

UNDERSTANDING THE EXPERIENCES OF POSTSECONDARY
FACULTY AND STUDENTS WITH PRECISION TEACHING:
A PHENOMENOLOGICAL APPROACH

by

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ABSTRACT

Precision Teaching, a learning monitoring system, has been used with learners of all ages to develop speed and accuracy, or fluency, in academic tasks. Researchers link fluency with retention, endurance and application. While several studies document the successful use of Precision Teaching in postsecondary classrooms, few report qualitative data. This study used a qualitative, phenomenological approach to examine the experiences of postsecondary faculty and their students with Precision Teaching. Interviews were conducted with 8 faculty members and 17 students. The faculty members had used Precision Teaching as part of their instructional strategy at a variety of postsecondary institutions throughout the United States. They taught courses to graduate students, undergraduates, and those seeking conditional college admission. Subject matter of courses included Precision Teaching itself, psychology, pre-calculus, and remedial reading, grammar, and writing. A series of open-ended questions guided the interviews, which were designed to encourage the participants to reflect on their experiences with Precision Teaching. Findings consisted of 6 faculty themes and 5 student themes. Although first impressions of many students were tentative or negative, faculty viewed the development of fluency as valuable for their students, and students' comprehension of course material and contribution to class discussions increased. As students gained experience, their outlook toward Precision Teaching improved, with many students reporting positive academic outcomes and positive affects. Students often struggled with the expectation of daily practice that often accompanies Precision Teaching, yet they valued the retention of material long after the course was over, in contrast to their experience of forgetting material from many classes. Several students reported adopting Precision Teaching as an individual study method for subsequent course work that contributed to their successful completion of courses and educational programs. Recommendations elaborate on the need to use Precision Teaching intelligently and responsibly.

CHAPTER 1

INTRODUCTION

Overview

Over the past several decades, a learning monitoring system has been developed for a wide range of educational settings, yet it is not in common use. This system, Precision Teaching (PT), uses the frequent measurement of speed and accuracy of individual student performance to guide instruction (Binder, 1996; Lindsley, 1992a; White, 1986). Its potential for postsecondary learners needs to be better understood.

While many educators have traditionally evaluated learning by measuring percentage correct, PT research spanning three decades has examined the efficacy of time measurements as a means to monitor learning (Binder & Watkins, 1990). According to researchers, PT has been an effective method of developing fluency (simply defined as speed and accuracy) which leads to retention (i.e., remembering course content), endurance (i.e., the ability to use the new knowledge or skills for a useful period of time and to resist distraction), and application (i.e., applying learned material to new content; Binder, 1996). These three outcomes are valuable in education.

By building fluency, noteworthy outcomes have resulted with learners of various ages. For example, elementary students using PT increased their scores on the Iowa Test of Basic Skills an average of 24 and 40 percentile points in reading and math, respectively, compared to other classes in the same district. Students using the PT

intervention altered their typical class day by only 20 to 30 minutes of PT activities each day over a three year period, otherwise their class day was similar to the control groups (Beck & Clement, 1991). At-risk youth and young adults in a basic skills program utilizing PT methods made 1.7 grades of literacy gains in 20 hours of instructional time “in stark contrast to the U.S. government standard of one grade level per 100 hours of instruction” (Johnson & Layng, 1992, p. 1483). Customer service call-center staff trained with PT outperformed non-PT trained staff by 60% after two weeks on the job (Binder & Sweeney, 2002).

Learning outcomes in postsecondary education have also been noteworthy, but only a few published studies have been found. For example, educators improved student performance in a pre-engineering class by redesigning homework to include a PT component, and course scores increased an average of one full letter grade. Prior to the PT intervention, about 34% of the students failed to earn a sufficient grade to move on in the engineering curriculum. After utilizing PT, only 17% did not earn a sufficient grade (Marr, Thomas, Benne, Thomas & Hume, 1999). In a second example, a five minute PT intervention at the beginning of an introductory psychology course helped students increase their reading and recall rate by 49% and 75% respectively. Finally, McDade (2002) reported that a basic academic skills program that utilized PT for entering freshmen at Jacksonville State University, Alabama, increased college persistence, first year GPA, and overall GPA compared to the university’s entering freshman class. This result is particularly remarkable considering course participants enrolled in the program

because they either lacked confidence in their readiness for college or did not meet college admission requirements.

These previous illustrations are a few examples from the large body of research that shows learners of all ages have found PT beneficial. Although only a few studies on postsecondary learners were found, they, too, showed positive outcomes. Thus, it is not surprising that precision teachers in postsecondary education have argued that PT in certain situations and used correctly can benefit many college learners (McDade, 2002). Further research efforts are needed in order to understand more fully what PT can do for these learners.

Qualitative research should be part of this effort, as it can yield “an abundance of potentially useful data and insights” (Gay, 1996, p. 230) and can “capture the points of view of other people” without forcing their responses into pre-written questionnaire categories (Patton, 2002, p. 21). An in-depth look at the experiences of faculty and students who have used PT in the postsecondary classroom can document the “experiences, perceptions, opinions, feelings and knowledge” (Patton, 2002, p. 4) that are not available in the literature, and which may ultimately be used to improve teaching and learning.

Statement of the Problem

Postsecondary educators need to know and understand the experiences that faculty and students have had with PT in order to gain understanding, assess its usefulness, and if desired, incorporate it effectively into their own programs.

Purpose of the Study

A large body of research on Precision Teaching exists, yet most were quantitative studies that counted and analyzed learning behavior. Phenomenological research can closely examine the experiences described by participants. The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT).

Research Question

The research question addressed in this study was “How do postsecondary faculty and students describe their experiences with PT?”

Introduction to the Literature and Conceptual Framework

Precision Teaching is a learning monitoring system that presents feedback graphically to guide teaching and learning. It “does not dictate what should be taught or how instruction should proceed” but can be used with a variety of instructional procedures and curricula (White, 1986, p. 522). Contrasting it to instructional strategies, Daly and Cooper (1993, para. 2) characterized PT as a technique “for making data-based instructional decisions and evaluating learning.” It is unique because it measures and analyzes speed of performance. It uses timed practice, frequent or daily measurement of performance, data plotted on standardized charts, and a time-based mastery criteria. A likeness of a PT chart is shown in Figure 1 and in more detail in Appendix A. A detailed

flow chart of how PT is often used is depicted in Figure 2 in Chapter 2. An experienced precision teacher derives useful information from the charted data to make curriculum and teaching decisions, and if necessary, adjustments that help the student learn the objectives (Binder, 1988).

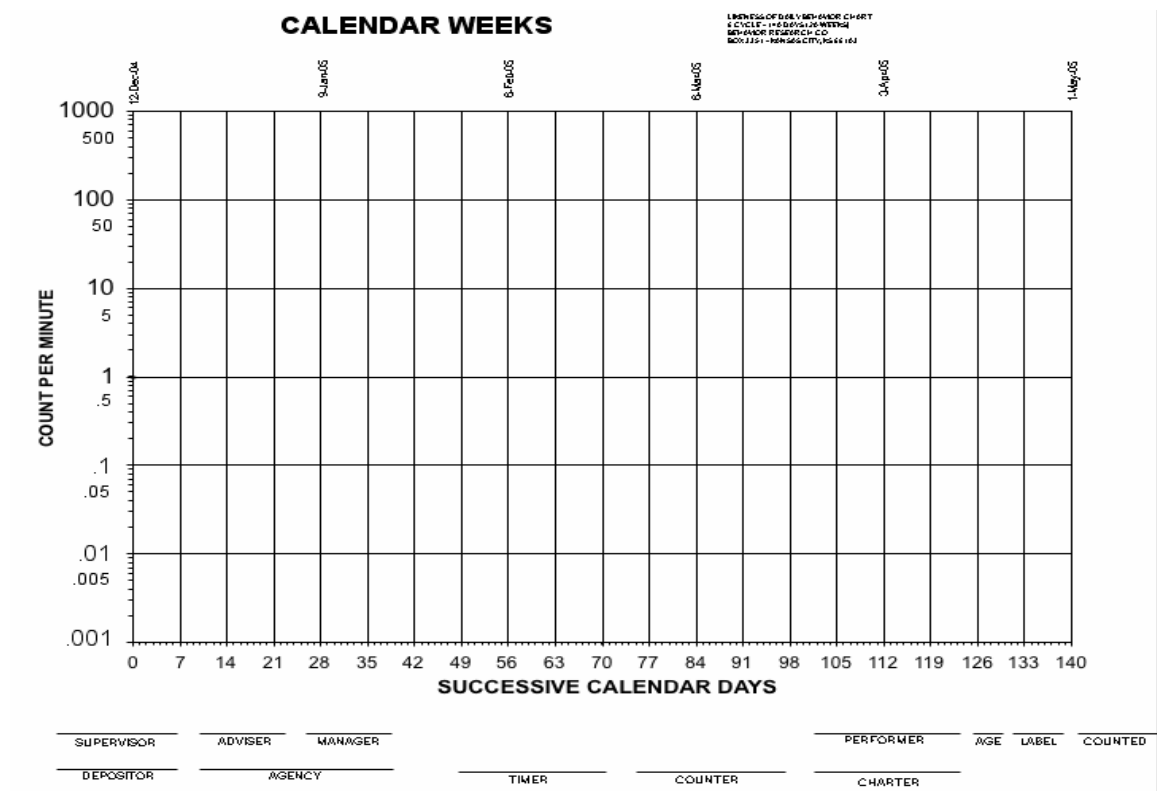


Figure 1. A likeness of the Standard Celeration Chart. Reprinted with permission from Behavior Research Company, Kansas City, Kansas, founded by Ogden Lindsley.

Fluency, an important outcome of PT, has been described by experts as the “fluid combination of accuracy plus speed that characterizes competent performance” (Binder, 1996, p. 164). Synonyms for fluency have included “smooth, rhythmically, effortless, automatic, [and] second nature” (Kubina & Morrison, 2000, p. 89). Researchers have

suggested that by developing fluency, learners accrue three important benefits: retention, application, endurance, and perhaps others (Binder, 1996; Bucklin, Dickinson, & Brethower, 2000; Peladeau, Forget, & Gagne, 2003).

Precision Teaching has been used with different ages of learners, including college students, since the 1970s (Binder, 1996). It was founded by Ogden Lindsley, who was a graduate student and research colleague of the behavioral psychologist B.F. Skinner at Harvard University (Maloney, 1998). As applications of Skinner's discoveries were applied to educational settings, most behavioral psychologists used percentage correct to measure learning, rather than the frequency measurement techniques that worked so well in the laboratory (Binder and Watkins, 1990).

Lindsley's initial, unique contribution to the field of education was the development of a standardized chart, upon which student response frequencies could be graphed, providing a visual representation of, and inquiry into, student learning. The chart Lindsley designed was called the Standard Behavior Chart and later the Standard Celeration Chart (Figure 1 and Appendix A). The chart's vertical axis is logarithmic and records behavior frequency. The logarithmic characteristic allows behaviors to be measured that occur as infrequently as once a day up to a theoretical maximum of 1000 per minute. Each mark on the horizontal axis represents one day, and the length of the page allows daily recordings over 140 consecutive calendar days, or 20 weeks. Lindsley taught teachers and students to "count and time behaviors and accomplishments in the classroom" (Binder & Watkins, 1990, pp. 76-77).

The PT community, while interested and involved in education, has strong academic connections to psychology. Lovitt (1983) stated that PT exists in academia as a subset of the branch of psychology known as Applied Behavior Analysis, which is populated by a group of teachers and researchers “who arrange contingencies, define and measure behaviors directly, chart these various frequencies often, manipulate one variable at a time, and scrutinize the efforts of each client” (p. 361). Recognizing that confusing language would slow the spread of their ideas to people outside of their academic niche, PT researchers and practitioners have tried to avoid jargon and espouse plain English (Graf & Lindsley, 2002). Nevertheless, this is a challenge since PT has an intellectually complex foundation.

A robust body of literature describing PT exists. The peer reviewed Journal of Precision Teaching and Celeration (originally Journal of Precision Teaching) has been publishing research since 1980 (Binder, 1996), although publication at times has been irregular. The Standard Celeration Society began in 1990, and references over 250 documents related to PT on its website. The list includes doctoral dissertations, journal articles, conference proceedings, and books. Lindsley supervised at least 45 doctoral dissertations and 19 masters theses, most related to various aspects of PT. In 2003, the European Journal of Behavior Analysis dedicated a special issue to PT (Calkin, 2003).

Much of the early work in PT supported elementary education (Lindsley, 1990), and much of the current work addresses special education applications including the needs of autistic learners (Fabrizio & Moors, 2003). It has been used with adults in the

workplace (Binder & Sweeney, 2002), in adult literacy education (Johnson & Layng, 1992), and with older adults (Kubina, Haertel, & Cooper, 1994).

A relatively small amount of research has been conducted on PT applications for postsecondary education, and most of this is quantitative. PT has been used to strengthen reading and comprehension skills in a required psychology course (Beneke, 1991) and to increase the problem solving skills of sophomore pre-engineering students (Marr et al., 1999). A substantial number of studies have been conducted at Jacksonville State University, Alabama, where PT has been used from the late 1970s to the present. In one example, a program that utilized PT boosted the basic skills of underprepared entering freshmen (McDade, 2002), and in a second example, PT was used to learn course content by students in an upper division pathophysiology course (Olander, Collins, McArthur, Watts, & McDade, 1986).

Qualitative research on PT that describes student or teacher experiences is scarce. Two studies and one informational DVD were located that interviewed students or asked open-ended questions, but qualitative research was not their main purpose. In the first study, Daly and Cooper (1993) surveyed inservice teachers (both elementary and secondary) and undergraduate college seniors (majoring in special education) about their experiences using PT with their students. In general, the participants reported that their students were satisfied with and enthusiastic about PT. Secondly, Marr et al., (1999) as part of their large quantitative study, collected interview data that were helpful in creating the PT interventions and in the interpretation of the study's results. Jacksonville State University Television Services (McDade, Hathcock, Thomas & Thomas, n.d.) produced

an informational DVD on the programs at Learning Services. Two students commented on their initial experiences with PT. One remarked, “I learned more [grammar fundamentals] in six weeks in [an instructor’s] class with Precision Teaching than I had in my entire college career.” The other commented on her learning with PT, “it was a lot different than high school learning... here you have to get more involved... the more you do, the more you learn.” No phenomenological studies of experiences with PT were found in the literature.

Since very limited interview data of postsecondary faculty and students describing their experiences with PT were found by this researcher, the voices of experience – the stories of college instructors who have worked with hundreds of students, and the words of students themselves – have been absent from the literature. This lack of information has been problematical. College educators who might consider incorporating PT into their own programs may lack a clear picture of what would be entailed, what might be expected, and what PT may offer. While the literature documents that PT may benefit students, few examples show how it has been used effectively. Experienced faculty who have successfully used PT have a wealth of experience that can contribute to the literature. Likewise, the perspectives and experiences of students can make a unique contribution that can help educators improve teaching and learning.

Significance of the Study

This phenomenological study contributes to the literature in several ways. Many of the postsecondary educators who are interested in broadening their understanding of

useful formative assessment techniques (Angelo & Cross, 1993) may find PT of interest. Yet the complexities of PT make it somewhat difficult to explain to non-practitioners how it is used and what is required of students and faculty (Keenan, 2003). This study explored the experiences of students and faculty, providing a clearer picture of what PT has to offer than what previously existed in the literature. Additionally, the exploration and documentation of a variety of experiences of postsecondary students and other faculty with PT may help PT-using faculty further develop and improve their instruction.

Method

Data Collection

Faculty and students who have experience with PT in the postsecondary classroom were interviewed. Creswell (1998) described data collection in qualitative research as a circle of inter-related activities “aimed at gathering good information to answer emerging research questions” (p. 110). These actions can be grouped into participant, data, and field activities.

Participant activities were the interwoven group of tasks that included the location of data-rich sites where the research project was permitted, the development of rapport with potential participants, and the choosing of participants using purposeful sampling. In this phenomenological study, the overriding criteria in sampling were that the participants have experienced the phenomenon and can articulate that experience. Purposeful sampling’s logic and strength lies in “selecting information-rich cases for study in depth.... Studying information-rich cases yields insights and in-depth understanding

rather than empirical generalizations” (Patton, 2002, p. 230). Creswell (1998) called for as many as 10 participants in phenomenological studies, basing his recommendation on the work of several researchers. “The important point is to describe the meaning of a small number of individuals who have experienced the phenomenon” (p. 122) but numbers have ranged from 1 to over 300 participants. Polkinghorne (1989) cited several phenomenological studies with 10 to 20 participants.

In this study, faculty and students who had experience with PT in the postsecondary classroom were found to be scattered in pockets across the country. To get a variety of experiences of the phenomenon, a series of interviews took place with faculty and students. Interviews took place with eight faculty members and 17 students affiliated with four different postsecondary institutions. Six of the eight faculty and 15 of the 17 students were interviewed face-to-face. Three interviews were by telephone and one faculty interview took place via instant messaging.

The interviews followed a series of steps. Faculty participants were offered the interview questions in advance. An hour was scheduled for each of the interviews, and the researcher was available in case they went longer. After the interviews, the researcher reviewed field notes and listened to the tapes of the interviews. After returning from the site, interview transcripts were made and sent to the participants, who were asked to read them, comment, elaborate, or clarify via email or by a phone conversation. The protocol for the interviews with student participants was similar.

The most information-rich research site appeared to be Jacksonville State University (JSU), Alabama, and indeed 16 of the 25 individuals interviewed were at JSU.

It was chosen because its Learning Services center had used PT for over 25 years (McDade, 2002). Many research papers had come out of Learning Services, by both the current and former directors. The director of the center was cooperative and agreeable to this research project and confirmed that faculty members and students would be available for interviews.

A second location chosen for face-to-face interviews was the Seattle campus of the University of Washington (UW). A faculty member who has used PT for many years indicated that he and three former students would be available for interviews. The faculty member at a third institution, Maine Maritime Academy (MMA), agreed to ask his students to volunteer for telephone interviews. Finally, a recently retired faculty member at a fourth institution, Youngstown State University (YSU), Ohio, was also available for an interview. These last two faculty members had already participated in preliminary interviews conducted in the early planning stages of this study.

Field activities were addressed with the cooperating faculty at each institution. Students were contacted and scheduled in different ways. At JSU this was done by the director and support staff; at UW this was done by the faculty member via email in conjunction with the researcher. For MMA, a list of student volunteers and contact information was given to the researcher.

Data activities included the collecting of the data, recording information and storing data. Interviews were recorded with a voice recorder, and field notes were taken to aid preliminary analysis and as a data backup. Preparatory and post-interview reflections by the researcher were conducted as a possible assistance to analysis. PT

materials and syllabi used by faculty members were collected, when possible, and were reviewed to further understand the experiences described by the participants.

Personal Profile

As the interviewer and researcher, a description of my background allows an honest evaluation of the bias I may have brought to this study. My academic background primarily has been in science and education. I graduated from California State University, Chico with a B.A. in Biology, earned teaching credentials there, and taught in public schools for several years. In 1993, I completed an M.S. program in Soil Science at MSU-Bozeman and worked until 2000 as a Research Associate in the Department of Land Resources and Environmental Sciences. Working collaboratively with other scientists, I conducted field studies, educational programs, and wrote a variety of journal articles and other publications.

My first exposure to PT occurred at a private tutoring service, Sage Learning Center, in Bozeman, MT. Several aspects of PT were intriguing – the time dimension of academic performance, the notion that knowing something fast and accurate is measurably superior to knowing something slow and accurate, that students could attack their studying in chunks rather than be overwhelmed into a stupor. My own experiences also suggested there was something to this – as an undergraduate, I used note cards to study for several science courses, and was surprised how effective they worked for me. Unbeknownst to me, PT researchers had developed a scientific and sophisticated method of using flashcards (Graf, 2004). As I have used an adaptation of these cards with

elementary and secondary students preparing for complex exams, their grades have substantially improved, and they now work competently and independently. It made sense to me that college students who know how to utilize these strategies would benefit from their use, and I do not think that assumption has biased my research procedure.

In 2002, I started to teach for University of Phoenix, and have taught over 40 sections of business statistics and environmental science, most through the online campus. At this time, I do not use PT or assign fluency building exercises to these students. Also in 2002, I joined my wife's tutoring service to expand the offered services, and I work with students from elementary to adult. At the time of this study, I did not use the Standard Celeration Chart to any substantial degree, although frequency data has been collected. This was due to several factors. First, I have only had introductory instruction in PT. Second, most PT work seemed to be done with a daily chart, and we typically only saw our students once a week, so charting became more challenging. Third, many of our tutoring activities did not easily lend themselves to frequency testing. Finally, I hesitated to get too involved with PT charting in order to maintain an interested outsider perspective on this study. Still, I have used many of the interventions that have worked well with PT. I have measured frequency, given plenty of practice on academic tasks, and have moved to new tasks when a target frequency has been reached. When a student had difficulty making progress, I investigated the student's prerequisite skills for that task, and provided practice when necessary.

While my belief that PT can be effective if properly deployed may have constituted a bias, it also drove a curiosity to understand the experiences of different

people. By focusing on both positive and negative experiences of the individuals I interviewed, I developed a greater understanding of the potential, if any, and shortcomings of this monitoring system in postsecondary education.

My plans for the future include continuing, at some level, providing educational services, contributing to fluency development and PT opportunities for students, and continuing to work in the environmental science field.

Data Analysis

The primary data that were analyzed in this phenomenological study were participant interviews. Audiotapes of the interviews were transcribed, producing narrative data for analysis, called “texts” by qualitative researchers (Piantanida, Tananis, & Grubs, 2004). No single approach or perspective on phenomenological analysis exists (Patton, 2002). Creswell (1998) reprinted an example of a phenomenological research study in his textbook on qualitative research. That study uses an analysis method from Colaizzi (1978) that provided a model that assisted the data analysis in this study, and is further discussed in Chapter 3. The adjusted model for analysis followed these steps:

1. Read all the interview transcripts to acquire an overall feeling.
2. Extract pertinent phrases or sentences that directly relate to the phenomenon.
3. Keep the connection to the original statement, and capture the meaning of the statements.
4. Organize the meanings of the statements into themes.
5. Present a comprehensive description of the themes.

6. Summarize the comprehensive description to answer the research questions.
7. Utilize ongoing dialogue with participants as a validating step, so that the researcher's understanding of phenomenon agrees with participants' experiences.

Limitations

Several limitations may have had an effect on this study. First, since PT has not been widely used in postsecondary education, there was not a large population of PT-using faculty and students to interview. Of the potential participants, not all were willing or available for interviews. Most student interviews were set up by faculty at the institution rather than by the researcher, and students were not always reliable in attending the interviews, although the faculty were. Scheduling interviews with students was more problematic. Although students provided email addresses for follow up, only four communicated with the researcher after the interview, and only two of those provided a thorough review of the transcripts. Five of the eight faculty communicated with the researcher after the interviews; three gave thorough reviews of the transcripts.

Delimitations

There were several delimitations inherent in this study. Data collection needed to be scheduled and completed in the semester period following approval of the proposal. Since participants lived a long distance away, interviews with participants in Maine and Ohio took place by telephone and email.

Definition of Terms

Research in the field of PT requires clarification of specific terms used in this study.

1. Application refers to a benefit attributed to fluency where previous learned material is applied to new learning (Binder, 1996).
2. Celeration is the change in a frequency over time. It is derived from the same root word that is found in acceleration and deceleration (Graf & Lindsley, 2002).
3. Component skills are skills that are part of more complex skills. E.g., letter identification is a component skill of reading (Johnson & Layng, 1992).
4. Composite skills are skills that are made up of two or more simpler skills. E.g., long division is a composite skill that requires multiplication and subtraction (Johnson & Layng, 1992).
5. Endurance is the concept that students can maintain attention on a task over extended durations of time, rather than swiftly becoming fatigued (Binder, 1996).
6. Fluency is the “fluid combination of accuracy plus speed that characterizes competent performance” (Binder, 1996, p. 164).
7. Tool skills are, theoretically, the simplest skills that cannot be divided further into any more component skills (Binder & Watkins, 1990).

Chapter Summary

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching. An overview of PT as a learning monitoring system was presented in this chapter. The problem, purpose, and research question were stated, followed by an introduction to the literature, the significance of the study, and the methods used in conducting the study. A more in-depth examination of the literature is presented in Chapter 2, and a more in-depth examination of the proposed methodology is presented in Chapter 3. The themes that were uncovered in this study are presented in Chapter 4, and the research question is answered in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). In this chapter, evaluation in education is briefly discussed, and the literature on PT is examined.

The literature on PT appeared to be thorough in many areas and lacking in others. The history and development of PT was adequately discussed, but few studies focused on PT applications for postsecondary learners. Discoveries in the literature were often presented using the Standard Celeration Chart that is unique to PT, which could be confusing for those unfamiliar with its charting protocol. Many studies in the literature correlated a PT intervention with academic gains. However, a demonstration of PT effectiveness in one subject area raises the question of how that discovery can be applied to other learning situations. Thus, the lack of examples of PT applications with college learners was a shortcoming in the literature.

This literature review first presents a brief overview of the role of evaluation in education. This is followed by a description and history of PT, and a review of its basic concepts. Several important and relevant PT studies are then presented, followed by studies on PT in postsecondary education. Next, several comments from researchers are

presented on the affective implications of PT. Lastly, a discussion of the challenges faced in further expansion of the use of PT in college settings is presented.

Evaluation in Education

Throughout history, evaluation has been, and continues to be, a key component of education. While learning can take place without evaluation, or even without teaching, “teaching without learning is just talking” (Angelo & Cross, 1993, p. 3). Evaluation is valuable because it measures what learning has taken place. Since learned individuals are potentially valuable to their community, evidence of learning is useful knowledge to society (Stiggins, 1997).

Traditional Function of Evaluation

Educators have only recently seen new potential for student learning by changing the way evaluation is conducted. Bloom, Hastings, and Madaus (1971) identified both the earlier function of evaluation as well as an emerging understanding of its more powerful potential.

An earlier view of evaluation was that it was primarily a sorting, ranking, or selecting of students (Bloom, et al., 1971; Stiggins, 1997). Early historical reports on learning lend support to this assertion. Monroe (1905/1911), using the writings of Plutarch, Plato, and Confucius, identified this trend in ancient Spartan, Athenian, and Chinese education. A Spartan boy who hesitated in his answers was considered “a boy of slow parts, and of a soul who would not aspire to honor” and suffered the negative social

consequences (p. 78). Ancient Athenian education included evaluation by parents, tutors and teachers. Students in ancient China were required to memorize long passages of Confucian texts and have knowledge of the numerous commentaries written about them. Those who passed examinations with the highest marks, achieved by writing near perfect essays, were rewarded with government leadership posts. Even reports of ancient Egyptian education suggested that these early people recognized that education did not always result in learning (Petrie, 1923/1970).

The sorting, ranking and selecting function has traditionally been seen in American elementary and secondary classrooms. Students were ranked and sorted, and only about the top 5% were ultimately selected for higher education. Evaluation, in general, was not used as a means to inform the teacher on ways to improve teaching and learning (Bloom et al., 1971).

In a thorough review of higher education in America before the twentieth century, Milton, Pollio, and Eison (1986) found only one reference to grades as motivators or as a tool to promote learning. “Almost from the beginning, the primary purpose of marks or grades has been that of ranking college students” (p. 5). In a 1935 book about grading practices at five early American schools, Smallwood stated that grades first appeared at Yale in 1783, in the form of four descriptive adjectives. In the early 1800s, a scale of four was used with a two as average, leading to the first grade point averages. Some Harvard professors used a 100 point scale that they converted to five groupings – an early form of the A, B, C, D and F grade scale. By the end of the nineteenth century, faculty commonly graded by initially using a scale of 100, and later converted that number to one of the

letter symbols. However, the cutoff point for failure varied substantially. At Mount Holyoke, failure was set at 75, at Michigan 50, and at Harvard it was 26, calling into question the meaning of the letters themselves (Milton et al., 1986).

At the start of the twentieth century, grading in higher education started to look more similar to today. The A, B, C, D, and F grade scale was gaining acceptance, but variation between faculty was a problem. An investigator at the University of Missouri found disarray in grading practices throughout the school, to the point where “students who were eager to win honors, for example, were advised openly to elect their work under certain instructors and to avoid others” (Milton et al., 1986, p. 7). During World War I, the bell curve came into use. Some educators recommended that the top 3% of a class should earn an A, the bottom 3% should fail, and the middle 50% should earn a C. The role of evaluation was to determine where the students belonged on the curve.

In the second half of the twentieth century, the five letter grading system (often modified with pluses and minuses) was used in over 90% of universities. In 1966, 400 schools were studied, and the distribution of final course grades was essentially the same regardless if the institution accepted all students or only top students. Chickering in 1983 found essentially the same thing (Milton et al., 1986). The authors point out that in the traditional evaluation system, students have been asked trivial questions rather than what they know, since the purpose of testing has been to sort the students. “Instead of telling students what we want them to know and then asking them to show us they know it, we ask them questions better suited to obsessive nitpicking than to critical or creative thinking” (Milton et al., 1986, p. 224).

Emerging Function of Evaluation

The emerging and developing view of evaluation is that it can be a powerful tool to inform teaching and learning (Angelo & Cross, 1993; Bloom et al., 1971; Bok, 2006; Milton et al., 1986). Bloom et al. (1971) articulated an argument that supports this viewpoint. “If the role of education is to produce changes in learners, then someone must decide what changes are possible and what are desirable” (p. 8). These changes become educational goals and objectives. Evaluation is “the systematic collection of evidence to determine whether in fact certain changes are taking place in the learners as well as to determine the amount or degree of change in individual students” (p. 8).

As educators became more invested in making evaluation inform teaching and learning, the concept of summative and formative evaluation developed (Bloom et al., 1971). The main purpose of formative evaluation has been to “determine the degree of mastery of a given learning task and to pinpoint the part of the task not mastered” (p. 61). Summative evaluation is “directed toward a much more general assessment of the degree to which the larger outcomes have been attained over the entire course or some substantial part of it” (p. 61).

Following this work, Cross and Angelo (1988; later updated in Angelo & Cross, 1993) developed and promoted a type of formative evaluation for the college classroom. It consisted of a variety of short procedures that shed light on how much students have learned, at a time before final grades are made, so that students still have time to learn before they receive their marks. At about the same time, Chickering and Gamson (1991) researched the best practices for undergraduate education. Of the seven top practices, one

was the need for students to receive prompt feedback. Students have a need to know their knowledge and competence as it develops during a course. They need to use their knowledge frequently in learning tasks and obtain guidance on bettering their performance.

After reviewing critiques of higher education in the past 20 years, Bok (2006, p. 54) stated that critics “almost never discuss the teaching methods professors use, let alone look to existing research for suggestions of better ways to help students learn.”

At the turn of the 21st century, education is much different than a century or a few decades ago. About two-thirds of graduating high school seniors immediately enter some type of post-secondary education program (U.S. Department of Education, 2006), yet only about half of these complete a certificate, associate’s or bachelor’s degree within five years (Horn & Berger, 2004). Educators have admitted that it is likely “that the contribution of formative assessment to student learning and retention is not being optimized” and is certainly needed (Yorke, 2001, p. 115).

Precision Teaching – Description and History

Description

PT is not readily defined with a short definition. The name “Precision Teaching” can be misleading to educators who are unfamiliar with it and assume it is a teaching method. It is not a method of instruction as much as a systematic method of evaluation (West, Young, & Spooner, 1990). Lindsley gave PT its name, noting that precision is added to the practice of teaching (Lindsley, 1972). Maloney called it “a measurement and

decision-making technology which uses frequency and rate of change in the behavior as its basic data” (1998, p. 119). Other researchers and practitioners described it “not as much a method of instruction as it is a precise and systematic method of evaluating instructional tactics and curricula” (West et al., 1990, p. 5). Binder described it as “teachers and their students [using] behavior frequency measures and the standard behavior chart to monitor individual classroom programs and make educational decisions” (Binder, 1996, p. 166). Its founder, Ogden Lindsley, described PT as “basing educational decisions on changes in continuous self-monitored performance frequencies” (Lindsley, 1992a, p. 51).

A series of sequential steps that characterize PT was consistently described in the literature (Figure 2). Learning tasks were designed that were part of the course objectives. Students practiced with these tasks. Speed and accuracy of the tasks were measured frequently – daily was generally considered ideal. Data, consisting of correct responses per minute, incorrect responses per minute, and length of timing period (as it often varied from a single minute) were plotted on a standard chart. Performance was plotted over several practice sessions, and the dots may have formed a zigzag series, usually following an upward, downward or level trend, called a celeration line. The plot of dots may have sloped up if speed and accuracy of responses increased over time, as it often does, as practice tends to improve performance. At the same time, errors tended to decrease over time as learning progressed. Alternatively, the response frequency may not have increased, may have even decreased, or may have been scattered. The instructor (alone or in consultation with the student) decided whether progress was sufficient towards a pre-

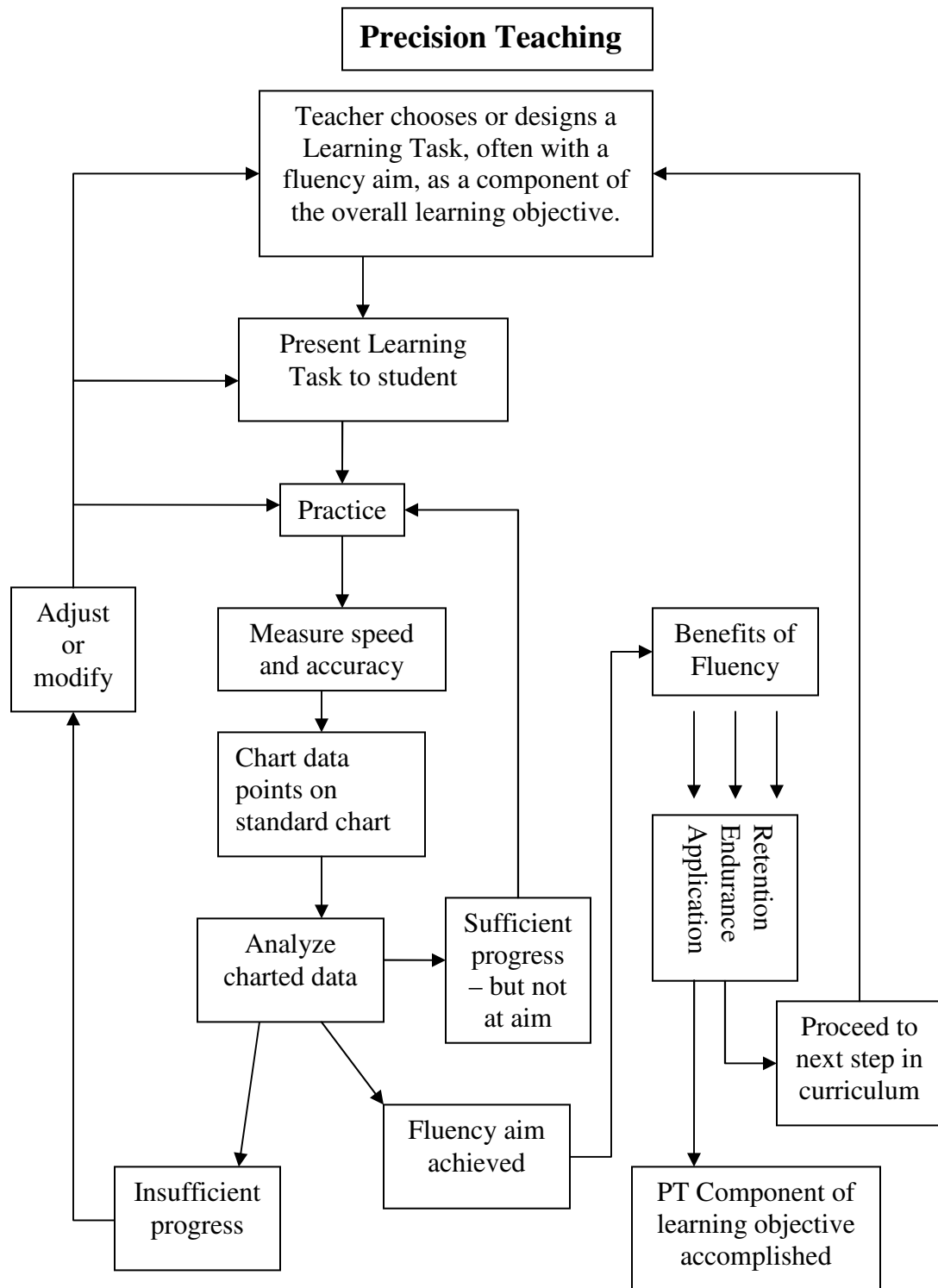


Figure 2. Flow chart of tasks commonly seen in PT applications.

determined speed and accuracy goal or aim. If not, adjustments were made, such as simplifying the learning task so that a component skill could be made fluent, or a change in the method of practicing. If progress towards fluency was deemed sufficient, the practice regimen remained the same and the fluency aim would likely have been achieved with continued practice. The chart served as an ongoing formative evaluation tool to measure learning as it occurred.

History

The roots of PT are found in the behavioral science laboratory of B.F. Skinner. Ogden Lindsley was a graduate student and later a research colleague of Skinner at Harvard University starting in the 1950s (Maloney, 1998). Skinner and Lindsley measured the frequency of behavior in laboratory animals and then in humans (Binder, 1996). Lindsley's early research in physiology showed that frequency was "10 to 100 times more sensitive than percentage correct in recording the effects of drugs and different reinforcers" on his subjects' behavior, whether they were healthy or psychotic (Lindsley, 1990, p. 10). Skinner considered his discoveries about the rate of response (frequency) and an instrument to measure that rate, the cumulative response recorder, as his major contributions to the field of behavioral science (Lindsley, 1991).

Skinner and other scientists applied their findings to classroom teaching and learning. However, only in the field of PT was the frequency of student response examined (Binder, 1996; Lindsley, 1990). Instead of leaving the frequency measures in the laboratory, Lindsley took them to the classroom. Except for particular cases like

typing speed and reading rate, most behaviorally oriented teachers used accuracy-only measures and generally ignored the information that can be gained from measuring frequency (Binder & Watkins, 1990). Accuracy-only measures had an inherent weakness, Lindsley believed, because “when the primary type of feedback students receive is percentage correct, with accuracy usually falling between 60% and 90%, students often become fearful of making errors” which in turn has a negative effect on exploration and creativity (Lindsley, 1990, p. 10). By measuring accuracy along the time dimension, and providing a scientific tool to teachers and students, that measures both speed and accuracy,

it would be possible for them to discover, in the case of each individual learner, what procedures and materials produced greatest improvements in learning and performance. In effect, Lindsley emphasized the evaluation and revision components of systematic instruction by encouraging teachers and students to pinpoint behaviors, count, time and chart them every day, and “try, try again” when initial procedures did not produce the desired results (Binder & Watkins 1990, pp. 76-77).

In some ways, Lindsley appeared to have pushed well beyond Skinner’s discoveries.

Skinner often said in classes, “Rate is a universal datum,” but he had recorded only the frequencies of lever pressing by rats and key pecking by pigeons. In Skinner's statement, I saw the opportunity for putting all behavior of all organisms on a frequency spectrum, as previously had been done with light, sound, and electricity (Lindsley, 1991, p. 254).

Lindsley’s research and measurement background provided him a rare opportunity to develop theory on the repeating patterns of behavior that he observed.

After collecting tens of thousands of records of hundreds of different behaviors, I am convinced that frequency is much more than Skinner's universal datum.... Frequency should not be considered a mere measure of behavior, it is a dimension of behavior. You have not accurately described a behavior until you have stated its frequency (Lindsley, 1991, pp. 254-255).

An in-depth exploration of this psychological dimension of PT is beyond the scope of this study. Instead, this study proposes to explore and describe the experiences of postsecondary faculty and students whose lives have intersected with PT use in the classroom.

The Standard Behavior Chart (later called the Standard Celeration Chart), was developed by Lindsley and his students as a relatively easy to use, inexpensive substitute for Skinner's cumulative recorder instrument (Maloney, 1998). This development made it possible for teachers and students to record performance frequencies over several days or weeks in a visual format. Although several variations exist (Calkin, 2005), what appeared to be the most common chart is used to graph up to 140 calendar days (about one semester) on the x-axis and frequency of behavior (in count per minute) on the y-axis. Chart users are interested in understanding a variety of behaviors that may range from one or more times a day (e.g., loud outbursts in the classroom) to over 100 times per minute (e.g., number of words read silently). In order to use the same chart for this range of frequencies, a logarithmic scale was implemented on the y-axis (Binder, 1996). This development had several noteworthy effects beyond the breadth of frequencies it could accommodate. First, it maintained integrity in displaying changes in performance frequency. For example, a student who progressed from reading 20 words per minute to 40 words per minute changed his or her reading behavior far more dramatically than

someone who progressed from reading 120 words per minute to 140 words per minute. On a linear scale, the rise on the y-axis would have been the same for both students, even though the learning represented by the first student was far more noteworthy than for the second. Using the logarithmic scale of the Standard Celeration Chart, the growth for both students is put into a more logical perspective. The first student increased reading rate by a factor of 2.00, and the slope of the data points illustrating that growth is substantially steeper than the slope of the data points for the second student, who improved reading rate by a factor of about 1.17. “The expression of learning as a multiplicative factor per week provides the first simple quantification of learning in the history of behavioral science” (Binder, 1990b, para. 10). Secondly, early users of the semi-logarithmic chart found that learning curves were transformed into “projectible straight-line trends” which permit “calculations and projections of celeration, the first easy-to-quantify and visualize measure of learning rate in the literature” (Binder, 1996, p. 167). By standardizing the chart, i.e., using identical or fundamentally similar axis scaling on the charts, students, teachers, and researchers familiar with these charting conventions could understand the implications of the chart much faster, without having to adjust to a new set of axis scaling. They can thereby interpret, compare, or discuss the information contained in the chart much more readily (Binder, 1990b, 1996). Although some adults may express dismay at needing to learn how to use the chart, elementary children as young as kindergarteners were able to use it to record data points (Lindsley, 1990).

Fluency

A major development in PT research was the concept of fluency by Haughton and Binder (Maloney, 1998). Fluency plays a central role in PT. The noun “fluency” commonly describes a high degree of competence in a foreign language, and is easily understood in educational contexts because of this well-known definition. It is related to the word “fluent,” an adjective that the unabridged Random House dictionary (Flexner & Hauck, 1987) defined as “spoken or written with ease.” Increasingly, “fluent” and “fluency” describe a level of mastery in performance. Fluency was defined by PT experts as the “fluid combination of accuracy plus speed that characterizes competent performance” (Binder, 1996, p164; Binder, 1988, p12). Kubina and Morrison (2000, p. 89) cited synonyms for fluency from the literature including “smooth, rhythmically, effortless, automatic, second nature,” as well as “masterful and expert behavior.” Binder (1990a) describes fluency as

the mark of the expert—the performer who thinks, acts or speaks confidently and without hesitation. Whether we’re talking about playing a musical instrument, answering sales objections, performing a martial art, using a computer software program, solving addition problems, handing off a football, comforting a dying patient or making a strategic decision, the ability to act and use knowledge correctly and quickly is what we recognize as true mastery. This is a level of performance that goes well beyond the point of 100 percent accuracy and into the realm of “over-learning”(p. 50).

In the area of education, Binder (1988) said

True mastery is fluency, a combination of accuracy (or quality) plus speed which ensures that students will be able to perform easily in the presence of distraction, will be able to retain newly-learned skills and knowledge, and will be able to apply what they've learned to acquire new skills or to real-life situations. Fluency is "second nature" knowledge, near-automatic performance, the ability to perform without hesitation. In short, fluency is true mastery (p. 12).

PT researchers have maintained that fluency is a logical goal of learning, and it is the point where learners can smoothly, confidently, accurately, and without hesitation use the knowledge they have acquired (Binder, 1990b). Progress toward its attainment has been measured by examining the frequency of learner responses. Research by Cortis in 1919 (cited by Wood, Burke, Kunzelmann, & Koenig, 1978, p. 30) "found that a one minute sample of correct performance reflected the skills a child had and how well or competent the child was in each skill." This sampling technique has been commonly used in PT, and is "based on the concept that short samples of many specific skills provide more useful information than long samples of mixed skills" (p. 30). Fluency building exercises are usually brief, lasting from 10 seconds to five minutes. They provide "highly concentrated chances for people to practice important skills and knowledge" (Binder, 1990a, p. 51).

Learning Goals or Aims

Learning objectives in PT include carefully considered timing requirements. The importance of setting high aims (or performance frequencies) for prerequisite skills was an early and critical PT discovery. Having a precise aim for students to work towards provided "self-satisfying indications of progress and accomplishment" for both teachers and students (Haughton, 1972, p.22). Achievement of these aims helps facilitate smooth

progress through the curriculum (Binder, 1990b). Furthermore, PT researchers have determined that “there is a level of performance for any given skill that will support retention and maintenance, endurance or attention span, and application or transfer” (Binder, 1990b, para. 11). “Standards of fluency are set by the demands of the environment and exist independently of the individual learners, just as standards for passing [medical] Board exams exist independently of the level of preparation of this year’s crop of residents” (Pennypacker & Binder, 1992, p. 20). Objective and unequivocal fluency standards can be obtained by direct measurement of small groups of individuals recognized as competent in a skill or knowledge area (Pennypacker & Binder, 1992).

Fluency Benefits: Retention, Endurance, Application

The benefits of fluency development have been grouped in three outcome categories: retention, endurance, and application (Binder, 1987, p2.). The definition of fluency has also developed in the PT literature to be that point where retention, endurance, and application dramatically increase. According to Binder and Watkins (1990), the theory that fluency supports retention, endurance, and application was also supported by what can be described as clinical evidence, the “literally hundreds of thousands of charted instructional projects [that] have demonstrated the effectiveness of this approach” and that have served as a growing knowledge and experience database (p. 82). Several published studies provide further understanding of this link.

Retention. Since forgotten knowledge or skills have little value, retention is critically important. If new concepts are not worked with or practiced with soon after presentation, little may be retained, in some cases even less than half. (Binder, 1987; Bok, 2006; McManus, 2003). Research in learning as far back as the late 1800s revealed a link between overlearning and retention. Through repeated efforts, subjects learned a task to 100% accuracy. When students were exposed to learning material beyond the point where 100% accuracy was obtained (the state of overlearning), retention time of the learned task increased (Krueger, 1929). As improved measuring instruments were developed, laboratory researchers detected a decrease in the latency time between stimulus and response as overlearning increased. With decreased latency came increased retention (Binder, 1987, 1996).

Fluency researchers discovered much the same thing. Bucklin et al. (2000) demonstrated empirically that college students trained to fluency accurately retained knowledge longer than those trained to accuracy only. Thirty students learned to associate a Hebrew symbol with a nonsense syllable, and then learned to associate the nonsense syllable with an Arabic numeral. One group (accuracy-only) practiced the task until accurately completing worksheets on the two tasks four times in a row. The other group (fluency) practiced to accuracy like the accuracy-only group and then practiced to fluency. The fluency group learned the first task to 50 correct responses per minute (in a one-minute timing) and the second task to 100 correct responses per minute. Sixteen weeks after the training period, the accuracy-only group was about 10% accurate on matching the Hebrew symbol with the corresponding nonsense syllable, whereas the

fluency group was 80% accurate. Similarly, on matching the nonsense syllable with the corresponding Arabic numeral, the accuracy-only group was about 20% accurate, while the fluency group was over 90% accurate. In this study, fluency training was clearly linked to increased retention.

Endurance. Second, endurance is also an important aspect of learning. Learners not only need to retain the information they have learned, they are often expected to have the endurance to resist distractions and use a learned skill for a useful period of time. For example, engineering students commonly have a need to use complex math skills in multi-hour study sessions. Several research studies link fluency to endurance. In the first example, students with severe developmental handicaps practiced counting quantities of small objects to match a numeral for three minute periods for several weeks. When the teacher changed to 15 minute practice durations, students who had been counting out 30 to 50 objects per minute for three minutes (a fluent performance frequency) could continue at that pace for the full 15 minutes. “However, students who performed at between 10 and 30 per minute for three minutes, fell to below 10 per minute after the change” (Binder, Haughton, & Van Eyk, 1990, p. 25). A second study examined 75 students in grades K-8. They practiced writing digits 0 to 9 on different days for either 15 seconds, 30 seconds, one minute, two minutes, four minutes, eight minutes, or 16 minutes. Those who wrote over 17.5 digits in 15 seconds (a rate of 70 digits per minute) maintained similar performance rates for up to 16 minutes. The slower writers in the 15 second timings deteriorated rapidly over longer periods. Some slower writing students

(about 20 digits per minute) in the 15 second timings actually stopped writing prior to the end of the 16 minute trial period. These results supported the link between fluency and endurance, i.e., “students who have not yet attained minimal levels of performance cannot be expected to continue working for longer than a brief interval without slowing down considerably” (Binder et al., 1990, p. 25).

In another study, Binder (1987) taught students to associate a numeral with an arbitrary Hebrew letter. They were then asked to “add” the Hebrew letters as quickly as possible. They wore audio headphones while they performed the task, and sometimes heard a voice saying random digits as they attempted to maintain the pace of “adding” the Hebrew characters.

At first, when they had merely learned the associations to the point of 100% accuracy, the distracting auditory number-reading almost completely disrupted the addition, slowing it down nearly to a stand still. As they continued to practice the basic associations between Hebrew characters and numbers, gaining fluency, they became capable of performing the addition task at a constant pace, despite distracting input from the headphones. In short, fluency in the basic associations produced resistance to distraction during the more complex task (Binder, 1987, p. 4).

These studies on endurance demonstrated that fluent performers were not as easily distracted and could work without showing the fatigue seen in hesitant performers, who tended to tire quickly. “Indeed when you ask those hesitant people to use skills or information for more than a brief period, they become discomfited, frustrated and sometimes angry” (Binder 1990a, p. 50).

Application. A basic tenet of PT is that developing fluency in a complex skill is facilitated by developing fluency in prerequisite skills. Thus, when a learner’s

performance in a complex task is slow, the task is analyzed, and prerequisite skills needed to complete that task are practiced to fluency. With these component skills fluent, the learner is better equipped to master the more complicated task (Binder & Watkins, 1990; Johnson & Layng, 1992). A component skill is a part of a more complex skill, which in the PT literature, is called a composite skill. For example, long division is a composite skill of which subtraction is a component skill. Simultaneously, subtraction is also a composite skill, made up of several component skills, one being number recognition. The simplest skill that cannot (theoretically) be broken into simpler components is called a tool skill. The use of component and composite skills in the PT literature is similar to the concept of necessary prerequisite skills in curriculum sequence, and to the concept that higher order skills cannot be learned until sufficient lower order skills have been learned, as presented in Bloom's Taxonomy of Learning (Bloom, 1956).

A study by Bucklin et al. (2000) demonstrated the relationship between fluency and application. Thirty college students were taught to associate a Hebrew symbol with a nonsense syllable, and then associate the nonsense syllable with an Arabic numeral (as discussed in the retention section above, half were trained to accuracy only, the other half were trained to fluency). Application was assessed immediately after training by presenting Hebrew symbols and asking participants to write the corresponding Arabic numeral, a task requiring mental manipulation in which they were not specifically trained. Subjects who were trained to fluency in the component skills averaged 17 correct responses per minute, while those trained to accuracy-only averaged less than nine. The accuracy of the responses (percent correct) each group made was not statistically

different, but the fluency trained group performed at almost twice the rate. Furthermore, over time, the new skill, based on application of the two trained skills, was retained at a greater rate by the fluency trained subjects. Accuracy of the fluency trained subjects declined from over 90% to around 65% over 16 weeks. Accuracy of the accuracy-only trained subjects declined from close to 90% immediately following training to around 15% four weeks after training, with little change thereafter. The study's results support the understanding that fluent component skills are available for use in new higher order challenges.

Not all researchers were in agreement with the idea that fluency supports retention, endurance, and application, or that fluency in component skills efficiently led to composite skill mastery. Peladeau et al. (2003, p. 772) stated that "it becomes difficult to ascertain whether the observed benefits of fluency training are caused by the achieved fluency level or simply by the amount of additional practice." Pellettiere (2002, p. 123) stated that "on the surface [these research findings] appear to contradict the positive effects of fluency training." While the researcher acknowledged that procedural differences or experimental parameters may have affected the results, the findings should not be casually dismissed.

Fluency Homologues

The concept of fluency as a characterization of performance has similarities to the concepts of overlearning (or overtraining) and automaticity, which developed along separate lines of research and are used in separate literatures. Dougherty and Johnson

(1996) concluded after reviewing the literature that fluency is closely related to overlearning and automaticity:

All three involve practice beyond acquisition and are characterized by improved short- and long-term retention. Furthermore, fluency and automaticity are said to be demonstrated by improved endurance on tasks as well as applicability of skills. Although these last two claims have not been specifically addressed in the overlearning (overtraining) literature, one might speculate that overtraining also leads to improved endurance and applicability because overtraining leads to fluency and automaticity (p. 289).

Overlearning. Overlearning (later also called overtraining) has been researched for many decades. Prior to 1900,

laboratory psychologists taught people arbitrary associations between words or nonsense syllables and then tested to see how accurately they could recall the associations later. The general findings were that people could retain more of what they had learned with “overlearning,” or added practice, beyond the point of 100% accuracy (Binder, 1987, p. 3).

For example, Krueger (1929) trained subjects on memorizing a list of single syllable words. The number of repetitions needed to recall the list accurately were counted, and when a subject could remember each following word accurately, a state of 100% learning had been achieved. Thus, further presentations of the word list constituted “over-learning.” By practicing the list even after it had been memorized, the retention period was lengthened. In later studies, the term “overtraining” was used, but measurement was still limited to 100% accuracy. Because

they only tested for accuracy (percentage correct) these scientists were unable to directly measure performance improvements beyond the point of 100% correct – even though they knew that practice beyond that point produced greater retention.” (Binder, 1987, p. 3.)

Automaticity. The concept of automaticity developed separately from that of fluency, yet they share many qualities. Automaticity refers to the “ability to perform complex skills with minimal attention and conscious effort” (Samuels & Flor, 1997, para. 1). Bloom describes automaticity as a series of subset skills that happen without thinking, and in fact are so automatic that one can think of something else while performing the automatic skill. He considered automaticity to be a prerequisite for higher-order comprehension (Bloom, 1986).

Precision Teaching Successes

Great Falls Precision Teaching Project

An important, large-scale demonstration of PT effectiveness took place in Montana in the 1970s. Under the title of the “Great Falls Precision Teaching Project,” elementary students at Sacajawea Elementary School in the Great Falls school district participated in their regular classes for three consecutive years. The PT activities took 20 to 30 minutes a day and teachers did normal classroom activities the rest of the time. By the end of the three-year study period, Iowa Test of Basic Skills test scores had increased 24 percentile points in reading and 40 percentile points in math compared to other fourth grade classes in the same district (Beck & Clement, 1991). The results of the program were presented to the U.S. Office of Education Joint Dissemination and Review Panel (JDRP). This panel, a precursor to the current Expert Panel System, reviewed evidence of efficacy of educational programs. Only approved programs “were to be endorsed by or disseminated as exemplary using federal Education Division funds” (U.S. Department. of

Education, 2001, para. 3). The PT program was validated by JDRP in 1979 for use by regular elementary programs. “In 1981, the State of Montana Office of Public Instruction formally named the Precision Teaching Project as a proven-validated practice for use in high school math and English programs” (Beck & Clement, 1991, p. 10).

After this official recognition of PT as a successful, worthwhile method, the use of PT increased for a while. Federal funds were used for PT training programs throughout the country. Beck and Clement (1991) stated that over 8000 educators had been trained, impacting 153,000 students. The model was adopted in 44 states and three Canadian provinces. However, Binder (1987) stated that although “the magnitude of this effect is unheard of in the educational literature... very few schools or school districts adopted precision teaching methods as more than a passing trend” (p. 7).

Corporate Training with Precision Teaching

With few examples of postsecondary education in the literature to examine, three corporate training examples can provide insight into PT. One study describes workplace training at AT&T. After a two week PT training program, customer service call-center trainees could handle the same calls per hour as their non-PT trained counterparts. However, once they started on the job, PT trainees increased the calls they could handle by 1.4 more calls per hour per week, an accelerating skill rate, whereas the number of calls that the non-PT trainees handled did not increase. After two weeks on the job, PT trainees performed at a 60% higher level than their non-PT counterparts (Binder &

Sweeney, 2002). The implication is that the PT intervention taught the employees how to learn on the job, something the traditional method did not demonstrate.

In a training program involving two banks, personnel underwent fluency training and increased their ability to answer questions about the products and services they sold from an average of five correct responses per minute to over 15, which allowed rapid fielding of questions while conducting sales. From their observations of trainees, the researchers noted that

adults who are not accustomed to being timed or having to verbally blurt out facts in organized practice often experience embarrassment, awkwardness, and anxiety....Once a few participants had achieved some progress with the fluency building exercises, the merits of this approach became apparent. They began to realize that learning product knowledge in this way can be more fun, and certainly more effective, than sitting through the usual lectures and videotapes (Binder & Bloom, 1989, p. 19).

In a third example, four of the 28 supervisors working for a large construction company participated in a PT study on job productivity. First, the supervisors' jobs were analyzed. Two job components were found to be inefficiently performed and thus were judged likely to benefit from fluency training. Both job aspects had to do with the assigning of operation codes. A PT intervention of 12 to 18 learning sessions, lasting no more than 20 minutes each, increased the supervisors' ability to handle the codes accurately and quickly in a less costly manner than current training practices (Pampino, Wilder, & Binder, 2005).

Precision Teaching for Engineering Students

Researchers successfully utilized PT in a sophomore level, pre-engineering physics course at the Georgia Institute of Technology (Marr et al., 1999; Thomas, Wilkinson, Marr, Thomas & Buboltz, 2001). They stated that basic science courses in engineering programs tend to filter out students who lack the dedication or talent needed to complete major courses and graduate. If PT could help learners succeed who would otherwise fail, it would be valuable to the students, the program and the institution. In this case, students needed to earn at least a “C” in an electromagnetism course in order to move on in the curriculum. Typically, one third of the class did not earn a “C” or higher (Marr et al., 1999).

The first step of the research was to perform a task analysis of the course. It was discovered that “expert performers had automated the lower-level skills involved in solving the more complicated physics problems” (Thomas et al., 2001, p. 193). Poor performance in the course resulted from a lack of fluency in four lower-level skill categories: skills in basic math, skills in working with units of measurement, a developed intuition about physics concepts, and skills in solving simple one and two step physics problems.

With this discovery, fluency building materials were written by physics professors and teaching assistants. Students were assigned a sequential, skill-building PT regimen as part of their assigned homework. With the PT intervention, the number of failing students (those who did not earn a high enough grade to move on in engineering) dropped to about one-half of predicted and overall class performance improved by almost one letter grade.

The researchers suggested that this type of course modification strengthened problem solving skills in students who were at risk of dropping out of the program.

One discovery highlighted the importance of regular practice for PT activities. In one part of the study, three interventions were compared – one used pencil and paper materials that the students were to complete on their own, a second used PT materials on a computer network that forced practice during prescribed timing windows, and the third was not a PT intervention, but an hour-long tutorial program based on standard text problems. The computer based intervention was more effective (measured by final exam scores) than the one using paper materials. Researchers found that the

disadvantage of the “take-home” delivery in the form of paper copies is that there was no guarantee of student compliance with the rules. Interviews with students revealed that a significant number (58%) did not properly follow instructions to perform the modules on a daily basis; rather there was a tendency to do all the modules on the day before the class audit (Marr et al., 1999, p. 797).

Subjects with GPAs of 3.5 to 4.0 performed better on the final exam with the one-hour tutorial program rather than the PT intervention, perhaps due to these advanced students having already mastered the skills taught via PT. Nevertheless, for all other GPA groups, the PT intervention was more effective than the one-hour tutorial program (Marr et al., 1999). Further developments by the researchers demonstrated that the web-based PT approach can track the progress of several hundred students at a time, can give students immediate feedback, and can make the approach both effective and efficient. With modern technology, the cost of implementation no longer outweighs the benefits of PT (Thomas et al., 2001).

Precision Teaching for Reading Skill Development

A second study in the literature on the use of PT in higher education took place at Lincoln University, Missouri. Introductory psychology students used PT as a method to increase their reading and comprehension skills (Beneke, 1991). Forty-nine students volunteered for an experimental section of this required course. A control group of 53 student volunteers were enrolled in two other sections. The instructor had no formal or informal training in reading instruction, and limited exposure to PT. The course consisted of 36 class periods, and at the beginning of each class, subjects spent approximately five minutes per day in a PT intervention. At the start of each class period, subjects silently read a prepared reading on psychology for one minute. Upon completion of the timing, they immediately turned the reading sheet over and listed as many ideas or concepts from the reading as they could remember. After the timings, subjects charted their reading speed and recall rate (items recalled per minute) on individual Standard Celeration Charts. Students received points for each day they participated, and late students could not participate (a feature that decreased tardiness). The control group had the same readings and recall timings for the first and last two days of the semester as the experimental group, and they did not chart their rates. Whereas the control students' reading rates did not increase, reading rates of students receiving the intervention significantly increased from approximately 200 words per minute to 300 words per minute by the end of class ($p < 0.0001$). In an end of course questionnaire, 65% of experimental subjects expressed the opinion that they believed their reading improvement transferred to other settings. The anonymity of the questionnaire precluded a comparison

between individual reading rate increases and perceived transfer of reading skill. Beneke suggested that since many universities have high percentages of students needing remedial reading help, a five-minute intervention in regular courses can help students develop their skills and alleviate some of the need of costly remediation programs. Although this study did not make use of all the features that PT offers, it shows its inherent flexibility.

Precision Teaching at Jacksonville State University

Precision Teaching has been used at the Learning Services (formerly the Center of Individualized Instruction) at Jacksonville State University (JSU) in Alabama from the late 1970s to the present (McDade, 2002). While relatively few PT studies have been conducted with postsecondary learners, many if not most of these have been conducted at JSU.

Research by Merbitz and Olander (1980) highlighted how charting various skill frequencies helped students understand the time and effort needed to progress through the curriculum. In order to move through each unit, an 80 to 90% accuracy score was required. Unlimited re-tests were initially allowed (although this was later changed to one test per day maximum to ease charting). After each test, the students met with advanced student advisors who discussed the tests with individual students, gave immediate feedback, and covered the points that needed attention. “After a few tests in a given unit, any student’s chart could be inspected and tentative celeration lines drawn through the frequencies” (p. 20). These projections indicated whether the student’s progress was

sufficient. One student took the first 35 days of the semester to complete one chapter. On day number 38, “the instructor intervened with a discussion of efficient study techniques... following the intervention, she completed the remaining nine chapters in only 64 days” (p. 20). Researchers found that by requiring a competency level in order to progress, students were not passed along with an inferior skill set and a low grade. In conclusion

the charted performance data freed the instructors to teach by putting them in the position of managing learning, while the individualized nature of the system gave the instructors the power, flexibility, time and feedback needed... The data also made it possible for students to find out which tactics were effective, and made it the student's responsibility to actually use those tactics. The union of the instructor and student in learning meant that instructors could do their best, most creative teaching with every student (Merbitz & Orlander, 1980, p. 25).

Later at JSU, McDade, Rubenstein, & Olander (1983) conducted a study to compare student outcomes in a theories of personality course. It examined the differences between using common PT flashcards and newly available flashcard software on micro-computers. It also looked at changes in essay writing as fluency was developed in core concepts. Course evaluation was based on students describing or identifying basic concepts, terms or definitions and the composition of an essay. Fluency testing required an accuracy of 80% and a minimum correct frequency of 10 concepts per minute. There was no detectable difference ($p = 0.05$) between flash card evaluation scores and computer scores, suggesting student learning can benefit from either computer fluency software or physical flash card decks. The researchers reported that when students increased their frequency of correct responses per minute on basic concepts, they also increased the frequency in using concepts correctly in written essay questions.

In a study that looked at essay exam quality, retention of course content and application were tested in students (Olander et al., 1986). Half of the 18 students in a pathophysiology course were taught using PT, the other half were taught with traditional methods. In the PT group, students proceeded to the next curriculum step when they achieved 80% accuracy and eight correct answers per minute. Comprehensive verbal review tests were also given after every two chapters. Eight month retention was measured for both groups by a two-part test. In the first part, students were given 36 terms and asked for a definition and an explanation of its physiologic significance. In the second part, students were asked to write essays on six physiologic concepts, one from each chapter of their class textbook. Tests were graded anonymously by two instructors using a double-blind procedure. The results showed that students taught with PT were 1.8 times more accurate and 1.8 times more fluent than their counterparts taught without PT ($p < 0.05$). “Surprisingly, these students, who never had written an essay exam in pathophysiology performed 1.4 times better than the traditionally taught students whose performance was always measured in this manner” (pp. 80-82). These findings suggest that PT supports long term retention. Additionally, the increased scores on essay exams written on course content, when the course was not taught using essay exams, reinforces the assertion that fluency supports application.

Finally, PT was used at JSU with students preparing for college. Prior to starting regular classes in the fall, these students attended a six-week intensive basic-skill summer program. The students enrolled because they either did not meet university admission requirements, or lacked confidence in their college readiness. When students who

completed this program were compared to the general freshman population, it was found that course participants had higher rates of college persistence, first year GPA, and overall GPA (McDade, 2002).

Special Education Teachers Surveyed on Precision Teaching

Two groups of special education teachers who received training in PT participated in a survey on their experiences. A group of 29 inservice teachers at Central Michigan University and a group of 34 pre-service teachers at Ohio State University participated in training that included instruction in PT. Seventy-six percent of both groups responded to the survey. Only two respondents thought PT was incompatible with their teaching style. Eleven respondents thought they were almost competent to use PT, while all of the others thought they were competent enough to use it. All but one teacher considered it worth learning, and only one participant said he or she would not likely use PT. Generally, inservice teachers who used PT and the chart reported student satisfaction and enthusiasm. “They believed students took more pride in their work, had more ownership of their learning, and were challenged. Most students like the counting periods and enjoyed charting” (Daly & Cooper, 1993, para. 18). Preservice teachers who used PT found the course valuable. They stated that they used PT even though their cooperating teachers did not necessarily support it. Preservice teachers who did not use PT cited “the influence of their cooperating teachers as the major reason for not using PT” (para. 20). Inservice teachers who did not use PT reported difficulty in implementing it with a large group, although they intended to use it at some future point. According to the researchers,

the subjects did not make high quality charts, indicating that follow up training is needed (Daly & Cooper, 1993).

Affective Component of Precision Teaching

The preceding studies primarily illustrate quantifiable changes in academic outcomes. Affective outcomes are more difficult to quantify, but are reported by researchers. Young students with disabilities showed more smiles and laughter (Binder, 1996) and fewer negative behaviors when very short timing periods, a characteristic of PT interventions, were used (Binder et al., 1990). In the corporate training environment, Binder (1990a) reported that trainees' test anxiety disappeared as timed measurements were built into practice activities. They showed excitement when they saw positive results and exhibited a "healthy competitive desire to improve on previous scores" (p. 52). Binder and Sweeney (2002) reported that after the first few days, customer service call-center trainees in a PT program began to "thrive on their own improvements" (p. 35). Without being told to do so, trainees practiced on their breaks, before and after work hours, and at home. They seemed engaged, proactive, and motivated. Meanwhile, learners in the traditional (non-PT) training program seemed familiar with the material, but overloaded with the mass of information, and appeared "passive, disengaged, and drained" (p. 36). Lindsley (1992b) stated that projecting learning on standardized charts reduced the stress of learning because learners could see their performance becoming fluent, and fluent performance is fun. The research of Peladeau et al. (2003) with college statistics students gave further support to the finding that fluency training is enjoyable,

although Marr et al. (1999, p. 799) found it challenging to “persuade the [college pre-engineering] students to undertake the work and to fully comply with the guidelines.” Finally, Graf (2004) stated PT builds fluency and fluency produces confidence. Reports on the affective domain almost always use the words of the researcher or writer, rather than the words of the learners.

Challenges in Expanding Use of Precision Teaching

Developing more widespread use of PT has been a challenge. Some educators worry that repeated practice negatively affects student attitudes and motivation (Bennett, Finn, & Cribb, 1999; Kohn, 1999), although Peladeau et al. (2003) did not find any empirical evidence to support that view. Since PT is based on repeated practice, educators who disagree with practice in general may categorically dismiss it. Peladeau et al. (2003) offered the following questions. Educators who might be concerned about practice may see PT in a different light after considering them:

How many times should students practice a specific skill? When should we interrupt practice on a specific topic and move on to something else? How should we schedule practice periods to optimize learning without submitting students to useless practice that can produce negative attitudes toward such a repetitive task?” (p. 770).

Some educators have criticized PT because of its philosophical roots in behaviorism. Clearly, B. F. Skinner was a world famous behavioral psychologist, and Ogden Lindsley, the founder of Precision Teaching was a graduate student of and coworker with Skinner. Binder and Watkins wrote a thoughtful response to the criticism that PT is “too behavioral,” or criticism that this method is

somehow impersonal or inhumane. However, the very reason that these teaching methods work is that they respond to individual measures of performance and error patterns, provide careful correction and prompting, and address the specific needs of individuals. One could argue that in effectively teaching what students need to know in order to succeed, *these methods are more humane than procedures that fail to teach and then blame failure on students themselves.... We propose that effective instructional methods are effective humanism* (emphases in original; Binder & Watkins, 1989, p38).

Thomas et al. (2001) listed four problems that have led to the failure of PT to attract mainstream educators. First, some educators have believed that PT “can only be applied to very low-level skills” (p. 193). Second, many educators have assumed it is expensive due to the low student to teacher ratio. Third, it has been assumed that teachers need to spend long hours in preparation of a large data bank of practice materials. Fourth, PT has been termed “a bureaucratic nightmare due to the extensive paper-work involved... [and] the need to graph and plot student performance and provide the student with continuous feedback” (p. 193).

These concerns, if not clearly understood, could present an obstacle to the growth of PT use. First, PT does work well with basic skills, which the well known Bloom’s Taxonomy (Bloom, 1956) recognized as important prerequisites to higher order learning. However, PT can also support learning in complex course content, as has been done in pre-engineering (Marr et al., 1999), pathophysiology (Olander et al., 1986), and psychology (McDade et al., 1983). Second, the cost of PT, as with any program, can be an issue, but college applications of PT have not necessarily required any change in the traditional student to teacher ratio (e.g., Beneke, 1991). Third, teachers have spent time in preparing materials for courses that use PT, just as they have been expected to prepare

materials for any type of course. These materials could be used in future courses, could be shared with other PT-using faculty, or students can help develop PT materials (McDade and Olander, 1990). Fourth, Thomas et al. (2001) addressed ways of handling the paperwork by using computer technology more effectively, and other educators have had students chart their own progress (Beneke, 1991) or use software (McDade & Olander, 1987).

In order for students to benefit from PT in the college classroom, faculty need to learn its use. Even with a cursory familiarity, positive outcomes from PT applications have been achieved (Beneke, 1991). However, inadequate instruction in PT can be a reason that no significant differences were found between it and other practice methods, as in the case where home schooling parents only had a two hour workshop in which to learn PT (Weed, 2005). Daly and Cooper (1993) realized that student teachers trained in PT needed follow up assistance to more effectively use the chart in their special education classrooms.

One educator, who served as dean of the school of education at Brigham Young University (Young, 1999), had some experience with charting autistic student progress (apparently not PT), and recognized that when he did something right, the child's performance data immediately showed an upward trend on the chart, and when an ineffective practice was used, progress flattened out or declined. Later, he learned of PT but recognized that his lack of proficiency still hindered his students' learning. He later attended a Great Falls, Montana, PT trainers' seminar, and described his experience:

On the first day we were all assigned a personal tutor. My tutor was Jack, a 4th grader. Jack sat down beside me and said, “How fast can you say the alphabet?” Being a brilliant Ph.D., I responded, “I don’t know.” Jack replied, “Do you want to see how fast I can say it in one minute?” I started the stop watch and tried to count the number of times he got to “z”. I believe it was 17 or 18 (over 400 letters per minute); I couldn’t count as fast as he talked. Then with a smirk on his face, Jack said, “How fast can you say it backwards?” Recognizing defeat before the game even started, I reached for the stop watch. This time Jack was slower, reciting a mere 260 (or so) letters per minute. What a powerful lesson in how performance precedes self-esteem.

Having demonstrated his fluency... Jack got to the real business at hand, making me fluent in the use of the standard celeration chart. With a firm resolve not to be totally outdone by this 4th grader, I concentrated my efforts on plotting dots, drawing trend lines, calculating the rates at which students were learning, and making data based decisions. Back home in Utah, I applied these skills and experienced the satisfaction of seeing increased growth in student learning. (Young, 1999, p. 3).

This vignette illustrates the challenge involved in training faculty in the use of PT, but it also presents the experiences of a faculty member in the role of a student, and a young student in the role of a teacher. Experiences of faculty and students can provide a valuable service in understanding more clearly the nature of PT.

Chapter Summary

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching. This chapter presented findings in the literature on the history, development, and major discoveries of PT, particularly what has been written about its use in postsecondary education. Most of the studies report quantitative results, either focusing on speed and accuracy of student responses, or on how students taught with PT compare to control groups using conventional educational measures. Often, researchers have

commented on the attitudes, demeanor, or other affective descriptions of students using PT, yet in general, little research in this area has been done. This phenomenological study differed in approach to other studies on PT in postsecondary education and was designed to fill a gap in the literature.

CHAPTER 3

METHODOLOGY

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). The design of the study, including methodology, data collection, and verification techniques are presented in this chapter.

Participant Criterion and Selection

Participants in phenomenological studies “must be individuals who have experienced the phenomenon being explored and can articulate their conscious experiences” (Creswell, 1998, p. 111). Polkinghorne recommended that participants have “the capacity to provide full and sensitive descriptions of the experience under examination” (1989, p. 47). Similarly, Moustakas recommended that participants (he refers to them as “co-researchers”) be “intensely interested in understanding [the phenomenon’s] nature and meanings” (1994, p. 107). In this study, participants were sought who had experience with PT that they could articulate and had a strong interest in seeing students succeed. Individuals chosen as study participants included both faculty and students. Most participants were interviewed face to face, but since PT was found to be scattered in pockets across the country, three participants were interviewed by telephone, and one was interviewed by instant messaging.

The criterion used in the initial selection of faculty participants was that they have worked for an accredited postsecondary educational institution where they used PT in a course. The use of PT was defined as: 1) students were timed on tasks, 2) the data on their timings were graphed on a standardized chart (or standardized chart building software was used), and 3) instructional decisions were made using information portrayed on the chart. This activity needed to have taken place either during class or outside of the actual class time. The criterion for participating students was that they were taking or had completed a postsecondary course where PT was used by an instructor whose course met the aforementioned criterion. Faculty members needed to be willing and available to participate in an interview, followed by a second interview, if necessary, and a telephone or email conversation about the content of transcripts that would be sent by the researcher, if further clarification was necessary. Student participants were also asked to participate in an interview with a possible follow-up interview. They were also asked to be willing to review the interview transcripts, which were sent via email. It was expected that students might find it more difficult than faculty members to attend scheduled interviews or articulate their experiences. However, while some students failed to keep their interview appointments, and were difficult to contact via telephone, student participants were quite capable of articulating their experiences, feelings, opinions, and ideas about learning, which contributed substantially to this study. Additionally, to avoid parental permission issues, all student participants were of legal adult age.

Creswell's (1998) guidelines for phenomenological studies called for "interviews with up to 10 people" (p. 113) and that "10 subjects in a study represents a reasonable

size” (p. 122). He cited studies with as few as one and as many as 325. In this study, three sites were chosen for interviews where at least one faculty member and several students could be interviewed. Help was needed from the faculty member at the sites in locating student participants with strong articulation skills and a wide range of experiences with PT. A total of eight faculty members and 17 students were interviewed. Six of the eight faculty interviews were face to face, one was via telephone, and one, at the participant’s suggestion, was via instant messaging. All but two of the student interviews were face-to-face, and those exceptions were by telephone. Two of the student interviews were with multiple participants – one with two students, and one with four.

Recruiting Participants

Individuals and locations that use PT in postsecondary education were identified through the literature, through the Standard Celeration Society website and its electronic mailing list, and in discussions with PT researchers. Six faculty members were asked if they would be willing to participate. Of these, four agreed, and volunteered four additional faculty members who subsequently participated.

The director of Learning Services at Jacksonville State University (JSU) in Alabama agreed to participate and scheduled three other faculty members and numerous students. The researcher visited JSU in October 2006 and interviewed four faculty members and 12 students. JSU, founded in 1883, is located in Jacksonville, Alabama, a town of about 10,000 residents. In fall 2004, 8,930 students were enrolled, about 70% full-time. Approximately 80% of the enrolled students were undergraduates, and 20%

were graduate students. Students earn bachelor's degrees, master's degrees and an education specialist degree, considered a "post-master's" degree (Jacksonville State University, 2004-2005). Some students with low SAT or ACT scores have taken a summer skill building program (called ExSEL) taught by Learning Services in order to boost their skills for a retake of these tests, or to earn a sufficient grade so that they can obtain conditional acceptance to the university (McDade, 2002). During the school year, Learning Services has offered developmental courses, 100 level academic skill development courses, 300 level career development courses, tutoring services for general studies courses, and other academic support for selected classes. PT has been used in the summer skill building course. Students who took this course were interviewed, as well as other JSU students who learned of PT by working as teaching assistants.

A faculty member at the University of Washington (UW) agreed to participate and scheduled interviews with three of his former students and one former college faculty member who was still very involved with PT. The researcher visited UW in November 2006 and interviewed one current faculty member, one former faculty member, and three former students. UW is a public research university founded in 1861 with campuses in three cities, with over 90% of the students at the Seattle campus. In fall 2005, approximately 30% of the student body were categorized as enrolled in graduate or professional programs, 65% were enrolled as undergraduates, and 5% were unmatriculated. During fall 2006, over 40,000 students were enrolled at the Seattle campus (University of Washington, 2006). In the 2000 census, Seattle had a population of approximately 563,000 people (U.S. Census Bureau, 2007).

A faculty member of Maine Marine Academy (MMA) also agreed to participate and provided the names and contact information of five students. Two of those students and the faculty member were interviewed by telephone in December 2006. MMA is a small, public college in Castine, Maine, whose population in 2000 was about 1,300 residents (U.S. Census Bureau, 2007). It was established in 1941, and is accredited by several boards, including the New England Association of Schools and Colleges, Inc. Approximately 800 students attend, focusing primarily on marine related programs. Students earn associate's degrees, bachelor's degrees, and master's degrees (Maine Marine Academy, n.d.). Additionally, the cooperating faculty member participated in a preparatory interview using a draft version of the interview protocol.

A former faculty member at Youngstown State University (YSU) in Ohio agreed to participate in this study, but none of his former students were interviewed. YSU was established in 1908, in Youngstown, Ohio. In fall 2004, 13,101 students were enrolled, about 74% full-time. Approximately 90% of the enrolled students were undergraduates, and 10% were graduate students. Students can earn associate's degrees, bachelor's degrees, master's degrees and a doctor of education degree (Youngstown State University, n.d.). In the 2000 census, Youngstown had a population of approximately 82,000 people (U.S. Census Bureau, 2007). The interview took place using instant messaging at the suggestion of the participant in December 2006. Additionally, this faculty member offered valuable suggestions in the early developmental stages of this study.

For this study, a preliminary exemption from review by the Institutional Review Board was granted by the Montana State University-Bozeman office, based on a qualitative research design using interviews of faculty and students. A copy of the memorandum has been included in Appendix B.

Confidentiality in this study was important to facilitate a safe and comfortable atmosphere where participants could discuss their experiences. Pseudonyms were used in the data analysis. It may be possible, due to the extensive quotations used, that readers who know the faculty members or students may be able to identify them. Since the postsecondary PT community has been relatively small, it may not be difficult to deduce which faculty members were interviewed. However, the comments of individuals have not been linked to their real names, and for faculty who were the only instructors using PT at their institution, their comments were not linked to their institutions. All faculty were aware of these policies and were asked to contact the researcher if they had special concerns, and none did.

Data Collection

Moustakas (1994) described the long interview as the typical method for collecting data in phenomenological studies.

The phenomenological interview involves an informal, interactive process and utilizes open-ended comments and questions. Although the primary researcher may in advance develop a series of questions aimed at evoking a comprehensive account of the person's experience of the phenomenon, these are varied, altered, or not used at all when the co-researcher shares the full story of his or her experience... (p 114)

In this study, faculty and student experiences were collected through interviews to more fully understand the meaning PT holds for these participants. The interviews and follow-up emails and conversations sought to produce authentic responses from the participants. All interviews were conducted by the researcher. In qualitative research, the researcher “is usually the only instrument” (Gay, 1996, p. 213). In this case, the researcher had a familiarity with PT. To avoid bias, phenomenological research requires the use of “*epoche*,” the setting aside of everyday understandings (Moustakas, 1994), which is discussed in further detail below. Prior to the interviews, the researcher reflected on his experiences with PT which included using it with a few students and family members, attendance at the 2004 PT conference, becoming acquainted with several PT-using educators, and reading numerous chapters and articles on the subject in the preparation of the literature review for this study. This reflection was done with the intended purpose of setting aside personal experiences to focus on the experiences of the participants.

Field sheets with questions to guide the interviews were prepared, one for the faculty interviews and one for the student interviews (Appendix C). Copies were provided to the participants so they could refer to the questions. The interviews began with an explanation of the purpose of the research, the explanation of the consent form (Appendix D), and the obtaining of a signature. Simultaneously, efforts were made to develop rapport with the participants. The participants were asked to consider themselves as co-researchers (Moustakas, 1994), whose experience was valuable in order to understand the phenomenon under investigation. Once they were clear on the procedure,

the voice recorder was started, and the researcher began asking open-ended questions designed to encourage the participants to reflect on their experiences with PT. After the interview, participants provided contact information, if necessary, and were asked to review forthcoming transcripts in order to clarify any statements they deemed necessary. One exception was a spontaneous group interview where the researcher observed a senior/graduate level class at JSU. At the end of class, student volunteers were invited to stay for a group interview. These students were provided field sheets so that they could submit written comments later if they did not have a chance to (or did not want to) contribute in the group setting. Following the interviews, the researcher listened to the recordings and took notes on the interviews and recorded his thoughts and comments.

Data Verification

Creswell (1998) stated that the goal of qualitative researchers was to develop understanding – “that deep structure of knowledge that comes from visiting personally with informants, spending extensive time in the field, and probing to obtain detailed meanings” (p. 193). Thus, researchers have been advised to ask participants, and even more importantly, reflect personally, on whether the finished account was “wrong” or inaccurate, or was believable, accurate, and “right.” Verification has been viewed as “a process that occurs throughout the data collection, analysis, and report writing of a study” (p. 194). He listed eight verification procedures for qualitative researchers, with the recommendation that at least two be used in any given study: prolonged engagement with persistent observation in the field, triangulation, peer review or debriefing, negative case

analysis, clarification of researcher bias, member checking, detailed and thick description, and external audits.

This study used triangulation, member checking, detailed and thick description, clarification of researcher bias, and a peer audit as verification procedures. Triangulation was described as using multiple sources of data to confirm the emerging findings (Merriam, 1988; Patton, 2002). In this study, post-interview reflections, syllabi and other course materials were compared with faculty and student accounts. Comparisons between student and faculty accounts were made, and comparisons between institutions were made.

In member checking, participants were asked to review transcriptions of the interviews to make sure that what was written in the transcript accurately reflected the meaning they wanted to convey. Transcripts were emailed to participants. Three of the eight faculty participants returned the transcripts which clarified words or concepts with which the researcher was unfamiliar during the original interview. Two of the 17 student participants replied with minor corrections.

A thick, rich description of participants' experiences "enables readers to transfer information to other settings" (Creswell, 1998, p. 203). By asking multiple participants to give a thorough description of their experiences, efforts were made to develop a sufficient, descriptive understanding of the phenomenon so that readers of this study will be able to appropriately apply the meaning in a useful way.

Clarification of researcher bias is very important in phenomenological research. The concept of "epoche" plays an important role:

Epoche is a Greek word meaning to refrain from judgment, to abstain from or stay away from the everyday, ordinary way of perceiving things.... In the Epoche, the everyday understandings, judgments, and knowings are set aside, and phenomena are revisited, freshly, naively, in a wide open sense, from the vantage point of a pure or transcendental ego (Moustakas, 1994, p. 33).

The researcher “looks inside to become aware of personal bias, to eliminate... or at least gain clarity about, preconceptions” (Patton, 2002, p. 485). In this study, the researcher made ongoing efforts to become conscious of bias, and to set it aside in every aspect of the research process.

Finally, a peer-audit review was conducted, where an experienced qualitative researcher not involved in this study, “can render judgment about the quality of data collection and analysis” (Patton, 2002, p. 562). An experienced educational researcher familiar with qualitative studies examined the transcripts, evaluated the reasoning used in theme development, and provided valuable feedback to the researcher during analysis.

Data Analysis

Numerous methods of analysis for phenomenological studies exist. The following protocol for data analysis was taken from Colaizzi (1978). This method was used in the phenomenological study that Creswell (1998) reprints in his textbook. These steps served as an initial guideline for the analysis phase of phenomenological research:

1. Read all of the participants’ descriptions in order to acquire a feeling for them.
2. Extract phrases or sentences that directly pertain to the phenomenon from the texts. If more than one person says nearly the same thing, eliminate duplicates.

3. Without severing the connection to the original statement, formulate meanings of the statements from participant statements.
4. Organize the formulated meanings into clusters of themes that emerge from all the participant's descriptions.
5. Write an exhaustive description of the phenomenon from the above process.
6. From the exhaustive description, formulate a statement that is as unequivocal as possible that identifies the phenomenon's fundamental structure.
7. As a validating step, check with participants to see if the ongoing descriptive results from this research agree with their experience.

Polkinghorne (1989) wrote a comprehensive paper on phenomenological research that included how data were analyzed in three studies, and how the basic phenomenological analysis method was adjusted to best work with the meanings disclosed by the participants. Polkinghorne described a general, three-step procedure for phenomenological investigation, and this format was followed for this study.

1. Gather a number of naïve descriptions from people who are having or have had the experience under investigation.
2. Engage in a process of analyzing these descriptions so that the researcher comes to a grasp of the constituents or common elements that make the experience what it is.
3. Produce a research report that gives an accurate, clear, and articulate description of an experience. The reader of the report should come away with

the feeling that “I understand better what it is like for someone to experience that” (Polkinghorne, 1989, p. 46).

In this study, 25 participants were interviewed. Eight of the participants had experience as college faculty, 17 were students. Faculty and student accounts were analyzed separately. Their experiences were organized into themes supported by participant statements. The summarized themes answered the research question.

Chapter Summary

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching. In this chapter, the criterion used in choosing participants was described. The procedures for these 25 interviews (eight faculty members and 17 students in 21 separate interviews) was described. Procedures for data collection, analysis, and verification were also presented. The results of the interviews and the organization of the data into themes are presented in Chapter 4.

CHAPTER 4

RESULTS

Introduction

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). The research question addressed in this study was as follows: “How do postsecondary faculty and students describe their experiences with PT?” The purpose of this chapter is to present the results of this study and to define the themes and central phenomenon that emerged from an analysis of the data.

Data Analysis

Data analysis proceeded by analyses of data from interviews with eight faculty members and 17 students. The faculty and student interviews were analyzed in two separate groups. The interviews were listened to, transcribed, and then examined for meaningful statements related to the focus of this research. These statements were coded and sorted into themes. The themes resulting from analysis of faculty experiences are presented first, followed by those from student experiences.

Pseudonyms were assigned to each participant as presented in Tables 1 and 2. Faculty are identified only to the extent of whether they worked for JSU or not. Since the

Table 1. Pseudonyms for Faculty Participants.

Pseudonym	Institution
Karen	JSU ¹
Rachel	JSU
Robert	JSU
Nathan	JSU
Stan	other
Will	other
Paul	other
James	other

¹Jacksonville State University

Table 2. Pseudonyms and Demographics for Student Participants.

Pseudonym	Institution	First PT Exposure	Class Level at Interview	Interview Group Size	Currently in only PT class	Experience as TA ¹
Sylvia	JSU ²	ExSEL ³	Grad Student	1	no	yes
Ellen	JSU	Junior	Adv. Degree ⁴	1	no	yes
David	JSU	ExSEL	Freshman	1	no	no
Mike	JSU	TA	Senior	1	no	yes
Chuck	JSU	ExSEL	Freshman	2	no	no
Sarah	JSU	ExSEL	Freshman	2	no	no
Jenna	JSU	Senior	Grad Student	1	yes	yes
Katie	JSU	Freshman	Senior	1	no	yes
Lauren	JSU	Senior	Senior	4	yes	no
Sally	JSU	Senior	Senior	4	yes	no
Curt	JSU	Freshman	Senior	4	no	no
Gordon	JSU	Senior	Senior	4	yes	no
Rose	UW ⁵	Grad Student	Adv. Degree	1	no	no
Marianne	UW	On the job	Adv. Degree	1	no	no
Gary	UW	Grad Student	Adv. Degree	1	no	no
Marcus	MMA ⁶	Freshman	Freshman	1	yes	no
Andy	MMA	Freshman	Freshman	1	yes	no

¹Teaching assistant; ²Jacksonville State University; ³Summer skill building class; ⁴Person who graduated with an advanced degree; ⁵University of Washington; ⁶Maine Maritime Academy.

institutions besides JSU only had one faculty member, identifying the institution would have essentially identified the individual. Several demographic details are given for each student. Besides institution, students' current class standing at the time of the study is given, as well as their class standing when they first learned about PT. The size of the interview group is given; since most students were interviewed individually, they were in a group of one. Finally, whether the student worked as a teaching assistant is given as a yes or no. If the student learned about PT while working as a teaching assistant, "TA" is listed under "Class with PT."

Description of the Context

Understanding the interview sequence and the backgrounds of the participants provides context to the results that follow. The researcher had met and visited with three of the Jacksonville State University faculty at the 2004 International Precision Teaching Conference, after recognizing that JSU was a data-rich environment for understanding the use of PT at the college level. The researcher spent one week in mid-October 2006 at the JSU campus in Alabama. Each faculty member was interviewed separately, but numerous, less formal conversations took place over the course of the week. Many hours were also spent within the Learning Services area, observing the arrival and departure of students for classes and for tutoring appointments. While PT was integrated throughout the summer ExSEL program, it was not used by all the Learning Services faculty in all the courses during the school year. Four JSU faculty members were interviewed for this study. This institution has primarily been a teaching university that grants bachelor's and

master's degrees. The four faculty worked for Learning Services, a university center that has provided remedial instruction in math and writing, and a variety of orientation, academic skill-building, and career development courses. All of the interviewed faculty had taught ExSEL, the six-week summer course for underprepared students.

The faculty members had their own areas of expertise. These included math, reading, and grammar and writing. The fourth faculty member handled administrative duties for ExSEL, gave instruction on charting, and other areas that needed attention.

One of the faculty members taught JSU courses outside of Learning Services; one was observed. It was a combination senior and graduate level psychology course. Seven students were present, and several were absent. During the class, the students had prepared PT chart overheads of their projects, which they shared with the other students. The instructor invited and encouraged the students to stay for a group interview, and four seniors stayed and participated.

One freshman grammar class in Learning Services was also observed by the researcher. In that class, students in two teams competed against each other to see which group had better knowledge of course material. Sample questions included: "What is a gerund? What are irregular verbs? Define minor and minor. What is an imperative sentence? ...an antecedent? They then spent time practicing their safmeds¹ in pairs, using timers that would ring in staggered fashion throughout that time of class. Students ignored all the ringing timers except their own. Students were not observed charting their

¹ Safmeds are referred to frequently in this study. The word stands for "Say All Fast Minute Every Day Shuffled" and refers typically to a stack of cards with a statement with a blank near the end of the sentence. On the other side is the word that goes in the blank.

data – they may have been recording their scores or simply practicing without recording the data. Most of the 21 students present were actively on task. When asked to do timings, they complied without surprise. Some of their tasks were in a “hurry-up” mode. They took a short quiz, with no observable time limit.

The student interview participants at JSU had a variety of backgrounds. All were interviewed individually, unless specifically mentioned. Sylvia was a graduate student working on her master’s degree in English, with aspirations to earn a doctorate. She was currently employed as a high school teacher, and made a special trip to JSU for the interview. She learned of PT as a student in ExSEL, had worked for Learning Services for several years as a teaching assistant, and had used PT to help her through her undergraduate and graduate coursework. Ellen transferred to JSU from a community college. Her first exposure to PT was in a psychology course, and later was hired by Learning Services for teaching and administrative assistant duties. She later used aspects of PT to help her complete her undergraduate and graduate degrees. David took ExSEL the summer prior to the October interview, and was currently enrolled in Learning Services courses that used PT. Mike was currently a senior, and had taken numerous courses in biology and chemistry. He had applied lessons he learned from using PT as a teaching assistant to his coursework. Chuck and Sarah were interviewed together. Both were students in ExSEL the previous summer. Chuck had a disappointing semester at a larger university, and moved to JSU after researching alternatives. During the interview, based on his ExSEL and first semester experiences, he was quite satisfied with the personal attention he has been receiving at JSU. Jenna was a graduate student who

worked for Learning Services as a teaching assistant. Additionally, she was a student in the graduate psychology course that the researcher observed. Growing up overseas, English was not Jenna's first language. Katie was a student over traditional age who returned to college to finish her undergraduate degree. She took a Learning Services course to strengthen her math skills, and was introduced to PT at that time. She later became a teaching assistant for ExSEL. Katie was close to graduation and the completion of her teaching credentials, and was in the midst of student teaching. Lauren, Sally, Curt, and Gordon were seniors in psychology who were taking the senior and graduate level psychology course on Criterion Based Behavior. Except for Curt, none had had previous exposure to PT. Curt had taken a Learning Services course as a freshman which had used safmeds.

The researcher spent two days in November 2006 in the Seattle, Washington, area. The faculty member who facilitated the visit was a professor in the Special Education area at the University of Washington. He arranged three interviews with former students and one interview with a colleague. The University of Washington is a major research university, granting bachelor's, master's, professional, and Ph.D. degrees. The Seattle campus had over 40,000 enrolled students in the fall of 2006. Besides the formal interviews, several less formal conversations took place with the faculty member and two of the former students. The faculty member has taught a 500 level graduate course in classroom measurement and management for many years. Precision Teaching has been taught in that class, as well as used in its instruction. The faculty member's colleague who was interviewed, started and has run a private school for over 25 years that

has incorporated PT. He taught a 300 level course on learning at Central Washington University for a year, replacing an instructor on sabbatical. Over the course of his career, he has had many experiences with adult and college learners that contribute to the topics examined in this study. While the researcher had never previously met the UW faculty member who facilitated the visit, he had briefly met his colleague at the 2004 International Precision Teaching conference.

The student participants interviewed in Seattle were not as diverse a group as the JSU students. All three had earned their advanced degrees; Rose and Marianne had earned master's degrees, and Gary had earned his Ph.D. All three were using PT in their careers. Rose had her own learning center, Marianne worked as a teacher and administrator at a private elementary and middle school, and Gary worked as a public high school special education teacher. Marianne had been working with PT at her current workplace prior to starting graduate school. Rose and Gary both learned of PT for the first time as graduate students at UW.

While the researcher had never met Gary before the November 2006 Seattle visit, he had briefly met Marianne on a visit to her school in 2004, and had met and spoke several times with Rose at the 2004 International Precision Teaching conference when she was in the planning and research phases of her business. The interviews with Marianne and Rose took place at their respective offices.

The interviewed faculty member at Maine Maritime Academy teaches pre-calculus. He was interviewed by telephone in December 2006. This small (approx. 800 students) public college offers associate's, bachelor's, and master's degrees. This faculty

member also had participated in a pilot telephone interview during the development of this project. In the fall of 2006, he asked his class if anyone would be willing to volunteer to be interviewed for this research project. Five students did volunteer, and the faculty member sent the potential participants' names, email addresses, and phone numbers to the researcher. Attempts to contact all five by email were made, but establishing contact remained difficult. Eventually, two were interviewed by telephone in December 2006. Both were taking the freshman pre-calculus course. Andy seemed like a traditional college-age student, who gave the impression of being immersed in and challenged by the approaching end of his first semester. Marcus gave the impression that he was over traditional age due to the life experiences to which he alluded. Although these students were polite and helpful in their answers, it was much more difficult for the researcher to develop a comparable level of rapport due to the nature of a telephone interview and the difficulty in imagining a setting in northern coastal Maine. Likewise, it would have been difficult to imagine the setting at JSU if it was not actually visited. Nevertheless, the participants offered valuable insights.

The interviewed faculty member at Youngstown State University, Ohio, taught courses in psychology, including a freshman level general psychology course and a junior level psychology course on intimate relationships. The researcher met him originally at the International Precision Teaching Conference in Chicago in 2004. At that time, the faculty member was asked whether he thought a qualitative dissertation on the experiences of college faculty would be viable. Since Precision Teaching is all about analyzing quantifiable data, the researcher was concerned that a qualitative study might

not be of interest to the very people that were sought as interview participants. However, his immediate reply was to actually sit down and answer the questions the researcher had been considering. That conversation was the first concrete indication that this study could yield useful data. In the fall of 2004, this faculty member was teaching at YSU, but subsequently retired, and so did not have students available for interviews during the research phase of this study. In December 2006, an interview was conducted by instant messaging at the suggestion of the participant.

Faculty Themes

The eight faculty interviews were examined, and six themes emerged from the data as presented in Figure 3. In Theme 1, the definition of PT was examined, leading to two subthemes: a narrow definition focusing on outcomes, and a broader definition that included teaching methods commonly used with PT. In Theme 2, the rationale and motivation for using PT was described, which included two subthemes: the recognition that fluency was valuable and the observation of conventional college instruction. In Theme 3, the first impressions of PT were described by faculty, while Theme 4 focused on the use of PT in the classroom. In Theme 5, the interaction between PT-using faculty and other instructors was described with two subthemes: the efforts to share PT with other faculty that led to acceptance or rejection, and the value of a PT-using friend. Student reactions comprised Theme 6.

Figure 3. Themes and subthemes of faculty experiences.

- Theme 1: Defining Precision Teaching
 - Subtheme A: A Concise Definition: Outcome Focused
 - Subtheme B: A Broader Definition: Teaching Methods and Outcomes
- Theme 2: Rationale/Motivation for Using Precision Teaching
 - Subtheme A: Recognizing Fluency is Valuable
 - Subtheme B: Observation of Conventional Model
- Theme 3: First Impression of Precision Teaching
- Theme 4: Use of Precision Teaching in the Classroom
- Theme 5: Interaction with Other Faculty
 - Subtheme A: Sharing Precision Teaching with Other Faculty: Acceptance and Rejection
 - Subtheme B: The Value of a Precision Teaching-Using Faculty Friend
- Theme 6: Student Reactions

Theme 1: Defining Precision Teaching

As mentioned in Chapters 1 and 2, an easily understood definition is not readily found in the literature. Three of the faculty used a strict definition of PT, others a more inclusive definition.

Subtheme A: A Concise Definition: Outcome Focused. Precision Teaching can mean different things to different people. Although none of the interview questions directly addressed PT's definition, clarity on its definition was sufficiently important that three of the faculty made specific references to it. Stan first learned about PT from Eric Haughton, who was an early graduate student of Lindsley. Stan explained that PT is not a

teaching method and does not prescribe what a teacher should do if progress in a learning task was not being made.

As defined by Lindsley [and taught by Eric Haughton, PT was inherently] pinpoint (precisely describe) some behavior, count it (under timed conditions), chart the results (on the standard chart), then decide if the behavior is changing rapidly enough to meet your needs and the needs of the behavior; if not, then change something to improve progress.... And that was all Precision Teaching was supposed to be.... [Use] your best intuition of what to do.”

A similar distinction was made by James who said, “Precision Teaching is ‘do what you can to get the rate up.’ There is nothing in PT about the interventions, it’s not like a teaching method, it’s like a measurement method, and then you do what you can to get that rate up.”

Subtheme B: A Broader Definition: Teaching Methods and Outcomes. Since most teaching methods do not measure frequency of student responses, PT users have collected a large number of techniques that work well in an environment that monitors speed and accuracy. Paul remarked that he

always regarded PT as a monitoring system ... you could use PT with anything—any teaching method. As time went on and teachers were sharing their findings and successes, a lot of procedures that turned out to be excellent monitoring tactics became associated with PT: one-minute timings (and later “sprints” of shorter duration), learning pictures, data decisions, safmeds, “ChartStat,” etc.¹

James explained it this way

¹ This list is a variety of procedures that have been used with PT.

You have to bring a whole set of skills about instructional design with you, or you will have students who have flat charts, and will be discouraged. So there is a whole skill set that is required to come along at the same time as the Precision Teaching – that is what Owen’s book did, it taught about slicing and stepping. It taught teachers about those kinds of skills. What do you do? How do you make the interventions? How do you look at a chart and see it flat, what do you do?

Essentially, to the degree that the timed task reflects the curriculum, the chart illustrates how rapidly a student is learning the material. If that learning is not taking place, it is up to the initiative and creativity of the teacher, often in conjunction with the student, to figure out what changes are called for in order for the learning to take place.

Theme 2: Rationale/Motivation for Using Precision Teaching

All of the interviewed faculty were committed to using PT, which reflected the purposive sampling method used in this study, where faculty familiar and experienced with PT were chosen for interviews. The faculty participants learned about PT in unique ways, but as they looked back, two convictions encourage continued use: recognition of the benefits of fluency and dissatisfaction with aspects of the conventional college instructional model.

Subtheme A: Recognizing Fluency is Valuable. Faculty knew from their own experiences that knowing a skill to fluency is powerful, achievable, and represents a high level of learning. Karen recognized how the lack of fluency in important vocabulary undermined her own college learning.

[I remember] my own graduate school experience of the teacher, who would be talking so fast about something that he was so fluent in, and I didn't understand fluency at the time, and I would be going "wait a minute, what is the difference between negative reinforcement and punishment? Oh gosh, what is the difference?" When, if I had had it down, and I had been fluent in it, then fine, I could have handled it.

Similarly, Will recognized that his math students lacked fluency in basic skills, and their sluggishness in basic cognitive steps undermined their ability to follow the lesson.

The kids no longer learn multiplication tables or even addition tables. And they are just not fluent in it. If I am up at the board saying $5x + 3x = \text{whatever}$, the kids are saying, $8x$? Where did he get $8x$? They can't follow. By that time I am over at another board talking about something else. And so you have lost them. So we need that fluency there and I thought, well, we've got to [develop fluency].

Subtheme B: Observation of Conventional Model. Faculty who had adopted PT as a preferred alternative were understandably dissatisfied with the conventional lecture-midterm-final model of instruction. Robert, who had taught grammar conventionally for many years before being introduced to PT, reflected on his experience. Often, the students would "learn this for a quiz tomorrow and then forget it." It was a result of learning just enough to get by. "In traditional lecture, the teacher teaches the [grammar] rules and the students don't learn. They just sit there. I will never do that again. Constant interaction. I will lead you to learning but I will not stand up here and bore you."

Karen commented, "I think that is a typical college faculty member's attitude. It is 'I throw it out and you are supposed to regurgitate it.' Not 'I am supposed to help you learn it.'" This was echoed in a similar vein by Rachel, "At the collegiate level, we are

just ‘here it is. Now take it and do whatever you can with it. It’s not my responsibility how you learn or if you learn. I am being paid to deliver.’ That is sad.”

James disliked the conventional instructional model because there was little expectation that students would retain the material after the course.

It’s the cram, get a good grade, and then move on to the next course. No one will ask you ... about something that you got an A in, we are done with that, unless I am in a sequential major or something. It’s like I got an A in macroeconomics, but don’t ask me anything about macroeconomics. Whereas in Precision Teaching, you develop a repertoire that is useful and long-lasting. So it is really a different outcome that you get. College teaching is typically focused on percent correct, immediately following instruction. Precision Teaching, when done correctly, is about developing learning – bringing learning to certain rates that predict retention, endurance, stability and application. And that is not about cramming.... it changes my whole way of thinking about teaching. College teaching or otherwise. It is really different.

Theme 3: First Impressions of Precision Teaching

When faculty first learned of PT, six saw it as intriguing and logical; two found it or parts of it undesirable. James described his reaction when he discovered PT.

This makes perfect sense. This is the way education should go....It seemed very Skinnerian, if you will, it was a rate measure, and I had studied experimental analysis of behavior in my college classes, learning theory classes, and worked with animals, and collected rate measures as Skinner did. And it seemed funny to me that when Skinner took his work into education that he dropped the rate measure and brought into the percent measures that were currently used.

Karen, trained as a “cognitive developmentalist,” did not have such a positive impression upon first learning of PT.

It took me two years kicking and screaming to ever even chart, because I didn't mind timings, but I thought the chart was too beyond me, because it was multiply scale and semi-logarithmic and too much like math. When I finally succumbed and realized how simple it really is, and how powerful it really is, that is when I got on the team and said okay, I was going to do this.... My first impression really wasn't a very positive one. So it never surprises me that other people are turned off by it at first.

Theme 4: Use of Precision Teaching in the Classroom

All faculty discussed the use of PT in their classrooms. Many different experiences were recalled. Since purposive sampling was used, it was not surprising that all interviewed faculty expressed a belief that PT had positive potential for postsecondary learning. Some of the experiences in using PT were negative, one was particularly unpleasant, and many were positive.

Nathan had a painful experience with a co-worker who “hated” PT, which illustrates the fact that not all teachers will embrace or enjoy the opportunity of using PT. “She didn't believe in it. She was strictly going by the book. She wasn't using it intelligently. She was simply going with overkill. She wanted to show how much she used it. So, I mean, we PT'ed the kids to death, and everybody hated it.”

All the interviewed faculty were convinced that PT has useful potential for postsecondary students, although several expressed frustrations in the application of PT in the classroom and were still in the process of adjusting how to use PT in their classrooms. Rachel said, “Some of my classes we chart, but in others we don't chart.” Will said, “Other people do it much better than I do, and do it correctly. I get better each year, but I have a long ways to go.”

Two faculty expressed the idea that it takes a lot of energy to push the students to develop their skills to fluency. Rachel said, “I push them beyond all limits,” Will stated, “I don’t push them enough.” Other faculty seemed to rely more on the students finding the motivation instead, either through friendly competition or for a grade.

In PT activities, students usually need to practice with the material to gain fluency. Paul mentioned that since class only met once or twice a week, he needed to adjust the class assignments.

The use of safmeds, self-monitoring, and self-charting tied into that daily practice. And it wasn’t just a “suggestion.” I set up consequences so students got credit or penalties that were checked by a partner first thing each class period for each of the days since the last class.

Robert simply stated “Not a lot of lecturing. A lot of practice. Everyday.... They are going to be involved.”

In answering a follow-up question on how he uses charts, Robert explained that the students keep and monitor their own charts. “[If] you have three days of flat data, there is a lapse in learning, so we need an intervention. More practice or try a different learning channel, and then the dots should go up.”

Faculty took advantage of the unique characteristics of PT and designed their own activities. One example by Paul was called “Free-Say,” in which, students needed to contribute something to a discussion in a given time period but were free to say what they wanted.

Based on the time available for Free-Say, I would let them know how many contributions they needed to make.... I would hold up a red card when they met their aim. I found this was necessary because some people would do all the talking if allowed to, and some would never say anything if somebody else was talking. It was interesting how people who had never talked in other classes would eventually, under this system, become accustomed to speaking their piece. And how those who feared 'public speaking' overcame this fear in this class.... The Free-Say discussion dynamic was really interesting. Once the basic material had been covered, students wouldn't want to look bad by saying the same thing, so they'd relate their own experiences relating to the topic. As a side note, it also made the classes much more interesting for me, because I never knew what they would come up with, as opposed to a setting where the teacher does all the telling. Whereas in many PT activities, the increase of response speed is very important,

two faculty tempered that tendency with their advice learned from experience. Stan said, "People say faster is better, but you can use frequency data to slow down... maybe speed them up later, but [if students are] just rushing and making all kinds of silly errors – so have them slowdown." Similarly, James stated

I had to teach people that it was about a pace not a race... the timers [seem to be] associated with winners and losers in races. So when you are working with adults, you have to break that mentality. And so I would do things like when you started a timing you'd say "please begin" not "on your mark, get set" – I see novices saying "Go!" when they start the timer. It's not about hurrying, it is about pacing yourself.... people who hurry have bursts and pauses, and bursts and pauses, and they don't reach the rate that they would reach if they were doing it in a "peaceful" manner.... I don't mean to take all the competition out of it, but it's not the racing part.

A strategic use of PT, especially in the college classroom, is to develop vocabulary to fluency so that it can be quickly understood and used by the student. The value of this exercise was described by Stan

[Say-Facts¹ or safmeds are very useful for learning because] any new body of information – philosophy, anything – is in large part vocabulary. And Say-Facts are a very efficient way of getting at vocabulary. Just because you say that “behavior is ‘boom’” [an example of a Say-Facts] it doesn't really mean you understand what that means. But if you've got that cognitive handle, then we can talk in class about what it means... So Say-Facts aren't the end all, but they get over the vocabulary, the formulas, the gristle, and then we just spend time developing the meat. Instead of me saying “rate is count divided by time” and everybody is writing [that down], they know rate is count divided by time [from studying their say-facts]. But what the hell does that mean? Why is that good? That is what we talk about. It should work in any classroom.

This example illustrates that frequency measurement expands the options available for teaching and learning. Because PT monitors a dimension of learning that is rarely perceived, previously unimagined activities become available.

Most of the faculty expressed a willingness to help students succeed with the somewhat unusual demands that PT presented. Karen spoke of her experiences with young college students with special needs. One had a stuttering problem; the other had cerebral palsy. In both cases, accommodations were made and positive learning outcomes resulted. The researcher observed two deaf students using safmeds in a class of hearing students. Typically safmeds are a “see card” then “say answer” exercise. The deaf students would see-sign their cards, i.e., “see card” then “sign answer” using sign language. They were very much engaged and involved in the class.

Stan spoke of accommodating students, doing whatever he could to make the students comfortable prior to the timing that was part of their grade. “I've had non-English or English as a second language students who weren't really proficient in

¹ Say-Facts are similar to safmeds, except they simply state the requirement to “say the memorized fact” rather than include the other technical aspects of safmeds, such as shuffling, saying for one minute, etc.

English, and so I'll have them do their Say-Facts in Chinese. I don't understand the answer, but then I take [a tape] over to the language department and somebody translates it for me and I can grade it."

Paul accommodated students who did not want timings to be part of their grade by providing two grading paths. "Can-Do" requires timings, the "Get-By" path does not.

If you achieved Can-Do status, the worst you could get was a B. The Get-By people had possibility of A-F, but the A was rare. It happened about 1% of the time with Get-By students. I should point out we monitored everyone, and so you could aspire to Can-Do but wind up on the Get-By path by performance. Or some people who thought they would go Get-By found out they could do the "impossible" fluency criteria of the safmeds and wound up Can-Do.

At least half of the faculty mentioned that the way PT is presented to students is very important. Karen said, "So much depends on how you present it to them." It was clear to faculty that presentation was important, but there were no instructions on how to present it. James wondered, "I was convinced that this was the way to go. My thing was, how do I unfold it successfully? How do I make it stick? How do I make this work? Because it is not laid out, when you learn about it, it is not laid out how you make it work." Paul reacted very similarly once he understood the rationale behind PT. "The chart is a big challenge to teach and learn ... To chart or not to chart was never an issue for me, so it was a challenge to get everyone to see the value of it." Different faculty explained how they presented PT to their students. Karen was matter of fact, Paul collected timing data for a number of weeks before having students plot it on a chart. Robert reported positive results by making timing activities fun. "I pulled out a deck of index cards. 'We are going to play a game. We'll put a term on one side and what it is on

the other, and then we are going to go as fast as we can. And we are not going to count incorrects.’ And they said, ‘Oh great, no incorrects.’ They were fascinated.”

Theme 5: Interaction with Other Faculty

Faculty interact with people, including other faculty members. They share their successes and struggles. As faculty discussed PT with other faculty, some would be interested and perhaps even try it out; those who were not interested would not implement it. However, PT-using faculty would reach out to other PT-using faculty to discuss techniques, even if they needed to develop relationships with people at other institutions.

Subtheme A: Sharing Precision Teaching with

Other Faculty: Acceptance and Rejection. Faculty who find benefits from any instructional strategy, may share their findings with others. In the case of PT, other faculty have become interested and adopted portions of PT after learning about it from other faculty. Nathan described one specific case, where an art instructor “got a technology grant to create a set of PowerPoint safmeds. She teaches art history and it is important for students to be able to call the title and the artist for an important work of art.”

In another example, Robert stated that PT is adopted both by sharing with other faculty and when students become teachers. “I can reach other faculty, if I have them in my class, and they see the techniques and how they work. I have a couple of former students who teach in the English department. They do use some of these techniques with

parts of speech, and it works well, or punctuation. So that is how it trickles down with the faculty.”

In most situations, however, faculty reported a lack of interest from their fellow faculty members. Stan reported that while a graduate student, his adviser encouraged him to take a class on PT, even though the advisor thought “it was too simpleminded ... thought it was hogwash.” Rachel stated, “There are some faculty who are totally opposed to the whole idea [of PT]. But then they are the ones who are totally opposed to any new idea.” According to Paul, fear may be another factor keeping other faculty from trying PT, “there is a very real social or political component to teaching that involves avoidance of fear – the fear of rejection or the fear of looking foolish. It’s an important life challenge that in my experience many professors never conquer.”

Subtheme B: The Value of a Precision Teaching-Using Faculty Friend. Faculty valued having colleagues with which they could discuss PT. Stan stressed the importance of having a PT-using colleague. He discovered that having a PT-using friend “is a big factor on whether people adopt and maintain Precision Teaching.” Will, the only PT-using faculty at his institution mentioned how much he valued his long distance relationships with other PT users. After being asked if any of his fellow instructors might use PT, he said “It would definitely help. There is one other guy doing a class [like mine]. If I could get him doing it, too, that would be interesting. And then we would also have some competition there.” All the faculty stated that interacting with other PT-using

colleagues was helpful, either through the annual PT conference, the PT list-serv, or individual conversations.

Theme 6: Student Reactions

Faculty commonly reported a spectrum of responses from students that ranged from positive to negative. There were no faculty reports of students who started out positive and became negative. Some students reportedly started and remained positive, others started and remained negative, while others started negative or unsure and became positive by the end of the course. Two faculty reported that occasionally students would express appreciation for the experience long after the course was over. Nathan gave an example of a student over traditional age that went from negative to positive.

She came in real negative towards her abilities and mathematics in general, and she absolutely hated timings. [I had created] an assignment on the computer that had 50 of those problems, way more than anyone could finish in 5 minutes. And I would have the students do a timing everyday on the problems. And I remember [this student] griping about it. And after about two chapters of that though, one day she came in, and my jaw just absolutely hit the floor. She said, “I kind of like these speed drills.” If she could see the light with them, then she could, over time, overcome her natural dislike of timings and fear of failure and everything.

Another example of a student going from negative to positive was from Will. The student entered the class late in the term, and did not like the timings.

He came in and said “No, I learn on my own, I can't learn this way, this is not the way I learn.” I said, “Well, okay, but I guess you have to humor me. You can go home and learn any way you want, I don’t care, but you’re going to have to humor me and go through this stuff.” And he came out one of the guys who had a better score at this time and is not against it anymore. So I guess we won him over.

Paul worked to sell the students on using PT. “I noticed that some students would embrace PT features of the course from day one. Others would be skeptical, but I could win them over. It reminded me of a boot camp type situation where you hate it at the start, but by the finish you’re gung ho.”

According to Will, some students who did not have records of high achievement did quite well in PT classes. “Some people, a few, say, ‘Gee, I could really help myself by getting good at this,’ and they go and do it. Including some students who are LD or whatever and really need the help. They seem more apt to buy into it.”

James was positive towards the reactions of students, “They love it because they reach the goals, and they make improvement. [When] you are seeing improvement on a moment to moment basis – it is very enlightening and a very positive thing for people to see. If you do PT right, there isn’t going to be any resistance.” Robert observed that struggling students can do better than expected. “There are slow learners. Once they watch the other students who are fluent, then they begin to practice more and that fear – that somewhat of a fear that can obstruct the learning – eases. So some may start very slow, and then they build, and that is okay.”

Some of the negative students became positive, others did not. Procrastination or neglect of the necessary practice was mentioned by several faculty as a problem. Stan reported that

Some of them delay for a while before they get really serious... what usually happens is that two weeks before the end of the quarter, they panic, "I'm not there yet!" so they finally start doing it daily, and then the celeration really takes off and they do just fine. The only one that failed to reach aim¹ was the only one that never did daily practice.

Will had a similar experience. "All of them said they can't go very fast, can't go over 30 or something.... All of a sudden, they have done it [reached the required aim] because they had to do it. They got desperate. And all of a sudden they're putting their time in. And if you do it, it works."

Paul mentioned that students might drop a course or avoid taking a course with PT. "The most enthusiastic made PT and charting part of their life.... [Interviewee named three people who interviewer recognized as well known and well published PT practitioners and researchers not involved in this study.] Some of the least enthusiastic would drop the course. Quickly."

Paul observed another negative student attitude that sometimes turned around, and sometimes not.

Some students had agendas where learning wasn't near the top of the priority list. Some of these actually surprised themselves with what they could accomplish with daily timings. There were many cases of students earning an 'A' who had no previous 'A's in any courses. There were almost always a few who didn't want to be bothered with any of the PT or charting aspects and resented the departure from a lecture format where they could sit and enjoy their private world.

Frequently, student reactions were positive, especially once they could see evidence of their learning on their charts. Two faculty members stated that students took responsibility for and scrutinized their own learning. Robert said,

¹ "Aim" is the speed and accuracy criteria that the student is expected to reach.

They monitor their own learning. I monitor it along with them, but they can tell when an intervention is called for or if they're not reaching aim in a particular area.... They take their first test and they have used these [learning] channels, and they are now fluent, they know their grade is going to be high, and it is.... Their very attitude changes tremendously, they are more positive.

Rachel said that it was exciting to have intelligent conversations with students about their learning.

I think [with PT] the students are more responsible. And I think they are more interested and they will talk in terms of how well they have done, and areas that they need to review. For example, "Can you go over this again with me because I am not doing so well?" I love that. I love that.

Student Themes

The interviews from the 17 students were examined, and five themes emerged from the data as presented in Figure 4. In Theme 1, students described their first impressions with PT. In Theme 2, students described the process of engaging in PT. In Theme 3, students discussed learning as an outcome of the PT exercises and drew a

Figure 4. Themes and subthemes of student experiences.

Theme 1: First Impressions and How They Changed

Theme 2: The Process of Engaging in Precision Teaching

Theme 3: Retention, Memorizing, and Learning

Theme 4: The Struggle

Subtheme A: Struggles Experienced

Subtheme B: Struggles Observed

Theme 5: Using Precision Teaching Lessons in Subsequent Classes

distinction with cramming and memorization. In Theme 4, the students shared their experience of the struggle of college, both in terms of what they experienced, and what they observed. Finally, in Theme 5, students who were looking back on their PT experiences described how it changed their subsequent college learning.

Theme 1: First Impressions and How They Changed

All of the students easily recollected their first experiences with timed tasks. They recognized that the time component of tasks was much different than their recent educational activities.

Sylvia reported her first impression was “Can I do it? At first you don’t think you can, but once you actually start you realize that it isn’t that difficult.” Additionally, she thought many of her classmates had a negative first impression, “a lot of them thought it was stupid at first. It was like ‘I don’t know if this is going to work’ but then you realize it may work, and some started to participate and there were still some who never really got into it.” Chuck remembered wondering, “What was the purpose? At first I didn’t think it was going to work. I just thought it was a waste of time ... writing these cards, we are never going to look at them.” Sarah explained that “we had watched a video, and we could see them going real fast, and we thought ‘man they are playing.’ Then when we got that good, we were going ‘hey, we are doing great!’” Andy admitted he was “hesitant” at first, “I started thinking that I’m really not the best when I work quickly, but as we started going along with it, it just develops your skills.”

Jenna remarked on her first experience with timings, “People are not comfortable. When I did safmeds the first time, it kind of got me nervous. I felt my face start brightening up and I would hesitate and think, because I didn’t like to get anything wrong. But timing does help because you have to just get it out quick.”

Marianne said of her first impression, “it was scary.” Rose described it as

Sheer panic. Then I thought about it and I thought, you know, if he is going to teach us how to teach ourselves, this is a good thing, because the young whippersnappers were picking things up so much more quickly than I was. I was over 50. That is when I figured out what a great tool PT was, because it was the reason I passed my classes. I used it to study.

Her reaction was different than the reaction she saw in other students in her class. “The older the person, the higher level of panic.... The younger people just sort of took it in their stride; it was just a tool to get the grade to get out of there.”

Gordon simply accepted it as the way things were done, “Originally, I had no attitude at all, the whole time. I’ve been too busy to really think about it with all my other classes.” Marcus had a similar non-reaction, although he admitted he did not initially care for the timings. “I don’t know, I didn’t mind. I had never heard of such a thing.... I didn’t really like it that much, because I had never done it before. I just didn’t really feel comfortable with it. It seemed a little remedial to me.” Later he sounded a little more positive, “Well I seemed to make an improvement. So that is as good as any. It’s kind of like lobstering, you just keep doing it and you get better at it.”

In summary, the interviewed students easily recalled their reactions when they first realized their class with PT would be different. They may have been unable to define

what PT was, but trying to perform a task during a timed period and recording that time made a lasting impression.

Theme 2: The Process of Engaging in Precision Teaching

Several of the students described what it was like to be engaged in the processes associated with PT. Sylvia encountered PT right before her freshman year, used it on her own throughout her college career, and has continued to find it helpful in graduate school. “It makes you want to see how much faster can I go. It’s like competing with yourself.... If anything, it’s going to help you, because it will show you whether or not you know what you studied.” Her remark illustrates that she monitored the effectiveness of her studying.

David thought that students in general “would be a lot more ready for college” if PT was used in earlier grades. He felt “if I would have had what I’m doing now in high school, I would have done much better.” He responded positively to the challenge of timings. “It was always exciting, it was like ‘how many am I going to get this time?’ The excitement never wore off.” Similarly, Sally stated “it ended up being easy and fun, I liked it.”

Ellen explained an important nuance of instruction she found with PT. “It doesn’t leave out students who don’t learn traditionally.... It’s just about being more individualized learning. I know PT is not the only thing that does that. But I know that’s how we use it. That is what I like about it.”

Chuck expressed his positive feelings when asked about timings, “I loved it. I think it worked.” Sarah elaborated, “I liked [timings] because they helped you on the tests. But if you didn’t study them, then you didn’t know the test material.”

Jenna, whose native language was not English, compared her study methods between her PT-using graduate course and one taught conventionally. She was worried about the following week’s exam in a non-PT course, but not about the upcoming quiz in the PT-using course.

[In the course that uses PT,] I wouldn’t be sitting there looking in a book and looking at my notes and trying to memorize everything.... If you are using safmeds you are actually testing yourself every day. So when you come to the test, like we have a quiz tomorrow, and I’m not even worried about it at all, but then I have a test in a [different] class a week from tomorrow, and I am like worried about that every day.

She did not plan to use PT in her other course, apparently because she did not feel adept at creating safmeds, and writing down her notes in English helped her remember.

Marianne easily compared coursework before and after learning to use PT, as she had gained several years of teaching experience at a private PT-using school prior to returning for graduate studies. After experiencing the contrast in learning, she looked at her earlier education in a much different manner. Before learning PT, she had little confidence in her abilities.

I never knew. I had no idea going into a test if I really knew it. And I left the test, and I still could not be precise and say I passed this with an A, B or C ... it was always like this anticipatory thing, did I do what they wanted? Did I get at all the points? I may later remember a couple things, well, did I put that in the answer? There was an uneasy feeling of waiting. So is the ax going to fall?

After gaining knowledge of PT, her confidence in her studying abilities increased.

I went through and practiced with my questions and with my answers... until I had an extremely high rate. And when we came in to do those essay questions, I would sit down, do my essay questions, and I was done – I was always the first one. And had a perfect paper.

Angry feelings arose as Marianne reflected on her high school and undergraduate experiences before she learned how to use PT.

So while in college I did well in certain subjects that I enjoyed, it was always really a struggle for me. When I got to graduate school, it was like I aced it. It was like the easiest classes that I had taken were really, in fact harder ones. But I knew that I had learned, for myself, a way to incorporate Precision Teaching in with my practice and study, and it became easy. It became actually easy....And high school was such a struggle.... It makes me angry that I went through that many years of school struggling. Not knowing, thinking that I was not as smart, when in fact, it really was [that] I did not have the tools to figure out how to retain information.

Theme 3: Retention, Memorizing, and Learning

The interviewed students recognized the need to recall the material they had studied. The experienced students, not so much the freshmen, admitted that much of their college studying involved cramming or memorizing material for exams, which was promptly forgotten. Several students also made a distinction between what they could recall using PT versus what they remembered from prior courses. When asked about what he remembered from the summer ExSEL class, David recalled, “I remember about 95% and because of his teaching method, and because of the timings and because we even do it now.” When asked how that compared to his high school senior year immediately prior to ExSEL, he laughed, “I can’t even too much tell you, probably less than 50%.”

Ellen saw the difference between her cramming strategy and what was happening in the PT classroom.

For memorization, most of the time it goes away.... It's just cramming for a test. [But PT] is different, because they are doing it every day. It isn't a two hour cram session to memorize for a test. They do it everyday and build on that everyday.... they already had a test on [material in a set of cards] but they're still doing that again in addition to the new ones they are learning.

She discovered that learning facts to fluency "would prompt me to think about the next idea." Her experience with fluency changed her study strategy when large numbers of facts were needed.

After working here, working with students [I realized] that it doesn't work to cram at all. Studying just a little bit every day is what I really learned from being here.... I was one of the only students [in a conventional course] who actually made cards and I would bring them in.... they really worked because we had so many works and so many authors and that is the way I remembered.

Mike also commented on the inadequate nature of memorization, based on his own experience of applying what he observed in the PT class to his own learning tasks.

[After] you take the test, you are going to forget about something that you memorized. But with safmeds, you're going to learn those things and you are going to continue doing them until you are fluent in whatever you are learning.... I am going to study and continue studying until I am fluent in what I know.... Formulas? I do not think I could [remember] the formulas without precision teaching. I still have my stacks of cards. And so I can always go back and look at something I am a little rusty on, and so I think PT has helped me a lot.

Andy reflected on building his basic math skills using PT. "I think doing the testings and doing the method that he is doing does help improve right-off-the-top-of-your-head math. You don't have to pull out a calculator and do it. And it does stick it in your head more, because you are focusing on it more."

In summary, the students made a clear distinction between their recall of facts learned to fluency and material they had crammed for a test. The main difference, they said, was that crammed material was quickly forgotten.

Theme 4: The Struggle

The student participants in this study had their own stories to tell, both their own experiences of struggling, as well as the experiences of watching others struggle. Sometimes there was overlap between the two – a student's own sense of struggle was similar to what he or she observed in others.

Subtheme A: Struggles Experienced. Four of the students reported experiencing a struggle that was related to PT and safmeds. Several students reported that the work involved in writing their own safmeds from a textbook was a struggle. Gordon spoke of the difficulty of going through the class text and making cards based on the content. Jenna said it was difficult to apply PT to her other classes due to the difficulty in making the brief, condensed safmeds cards.

I don't know how to make my cards. Because I am so used to writing the word, and the definition [on the other side of the card] would be four lines long, so what is the main part that I do have to memorize? That is what needs to be on the back of the card. So for some college courses, it is hard, because the book is this thick. How am I going to turn those into cards?

This student was only about one-third of the way through the course that used PT, so there was still time for her to develop this skill. Another student in the class, Gordon, struggled with making cards for an in-class project.

It wasn't so much studying the cards that was a problem, it was making them. Confidentially, some of my chart data isn't quite accurate. I got cards done like two days before I had to share¹ a chart.... I studied the ones I had before that a little bit, but I didn't get them done.... It would be so much easier if you had someone [sell you] your cards.

Lauren found the struggle with PT to be with the unusual demand for daily practice. "I was somewhat overwhelmed for a little while with other classes, and then the safmeds thing included, and that is an everyday – Saturday, Sunday, all-the-time – thing that we had to do in order to reach our aim. And I felt like that was a lot of busywork on top of all the other things I had, like with stats."

Subtheme B: Struggles Observed. More student participants commented on struggles they observed in other students than on their own personal struggles. Sometimes there was an overlap when a student observed struggles in others that were in common with their own.

In a group interview with three senior psychology students, one mentioned procrastination as the main struggle, exacerbated perhaps by a daily study time expectation. Curt stated, "I don't think anybody was struggling anymore than anybody else. You see a lot of people procrastinate. [Group laughs.] I guess that that's the struggle." Lauren agreed, "That is the struggle." As mentioned earlier, the struggle in making the safmeds cards was a personal, as well as an observed, struggle. Curt, however, perceived value in the effort.

¹ Participants occasionally referred to "sharing charts," "chart-shares," or "data-shares." This, typically, is a time set aside for students or faculty to present an overhead of a chart and briefly describe the learning task or charted behavior.

Most everybody in this class, with the other classes they are taking, have a pretty good load, as far as outside of class time that they have to be working on that class. So making the safmeds took a while. And a few people were probably concerned that they had too much other stuff to do with their other classes to have to do this. They thought it was busywork, but making the safmeds, they probably didn't understand it at first. They work – it doesn't take that long actually.

Rose reflected on her recollection of struggling students.

I recall seeing classmates who struggled, and were extremely frustrated at first. Midway through the course, I heard no complaints, and I think it was because they were feeling successful. I very much recall the day where we all had to do our Safmeds aloud ... people were exceeding the expectation; so proud of themselves. So why would you not want to use it? It was just great. We struggled initially because it was new and different, and there was admittedly an awful lot of material to memorize, but the success was exciting.

Graduate students may experience a struggle, but they have already earned a college degree, and chose to take on a new challenge. College freshmen have a different struggle. While they have made it to college, they do not have a long string of successful college courses behind them. Perhaps not surprisingly, many struggles of freshmen students had to do with not doing the work. Student participants shared their experiences with struggling freshmen. Sylvia said, “some struggle because they really didn't want to be here. Others struggle because they really couldn't do it. That's when all of us came in and worked together. We had study groups – we go through our cards together – we studied for our tests together.” Ellen said, “the ones who really struggle are the ones who just don't do it ... they are not using what they have. A lot of students have never had to study.... I can't think of students who are struggling who are studying.” This study did not have participants who fit the category of students who did not do the work. Thus, this study does clearly describe the struggle and the experiences of these students.

Theme 5: Using Precision Teaching Lessons in Subsequent Classes

Seven of the student participants, essentially those who had a number of classes after learning about PT, applied knowledge they learned using PT in subsequent courses. They credited many of their successes to PT or the techniques that frequently go along with it.

Sylvia stated

You always saw me with notecards because I realized that it really helped. Some classes, you couldn't put everything you need to know on a note card. But the things that I could, I always did, and it helped me out a lot. And I would time myself just like we did in class. Maybe not a minute, especially biology, but I used the same techniques that I use in ExSEL for my freshman classes. Still in my graduate classes, I still use notecards.

Katie, who was over traditional age, used elements of PT, particularly safmeds, in completing her degree,

I used to take them with me if I was doing errands. Sitting at the bank, flip them. People would ask, what are you doing? "I am studying for a test." Standing at the line in the grocery store, flip them. Anywhere. They're so portable, you can take them anywhere with you. You can't take those books with you everywhere you go.

Mike also used it for his classes, "I took a botany class this summer. I transferred the drawings that I did when I was in the field ... to my safmeds cards." Gary stated that the class taught with PT "made me a better learner. And I looked at my learning differently because of him. I do recall when I went back for my doctorate, there was a course from [a professor] in statistics. And I tried to make up say-facts [a fluency exercise] for statistics because it was so hard for me to understand."

Rose affirmed that she studied differently after learning about PT.

I would look through the material in other classes and would create cards for key points. I would study them sequentially initially, until I had a grasp of the full picture. Then I would shuffle them, and chart my progress until I felt I had a high enough rate of frequency for automatic recall, especially for the final master's exam.

During the interview, Rose was asked how she would have studied for that master's exam without PT, and she replied

I probably would have read the material, underlined key points, and reread the key points. I often outlined it. I didn't learn it to mastery, but retained it long enough to regurgitate it back and go on.

Two students who were new to PT recognized that it could be valuable in the future. David recognized after the staff shared their charts with the class that "the whole safmeds method can be used on almost anything that is teachable." Gordon watched a fellow student present how she is using safmeds to teach her daughter German, "I will make Spanish cards in the future, and I just thought of that in class today."

Differences Within the Experiences

As described above, similarities were found within the faculty and student experiences, which allowed them to be organized into themes. Differences were also found within the experiences of participants and are presented in this section.

Differences were found in the experiences at the different institutions. At JSU, PT was used by at least three faculty and an administrative faculty member who have worked closely together. They know many of the same individual students and can compare charts and notes on them. Students seemed to perceive timings as part of the way things were done in the Learning Services area of the campus. Students in the summer six-week

ExSEL program knew they needed to pass the course in order to be admitted, or saw it as their first college challenge.

In contrast, MMA only had one faculty member who used PT. Since only two students at MMA were interviewed, and the interviews were done by phone, the understanding of their experience was more limited. However, students worked with timings and fluency development in only one course by only one instructor, and thus PT was a more peripheral component of students' lives, even though the students knew their math course was important to their progress. The students experiences at MMA might be somewhat similar to the seniors and grad students at JSU who only take one course in psychology that uses PT and are not involved with Learning Services. But one important difference is that the faculty member at JSU has colleagues using PT whereas the faculty member at MMA has to reach beyond his institution for relationships with PT-using colleagues.

The students at UW were graduate students. They learned about PT in the context of it being a classroom measurement tool that should be considered for use in the elementary or secondary education classroom.

Differences by class standing were evident. The attitudes of freshman students were more accepting of something new and different than seniors. Perhaps since freshmen were new in college they did not have as many expectations about what a typical class would be like. The seniors recognized that they were learning in a different way, but found the different class structure with an expectation of daily practice to be unsettling given their other time demands. Of the four graduate students interviewed, one

had already embraced PT before returning for her graduate degree. Of the other three, one found it intriguing and challenging right away, the other two struggled awhile. Of the two that struggled, one subsequently came to use it in her practice. The other was interviewed while currently enrolled in her first class with PT. She was generally positive, although still somewhat puzzled.

An important distinction was noted between students who were more randomly selected versus those who were chosen by faculty. In this study, faculty participants were selected using purposive sampling, and faculty were understandably positive about PT. The researcher needed the help of the faculty participants to find students to interview. These students picked by faculty tended to be students still in contact with the faculty member. Arguably, these students were interested in, involved with, or working with PT. However, not all student interviews were set up by faculty. The instructor at MMA asked for volunteers during his class. Five students volunteered, and two were subsequently interviewed, the first two who could actually be reached by telephone. Similarly, while visiting and interviewing faculty and students at JSU, the researcher observed a senior psychology course. Four students volunteered to leave class early and participate in a group interview. Thus, the faculty-scheduled students could be compared with the volunteer-students. Complicating the comparison, all but one of the volunteer students were in the midst of their only PT-using class. The faculty-scheduled students had their first experience with PT in an earlier term, experienced the complete course, and had time to reflect on and compare their learning. Therefore, this comparison might be more

accurately considered a comparison between faculty-scheduled veteran students, and volunteer rookie-students.

The volunteer rookie-students were noticeably more tentative, and less committed to PT. In general, they were aware that building fluency took extra work, and described that effort as busywork. They had other priorities than developing fluency in the course material. Somewhat paradoxically, they also recognized benefits from the content they were learning to fluency. These students saw PT-use as unfamiliar territory. Furthermore, they seemed somewhat puzzled by the presence of a researcher investigating this phenomenon. The faculty-scheduled veteran students had a PT experience on which to look back. Being separated by at least several months from the class that used PT allowed them to reflect on the nature of the learning from that class. Instead of looking at the work in which they were involved, they could look at the work compared to the long term benefit, and they could evaluate retention and other qualities of learning that do not become apparent until after the class. These students were more positive about PT. They did not seem puzzled about a researcher being present. The undergraduates seemed pleased to share their stories, and the three graduate students (who use PT in their current positions) were pleased to see this research project undertaken. None of the faculty-scheduled veteran students called the fluency building efforts busywork. One admitted it was a lot of work, but she became very interested in the topic and valued learning it to a mastery level. The one student who was an exception to this distinction was a volunteer participant who was a veteran with PT. He had used safmeds before, stated in the group

interview that he saw their value in learning, and did not find making them from the text particularly difficult.

Chapter Summary

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). The research question addressed in this study was, “How do postsecondary faculty and students describe their experiences with PT?” The answer to this research question was found by interviewing faculty and students about their experiences with PT. The experiences were divided into a faculty category and student category, and then sorted into themes. These themes were presented in this chapter, with selected supporting quotations. Chapter 5 presents the conclusions of this study.

CHAPTER 5

CONCLUSIONS

Introduction

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). The research question addressed in this study asked: “How do postsecondary faculty and students describe their experiences with PT?” This research may be of interest to PT-using faculty who would like increased understanding of student and faculty experiences, and it may interest faculty or administrators considering PT use in their programs who want to know what to expect.

Overview

The learning monitoring system known as Precision Teaching has been used in a wide variety of educational settings for the last several decades. It has not been widely used at the college level, although academic benefits have been documented in the literature. Further research on its effectiveness would be useful to individuals considering its use. Very little is available in the literature on the experiences of college students using PT, along with their opinions, perceptions, and feelings. This study set out to interview students about their experiences with PT, along with faculty members who have collectively worked with thousands of students.

Methods and Data Collection

A qualitative, phenomenological approach was chosen for this study, as it was judged well suited for examination of participants' experiences of a specific phenomenon. Verification procedures were built into the study. These included triangulation, member checking, detailed and thick description, clarification of researcher bias, and a peer audit. Locations where PT has been used at the postsecondary level were located through the literature and by referral of published PT researchers. Face-to-face interviews took place with four faculty members and 12 students in Jacksonville, Alabama, in October 2006, and with two faculty members and three former graduate students in Seattle, Washington, in November 2006. Telephone interviews took place with one faculty member and two students in Castine, Maine, in December 2006. All interviews were recorded. An instant messaging interview took place with a former faculty member in Youngstown, Ohio, in December 2006, a few hours after he had emailed his written answers to the interview questions.

Data Analysis

Interviews were recorded and transcribed by the researcher. Transcripts were sent via email to the faculty and student participants, who were asked to check the transcripts in case anything was recorded incorrectly or had a different meaning than what they wanted to convey. An exception was a group interview with four students at JSU, where students were given a copy of the interview questions and asked to clarify any of their statements or to write anything down that they were uncomfortable sharing in a group

situation. Most participants were apparently satisfied with the transcripts and did not respond. However, three faculty members and two students responded via email with clarifications, which were incorporated into the texts used in analysis. The faculty and student transcripts were examined separately. Statements were sorted into themes describing participants' experiences, and the themes were presented in Chapter 4.

Answers to the Research Question

The research question asked, "How do postsecondary faculty and students describe their experiences with PT?" This question was answered by looking at faculty and students separately, and dividing their answers into separate themes. These themes are summarized below.

When they spoke of PT, some of the faculty included all the techniques that work well with timings, which have evolved along with PT for decades. Others clearly defined PT as a process of monitoring learning using the Standard Celeration Chart. A flat chart meant learning was not happening, and that something needed to change. A PT-using teacher needed a repertoire of adjustments and suggestions to help students learn.

Without frequent measurements of their performance, students may not have known if they were effectively learning the course material. Sometimes PT contributed to a struggle to learn, especially as they dealt with something different. Oftentimes the initial struggle led to academic successes. Struggles that were experienced included making safmeds when that process was unfamiliar and the payoff unclear, and adjusting to the expectation of daily practice. It appeared that some students would drop or avoid a

course with PT in order to avoid timings, or not make safmeds even if all the materials were given to the student. Unfortunately, students with this experience were not interviewed and so this study does not shed light on this type of experience.

Most students reported, and faculty observed, an initial fear, skepticism or uncertainty about being timed as part of the class requirements. Participants reported that this initial reaction typically gave way to toleration, on one end of the spectrum, and to excitement and enthusiasm on the other. Similarly, faculty participants either found PT interesting and logical or had an initial aversion that they worked through. Faculty who tried PT and gave up on it were not interviewed.

The interviewed faculty saw the development of fluency in course material as a valuable service to their students, and they saw PT as the most efficacious means to that end. They did not object to being known as supporters of PT. They continued to adjust and improve their instructional activities. Two faculty mentioned the need to push students to perform, while others let the grading structure drive student participation and effort. A key point was made that fluent knowledge of important vocabulary contributed to the quality of classroom discussions. Faculty spoke of a willingness to accommodate students with special or unique needs. One faculty member simply let students who did not want to participate in timings follow an alternative grading rubric.

Students were able to describe their experiences resulting from PT activities. One student mentioned that she learned to monitor her learning and the effectiveness of her studying. Several students said they enjoyed PT; one remarked that he enjoyed competing with himself, that the timings were exciting. Each time he wondered if he could increase

his score. One student worried about an exam a week away in a different class, but was not worried about the test a couple days away in her PT-using class. Another student did not like practicing math facts at night – he felt he knew them sufficiently.

Students reported that they remembered substantially more of the course content from PT-using courses than from their conventionally taught courses, especially when the latter included cramming for exams. Some students could reflect back on an earlier PT course and compare it to other courses, and these students saw benefits of learning to fluency. Students who were still taking their first course that used PT had little comprehension of potential long term benefits of fluency.

A number of the student participants said that after learning about PT, they used safmeds to study for subsequent courses. Some students continued to use charts and timers, others mainly used cards like those used with PT. Even new students saw PT's value from charted learning projects presented by classmates and instructors. One student found graduate school much easier than her undergraduate education because she had learned to use PT before starting her graduate program. As she learned new material to fluency, it produced a confidence and mastery of the material previously unknown.

Similar factors that led students to use PT on their own also motivated faculty to use PT in their classes. Interviewed faculty found fluency to be indicative of a valuable level of learning. Once the faculty thought in terms of fluency, they could relate it to their own experience and the performance of their students. Developing fluency appeared valuable because they saw it as a means whereby students would retain important content and be able to apply current learning to future coursework.

Many of the faculty expressed dissatisfaction with the conventional lecture-midterm-final exam model of college instruction. Bored students, lectures that precluded student interaction with material, and minimal feedback on student learning were among the objections. One instructor felt that while faculty members were interested in delivering content, they were not concerned whether students were learning. Finally, one faculty member regretted that students forget a great deal of course content once the class is over. To these dissatisfactions with the way college is commonly taught, PT offered one way to improve the situation.

Faculty participants shared their experiences with others. Some colleagues adopted PT. Former students have used PT after becoming teachers. But a lack of interest in PT by other faculty members was frequently experienced by PT-using faculty. Several attributed the lack of interest to fear (of the chart, rejection, or looking foolish); another saw the reason as opposition to new ideas. Regardless of the reason, PT is rarely used in the postsecondary classroom. Faculty repeatedly mentioned that interaction with PT-using colleagues is important and helpful, even if those relationships are with people living at a distance.

Comparison to the Literature

The results of this study support several of the findings in the literature and raise questions with others. Some educators in postsecondary education have written of an emerging and developing view that evaluation can be a powerful tool to inform teaching and learning (Angelo & Cross, 1993; Bok, 2006; Milton et al., 1986). In this study, not

only did faculty find value in regular monitoring of student progress, but the faculty and students both valued being able to watch their individual progress on the chart and make adjustments if they were not advancing.

Chickering and Gamson's (1991) research on the best practices for undergraduate education showed the need for students to receive prompt feedback. This study confirmed that students value prompt feedback. It also showed that prompt feedback could be almost instantaneous, and that some students continued to monitor themselves effectively in their future courses, once they learned the technique.

Pennypacker and Binder (1992, p. 20), directing their comments towards elementary and perhaps secondary education stated that "fluency standards can be determined objectively and unequivocally by measuring directly the performance of small groups of individuals recognized as competent in particular skills or areas of knowledge." In this study with postsecondary learners, setting fluency standards or aims was not always easy. One faculty participant found it challenging because some students had a great difficulty meeting the aims that other students could achieve. Given the length of time in a semester or a program, some students needed an easier aim; otherwise, they might fall too far behind the other students or become too discouraged. When another faculty member recognized the special needs of her students, she did not hesitate to adjust the aims. She rhetorically asked, "How do you set an aim? I don't think there is a set answer to that."

Researchers (e.g., Binder, 1996) described fluency as speed and accuracy in learning to the point where retention, endurance, and application were enhanced. In this

study, students gave personal examples that the material they had learned to fluency was material they were confident in, had mastered, and could recall long after the course was finished. Up until this point, these stories have not been documented in the literature.

Some of the PT literature gave a technical description of Lindsley's and Skinner's reflections on the meaning of frequency of behavior and learning. One faculty participant stated that PT could be effectively used without a thorough knowledge of behavioral psychology. "Behavioral theory could be ignored by a teacher. I think you're making an important point with that observation."

Only a few examples of the affective component of PT were found in the literature, and these mainly were with workplace learners (Binder, 1990a; Binder & Sweeney, 2002). Similar results were found in the postsecondary classroom, i.e., many students were hesitant at first, and then became engaged. Perhaps motivation is greater in a workplace environment, where the skills being taught directly relate to skills needed to succeed on the job. College students, however, may not see the link between the work they are asked to do and any long term benefits.

Thomas et al. (2001) listed four perceived problems or misconceptions that have led to a failure for PT to attract mainstream educators. These generalizations could be countered based on the literature alone; however, the experiences of the faculty and students shared in this study further supported the dismissal of the claims. The first concern, that PT is only for very low-level skills, does not hold up when compared to faculty and student experiences. For example, one student learned of PT before her freshman year. She used it all through college on her own initiative and now uses it in

graduate school (and is experimenting with its use in her own classroom). Another student learned PT prior to returning to graduate school, and used PT on her own initiative for all of her classes. Clearly, PT is not only for the development of low-level skills.

The second commonly believed notion that Thomas et al. (2001) reported was that PT required an expensively low student-to-teacher ratio. This study found that motivated students have used PT by themselves in courses not taught with PT. So at the postsecondary level, faculty involvement was not even needed for trained and motivated students.

The third assumption cited by Thomas et al. (2001) was that teachers need to spend long hours preparing practice materials. While materials are needed for timings, this study showed that these materials can come from a variety of sources. In this study, several of the faculty have prepared materials and have given them away on their websites, while others offer them at a nominal cost. One faculty member stated that textbook study guides often have exercises that can easily be used with a time component without modification. An instructor could prepare a list of 50 to 100 terms and definitions, give it to his or her students to copy onto note cards, and then provide instruction on recording their timings. The time needed to prepare these types of materials does not seem unreasonable.

Finally, the fourth concern cited by Thomas et al. (2001) was the extensive paperwork involved in charting each student. It appeared that all of the faculty in this

study had the students keep their own charts, and encouraged the students to seek advice if their progress as shown on the chart was insufficient.

Recommendations

A total of 21 interviews took place with eight faculty members and 17 students. As the only individual present at all interviews, the researcher was in a unique position to synthesize their content and make some recommendations for incorporating PT into postsecondary instruction.

1. Faculty considering implementing PT or time-based measurements need to weigh the potential advantages versus any disadvantages. The use of PT offers several benefits to students – two are repeated here. First, by developing fluency in important content, the student has knowledge that is likely to be retained and available for immediate use and to be applied to future learning. Second, some students may adopt PT as an active studying technique that serves them through their college career and beyond. The disadvantage lies in the risk of losing students who are distracted, irritated, or intimidated by timings and cannot rise above that state of mind.

2. Students should not be abused or neglected with Precision Teaching. Using PT is analogous to opening the curtains on an unused window. The knowledge gained of student learning still has to be used responsibly. Abuses such as shaming or inappropriately ranking students remain abuses even if PT is used. Collecting data on student performance and then not using that data responsibly could be construed as neglectful, as would not helping students figure out what to do differently. In this study,

none of the interviewed students reported abuses or neglects. Two of the faculty suggested these things could happen.

3. Simply adopting PT will not improve a failing instructional system. PT may pinpoint weaknesses in the system, but creative and innovative teaching is still required in doing something about it.

For those who choose to try elements of PT in their classes, the following suggestions are offered:

1. Daily (or close to daily) practice with the material is important. One student who succeeded in graduate school after learning PT as a teaching assistant found that daily practice was perhaps the most important component she took from PT. One faculty member stated that something beyond verbal encouragement was needed to get students to interact with material more regularly, particularly if classes only met once or twice a week. He set up points and penalties based on the student engaging in practices since the last class session. This faculty member had student partners check each other for daily practice since last class session. Evidence that students are practicing throughout the week and not just the night before class has also been collected by a web based practice activity with a built in time stamp, although this gets more complicated. Verification may also be accomplished by short in-class quizzes on the material that students are practicing. A student who claims to be practicing yet is getting low quiz scores may need some intervention.

2. Fluency on key vocabulary can help student participation, understanding, and learning in class discussions and lectures. Vocabulary materials should be organized so

that students at least have the opportunity to practice with key words or concepts prior to the introduction of the concept in class. Thus, instead of students writing down the meaning of a word during a lecture, they may already have familiarity or even fluency with its definition, and so lecture and discussion time then develop the understanding of that definition.

3. The academic load on students needs to be balanced. Learning material to fluency requires much more work than a basic understanding of material immediately after instruction or review. Faculty should carefully select which material or skills should be developed to fluency. For example, a faculty member might reasonably expect students to have a familiarity with concepts presented in each lecture. However, it could easily be unreasonable to expect students to develop fluency in that same quantity of material, especially if there is new material on a regular basis.

4. Faculty should avoid overwhelming students with a fluency expectation. Most students have had very limited exposure to the timed practices as used in PT. Some students may be reluctant to risk full participation until they have a sense that they have a reasonable chance of being successful. Some type of PT orientation that includes the course curriculum may be warranted in the early part of the course. One faculty member designed an alternative grading track so that students could opt out of timings and be graded on more conventional assignments.

5. Courses that include PT components need the willing cooperation of the instructor. One faculty member had a co-teacher who “hated” PT and did not use it intelligently. Consequently, the students ended up hating it as well. Precision Teaching

is not a stand alone technology, but exists in a synergistic relationship with competent, caring faculty.

6. Faculty should recognize that PT has the potential to not only help students with their immediate courses, but their future learning as well. When possible, students should be shown how to use timings, charting, and fluency in ways that they can use in their future learning.

Future Research

One of the advantages of qualitative studies is that they generate insights that can direct future research. The literature suggested that PT is a way to help college students learn. This study asked the students and faculty about their experiences with PT. Each of the themes could suggest areas of future study.

The development of a list of interventions that work well with college learners might be very useful. If PT, as one faculty member said, is “do what you can to get the rate up,” a collection of those methods that go along with PT and help the rate go up could be valuable. Some faculty members have favorite techniques: switching learning channels, using shorter timings, or “slicing back” in the curriculum. Some students put the facts they were learning for their safmeds on an audio tape or audio CD to play in their cars, another practiced safmeds with a friend over the phone (while simultaneously nursing her baby daughter). Students said that while sometimes they were practicing for speed, often they would read and think about the cards.

Since PT-using faculty and students made a distinction between memorizing (or cramming) and fluency, two hypothetical questions might open up an interesting line of research. To what degree are college grades based on forgotten material? And if indeed students are cramming (and quickly forgetting) important course material, is it because they do not know an effective method that leads to long term retention?

Binder (1996) speaks of a concept of cumulative dysfluency. In college learners, for example, this could be a situation where a student is particularly weak in several important component skills that are needed to pass required courses. These might include a weakness in basic math operations with negative numbers, a weakness in recognizing subject-verb agreement in sentences, or difficulty in reading new complex vocabulary words. The cumulative effect would be the added difficulty in passing courses where algebra, writing, and working efficiently with new vocabulary is important. How often do weaknesses in identifiable skills remain unaddressed, leading to poor grades, inefficient learning, and college drop out?

Several students (some as teaching assistants) took the lessons learned in a PT course and developed effective study habits. The students attributed their college success to those study skills. This suggests that perhaps PT should be taught in areas where students learn study skills, such as freshmen seminars and academic support centers. This research direction might help a great number of students.

This study set out to discover the experiences of students and faculty with PT. It used a set of questions designed to lead the conversation into what students and faculty found most meaningful about PT. Perhaps other questions would lead to other interesting

areas, and so this line of research that examines experiences may only be the beginning. Phenomenological researchers state that it is very difficult to explore consciousness scientifically, as getting a handle on what to measure is difficult. Therefore, simply asking people about their experience, and carefully examining their answers can contribute to improvements in teaching and learning.

Chapter Summary

The purpose of this phenomenological study was to develop an understanding of the experiences that postsecondary faculty and their students have had with Precision Teaching (PT). The results of this study may help educators understand and improve teaching and learning at the postsecondary level. It may also help those who are considering using PT to understand it more clearly, and it may help some PT-using faculty make adjustments or improvements in their programs.

The literature does not address the experiences faculty and students have had with PT, except in rather short descriptions scattered throughout. This study collected an in-depth description of the experiences of PT-using faculty and their students.

The purpose of this chapter was to present the answers to the research question, to look at differences between the experiences of the participants, to compare the findings of this study to the literature, to make recommendations for practitioners to consider, and to present suggestions for future research.

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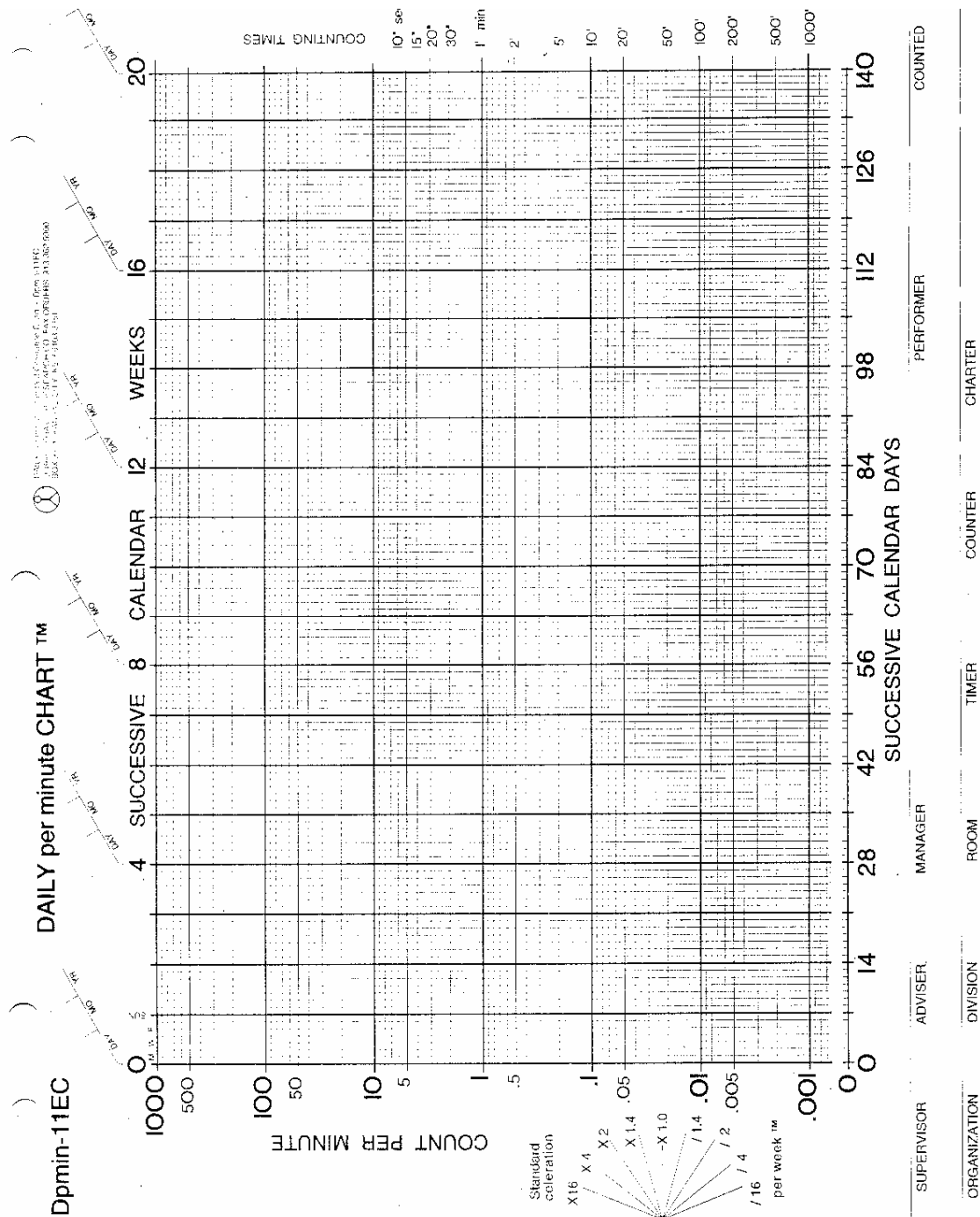
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APPENDICES

APPENDIX A

STANDARD CELERATION CHART



Likeness of Standard Celeration Chart. Used with permission from Behavior Research Company, Kansas City, KS. Since this chart is copied and reduced, the angles may be slightly distorted.

APPENDIX B

EXEMPTION FROM INSTITUTIONAL REVIEW



MEMORANDUM

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects

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TO: Scott Lorbeer

FROM: Mark Quinn, Ph.D. Chair *Mark Quinn Ch.*
Institutional Review Board for the Protection of Human Subjects

DATE: June 23, 2005

SUBJECT: *Understanding Precision Teaching in Post*

The above research, described in your submission of June 23, 2005, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal Regulations, Part 46, section 101. The specific paragraph which applies to your research is:

- ☐ (b)(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- ☒ (b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
- ☐ (b)(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
- ☐ (b)(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.
- ☐ (b)(5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
- ☐ (b)(6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

NOTE: Make sure letter indicates that interviews are voluntary.

APPENDIX C

INTERVIEW PROTOCOLS

Interview Protocol – Faculty Sheet

Project: Experiences of college faculty and students with Precision Teaching

Time of Interview:

Date:

Place:

Interviewer: Scott Lorbeer

Interviewee:

The purpose of this project is to explore and describe the experiences that postsecondary faculty and their students have had with Precision Teaching (PT).

Questions:

Think about when you first encountered PT and started to understand it. Describe your first impressions. Does anything come to mind as particularly meaningful?

As you grew to understand PT, did your impressions of it change, and if so, in what way?

How did you first become interested in PT? How did you pursue learning about it? What experiences were helpful?

Did you use the chart to experiment with your own behavior? What did you learn? Was that an important discovery? How did you see (or what did you think of) the chart? As a behavior measuring system, an educational tool, something else?

How did it feel to use PT for the first time with students? What changes did you have to make? What suggestions do you have for others?

As you started using PT in the classroom, how did you experience the reaction of your students? What appeared to be meaningful for them? What were the differences in reactions between the most and least enthusiastic students? As you gained experience with PT in the classroom, did your students' reactions change?

As you started using PT in the classroom, how did you experience the reaction from other faculty or college administrators? How did that color your experience with PT?

Do you feel your students' interactions with the course content changed because of frequency timings and fluency?

Do you look at college learning differently now that you have experience with PT?

Were there students who appeared to struggle with PT? What was your impression of their struggle?

Do you think your students will approach their college learning differently now that they have experience with PT? Why and how?

Anything else you care to share about what you have found to be meaningful about the use of PT?

Interview Protocol – Student Sheet

Project: Experiences of college faculty and students with Precision Teaching

Time of Interview: _____

Date: ____/____/____

Place: _____

Interviewer: Scott Lorbeer

Interviewee: _____

Student of faculty member: _____

The purpose of this project is to explore and describe the experiences that postsecondary faculty and their students have had with Precision Teaching (PT).

Questions:

One of your recent courses _____ used a teaching technique called Precision Teaching. It can be used in different ways, but generally speaking, students use short timings on academic tasks, and the time it took to complete that task is recorded on a paper chart or in a computer program. You may have used this in class or out of class, and it is likely that you timed yourself every day or several times during a week. Maybe you charted the information or entered it into a computer yourself.

Think about when you first realized that learning tasks would not only be checked for accuracy, but also timed. What was your initial reaction? (Both positive and negative?)

What were your classmates' initial reactions? Did your classmates' reaction have any impact on you? (Both positive and negative?)

What did you think after you worked with timings for awhile? Did your feelings or thoughts about them change? If so, how?

How much of the course content do you remember? Is that different than other courses?

Did you see any of your classmates struggle? What was your impression of their struggle?

Did you find yourself studying for this class in a different way?

What was your impression of the instructor's experience using PT?

Have you found yourself studying for other classes differently now?

Anything else you care to share about what you have found to be meaningful about the use of PT?

APPENDIX D

PARTICIPANT CONSENT FORMS

Consent Form- Faculty

Researcher: Scott Lorbeer
Faculty Advisor: Dr. Marilyn Lockhart
Department of Education
MSU-Bozeman

Thank you for your interest in this research study. You are free to decide not to participate, or to terminate the interview at any time. You are also free to decline to answer any question.

The purpose of this study is to develop an understanding of the experiences that students and faculty had with Precision Teaching. I expect the first interview can be completed within an hour or less. A follow-up interview should take even less time. Within a few weeks, I will email or mail you transcripts from this interview and some of my analyses. I would like you to read them and visit with me briefly via telephone or email with any correction, clarification, or elaboration as you see necessary. An audio recording will be made of the interviews, and any tapes, data files, notes, or transcripts that identify you by name will be kept securely in the possession of the researcher.

Every effort to maintain confidentiality will be made. Since the number of Precision Teaching faculty is relatively small, your comments may give clues to your identity to readers who are familiar with you or your work. Nevertheless, your comments reported in the dissertation will not be linked with your name. If you have concerns and want further steps to protect your identity, let me know and I will work with you to ensure that happens.

Copies of your course syllabi or other handouts or timings sheets you have used in your Precision Teaching course would be helpful for the researcher to examine. If you need these returned, please let me know.

All interview tape recordings and transcripts will be confidential. Recordings and transcripts containing identifying information will be destroyed six months after completion of this research project.

Please do not hesitate to ask any questions or share any concerns about the interview process. I will be happy to share the research findings with you when the research is completed.

There are no known risks or discomfort associated with this study. The only anticipated benefit to the participant is knowing that others may learn from your experiences.

Please sign your consent with full knowledge of the nature and purpose of the study.

Signature of Participant

Date

Consent Form- Student

Researcher: Scott Lorbeer
Faculty Advisor: Dr. Marilyn Lockhart
Department of Education
MSU-Bozeman

Thank you for your interest in this research study. You are free to decide not to participate, or to terminate the interview at any time. You are also free to decline to answer any question.

The purpose of this study is to develop an understanding of the experiences that students and faculty had with Precision Teaching. Precision Teaching is a means of gathering information about student performance by using short timings on assignments.

The interview should take about an hour. If you are available for a short follow up interview, please let me know. An audio recording will be made of the interviews, and any tapes, data files, notes, or transcripts that identify you by name will be kept securely in the possession of the researcher.

Every effort to maintain confidentiality will be made. Since Precision Teaching is not widely used, your comments may give clues to your identity to readers who know you. Nevertheless, your comments reported in the dissertation will not be linked with your name. If you have concerns and want further steps to protect your identity, let me know and I will work with you to ensure that happens.

All interview tape recordings and transcripts will be confidential. Recordings and transcripts containing identifying information will be destroyed six months after completion of this research project.

Please do not hesitate to ask any questions or share any concerns about the interview process. I will be happy to share the research findings with you when the research is completed.

There are no known risks or discomfort associated with this study. The only anticipated benefit to the participants is knowing that others may learn from your experiences.

Please sign your consent with full knowledge of the nature and purpose of the study.

Signature of Participant

Date