	4 (0–53)	0
S6. Discussions with other school personnel	1 (0–15)	1 (0–30)	1 (0–45)
S7. Discussions with parents	3 (0–60)	5 (0–45)	3 (0–60)
S8. Discussions with others about teaching	2 (0–53)	1 (0–15)	0

^a Extends from the beginning to the end of the scheduled school day. Teacher breaks, lunch periods, planning periods, etc. are included.

^b In several instances, though school was in session, teachers were out of their classrooms for workshops or inservice meetings.

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